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LONDON

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W. W.	WILLISTON WALKER, PH.D., D.D. Formerly Professor of Church History, Yale University. Author of *History of the Congregational Churches in the United States, The Reformation, John Calvin.*	**Hopkins, Samuel.**
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W. W. P.	W. WYATT PAINE, J.P., F.S.A. Author and Editor of numerous legal textbooks.	**Husband and Wife** (*in part*)

THE ENCYCLOPÆDIA BRITANNICA

FOURTEENTH EDITION

VOLUME 11

GUNNERY TO HYDROXYLAMINE

GUNNERY, NAVAL. It is no easy matter to hit a moving target at sea, with a gun mounted upon an unstable platform which is also moving in relation to the target. Two elements must be accurately known to obtain a hit. Firstly, the correct range, so that the gun, when fired, shall be at the proper elevation to throw its shell to that distance and, secondly, the deflection, or lateral correction, to allow for the wind and the movement of the target whilst the shell is in flight. A gunlayer firing a single gun at short range can follow the path of his shot and see it strike the water or target, and can correct his sights so that the next shot will hit. Under battle conditions, with a number of guns firing, this becomes a sheer impossibility for anyone stationed at the guns. Hence the necessity for controlling the gunfire of a ship from a position remote from the guns themselves. The control officer is stationed high up in the ship, where he is in the best position to see the fall of the shot and where he has all the available information for estimating the hitting range and arrangements for communicating it to the guns. The gunlayers keep their guns laid upon the target and fire on the command of the control officer.

Let us consider the simple case of a ship firing at a target at a range of about 10,000 yards. The range is obtained by the rangefinder, and certain corrections, which will be explained later, are applied to the rangefinder range to obtain the "gun range" which, with the estimated deflection, is passed to the guns. As the target and the firing ship are both moving, the range must be changing at a certain rate: this "rate of change of range" is estimated and applied to the gunsights at set intervals. The control officer fires a salvo and watches the fall of shot. He makes a spotting correction in range and deflection, calculated to get the next salvo to fall upon the other side of the target to the first one. If this happens he halves his original spotting correction and applies it in the opposite direction and fires again. This third salvo should fall close around the target, and if the rate of change of range has been correctly estimated, subsequent salvoes will continue to hit. This is a very simple case of a bracket system which is used, in one form or another, by all control officers.

Corrections.—The corrections, which must be applied to the rangefinder range in order to obtain the hitting or gun range, are due to (1) the differences in muzzle velocity of individual guns, (2) the effect upon muzzle velocity of the temperature of the charges, (3) the direction and force of the wind, and (4) the height of the barometer and thermometer. The first two are usually applied direct on to the sights of each individual gun and remain more or less constant for any one day. The last two factors vary from hour to hour and are applied as a correction to the rangefinder readings. The rate at which the range is changing is another variable factor, since it depends upon the bearing between the ship and the target, which is constantly changing. The same applies, in a lesser degree, to the deflection, and constant corrections in both rate and deflection are necessary to maintain hitting after it is established.

Thus there are many problems to be solved, even in the simple case of firing at a target at 10,000 yards. Battle ranges have now been extended up to 20,000 yards and more, and as the range increases the problems with which the control officer is faced become much more complicated. At long ranges the observation of the fall of shot becomes extremely difficult, and as the range increases errors caused by the roll, yaw and pitch of the ship become accentuated. The shells in their flight reach a very high altitude and the wind and atmospheric conditions in the upper air cannot be known with sufficient accuracy to enable corrections to be made. The effects of the variations in the muzzle velocity, due to the wear of the guns, to changes in temperature of charges and to more obscure causes, become more pronounced. Range observation, even with the most perfect instruments and with the best trained observers, becomes less accurate as the range increases. It is therefore a matter of great difficulty to make an accurate forecast of the initial gun range and deflection. It has become the practice to obtain the hitting range by a process of "trial and error," using the gun as its own rangefinder with a large bracket system, after obtaining what assistance is possible from the instruments of observation. This can be done as long as the fall of shot can be observed, but becomes impossible as soon as this condition ceases to exist. Aircraft are now used to assist in the observation of fire at extreme ranges, and it is in this direction that future developments may be expected.

THE MECHANISM OF FIRE CONTROL

The installation used for fire control was intricate in the years before 1914, and war experience has made necessary the addition of further complications. The perfecting of the fire control organization of any ship is the most important item in making her into an efficient fighting unit, and it requires painstaking exercise

lasting over many weeks. Little can be said of the details of the various instruments used. Each navy regards its installation as confidential, and the functions, and even the existence of some instruments, are kept as secret as possible. The main problems are, however, the same for all and may be divided into three parts. (1) the communications between the control stations and the guns; (2) the apparatus for obtaining the hitting range and deflection and for keeping them both correct; (3) the arrangements for firing the guns and for observing the fall of shot

Communications.—Communication must be maintained between the observing stations aloft, the principal control position, the transmitting station and the gun positions. As most of the information is only of value at the moment of transmission and loses its significance if delay occurs, communications must be rapid and sure, and hence several lines usually exist between important stations. All lines of communication are generally concentrated into the transmitting station, which is situated well below the armoured deck in the quietest place that can be selected. Voice-pipes are used between stations that are moderately close together. A voice-pipe must be as straight as possible and there are well defined limits of length for each diameter of pipe, beyond which the acoustic properties are lost The telephone is used between all stations and there is usually a telephone exchange, in or near the transmitting station, solely for the use of the fire control organization. The telephone transmitters and receivers are specially designed for use by operators who have other duties to perform, or for instruments that are exposed to the weather or the blast of the guns Electro-mechanical transmitters and receivers are used for passing ranges, deflection, bearing, orders and other information of a standard character There are many different patterns of these instruments, those most commonly used in all navies being the Barr and Stroud "step by step," the Vickers "counter" and the "follow the pointer" types

The Transmitting Station.—In the transmitting station are situated the majority of the calculating instruments, and to this position are passed the results of all observations of range; etc. The functions of most of these instruments are confidential. Broadly, they consist of arrangements for deducing the course and speed of the enemy from the data available and for calculating from this the rate of change of range and the deflection to be applied to the gun sights. In the British service the Dreyer calculating table is in general use and to this, the details of which are secret, constant improvements are being made. In all navies some form of calculating apparatus is used, and there are a number of patented sets of instruments, notably the Argo and the Ford, which are designed for this purpose

Rangefinders.—The Barr and Stroud coincidence rangefinder is the one most commonly used by all navies, and this instrument forms the equipment of the British fleet. In a capital ship there are at least six large rangefinders, and the number and size of the instruments are reduced proportionately in smaller ships The observations of each instrument are transmitted electrically to the transmitting station, where apparatus exists for obtaining a mean of all the observations, thus giving what is called the "mean rangefinder range." To this are applied the corrections for the density of the air, the effect of wind, the change of range during the flight of the projectile and for several other variables. (*See* also RANGEFINDER, NAVAL.)

Change of Range Calculators.—To obtain the rate at which the range is changing at any moment involves the solution of two triangles, the functions of which are the course and speed of the firing ship and the bearing, course and speed of the target ship. The first two of these are known, the third is easily observable, but the last two can only be obtained by calculation or be judged approximately by observation. The speed of the target must always be guessed in the first instance, and instruments known as inclinometers are used whereby the angle between the line of fire and the course of the target ship can be observed with fair accuracy. There are several types of change of range calculators: that used in the British service is the Dumaresque, in which the elements are set graphically and the resulting rate of change of range is read off in "yards per minute," which is what is required.

Range Clocks.—Some type of clock, which can be set to run at the rate at which the range is changing, is used by all navies. In the British service the Vickers clock is used. This consists of a powerful clockwork escapement, driving a large pointer round a clock face, the perimeter of which is graduated in yards. A method of altering the speed of the pointer is fitted, so that it can be made to run at speeds of 0 to 2,000 yards per minute in either direction (*i.e.*, increasing or decreasing range) Arrangements are made for large corrections in range to be made to the perimeter of the clock without interfering with the motion of the pointer, so that the clock can always be run at the range that it is desired to transmit to the guns.

Deflection Calculators.—To obtain the correct deflection for hitting at long range is a difficult matter. There are many types of deflection calculators which give an approximation to the deflection, but all these instruments have their limitations. Allowance can be made for the wind at the firing ship, but at long range the wind effect at the target may be entirely different. Also, the direction and force of the wind in the upper air through which the projectile passes are unknown factors. The practice is to calculate the proper setting as near as is possible and then to correct it by observation of the fall of shot. Correct deflection is of the greatest importance whilst ranging, for at long ranges, unless the shot fall in line with the target it is impossible to tell whether they are short or over.

Bearing Indicators.—Azimuth plates are carried in the control positions with telescopes mounted upon them The zero is fixed in the fore and aft line of the ship and the bearing of any object with reference to this can be readily observed In the Evershed type, used in the British navy, the bearings are transmitted electrically and the instruments afford a ready means of indicating the correct target to the guns, but this system, even where still fitted, is now secondary to the Director (*see* below).

OBSERVING AND FIRING THE GUNS

When the ranges were moderate it was the practice to use a single gun for ranging, before opening fire with the whole broadside But no two guns can be built that will always shoot alike, and the differences between individual guns become accentuated at long ranges, owing to a variety of causes This leads to a spread or "pattern" when a number of guns of the same size are fired at the same elevation. The "spread of the salvo," as it is called, can be reduced by making careful adjustments, but it can never be eliminated entirely, even if there are no errors in laying the guns. The spread can, however, with care and training of the personnel, be made an approximately constant quantity, and this quantity is known to the control officer of each individual ship It is now the general practice to range with a salvo of several guns, usually half the broadside, and to continue firing alternate salvos, of an equal number of guns. The object of the control officer is, by using some form of bracketing system, to bring the mean point of impact of his salvos on to the target. This is termed a "straddle," that is, some shots over and some short, the maximum hitting effect being obtained.

Director Firing.—All modern navies have adopted some form of master sight or director, whereby all guns can be fired by a single layer. This system of firing has many advantages, chief amongst which are the elimination of smoke interference, the reduction of personal errors and the simplification of control

In the British navy the director installation invented by Admiral Sir Percy Scott is used. This consists of a director sight situated well away from the guns themselves and carried in a mounting which can be trained and elevated in the same manner as a gun mounting. The motion of the director mounting is transmitted electrically to the pointers of training and elevation receivers at the guns. On these receivers are mechanical pointers geared to the training and elevating gear of the turret or gun. The gun is moved in training and elevation so that the mechanical pointers are kept in line with the electric ones worked by the director mounting. The guns thus follow the motions of the director or master sight and are laid at the desired elevation and training. The gun range and deflection are set upon the director

sight and the director telescope is laid upon the target in the same manner as a gunsight. The firing circuits of all guns are brought to a single trigger at the director sight so that all guns can be fired simultaneously by the director layer.

This brief description indicates the principle upon which the director is worked, but in practice there are many complications. Corrections have to be made for the relative positions and levels of the different gun mountings and for many other matters. The installation is intricate, but it has withstood the acid test of prolonged war service In capital ships there are, as a rule, two director sights, one mounted aloft and one just above the level of the guns, which can be used alternatively for the main armament. A director is also fitted for use with the secondary armament.

Squadron Firing.—In the foregoing the gun control of a single ship only has been dealt with, but under modern battle conditions it often happens that more than one ship will engage the same target. When this occurs, unless there is some prearranged organization, confusion will arise owing to the spotting officer taking the fall of the other ship's salvoes for his own. Therefore a pair of ships firing at the same target will generally fire a salvo or pair of salvoes alternately, each waiting upon the other A squadron of four ships may fire together at the same target, the fire being controlled by the control officer of the leader, who orders the gun range at which each ship shall fire. He receives the results of observations of the fall of shell from his own and the other ship's spotting officers or from aircraft. Such practice necessitates high organization and an intimate intercommunication between the control officers, which has been made possible by wireless telegraphy. The object of the squadron control officer is the same as that of the control officer of a single ship, that is, to bring the mean point of impact of the fire of the whole armament of the squadron as near the target as possible, for then only can he be sure that he is getting the maximum hitting effect In view of the extreme ranges at which future actions at sea will be fought, it appears certain that fire tactics will tend to develop in the direction of concentrated fire by pairs of ships or by squadrons, aided by observation from the air

(S. T. H. W.)

GUNPOWDER is a mixture of saltpetre, sulphur and charcoal in such proportions that, when a part is heated to a certain temperature, combustion takes place with great rapidity through the bulk in contact and an explosive effect is produced It may be more correct to speak of the introduction than of the invention of gunpowder, for Friar Roger Bacon chanced upon it as the result of obtaining nearly pure nitre (*See* EXPLOSIVES.) The honour has, however, also been associated with the name of Berthold Schwartz, a German monk, of whom O Guttmann writes (*Monumenta pulveris pyrii*, p 6, 1904): "Berthold Schwartz was generally considered to be the inventor of gunpowder, and only in England has Roger Bacon's claim been upheld, though there are English writers who have pleaded in favour of Schwartz. Most writers are agreed that Schwartz invented the first fire-arms, and as nothing was known of an inventor of gunpowder it was perhaps considered justifiable to give Schwartz the credit thereof. There is some ambiguity as to when Schwartz lived The year 1354 is sometimes mentioned as the date of his invention of powder, and this is also to be inferred from an inscription on the monument to him in Freiburg But considering there can be no doubt as to the manufacture in England of gunpowder and cannon in 1344, that we have authentic information of guns in France in 1338 and in Florence in 1326, and that the Oxford ms. *De officiis regum* of 1325 gives an illustration of a gun, Berthold Schwartz must have lived long before 1354 to have been the inventor of gunpowder or guns." In Germany also there were powder-works at Augsburg in 1340, in Spandau in 1344, and Liegnitz in 1348. An indenture first published by Sir N. H. Nicolas (*History of the Royal Navy*, 1846) and later by Col. Brackenbury (*Proc. R. A. Inst.*, 1865), stated to be of 1338, contains references to small cannon as in the stores of the Tower, in London, and also mentions "a small barrel of gunpowder." In the Record Office, in London, also are trustworthy accounts of the purchase of ingredients of powder (starting with the year 1345) and of the shipping of cannon to France, and in 1346 Edward III appears to have ordered all the available sulphur and saltpetre to be bought up for him. The manufacture of gunpowder seems to have been carried on as a Crown monopoly about the time of Elizabeth, and regulations respecting gunpowder and nitre were made about 1623 (James I). Powder-mills were probably in existence at Waltham Abbey, England, about the middle or towards the end of the 16th century.

Roger Bacon, in his anagram, gives the first real recipe for gunpowder (*see* Hime, *Gunpowder and Ammunition*, 1924), viz., saltpetre 41·2, charcoal 29·4, sulphur 29·4%. Dr John Arderne of Newark, who began to practise about 1350 and was later surgeon to Henry IV., gives a recipe (Sloane mss 335,795)—saltpetre 66·6, charcoal, 22 2, sulphur 11·1%, "which are to be thoroughly mixed on a marble slab and then sifted through a cloth" This powder is nominally of the same composition as one given in a ms. of Marcus Graecus, but the saltpetre of his formula was undoubtedly answerable for the difference in behaviour of the two compositions. Roger Bacon had not only refined and obtained pure nitre, but had appreciated the importance of mixing thoroughly the components of the powder. Most if not all the early powder was a "loose" mixture of the three ingredients, and the most important step in connection with the development of gunpowder was undoubtedly the introduction of wet mixing or "incorporating" Whenever this was done the improvement in the product must have been immediately evident In the damp or wetted state pressure could be applied with comparative safety during the mixing The loose powder mixture came to be called "serpentine"; after wet mixing it was more or less granulated or corned and was known as "corned" powder. Corned powder seems to have been gradually introduced; it is mentioned in the *Fire Book* of Conrad von Schongau (1429) It would seem that corned powder was used for hand-guns or small arms in the 15th century, but cannon were not made strong enough to withstand its explosion for quite another century (Hime) According to the same writer, in the period 1250–1450, when serpentine only was used, one powder could differ from another in the proportion of the ingredients; in the modern period, say 1700–1886, the powders in use (in each state) differed only as a general rule in the size of the grain, whilst during the transition period, 1450–1700, they generally differed both in composition and size of grain Corned or grained powder was adopted in France in 1525, and in 1540 the French utilized an observation that large-grained powder was the best for cannon and restricted the manufacture to three sizes of grain or corn, possibly of the same composition. Early in the 18th century two or three sizes of grain and powder of one composition appear to have become common. The composition of gunpowders used in different countries at different times is illustrated in the following tables:

English Powders (Hime)

	c. 1250	1350	1560	1647	1670	1742	1781
Saltpetre	41·2	66·6	50·0	66 6	71·4	75·0	75 0
Charcoal	29·4	22·2	33·3	16 6	14 3	12 5	15 0
Sulphur	29·4	11·1	16 6	16 6	14 3	12 5	10 0

Foreign Powders (Hime)

	France	Sweden	Germany	Denmark	France	Sweden	Germany
	1338	1560	1595	1608	1650	1697	1882
Saltpetre	50	66·6	52·2	68·5	75 6	73	78
Charcoal	25	16·6	26 1	23 2	13·6	17	19
Sulphur	25	16 6	21·7	8·5	10 8	10	3

The last column in the preceding table represents brown or coco-powder for large charges in guns. The charcoal involved is not burnt black but is roasted until brown, and is made, not from wood, but from some variety of straw. When reasonably pure, none of the ingredients of gunpowder absorbs any material quantity of moisture from the atmosphere, and only the nitre is a

soluble substance. The three substances were often mixed dry, just before being required; since saltpetre is considerably heavier than sulphur or charcoal, it would tend to separate out towards the bottom of the containing vessel and hence, with dry mixing, the proportions of the three ingredients would alter on carriage. Saltpetre and sulphur are chemical individuals and therefore, if pure, are always of the same composition, but this is not the case with charcoal—its composition, rate of burning, etc., depend not only on the nature of the woody material from which it is made, but quite as much on the temperature and time of heating employed in the making (*see* CHARCOAL). The woods from which it is made contain carbon, hydrogen and oxygen, and the last two are never thoroughly expelled in charcoal-burning. If they were, the resulting substance would be of no use for gun-powder: 1–3% of hydrogen and 8–15% of oxygen generally remain in charcoals suitable for gunpowder. A good deal of the fieriness and violence of explosion of a gunpowder depends on the mode of burning of the charcoal, as well as on the wood from which it is made.

Properties of Ingredients.—Charcoal, the chief combustible in powder, must burn freely, leaving as little ash or residue as possible, and it must be friable and grind into a non-gritty powder. The sources from which powder charcoal is made are dogwood (*Rhamnus frangula*), willow (*Salix alba*) and alder (*Betula alnus*). Dogwood is mainly used for small-arm powders which burn more rapidly than those from willow, etc. The wood after cutting is stripped of bark and allowed to season for 2 or 3 years. It is then picked to uniform size and charred for 5 to 7 hours in cylindrical iron cases or slips, which can be introduced into slightly larger cylinders set in a furnace. The slips are provided with openings for the escape of gases. The rate of heating as well as the temperature attained have an effect on the product, a slow rate of heating yielding more charcoal, and a high temperature reducing the hydrogen and oxygen in the final product. When heated for 7 hours to about 800° C to 900° C, the remaining hydrogen and oxygen amount to about 2% and 12% respectively. After heating, the slips are placed in a larger iron vessel, where they are kept comparatively air-tight until quite cold. The charcoal is then sorted, stored for some time, and then ground, the powder being sifted on a rotating reel or cylinder of fine mesh copper-wire gauze. The sifted powder is again stored for some time in closed iron vessels before use.

Sicilian sulphur, which is most generally employed for gunpowder, is purified by distillation, melting and moulding. It is afterwards ground into a fine powder and sifted as in the case of charcoal.

Manufacture.—During the mixing of the ingredients in the incorporating mill each batch is sprayed with water until the required amount has been added, and the sprays are so arranged that at the least sign of incipient firing in one mill, the contents of all the mills are immediately drenched. The milled cake is then reduced to a meal by gun-metal rollers regulated so that the pressure at any point nowhere exceeds 56 lb. per sq.in., thus avoiding dangerous friction. The meal is placed in a hydraulic press giving ultimately about 400 lb. per sq.in., and the ebonite plates used in the press are earthed in order to avoid accumulation of static electricity. The cakes are then trimmed down slightly since the outer layers are not so compressed as the inner parts. The pressed cake is grained or corned by passing down through inclined rollers, and is then screened. The material passing a 10-mesh and retained by a 20-mesh sieve is used for small-arm powders (R.F.G. or R.F.G.^{2}), whereas the larger (10-mesh) and smaller (powdery) grains are returned to the hoppers or the incorporating mill, respectively, for further treatment.

The grains are freed from dust by being revolved in slightly tilted frames covered with 20-mesh gauze. They are then polished in order to diminish the tendency to absorb moisture—the process also increases the density. This is effected by rotation for 5–10 hours in large drums, the friction producing a brilliant glaze without the use of graphite in this type of powder. Other powders are run for shorter periods with about 1 oz. of graphite per 100 lb. of powder. The powders are placed in open-work shelves in a drying room heated by steam to about 40° C, the moist air being carried off by efficient ventilators. Even and slow drying is best, for rapid drying tends to crack the grains; the time required is from 1 to 6 hours, depending on the size of grain and the moisture content. In this process the powder is rotated in long, horizontal, cylindrical wooden frames covered with canvas, whereby it is freed from the dust produced in drying and given a final glaze. At several stages in the manufacture, the various batches are mixed or "blended" in order to produce as uniform a product as possible.

The following data are approximate values for average powders and do not apply to powders of special composition for particular purposes, such as mining powders. According to Noble and Abel, 1 gr. of dry powder produces 720–800 gram-calories of heat on explosion, attaining a temperature of about 2,100° C, and giving 200–300 cu-cm. of permanent gases (*i.e.*, gases which do not condense to liquids on cooling to the ordinary temperature). The composition of these permanent gases (percentage by volume) is roughly:

Carbon dioxide	50	Sulphuretted hydrogen	3
Carbon monoxide	10	Hydrogen	2
Nitrogen	35	Methane and oxygen	traces

The composition of the dry solid residue (percentage by weight) is approximately:

Potassium carbonate .	56	Potassium thiocyanate	0·5
Potassium sulphate .	16	Potassium nitrate	0·2
Potassium sulphides (mono- and poly-)	25	Charcoal and ammonium carbonate	traces

Variations in conditions of burning may alter the foregoing proportions very appreciably.

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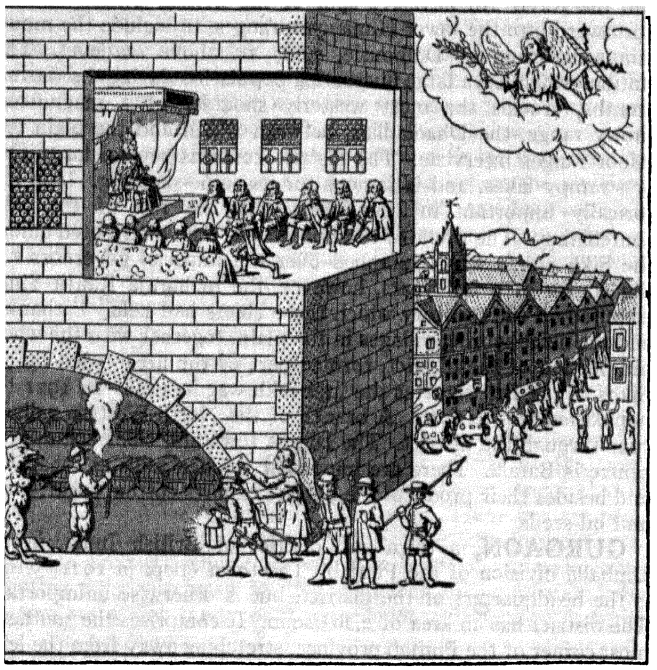
(W. R. Ho.)

GUNPOWDER PLOT, the name given to a conspiracy for blowing up King James I. and the parliament on Nov. 5, 1605. Organized as a reply to the anti-Roman Catholic laws, which, after a temporary relaxation, were being applied by James with renewed vigour, it originated at a meeting, probably in Jan. 1604, at a house in Lambeth, between Robert Catesby, Robert Winter his cousin, and John Wright. Later, several other persons were included in the plot, Winter's brother Thomas, Thomas Percy, John Grant, Ambrose Rokewood, Robert Keyes, Sir Everard Digby, Francis Tresham, a cousin of Catesby, and Thomas Bates, Catesby's servant, all, with the exception of the last, being men of good family and all Roman Catholics. Father Greenway and Father Garnet, the Jesuits, were both cognizant of the plot. Guy Fawkes was brought over from Flanders in April 1605. In March a vault immediately under the House of Lords was hired by Percy and 36 barrels of gunpowder (amounting to about 1 ton 12 cwt.), concealed there under coal and faggots. The preparations being completed in May the conspirators separated.

On Oct. 26 Lord Monteagle, a brother-in-law of Francis Tresham, who had engaged in Romanist plots against the government, but who had given his support to the new king, was seated at supper at Haxton when the following letter was brought to him: "My lord, out of the love I bear to some of your friends, I have a care for your preservation. Therefore I would advise you, as you tender your life, to devise some excuse to shift of your attendance



THE GUNPOWDER PLOT, 1605, AS REPRESENTED IN AN OLD PRINT
James I. is seen opening Parliament. Guy Fawkes stands below, at the entrance to the cellar, with lighted taper ready to fire the barrels of gunpowder. The Devil is at his side with bellows. An angel accompanies the discoverer of the plot, who is shown with lighted lantern. The scene is purely imaginative, since the plot was discovered two days before Parliament opened

of this Parliament, for God and man hath concurred to punish the wickedness of this time. And think not slightly of this advertisement, but retire yourself into your country, where you may expect the event in safety, for though there be no appearance of any stir, yet I say they shall receive a terrible blow, the Parliament, and yet they shall not see who hurts them. This counsel is not to be contemned, because it may do you good and can do you no harm, for the danger is past as soon as you have burnt the letter: and I hope God will give you the grace to make good use of it, to whose holy protection I commend you."

The authorship of the letter has never been disclosed or proved, but all evidence seems to point to Tresham and to the probability that he had some days before warned Monteagle and agreed with him as to the best means of making known the plot and preventing its execution, and at the same time of giving the conspirators time to escape (*see* TRESHAM, FRANCIS).

Monteagle at once showed the letter to Salisbury and other ministers, but the cellar under the House of Lords was not searched till Nov. 4. The whole plot was then discovered; Fawkes was arrested and tortured, while Catesby and others fled into the country, rejoining each other in Warwickshire, as had been agreed in case the plot had been successful. Catesby, who with some others had covered the distance of 80m. between London and his mother's house at Ashby St. Legers in eight hours, informed his friends in Warwickshire of the failure of the plot, but succeeded in persuading Sir Everard Digby, by an unscrupulous falsehood, further to implicate himself in his hopeless cause by assuring him that both James and Salisbury were dead. They failed to rally any of the support that they had expected from the countryside, and their small party was run to earth by the sheriff at Hewell Grange on Nov. 8. Catesby, Percy and the two Wrights were killed, Winter and Rokewood wounded and taken prisoners with the men who still adhered to them. In all eight of the conspirators, including the two Winters, Digby, Fawkes, Rokewood, Keyes and Bates, were executed, while Tresham died in the Tower. Of the priests involved, Garnet was tried and executed, while Greenway and Gerard succeeded in escaping. The allegation that the whole affair was an *agent-provocateur's* plot for which Salisbury was responsible is now generally regarded as baseless.

In England, the anniversary of the discovery of the Gunpowder plot is still celebrated on Guy Fawkes' day (Nov. 5) by bonfires, fireworks, and the carrying of "guys" through the streets.

BIBLIOGRAPHY.—The great controversy of last century concerning the nature of the plot can be followed in: *What was the Gunpowder Plot?* by John Gerard, S.J. (1897); *What the Gunpowder Plot was,* by S. R. Gardiner (a rejoinder) (1897); *The Gunpowder Plot . . . in reply to Professor Gardiner,* by John Gerard, S.J. (1897); *Thomas Winter's Confession and the Gunpowder Plot,* by John Gerard, S.J. (with facsimiles of his writing) (1898); *Eng. Hist. Rev.,* iii. 510 and xii. 791; *Edinburgh Review,* clxxxv. 183; *Athenaeum,* 1897, ii. 149, 785, 855; 1898, i. 23, ii. 352, 420; *Academy,* vol. 52, p. 84; *The Nation,* vol. 65, p. 400. *See* also: D. Jardine, *The Gunpowder Plot* (1857); the official account, *A True and Perfect Relation of the Whole Proceedings against the late most Barbarous Traitors* (1606), and the collection of letters and papers in the State Paper Office called the *Gunpowder Plot Book* (1819).

GUNTER, EDMUND (1581–1626), English mathematician, of Welsh extraction, was born in Hertfordshire in 1581. He was educated at Westminster school, and in 1599 was elected a student of Christ Church, Oxford. He was professor of astronomy at Gresham college from 1619 until his death on Dec. 10, 1626. With Gunter's name are associated several useful inventions, descriptions of which are given in his treatises on the *Sector, Cross-staff, Bow, Quadrant and other Instruments.* In 1620 he published his *Canon triangulorum.* There is reason to believe that Gunter was the first to discover (in 1622 or 1625) that the magnetic declination at one place varies (*see* TERRESTRIAL MAGNETISM). He introduced the words cosine and cotangent (*see* TRIGONOMETRY), and he suggested to Henry Briggs, his friend and colleague, the use of the arithmetical complement (*see* Briggs' *Arithmetica Logarithmica,* cap. xv., and LOGARITHMS).

His practical inventions are *Gunter's Chain,* the chain in common use for surveying, 22 yd. long and divided into 100 links;

Gunter's Line, a logarithmic line, the forerunner of the slide rule;

Gunter's Quadrant, used to find the hour of the day, the sun's azimuth, etc., and also to take the altitude of an object in degrees; and

Gunter's Scale (generally called by seamen the *Gunter*), a large plane scale, engraved with various lines of numbers and used to solve problems in navigation, trigonometry, etc., with the aid of a pair of compasses.

GÜNTHER, JOHANN CHRISTIAN (1695–1723), German poet, was born at Striegau, Lower Silesia, on April 8, 1695. He studied medicine at Wittenberg; but he was idle and dissipated and came to a complete rupture with his family. In 1717 he went to Leipzig, where he was befriended by J. B. Mencke (1674–1732), who recognized his genius. A recommendation from Mencke to Frederick Augustus II. of Saxony, king of Poland, proved worse than useless, as Günther appeared at the audience drunk. He died at Jena on March 15, 1723, when only in his 28th year. Goethe pronounces Günther to have been a poet in the fullest sense of the term. His lyric poems reveal fine imagination, clever wit and a true ear for melody and rhythm; but dull or vulgar witticisms are not infrequently found side by side with the purest inspirations of his genius.

Günther's collected poems were published in four volumes (Breslau, 1723–1735). They are also included in vol. vi. of Tittmann's *Deutsche Dichter des 17ten Jahrh.* (Leipzig, 1874), and vol. xxxviii. of Kürschner's *Deutsche Nationalliteratur* (1883). A life of him by Siebrand appeared at Leipzig in 1738. *See* Hoffmann von Fallersleben, *J. Ch. Günther* (Breslau, 1833); M. Kalbeck, *Neue Beiträge zur Biographie des Dichters C. Günther* (Breslau, 1879); A. Hoffmann, *Deutsche Dichter im Schlesischen Gebirge* (1897) and *Die Wahrheit über Günthers Leonore* (1925).

GÜNTHER OF SCHWARZBURG (1304–1349), German king, was a descendant of the counts of Schwarzburg and the younger son of Henry VII., count of Blankenburg. He was elected

German king at Frankfort on Jan. 30, 1349 by four of the electors, who were partisans of the house of Wittelsbach and opponents of Charles of Luxemburg, afterwards the emperor Charles IV. Charles defeated him at Eltville, and Gunther renounced his claims for the sum of 20,000 marks of silver. He died three weeks afterwards at Frankfort, and was buried in the cathedral.

See Graf L. Utterodt zu Scharffenberg, *Gunther, Graf von Schwarzburg, erwählter deutscher König* (Leipzig, 1862), and K. Janson, *Das Königtum Gunthers von Schwarzburg* (Leipzig, 1880).

GUNTRAM or GONTRAN (561–592), king of Burgundy, was one of the sons of Clotaire I. On the death of his father (561) he and his three brothers divided the Frankish realm between them, Guntram receiving as his share the valleys of the Saône and Rhone, together with Berry and the town of Orleans, which he made his capital. On the death of Charibert (567), he further obtained the *civitates* of Saintes, Angoulême and Périgueux. During the civil war which broke out between the kings of Neustria and Austrasia, he sought to maintain equilibrium. After the assassination of Sigebert (575), he took the youthful Childebert II. under his protection. After the death of Chilperic (584) he protected the young Clotaire II., and prevented Childebert from seizing his dominions. The danger to the Frankish realm caused by the expedition of Gundobald (585), and the anxiety which was caused him by the revolts of the great lords in Austrasia finally decided him in favour of Childebert. He adopted him as his son, and recognized him as his heir at the treaty of Andelot (587); he also helped him to crush the great lords, especially Ursion and Berthefried, who were conquered in la Woevre. From this time on he ceased to play a prominent part in the affairs of Austrasia. He died in 592, and Childebert received his inheritance without opposition.

See Krusch, "Zur Chronologie der merowingischen Könige," in the *Forschungen zur deutschen Geschichte*, xxii. 451–490, Ulysse Chevalier, *Bio-bibliographie* (2nd ed.), *s.v.* "Guntram."

GUNTUR, a town and district of British India, in the Madras presidency. The town (pop. in 1921, 48,184) has a station on the Bellary-Bezwada branch of the Madras and Southern Mahratta railway. It is situated east of the Kondavid hills, and is very healthy. It appears to have been founded in the 18th century by the French. At the time of the cession of the Circars to the English in 1765, Guntur was exempted during the life of Basalat Jang, whose personal *jagir* it was. In 1788 it came into British possession, the cession being confirmed in 1823. It has an important trade in tobacco and cotton, with presses and ginning factories, tobacco factories and oil and rice mills. There is a college and training schools. The DISTRICT OF GUNTUR, constituted in 1904 from territory which till then had been divided between Kistna and Nellore, has an area of 5,735 sq.m.; population (1921) 1,809,574. The district is bounded on the east and north by the river Kistna; in the west a part of the boundary is formed by the Gundlakamma river. Most of the district is a fertile plain irrigated by canals from the Kistna, and producing cotton, rice and other crops. The population is increasing, owing to the increased area of irrigated land. Saltpetre is worked.

GUPTA, SIR KRISHNA GOVINDA (1851–1926), Indian statesman, was a native of eastern Bengal, and was educated at Calcutta university. He then came to England, passed for the Indian Civil Service, and was called to the bar. He had a distinguished career in the civil service, and in 1907 was appointed one of the two Indian members on the India Council. He retired in 1915, and devoted his leisure partly to promoting the education of Indian women. Gupta received the K.C.S.I. in 1911. He died on March 30, 1926.

GURA, EUGEN (1842–1906), German singer, was born near Saatz in Bohemia on Nov. 8, 1842, and studied singing at the Munich Conservatorium. In 1865 he made his début at the Munich opera, and in the following years he gained the highest reputation in Germany, being engaged principally at Leipzig till 1876 and then at Hamburg till 1883. He was one of the greatest Wagnerian singers of his time and his Hans Sachs is still remembered. He died at Aufkirchen, Bavaria, on Aug. 26, 1906.

GURDASPUR, a town and district of British India, in the Lahore division of the Punjab. The town had a population in 1921 of 8,906. It has a fort (now containing a Brahman monastery) which was famous for the siege it sustained in 1712 from the Moguls.

The DISTRICT comprises an area of 1,889 sq.m. It occupies the submontane portion of the Bari Doab, or tract between the Beas and the Ravi. An intrusive spur of the British dominions runs northward into the lower Himalayan ranges, to include the mountain sanatorium of Dalhousie, 7,687 ft. above sea-level. This station, which has a large fluctuating population during the warmer months, crowns the most westerly shoulder of a magnificent snowy range, the Dhaoladhar, between which and the plain two minor ranges intervene. The district contains several large *jhils* or swampy lakes, and is famous for its snipe-shooting. It is historically important in connection with the rise of the Sikh confederacy. The whole of the Punjab was then distributed among the Sikh chiefs who triumphed over the imperial governors. In the course of a few years, however, the maharaja Ranjit Singh acquired all the territory which those chiefs had held. Pathankot and the neighbouring villages in the plain, together with the whole hill portion of the district, formed part of the area ceded by the Sikhs to the British after the first Sikh war in 1846. In 1921 the population was 852,192. A branch of the North-Western railway runs through the district. The largest town and chief commercial centre is Batala. There are important woollen mills at Dhariwal and besides their products the district exports cotton, sugar, grain and oil-seeds.

GURGAON, a town and district of British India, in the Umballa division of the Punjab. The town (pop. in 1921, 5,107) is the headquarters of the district, but is otherwise unimportant. The district has an area of 2,263 sq.m. It comprises the southernmost corner of the Punjab province, stretching away from the level plain towards the hills of Rajputana. Two low rocky ranges enter its borders from the south and run northward in a bare and unshaded mass toward the plain country. To the west lies the subdivision of Rewari, consisting of a sandy plain dotted with isolated hills. Numerous torrents carry off the drainage from the upland ranges, and the most important among them empty themselves at last into the Najafgarh *jhil*. Salt is manufactured in wells at several villages. The mineral products are iron ore, copper ore, plumbago and ochre.

In 1803 Gurgaon district passed into the hands of the British after Lord Lake's conquests. On the outbreak of the Mutiny in May 1857, the Nawab of Farukhnagar, the principal feudatory of the district, rose in rebellion. The Meos and many Rajput families followed his example. After the fall of the rebel capital, a force marched into the district and either captured or dispersed the leaders of rebellion. The territory of the Nawab was confiscated. Civil administration was resumed under orders from the Punjab government, to which province the district was formally annexed on the final pacification of the country. The population in 1921 was 682,003. The largest town and chief trade centre is Rewari. The district is now traversed by several lines of railway, and some irrigation is provided by the Agra canal. The chief trade is in cereals, but hardware is also exported.

GURKHA, the ruling Hindu caste in Nepal (*q.v.*). Courageous, faithful and self-reliant, they make excellent riflemen, at their best in hill-warfare. The national weapon is the *kukri*, a heavy curved knife, used for every conceivable purpose.

GURKO, OSSIP VLADIMIROVICH (1828–1901), Russian field-marshal, was born on Nov. 15, 1828. He fought in the Russo-Turkish War (1877–78), and in June 1877 with the rank of lieutenant-general, commanded a detachment which was to advance to Trnovo, with the object of forcing one of the passes and raising a revolt in Bulgaria. He took part in the attack on the Shipka pass, which he was to attack from the south, while the VIII. Corps attacked simultaneously from the north. The Turks delayed Gurko's advance, with the result that he failed to co-operate and the VIII. Corps was repulsed (July 17, 1877). After the war Gurko was made successively governor-general of St. Petersburg (1879), Odessa (1882) and Warsaw (1883). He

retired in 1894, having attained the rank of field-marshal, and died on June 28, 1901, at Sacharov (Tver).

GURKO, VASILI (1864–), Russian general, was born in 1864. He was educated in the Corps of Pages, and in 1885 was given a commission in the Grodno Hussar regiment. In 1911 he was chief of the 1st Cavalry division, with which in Aug. 1914 he advanced into Eastern Prussia. In 1915 he was the commander of the VI. corps. At the end of 1917, during General Alexeiev's illness, he fulfilled the duties of chief of staff. Later, after the revolution, he was dimissed by Kerensky, because of his objections to risking an offensive with the army in its then condition of ferment, and of his outspoken opinions as to the causes of this condition. Gurko was imprisoned, released, imprisoned again, and finally sent out of Russia by way of Archangel, with his wife, who was killed in action at a French Red Cross dressing-station on March 23, 1918. General Gurko published *Memories and Impressions of War and Revolution in Russia* (Eng. ed. 1918).

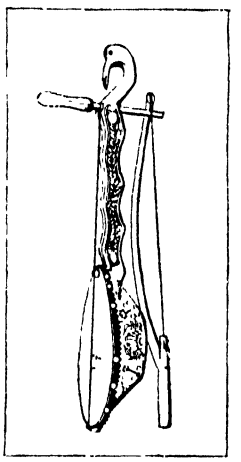
GURNARD (*Trigla*), a genus of fishes forming a group of the family *Triglidae*, recognized by the three first fin-rays of the pectoral fin being detached to form movable finger-like appendages, serving as organs of touch and of locomotion along the bottom, and by their large, angular, bony head. Gurnards are coast-fishes, generally distributed over the tropical and temperate areas, of the 40 species known, six occur on the coast of Great Britain. Although never found far from the coast, gurnards descend to several hundred fathoms; they are caught chiefly by the trawl. In young fishes, the pectorals are comparatively longer than in the adult, extending to the end of the body. These fins are beautifully coloured, especially in the young; they help to prevent the fish from sinking. When taken out of the water, gurnards emit a grunting noise produced by the vibrations of a perforated diaphragm across the cavity of the air-bladder. Their flesh is white, firm, and wholesome.

GURNEY, the name of an English family of bankers and merchants, descendants of Hugh de Gournay, who accompanied William the Conqueror to England. At Norwich in 1770 the brothers John and Henry Gurney founded a banking-house, the business passing in direct line to SAMUEL GURNEY (1786–1856) who assumed the control of the Norwich bank in 1809. Samuel Gurney also took over about the same time the control of the London bill-broking business of Richardson, Overend and Company, founded in 1800. At that time bill-discounting was carried on in a spasmodic fashion by the ordinary merchant in addition to his regular business, but Richardson considered that there was room for a London house which should devote itself entirely to the trade in bills. This idea proved an instant success. The title of the firm was changed to Overend, Gurney and Company, and for 40 years it was the greatest discounting house in the world. The house became known as "the bankers' banker," and secured many of the Bank of England's clients. Samuel Gurney died in 1856. During the latter years of his life philanthropic undertakings monopolized his attention. In 1865 the business of Overend, Gurney and Company was converted into a joint stock company, and in 1866 the firm suspended payment with liabilities amounting to eleven millions sterling.

GURNEY, EDMUND (1847–1888), English psychologist, was born at Hersham, near Walton-on-Thames, on March 23, 1847. He was educated at Blackheath and at Trinity College, Cambridge, and found his life-interest in that outlying field of psychology which is called "Psychical Research. In 1882 the Society for Psychical Research was founded, the first results being embodied in *Phantasms of the Living*, 2 vols. (1886), in the *Proceedings* of the Society, and in Gurney's remarkable essay, *Hallucinations*. The chief consequence was to furnish evidence for the process called "telepathy." In addition to his psychological writings, Gurney was the author of *The Power of Sound* (1880), and *Tertium Quid* (1887), a collection of essays. He died at Brighton on June 23, 1888, from the effects of an overdose of narcotic medicine. *See* PSYCHICAL RESEARCH.

GURWOOD, JOHN (1790–1845), British soldier, entered the army in 1808. He served through the Peninsular War, distinguishing himself at Ciudad Rodrigo (1812), and as brigade-major of Lambert's brigade of the 6th Infantry Division in all the important actions of 1813–14. He then served under the prince of Orange in the Netherlands, and was severely wounded (for the third time) at Waterloo. Gurwood was for many years Wellington's private secretary; he was occupied from 1837 to his death (Dec. 25, 1845) with the preparation of *Wellington's Despatches*.

GUSLA or **GUSLI,** an ancient stringed instrument still in use among the Slavonic races. The modern Serbian gusla is a kind of tanbur (*see* PANDURA), consisting of a round, concave body covered with a parchment sound-board and but one horse-hair string. The gusla is played with a primitive bow called *goudalo*. Among the Russians, the gusli is an instrument of a different type, a kind of psaltery having five or more strings stretched across a flat, shallow sound-chest in the shape of a wing.



BY COURTESY OF METROPOLITAN MUSEUM OF ART, N.Y.

THE BULGARIAN GUSLA, STILL IN USE AMONG SLAVONIC RACES

GUSTAVUS I. ERIKSSON (1496–1560), king of Sweden, was born at his mother's estate at Lindholm on Ascension Day 1496. His family was conspicuous in 15th century politics, though it generally took the anti-national side. Gustavus's youthful experiences gave him a lifelong distrust of everything Danish which was strengthened by the fact that in 1516 King Christian, to whom he had been sent as a hostage, treacherously carried him prisoner to Denmark. He was detained for 12 months in the island fortress of Kalo, on the east coast of Jutland, but contrived to escape to Lubeck in September 1519. There he found an asylum till May 20, 1520, when he chartered a ship to Kalmar, one of the few Swedish fortresses which held out against Christian II.

It was while hunting near Lake Mälar that the news of the Stockholm massacre was brought to him by a peasant, who told him that a price had been set upon his head. In his extremity Gustavus appealed to the sturdy yeomen of the dales, and finally drove the Danes out of Sweden (1521–23). But his worst troubles only began after his coronation on June 6, 1523. By releasing his country from the tyranny of Denmark, Gustavus had made the free independent development of Sweden a possibility. It was for him to realize that possibility. First of all, order had to be evolved from the chaos in which Sweden had been plunged by the disruption of the Union; and the shortest, perhaps the only, way thereto was to restore the royal authority, which had been in abeyance during 90 years. But an effective reforming monarchy must stand upon a sound financial basis, and the usual revenues of the crown were so diminished that they did not cover half the daily expenses of government. New taxes could only be imposed with extreme caution, while the country was still bleeding from the wounds of a long war. Moreover, the lack of capable, trustworthy administrators threw the whole burden of government exclusively on the shoulders of the new king, a young man of 27. Half his time was taken up in travelling from one end of the kingdom to the other and doing purely clerical work for want of competent assistance; in 1533, he could not send an ambassador to Lübeck because not a single man in his council, except himself, knew German. This lack of native talent compelled Gustavus to employ the services of foreign adventurers like Berent von Mehlen, John von Hoja, Konrad von Pyhy and others.

Gustavus had constantly to be on the watch lest the Swedish peasantry should encroach on his prerogative. He succeeded in putting down the four rebellions between 1525 and 1542, but the strain upon his resources was very damaging, and more than once he was on the point of abdicating and emigrating out of sheer weariness. He was, moreover, in constant fear of the Danes. Necessity compelled him (1534–36) to take part in *Grevens fejde* (Counts' War) (*see* DENMARK, *History*), as the ally of Christian III., but his exaggerated distrust of the Danes was invincible. A fresh cause of dispute was generated in 1548, when Christian III.'s daughter was wedded to Duke Augustus of Saxony. On that occa-

sion, apparently by way of protest against the decree of the diet of Vesterás (Jan 15, 1544), declaring the Swedish crown hereditary in Gustavus's family, the Danish king caused to be quartered on his daughter's shield not only the three Danish lions and the Norwegian lion with the axe of St. Olaf, but also "the three crowns" of Sweden. Gustavus, naturally suspicious, was perturbed by the innovation, and warned all his border officials to be watchful. In 1557 he even wrote a letter of protest to the Danish king, but Christian III replied that "the three crowns" signified not Sweden in especial, but the three Scandinavian kingdoms, and that their insertion in the Danish shield was only reminiscent of the union of Kalmar. But Gustavus was not satisfied, and this was the beginning of "the three crowns" dispute which did so much damage to both kingdoms.

The rupture of Gustavus with the Holy See was a purely political act, as Gustavus, personally, had no strong dogmatic convictions. He not unnaturally expressed his amazement when Olavus Petri informed him that the pope was antichrist. He consulted the older and graver Laurentius Andreae, who told him how "Doctor Martinus had clipped the wings of the pope, the cardinals and the big bishops," which could not fail to be pleasing intelligence to a monarch who was never an admirer of episcopacy, while the rich revenues of the church were tempting to the impecunious ruler of an impoverished people When the Protestant hierarchy was forcibly established in Sweden, matters were much complicated by the absolutist tendencies of Gustavus. The incessant labour, the constant anxiety, which were the daily portion of Gustavus Vasa during the 37 years of his reign, told at last even upon his magnificent constitution In the spring of 1560, conscious of a decline of his powers, Gustavus summoned his last diet, to give an account of his stewardship. On June 16, 1560 the assembly met at Stockholm Ten days later, supported by his sons, Gustavus greeted the estates in the great hall of the palace, when he took a retrospect of his reign. Four days later the diet passed a resolution confirming the hereditary right of Gustavus's son, Prince Eric, to the throne. The old king's last anxieties were now over and he could die in peace He expired on Sept 29, 1560.

Gustavus was thrice married His first wife, Catherine, daughter of Magnus I, duke of Saxe-Lauenburg, bore him in 1533 his eldest son Eric. This union was neither long nor happy, but the blame for its infelicity is generally attributed to the lady, whose abnormal character was reflected and accentuated in her son. Much more fortunate was Gustavus's second marriage with his own countrywoman, Margaret Lejonhufvud, who bore him five sons and five daughters, of whom three sons, John, Magnus and Charles, and one daughter, Cecilia, survived their childhood. Queen Margaret died in 1551; and a twelvemonth later Gustavus wedded her niece, Catharine Stenbock, a handsome girl of 16, who survived him more than 60 years

Gustavus's outward appearance in the prime of life is thus described by a contemporary. "He was of the middle height, with a round head, light yellow hair, a fine long beard, sharp eyes, a ruddy countenance . . and a body as fitly and well proportioned as any painter could have painted it" Learned he was not, but he had naturally bright and clear understanding, an unusually good memory, and a marvellous capacity for taking pains. He was also very devout, and his morals were irreproachable. On the other hand, Gustavus had his full share of the family failings of irritability and suspiciousness, the latter quality becoming almost morbid under the pressure of adverse circumstances. His energy too not infrequently degenerated into violence, and when crossed he was apt to be tyrannical

See A Alberg, *Gustavus Vasa and his Times* (London, 1882); R. N. Bain, *Scandinavia*, chaps iii. and v (Cambridge, 1905); P. B. Watson, *The Swedish Revolution under Gustavus Vasa* (London, 1889); O. Sjogren, *Gustaf Vasa* (Stockholm, 1896); C. M Butler, *The Reformation in Sweden* (New York, 1883); *Sveriges Historia* (Stockholm, 1877–81); J Weidling, *Schwedische Geschichte im Zeitalter der Reformation* (Gotha, 1882), M. Edén, *Om Centralregieringens Organisation* 1823–94 (1899); A. Falk, *G. Wasas utrikes politik med afseende pâhandeln* (1907). (R N B; X.)

GUSTAVUS II. ADOLPHUS (1594–1632), king of Sweden, the eldest son of Charles IX. and of Christina, daughter of Adolphus, duke of Holstein-Gottorp, was born at Stockholm castle on Dec. 9, 1594. From the first he was carefully nurtured to be the future prop of Protestantism by his austere parents. Gustavus was well grounded in the classics, and his linguistic accomplishments were extraordinary. He may be said to have grown up with two mother-tongues, Swedish and German; at twelve he had mastered Latin, Italian and Dutch; and he learnt subsequently to express himself in Spanish, Russian and Polish But his practical father took care that he should grow up a prince, not a pedant. So early as his ninth year he was introduced to public life; at 13 he received petitions and conversed officially with the foreign ministers; at 15 he administered his duchy of Vestmanland and opened the Örebro diet with a speech from the throne; indeed from 1610 he may be regarded as his father's co-regent. In all martial and chivalrous accomplishments he was already an adept; and when, a year later, he succeeded to supreme power, his superior ability was as uncontested as it was incontestable.

The first act of the young king was to terminate the fratricidal struggle with Denmark by the peace of Knäred (Jan. 28, 1613). Simultaneously, another war, also an heritage from Charles IX, had been proceeding in the far distant regions round lakes Ilmen, Peipus and Ladoga, with Great Novgorod as its centre It was not, however, like the Danish War, a national danger, but a political speculation meant to be remunerative and compensatory, and was concluded very advantageously for Sweden by the peace of Stolbova on Feb. 27, 1617 (*see* SWEDEN: *History*). By this peace Gustavus succeeded in excluding Muscovy from the Baltic. "I hope to God," he declared to the Stockholm diet in 1617, when he announced the conclusion of peace, "that the Russians will feel it a bit difficult to skip over *that* little brook." The war with Poland which Gustavus resumed in 1621 was a much more difficult affair. It began with an attack upon Riga as the first step towards conquering Livonia. Riga was invested on Aug 13 and surrendered on Sept. 15; on Oct. 3 Mitau was occupied; but so great were the ravages of sickness during the campaign that the Swedish army had to be reinforced by no fewer than 10,000 men A truce was thereupon concluded and hostilities were suspended till the summer of 1625, in the course of which Gustavus took Kokenhusen and invaded Lithuania. In Jan. 1626 he attacked the Poles at Walhof and scattered the whole of their army after slaying a fifth part of it This victory, remarkable besides as Gustavus's first pitched battle, completed the conquest of Livonia. As, however, it became every year more difficult to support an army in the Dvina district, Gustavus now resolved to transfer the war to the Prussian provinces of Poland with a view to securing the control of the Vistula, as he had already secured the control of the Dvina At the end of 1626, the Swedish fleet, with 14,000 men on board, anchored in front of the chain of sand-dunes which separates the Frische-Haff from the Baltic. Pillau, the only Baltic port then accessible to ships of war, was at once occupied, and Konigsberg shortly afterwards was scared into an unconditional neutrality. July was passed in conquering the bishopric of Ermeland. The surrender of Elbing and Marienburg placed Gustavus in possession of the fertile and easily defensible delta of the Vistula, which he treated as a permanent conquest, making Axel Oxenstjerna its first governor-general. Communications between Danzig and the sea were cut off by the erection of the first of Gustavus's famous entrenched camps at Dirschau. From the end of August 1626 the city was blockaded, and in the meantime Polish irregulars, under the capable Stanislaus Koniecpolski, began to harass the Swedes. But the object of the campaign, a convenient basis of operations, was won; and in October the king departed to Sweden to get reinforcements. He returned in May 1627 with 7,000 men, which raised his forces to 14,000, against which Koniecpolski could only oppose 9,000. But his superior strategy frustrated all the efforts of the Swedish king, who in the course of the year was twice dangerously wounded and so disabled that he could never wear armour again. Gustavus had made extensive preparations for the ensuing campaign and took the field with 32,000 men. But once again, though far outnumbered, and unsupported by his own government, the Polish grand-hetman proved more than a match for Gustavus, who, on Sept. 10, broke up his camp and returned to

Prussia; the whole autumn campaign had proved a failure and cost him 5,000 men. During the ensuing campaign of 1629 Gustavus had to contend against the combined forces of Koniecpolski and 10,000 of Wallenstein's mercenaries. The Polish commander now showed the Swedes what he could do with adequate forces. At Stuhm, on June 29, he defeated Gustavus, who lost most of his artillery and narrowly escaped capture. The result of the campaign was the conclusion of the six years' truce of Altmark, which was very advantageous to Sweden.

And now Gustavus turned his attention to Germany. The motives which induced the Swedish king to intervene directly in the Thirty Years' War are told us by himself in his correspondence with Oxenstjerna Here he says plainly that it was the fear lest the emperor should acquire the Baltic ports and proceed to build up a sea-power dangerous to Scandinavia. For the same reason, the king rejected the chancellor's alternative of waging a simply defensive war against the emperor by means of the fleet, with Stralsund as his base. He was convinced by the experience of Christian IV. of Denmark that the enemies' harbours could be wrested from them only by a successful offensive war on land; and, while quite alive to the risks of such an enterprise in the face of two large armies, Tilly's and Wallenstein's, each of them larger than his own, he argued that the vast extent of territory and the numerous garrisons which the enemy was obliged to maintain, more than neutralized his numerical superiority. Merely to blockade all the German ports with the Swedish fleet was equally impossible. The Swedish fleet was too weak for that, it would be safer to take and fortify the pick of them In Germany itself, if he once got the upper hand, he would not find himself without resources It is no enthusiastic crusader, but an anxious and far-seeing if somewhat speculative statesman who thus opens his mind to us. No doubt religious considerations largely influenced Gustavus. He had the deepest sympathy for his fellow-Protestants in Germany; he regarded them as God's peculiar people, himself as their divinely appointed deliverer But his first duty was to Sweden; and, naturally and rightly, he viewed the whole business from a predominantly Swedish point of view. Lutherans and Calvinists were to be delivered from a "soul-crushing tyranny"; but they were to be delivered by a foreign if friendly power; and that power claimed as her reward the hegemony of Protestant Europe and all the political privileges belonging to that exalted position.

On May 19, 1630 Gustavus solemnly took leave of the estates of the realm assembled at Stockholm. He appeared before them holding in his arms his only child and heiress, the little princess Christina, then in her fourth year, and tenderly committed her to the care of his loyal and devoted people Then he solemnly took the estates to witness, as he stood there "in the sight of the Almighty," that he had begun hostilities "out of no lust for war, as many will certainly devise and imagine," but in self-defence and to deliver his fellow-Christians from oppression. On June 7, 1630 the Swedish fleet set sail, and two days after midsummer day, the whole army, 16,000 strong, was disembarked at Peenemünde. Gustavus's plan was to take possession of the mouths of the Oder Haff, and, resting upon Stralsund in the west and Prussia in the east, penetrate into Germany. In those days rivers were what railways now are, the great military routes; and Gustavus's German war was a war waged along river lines. The opening campaign was to be fought along the line of the Oder. Stettin, the capital of Pomerania, and the key of the Oder line, was occupied and converted into a first-class fortress. He then proceeded to clear Pomerania of the piebald imperial host composed of every nationality under heaven, and officered by Italians, Irishmen, Czechs, Croats, Danes, Spaniards and Walloons. Gustavus's army has often been described by German historians as an army of foreign invaders; in reality it was far more truly Teutonic than the official defenders of Germany at that period. Gustavus's political difficulties (*see* SWEDEN: *History*) chained him to his camp for the remainder of the year. But the dismissal of Wallenstein and the declaration in Gustavus's favour of Magdeburg, the greatest city in the Lower Saxon Circle, and strategically the strongest fortress of north Germany, encouraged him to advance boldly. But first, honour as well as expediency moved him to attempt to relieve Magdeburg, now closely invested by the imperialists, especially as his hands had now been considerably strengthened by a definite alliance with France (treaty of Bärwalde, Jan. 13, 1631) Magdeburg, therefore, became the focus of the whole campaign of 1631; but the obstructive timidity of the electors of Brandenburg and Saxony threw insuperable obstacles in his way, and, on the very day when John George I. of Saxony closed his gates against Gustavus the most populous and prosperous city in north Germany became a heap of smoking ruins (May 20) Gustavus, still too weak to meet the foe, entrenched himself at Werben, at the confluence of the Havel and Elbe Only on Sept 12 did the elector of Saxony, alarmed for the safety of his own states, now invaded by the emperor, place himself absolutely at the disposal of Gustavus, and, five days later, at the head of the combined Swedish-Saxon army, though the Swedes did all the fighting, Gustavus routed Tilly at the famous battle of Breitenfeld, north of Leipzig

The question now was In what way should Gustavus utilize his advantage? Should he invade the Austrian crown lands and dictate peace to Ferdinand II at the gates of Vienna? Or should he pursue Tilly westwards and crush the league at its own hearth and home? Oxenstjerna was the first alternative, but Gustavus decided in favour of the second His decision has been greatly blamed More than one modern historian has argued that if Gustavus had done in 1631 what Napoleon did in 1805 and 1809, there would have been a fifteen instead of a thirty years' war. But it should be borne in mind that, in the days of Gustavus, Vienna was by no means so essential to the existence of the Habsburg monarchy as it was in the days of Napoleon; and even Gustavus could not allow so dangerous an opponent as Tilly time to recover himself Accordingly, he set out for the Rhine, taking Marienberg and Frankfort on his way, and on Dec 20 entered Mainz, where he remained throughout the winter of 1631–32 At the beginning of 1632, in order to bring about the general peace he so earnestly desired, he proposed to take the field with an overwhelming numerical majority The signal for Gustavus to break up from the Rhine was the sudden advance of Tilly from behind the Danube. Gustavus pursued Tilly into Bavaria, forced the passage of the Danube at Donauwörth and the passage of the Lech, in the face of Tilly's strongly entrenched camp at Rain, and pursued the flying foe to the fortress of Ingolstadt where Tilly died of his wounds a fortnight later. Gustavus then liberated and garrisoned the long-oppressed Protestant cities of Augsburg and Ulm, and in May occupied Munich. The same week Wallenstein chased John George from Prague and manoeuvred the Saxons out of Bohemia Then, armed as he was with plenipotentiary power, he offered the elector of Saxony peace on his own terms Gustavus suddenly saw himself exposed to extreme peril. If Tilly had made John George such an offer as Wallenstein was now empowered to make, the elector would never have become Gustavus's ally; would he remain Gustavus's ally now? Hastily quitting his quarters in upper Swabia, Gustavus hastened towards Nuremberg on his way to Saxony, but finding that Wallenstein and Maximilian of Bavaria had united their forces, he abandoned the attempt to reach Saxony, and both armies confronted each other at Nuremberg which furnished Gustavus with a point of support of the first order. He quickly converted the town into an entrenched and fortified camp Wallenstein followed the king's example, and entrenched himself on the western bank of the Regnitz in a camp twelve English miles in circumference His object was to pin Gustavus fast to Nuremberg and cut off his retreat northwards. Throughout July and August the two armies faced each other immovably. On Aug. 24 after an unsuccessful attempt to storm Alte Veste, the key of Wallenstein's position, the Swedish host retired southwards

Towards the end of October, Wallenstein, after devastating Saxony, was preparing to go into winter quarters at Lützen, when the king surprised him as he was crossing the Rippach (Nov 1) and a rearguard action favourable to the Swedes ensued. Indeed, but for nightfall, Wallenstein's scattered forces might have been routed. During the night, however, Wallenstein re-collected his host for a decisive action, and at daybreak on Nov 6, while an autumn mist still lay over the field, the battle began It was obviously Gustavus's plan to drive Wallenstein away from the Leip-

zig road, north of which he had posted himself, and thus, in case of success, to isolate, and subsequently, with the aid of the Saxons in the Elbe fortresses, annihilate him. The king, on the Swedish right wing, succeeded in driving the enemy from the trenches and capturing his cannon What happened after that is mere conjecture, for a thick mist now obscured the autumn sun, and the battle became a colossal mêlée the details of which are indistinguishable. It was in the midst of that awful obscurity that Gustavus met his death—how or where is not absolutely certain; but it would seem that he lost his way in the darkness while leading the Småland horse to the assistance of his infantry, and was despatched by a hostile horseman as he lay severely wounded on the ground.

By his wife, Marie Eleonora, a sister of the elector of Brandenburg, whom he married in 1620, Gustavus Adolphus had one daughter, Christina, who succeeded him on the throne of Sweden.

(R. N. B.)

See *Sveriges Historia* (Stockholm, 1877, 81), vol. iv; A. Oxenstjerna, *Skrifter och Brefvexling* (Stockholm, 1900, etc.); G. Björlen, *Gustaf Adolf* (Stockholm, 1890), R. N. Bain, *Scandinavia* (1905); C. R. L. Fletcher, *Gustavus Adolphus* (1892); J. L. Stevens, *History of Gustavus Adolphus* (1885); J. Mankell, *Om Gustaf II. Adolfs politik* (Stockholm, 1881); E. Bluemel, *Gustav Adolf, Konig von Schweden* (Eisleben, 1894); A. Rydtors, *De diplomatiska forbindelserna mellan Sverige och England 1624–1630* (Upsala, 1890); Vårenius, *Gustav Adolfs Sverige* (1900), H. Hjarne, *Gustav Adolf, protestantismens forkampe* (1901; Ger. trans. 1901); G. Egelhaaf, *Gustav Adolf in Deutschland 1630–32* (1901); J. Kretzschmar, *Gustav Adolfs Plane und Ziele in Deutschland* (1904); Fr. Bothe, *Gustav Adolfs und seines Kanzlers wirtschaftpolitische Absichten auf Deutschland* (1910); Adolf och Ebba Brahe, *Brefvaxlingen mellan Gustaf II.* (1915).

GUSTAVUS III. (1746–1792), king of Sweden, the eldest son of Adolphus Frederick, king of Sweden, and Louisa Ulrica of Prussia, sister of Frederick the Great, was born on Jan. 24, 1746. Gustavus was educated under the care of two eminent Swedish statesmen, Carl Gustaf Tessin and Carl Scheffer; but he owed most, perhaps, to the poet and historian Olof von Dalin. His teachers were amazed by the brilliance of his natural gifts, and, while still a boy, he possessed that charm of manner which was to make him so fascinating and so dangerous in later life, coupled with the strong dramatic instinct which won for him his honourable place in Swedish literature. There was scarce a French author of his day with whose works he was not intimately acquainted, while his enthusiasm for the new French ideas of enlightenment was as sincere as his mother's. On Nov. 4, 1766, Gustavus married Sophia Magdalena, daughter of Frederick V. of Denmark. The match was an unhappy one.

Gustavus first intervened in politics in 1768, at the time of his father's interregnum, when he compelled the dominant Cap faction to summon an extraordinary diet from which he hoped for the reform of the Constitution in a monarchical direction. But the Hats refused to redeem the pledges which they had given before the elections. "That we should have lost the constitutional battle does not distress us so much," wrote Gustavus, "but what does dismay me is to see my poor nation so sunk in corruption as to place its own felicity in absolute anarchy." From Feb. 4 to March 25, 1771, Gustavus was in Paris, where the poets and the philosophers paid him enthusiastic homage. But his visit to the French capital was a political mission. The duc de Choiseul, weary of Swedish anarchy, had resolved to discuss with him the best method of bringing about a revolution in Sweden. Before he departed, the French Government undertook to pay the outstanding subsidies to Sweden unconditionally, at the rate of one and a half million livres annually; and the comte de Vergennes was transferred from Constantinople to Stockholm. On his way home Gustavus visited his uncle, Frederick the Great, at Potsdam. Frederick bluntly informed his nephew that, in concert with Russia and Denmark, he had guaranteed the integrity of the existing Swedish constitution, and advised the young monarch to play the part of mediator and abstain from violence.

On his return to Sweden Gustavus made a sincere attempt to mediate between the Hats and Caps who were ruining the country between them (*see* SWEDEN: *History*). On June 21, 1771, he opened his first parliament in a moving speech. Addressing the diet in the Swedish tongue, he laid stress on the necessity of sacrifice for the common weal and offered to mediate between contending factions. A composition committee was actually formed, but it proved illusory from the first. The subsequent attempts of the dominant Caps still further to limit the prerogative, induced Gustavus at last to consider the possibility of a revolution. Of its necessity there could be no doubt. Under the sway of the Cap faction, Sweden, already the vassal, could not fail to become the prey of Russia. Only by a swift *coup d'état* could the independence of a country isolated from the rest of Europe by a hostile league, be saved from absorption into that northern system, the invention of Count Nikita Panin. At this juncture Gustavus was approached by Jakob Magnus Sprengtporten, a Finnish nobleman of determined character, with the project of a revolution. He undertook to seize the fortress of Sveaborg, and, Finland once secured, to embark for Sweden, meet the king and his friends near Stockholm, and surprise the capital by a night attack, when the estates were to be forced to accept a new constitution from the king.

The plotters were reinforced by an ex-ranger from Scania (Skåne), Johan Kristoffer Toll, also a victim of Cap oppression. Toll proposed that a second revolt should break out in the province of Scania, to confuse the Government still more, and undertook to secure the southern fortress of Kristianstad. It was finally arranged that, a few days after the Finnish revolt had begun, Kristianstad should declare against the Government. Prince Charles was thereupon to mobilize the garrisons of all the southern fortresses, ostensibly to crush the revolt at Kristianstad; but on arriving before the fortress he was to make common cause with the rebels, and march upon the capital from the south, while Sprengtporten attacked it simultaneously from the east. On Aug. 6, 1772, Toll succeeded in winning the fortress of Kristianstad, and on the 16th Sprengtporten successfully surprised Sveaborg. But contrary winds prevented him from crossing to Stockholm, and in the meanwhile events had occurred which made his presence there unnecessary.

On Aug. 16, the Cap leader, Ture Rudbeck, arrived at Stockholm with the news of the insurrection in the south, and Gustavus, finding himself isolated in the midst of enemies, resolved to strike the decisive blow without waiting for the arrival of Sprengtporten. On the evening of the 18th all the officers whom he thought he could trust received instructions to assemble in the square facing the arsenal on the following morning. At ten o'clock on the 19th Gustavus rode to the arsenal, joined on the way by his adherents, so that by the time he reached his destination he had about 200 officers in his suite. After parade he reconducted them to the guard-room of the palace and unfolded his plans. He then dictated a new oath of allegiance, absolving them from their allegiance to the estates, and binding them to obey their lawful king, Gustavus III. Meanwhile the senate and the governor-general, Rudbeck, had been arrested and the fleet secured. On the evening of the 20th heralds proclaimed that the estates were to meet in the Rikssaal on the following day; every deputy absenting himself would be regarded as the enemy of his country and his king. On the 21st, a few moments after the estates had assembled, the king in full regalia appeared, and taking his seat on the throne, delivered that famous philippic in which he reproached the estates for their unpatriotic venality in the past. A new constitution was recited by the estates and accepted by them unanimously. The diet was then dissolved.

Gustavus was inspired by enthusiasm for the greatness and welfare of Sweden, and worked in the same reformatory direction as the other contemporary sovereigns of the "age of enlightenment." He took an active part in every department of business, but relied far more on extra-official counsellors of his own choosing than upon the senate. The effort to remedy the corruption which had been fostered by the Hats and Caps engaged a considerable share of his time and he even found it necessary to put the whole of a supreme court of justice (*Göta Hofrätt*) on its trial. Measures were taken to reform the administration and the judicial procedure, and torture as an instrument of legal

investigation was abolished. In 1774 an ordinance providing for the liberty of the press was issued, the national defences were developed on a "Great Power" scale, and the navy was so enlarged as to become one of the most formidable in Europe. The finances were set in good order by the "currency realization ordinance" of 1777, and in 1775 free trade in corn was promoted and a number of oppressive export-tolls abolished.

The poor law was amended, absolute religious liberty was proclaimed, and he even succeeded in inventing and popularizing a national costume which was in general use from 1778 till his death. His one economic blunder was the attempt to make the sale of spirits a government monopoly, which was an obvious infringement upon the privileges of the estates. His foreign policy, on the other hand, was at first both wise and wary. Thus, when the king summoned the estates to assemble at Stockholm on Sept. 3, 1778, he could give a brilliant account of his six years' stewardship. Never was a parliament more obsequious or a king more gracious. Yet, short as the session was, it was long enough to open the eyes of the deputies to the fact that their political supremacy had departed. They had changed places with the king, who for all his gentleness, guarded his prerogative jealously. Even the few who were patriotic enough to acquiesce in the change by no means liked it. The diet of 1778 had been obsequious; the diet of 1786 was mutinous. The consequence was that nearly all the royal propositions were either rejected outright or so modified that Gustavus himself withdrew them.

The diet of 1786 marks a turning-point in Gustavus's history. Henceforth we observe a determination on his part to rule without a parliament; a passage, cautious and gradual, yet unflinching, from semi-constitutionalism to semi-absolutism. His opportunity came in 1788, when the political complications arising out of his war with Catherine II. of Russia enabled him by the Act of Unity and Security (on Feb. 17, 1789) to override the opposition of the rebellious gentry, and, with the approbation of the three lower estates, establish a new constitution, in which, though the estates still held the power of the purse, the royal authority largely predominated. Throughout 1789 and 1790 Gustavus gallantly conducted the unequal struggle with Russia, finally winning in the Svensksund (July 9–10) the most glorious naval victory ever gained by the Swedish arms, the Russians losing one-third of their fleet and 7,000 men. A month later, on Aug. 14, 1790, peace was signed between Russia and Sweden at Varälä. The peace of Varalä saved Sweden from humiliating concessions, and in Oct. 1791 Gustavus took the bold step of concluding an eight years' defensive alliance with the empress, who thereby bound herself to pay her new ally annual subsidies amounting to 300,000 roubles.

Gustavus now aimed at forming a league of princes against the Jacobins, and every other consideration was subordinated thereto. His profound knowledge of popular assemblies enabled him accurately to gauge from the first the scope and bearing of the French Revolution. But he was hampered by poverty and the jealousy of the other European Powers, and, after showing once more his unrivalled mastery over masses of men at the brief Gefle diet (Jan. 22–Feb. 24, 1792), he fell a victim to a widespread aristocratic conspiracy. Shot in the back by Ankarstrom at a midnight masquerade at the Stockholm opera-house, on March 16, 1792, he died on the 29th.

Although he may be charged with many foibles and extravagances, Gustavus III. was indisputably one of the greatest sovereigns of the 18th century. Unfortunately his genius never had full scope, and his opportunity came too late. Gustavus was, moreover, a most distinguished author. He may be said to have created the Swedish theatre, and some of the best acting dramas in the literature are by his hand. His historical essays, notably the famous anonymous eulogy on Torstenson crowned by the Academy, are full of feeling and exquisite in style,—his letters to his friends are delightful. Every branch of literature and art interested him, every poet and artist of his day found in him a most liberal and sympathetic protector. (R. N. B.; X.)

See E. G. Geijer, *Konung Gustaf III.'s efterlemnade papper* (Upsala, 1843–45); B. von Beskow, Om Gustaf III. sasom Konung och människa (1860–61), Geffroy, *Gustav III. et la cour de France* (1867–2 vols.), Ehrensvärd, *Dagboksanteckningar förda vid G. III's hof* (1878); *Gustaf III.'s bref till G. M. Armfelt* (Fr.) (1883), Y. K. Grot, *Catharine II. and Gustavus III.* (Russ.) (St. Petersburg, 1884); C. T. Odhner, *Sveriges politiska historia under Konung Gustaf III.'s regering* (1885–96), Mellin, *Verschwörung und Mordal tentat gegen G. III* (1890), E. Tegner, *Fran Tredje Gustavs dagar* (1892–94), O. Levertin, *Gustaf III. som dramatisk författare* (1894); and *Fran Gustav III.* (1900); H. Schück, *Gustav III., en karaktärsstudie* (1901), R. N. Bain, *Gustavus III and his Contemporaries* (1904), Stavenow, *Konung G. III.* (2nd ed. 1910); A. Soderhjelm, *Sverige och den franska revolutionen* (1920).

GUSTAVUS IV. (1778–1837), king of Sweden, the son of Gustavus III. and Queen Sophia Magdalena, was born at Stockholm, on Nov. 1, 1778. Carefully educated under the direction of Nils von Rosenstein, he grew up serious and conscientious. In 1797 he married Frederica Dorothea, daughter of Charles Frederick, grand-duke of Baden, a marriage which might have led to a war with Russia but for the hatred of the French republic shared by the emperor Paul and Gustavus IV., which served as a bond of union between them. Indeed the king's morbid horror of Jacobinism drove him to adopt all sorts of reactionary measures and to postpone his coronation for some years, so as to avoid calling together a diet; but the disorder of the finances, caused partly by the continental war and partly by the almost total failure of the crops in 1798 and 1799, compelled him to summon the estates to Norrkoping in March 1800, and on April 3, Gustavus was crowned.

The change which now took place in Sweden's foreign policy and its consequences are elsewhere set forth (*see* SWEDEN, *History*). By the end of 1808 it was obvious that the king was insane. His violence had alienated his most faithful supporters, while his obstinate incompetence paralysed the national efforts. To remove a madman by force was the one remaining expedient; and this was successfully accomplished by a conspiracy of officers of the western army, headed by Adlersparre, the Anckarsvärds, and Adlercreutz. On March 13, 1809 seven of the conspirators broke into the royal apartments unannounced, seized the king, and conducted him to the château of Gripsholm, Duke Charles was persuaded to accept the leadership of a provisional Government, which was proclaimed the same day, and a diet, hastily summoned, approved the revolution.

On March 29, Gustavus, in order to save the crown for his son, voluntarily abdicated; but on May 10, the estates, dominated by the army, declared that his whole family had forfeited the throne. One June 5, the duke regent was proclaimed king under the title of Charles XIII., after accepting the new liberal constitution, which was ratified by the diet the same day. In December Gustavus and his family were transported to Germany. Gustavus now assumed the title of count of Gottorp, but subsequently called himself Colonel Gustafsson, under which pseudonym he wrote most of his works. Separated from his family, he led an erratic life for some years; was divorced from his consort in 1812; and finally settled at St. Gall in Switzerland in great loneliness and indigence. He died on Feb. 7, 1837, and, at the suggestion of King Oscar II. his body was brought to Sweden and interred in the Riddarholmskyrka.

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GUSTAVUS V. (1858–), king of Sweden, son of Oscar II., king of Sweden and Norway, and Queen Sophia Wilhelmina, was born at Drottningholm on June 16, 1858. He entered the army, and was, like his father, a great traveller. As crown prince he held the title of duke of Warmland. He married in 1881 Victoria (b. 1862), daughter of Frederick William Louis, grand duke of Baden, and of Louise, princess of Prussia. The duchess of Baden was the granddaughter of Sophia, princess of Sweden, and the marriage of the crown prince thus effected a union between the Bernadotte dynasty and the ancient Swedish royal

house of Vasa. During the absence or illness of his father Gustavus repeatedly acted as regent, and was therefore already thoroughly versed in public affairs when he succeeded to the Swedish throne on Dec. 8, 1907, the crown of Norway having been separated from that of Sweden in 1905.

The crown prince, Oscar Frederick William Gustavus Adolphus, duke of Scania (b. 1882), married in 1905 Princess Margaret of Connaught (b. 1882, d. 1920), niece of King Edward VII. A son was born to them at Stockholm on April 22, 1906, and another son in the following year. The king's two younger sons were William, duke of Sudermania (b. 1884), and Eric, duke of Westmanland (b. 1889).

See G. Asbrinkt, *Konung Gustav V. sextio år* (1918).

GUSTAVUS ADOLPHUS UNION, a society formed of members of the Evangelical Protestant churches of Germany, which has for its object the aid of feeble sister churches, especially in Roman Catholic countries. The project of forming such a society was first broached in connection with the bicentennial celebration of the battle of Lutzen on the 6th of November 1832, a proposal to collect funds for a monument to Gustavus Adolphus having been adopted, it was agreed that the best memorial to the great champion of Protestantism would be the formation of a union for propagating his ideas. The society received a new impulse in 1841 through the energy and eloquence of Karl Zimmermann (1803–1877), under whose direction it became more definitely "evangelical" in its tone. The society has distributed about two and a half million pounds for church aid and development among various Protestant evangelical communities.

See K. Zimmermann, *Geschichte des Gustav-Adolf-Vereins* (Darmstadt, 1877).

GÜSTROW, a town of Germany, in the republic of Mecklenburg-Schwerin, on the Nebel and the railway from Lubeck to Stettin, 20 m. S. of Rostock. Pop. (1925) 18,837.

Gustrow, capital of the Wend district, was a place of some importance as early as the 12th century, and in 1219 it received Schwerin privileges. From 1316 to 1436 the town was the residence of the princes of the Wends, and from 1556 to 1695 of the dukes of Mecklenburg-Gustrow.

The principal buildings are the castle, erected in the middle of the 16th century, the cathedral, dating from the 13th century, restored in 1868, and the town hall (Rathaus), which dates from the 16th century. The town has machine works, foundries, sawmills, breweries, distilleries, and manufactories of chemicals, sugar and soap. There is also a considerable trade in wool, corn, wood, butter and cattle.

GUTENBERG, JOHANN (*c.* 1398–1468), German printer, is supposed to have been born *c.* 1398–1399 at Mainz of well-to-do parents, his father being Friele zum Gensfleisch and his mother Elsgen Wyrich (or, from her birthplace, zu Gutenberg, the name he adopted). The family appears to have been expelled from Mainz and to have settled in Strasbourg. Gutenberg is said to have been living there in 1434, and to have seized and imprisoned the town clerk of Mainz for a debt due to him by the corporation of that city, releasing him, however, at the representations of the mayor and councillors of Strasbourg, and relinquishing at the same time all claims to the money.

In 1438 a partnership arrangement was made between Gutenberg, Andreas Dritzehn, and Andreas and Anton Heilmann, and that this had in view the art of printing has been inferred from the word "drucken" used by one of the witnesses in the law proceedings which soon after followed. An action was brought, after the death of Dritzehn, by his two brothers to force Gutenberg to accept them as partners in their brother's place, but the decision was in favour of the latter. Documents of 1441 and 1442 show him to have been still in Strasbourg, but there is no trace of him between March 1444 and Oct. 1448. About 1450 Johann Fust (*q.v.*) advanced him 800 guilders to promote his work, on no security except that of "tools" still to be made. Fust seems also to have undertaken to advance him 300 guilders a year for expenses, but he does not appear to have ever done so. If at any time they disagreed, Gutenberg was to return the 800 guilders, and the "tools" were to cease to be security. In the minutes of the law-suit of 1455 Gutenberg says that he had to make his "tools" with the money advanced. But he is presumed to have begun a large folio Latin Bible, and to have printed during its progress some smaller books[1] and likewise the Letter of Indulgence (of April 12, 1451, by Pope Nicholas V. in aid of John II., king of Cyprus, against the Turks), of 31 lines, having the earliest printed date 1454, of which several copies are preserved in various European libraries.

It is not known whether any books were printed while this partnership between Gutenberg and Fust lasted. Trithemius (*Ann. Hirsaug.* ii. 421) says they first printed, from wooden blocks, a vocabulary called *Catholicon,* which cannot have been the *Catholicon* of Johannes de Janua, a folio of 748 pages in two columns of 66 lines each, printed in 1460, but was perhaps a small glossary now lost[2].

The Latin *Bible of 42 lines,* a folio of 1282 printed pages, in two columns with spaces left for illuminated initials (so called because each column contains 42 lines, and also known as the *Mazarin Bible,* because the first copy described was found in the library of Cardinal Mazarin), was finished before Aug. 15, 1456[3]; German bibliographers now claim this Bible for Gutenberg, but, according to bibliographical rules, it must be ascribed to Peter Schoffer, perhaps in partnership with Fust. It is in smaller type than the *Bible of 36 lines,* which latter is called either (*a*) the *Bamberg Bible,* because nearly all the known copies were found in the neighbourhood of Bamberg, or (*b*) *Schelhorn's Bible,* because J. G. Schelhorn was the first who described it in 1760, or (*c*) *Pfister's Bible,* because its printing is ascribed to Albrecht Pfister of Bamberg, who used the same type for several small German books, the chief of which is Boner's *Edelstein* (1461, 4to), 88 leaves, with 85 woodcuts, a book of fables in German rhyme. Some bibliographers believe this 36-line Bible to have been begun, if not entirely printed, by Gutenberg during his partnership with Fust, as its type occurs in the 31-line Letters of Indulgence of 1454, was used for the 27-line Donatus (of 1451?), and, finally, when found in Pfister's possession in 1461, apparently was old and worn, except the additional letters *k, w, z* required for German, which are clear and sharp like the types used in the Bible. Again, others profess to prove (Dziatsko, *Gutenberg's fruheste Druckerpraxis*) that B^{36} was a reprint of B^{42}.

Gutenberg's work, whatever it may have been, was not a commercial success, and in 1452 Fust had to come forward with another 800 guilders to prevent a collapse. But some time before November 1455 the latter demanded repayment of his advances (*see* the Helmasperger Notarial Document of Nov. 6, 1455, in Dziatzko's *Beiträge zur Gutenbergfrage,* Berlin, 1889), and took legal proceedings against Gutenberg. We do not know the end

[1] Among these were perhaps (1) one or two editions of the work of Donatus, *De octo partibus orationis,* 27 lines to a page, of one of which two leaves, now in the Paris National Library, were discovered at Mainz in the original binding of an account book, one of them having, but in a later hand, the year 1451 (?), (2) the *Turk-Kalendar* for 1455 (preserved in the Hof-Bibliothek at Munich); (3) the *Civianus* (preserved in the Cambridge Univ. Libr.), and perhaps others now lost.

[2] Ulric Zell states, in the Cologne Chronicle of 1499, that Gutenberg and Fust printed a Bible in large type like that used in missals. It has been said that this description applies to the 42-line Bible, as its type is as large as that of most missals printed before 1500, and that the size now called missal type (double pica) was not used in missals until late in the 16th century. This is no doubt true of the smaller missals printed before 1500, some of which are in even smaller type than the 42-line Bible. But many of the large folio missals, as that printed at Mainz by Peter Schöffer in 1483, the Carthusian missal printed at Spires by Peter Drach about 1490, and the Dominican missal printed by Andrea de Torresanis at Venice in 1496, are in as large type as the 36-line Bible. Peter Schoffer (1425–1502) of Gernsheim, between Mainz and Mannheim, who was a copyist in Paris in 1449, and whom Fust called his servant (*famulus*), is said by Trithemius to have discovered an easier way of founding characters, whence Lambinet and others concluded that Schöffer invented the punch. Schöffer himself, in the colophon of the Psalter of 1457, a work which some suppose to have been planned and partly printed by Gutenberg, claims only the mode of printing rubrics and coloured capitals.

[3] The Leipzig copy of this Bible (which formerly belonged to Herr Klemm of Dresden) has at the end the ms. year 1453 in old Arabic numerals. But certain circumstances connected with this date make it look very suspicious.

of these proceedings, but if Gutenberg had prepared any printing materials it would seem that he was compelled to yield up the whole of them to Fust; that the latter removed them to his own house at Mainz, and there, with the assistance of Peter Schöffer, issued various books until the sack of the city in 1462 by Adolphus II. caused a suspension of printing for three years, to be resumed again in 1465

We have no information as to Gutenberg's activity, and very little of his whereabouts, after his separation from Fust. A document dated June 21, 1457, shows that he was then still at Mainz Entries in the registers of the St Thomas Church at Strasbourg make it clear that the annual interest on the money which Gutenberg on the 17th of November, 1442, had borrowed from the chapter of that church was regularly paid till Nov 11, 1457, either by himself or by his surety, Martin Brechter. But the payment due on the latter date appears to have been delayed, as an entry in the register of that year shows that the chapter had incurred expenses in taking steps to have both Gutenberg and Brechter arrested. This time the difficulties seem to have been removed, but on and after Nov 11, 1458, Gutenberg and Brechter remained in default The chapter made various efforts, all recorded in their registers, to get their money, but in vain Every year they recorded the arrears with the expenses to which they were put in their efforts to arrest the defaulters, till at last in 1474 (six years after Gutenberg's death) their names are no longer mentioned

Meantime Gutenberg appears to have been *printing*, as we learn from a document dated February 26, 1468, that a syndic of Mainz, Dr Conrad Homery (who had formerly been in the service of the elector Count Diether of Ysenburg), had at one time supplied him not with money, but with some formes, types, tools, implements and other things belonging to printing, which Gutenberg had left after his death, and which had, and still, belonged to him (Homery); this material had come into the hands of Adolf, the archbishop of Mainz, who handed or sent it back to Homery, the latter undertaking to use it in no other town but Mainz nor to sell it to any person except a citizen of Mainz, even if a stranger should offer him a higher price for the things This material has never yet been identified, so that we do not know what types Gutenberg may have had at his disposal; they could hardly have included the types of the *Catholicon* of 1460, as is suggested, this work being probably executed by Heinrich Bechtermunze (d 1467), who afterwards removed to Eltville, or perhaps by Peter Schoffer, who, about 1470, advertises the book as his property (*See* K Burger, *Buchhändler-Anzeigen*)

It is uncertain whether Gutenberg remained in Mainz or removed to the neighbouring town of Eltville, where he may have been engaged for a while with the brothers Bechtermunze, who printed there for some time with the types of the 1460 *Catholicon* On Jan 17, 1465, he accepted the post of salaried courtier from the archbishop Adolf, and in this capacity received annually a suit of livery together with a fixed allowance of corn and wine Gutenberg seems to have died at Mainz at the beginning of 1468, and was, according to tradition, buried in the Franciscan church in that city. No books bearing the name of Gutenberg as printer are known, nor is any genuine portrait of him known, those appearing upon medals, statues or engraved plates being all fictitious

In 1898 the firm of L Rosenthal, at Munich, acquired a *Missale speciale* on paper, which Otto Hupp, in two treatises published in 1898 and 1902, asserts to have been printed by Gutenberg about 1450, seven years before the 1457 Psalter. Various German bibliographers, however, think that it could not have been printed before 1480, and, judging from the facsimiles published by Hupp, this date seems to be approximately correct.

In 1902 a vellum fragment of an Astronomical Kalendar was discovered by the librarian of Wiesbaden, Dr. G. Zedler (*Die älteste Gutenbergtype*, Mainz, 1902), apparently printed in the 36-line Bible type, and as the position of the sun, moon and other planets described in this document suits the years 1429, 1448 and 1467, he ascribes the printing of this Kalendar to the year 1447. A paper fragment of a poem in German, entitled *Weltgericht*, said to be printed in the 36-line Bible type, appears to have come into the possession of Herr Eduard Beck at Mainz in 1892, and was presented by him in 1903 to the Gutenberg Museum in that city. Zedler published a facsimile of it in 1904 (for the *Gutenberg Gesellschaft*), with a description, in which he places it before the 1447 *Kalendar*, c. 1444–1447 Moreover, fragments of two editions of Donatus different from that of 1451 (?) have recently been found; *see* Schwenke in *Centralbl. fur Bibliothekwesen* (1908)

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GÜTERSLOH, a town in the Prussian province of Westphalia, 11 m S W from Bielefeld by the railway to Dortmund Pop (1925) 22,138 It is a seat of the cotton industry, and has a large trade in Westphalian hams and sausages Printing, brewing and distilling are also carried on, and the town is famous for its rye-bread (*Pumpernickel*)

GUTHRIE, SIR JAMES (1859–), Scottish painter, and one of the leaders of the Glasgow School, was born at Greenock. In his early works, such as "The Gipsy Fires are Burning, for Daylight is Past and Gone" (1882), and the "Funeral Service in the Highlands," he favoured a thick impasto, but with growing experience he used his colour with greater economy and reticence. Subsequently he devoted himself almost exclusively to portraiture. He was elected A R.S.A in 1888, R S A in 1892, P R S A in 1902, and was knighted in 1903 He was trustee of the National Galleries of Scotland from 1906 to 1920. His painting "Schoolmates" is at the Ghent gallery. Among his most successful portraits are those of his mother, Major Hotchkiss, Professor Jack, and Mrs Watson

GUTHRIE, THOMAS ANSTEY (1856–), known by the pseudonym of F. Anstey, English novelist and playwright, was born in Kensington, London. He was educated at King's college, London, and at Trinity Hall, Cambridge, and was called to the bar in 1880 The popular success of his story *Vice-Versa* (1882), with its topsy-turvy substitution of a father for his schoolboy son, made his reputation, which was further confirmed by *The Black Poodle* (1884), *The Tinted Venus* (1885), *The Fallen Idol* (1886) and other works. On the stage his best piece was *The Man from Blankley's* (1901)

GUTHRIE, a city of Oklahoma, U.S.A, near the Cimarron river, 30m N. of Oklahoma city, the county seat of Logan county. It is on Federal highway 77, has an airport (50ac) and is served by the Fort Smith and Western, the Oklahoma (electric) and the Santa Fe railways The population was 11,757 in 1920 (20% negroes), and was estimated locally at 15,000 in 1928 Guthrie is the trade centre for a large and productive agricultural region, specializing chiefly in fruit, poultry-raising and dairying It has sundry manufacturing industries (with an output in 1925 valued at $1 241,367) including the first cotton mill established in the State. There are several deep mineral springs in the city, and numerous oil-wells in the county Guthrie was founded in 1889, when Oklahoma was opened to settlement. It was the capital of the territory and the State from 1890 to 1910.

GUTHRUM (GODRUM) (d 890), king of East Anglia, first appears in the *English Annals* in the year 875, when he is mentioned as one of three Danish kings who went with the host to Cambridge He was probably engaged in the campaigns of the next three years, and after Alfred's victory at Edington in 878, Guthrum met the king at Aller in Somersetshire and was baptized there under the name of Aethelstan He stayed there for twelve days and was greatly honoured by his godfather Alfred. In 890

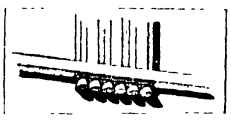
Guthrum-Aethelstan died: he is then spoken of as "se norðerna cyning" (probably) "the Norwegian king," referring to the ultimate origin of his family, and we are told that he was the first (Scandinavian) to settle East Anglia. Guthrum is perhaps to be identified with Gormr (= Guthrum) hinn heimski or hinn riki of the Scandinavian sagas, the foster-father of Hörðaknutr, the father of Gorm the old. There is a treaty known as the peace of Alfred and Guthrum. For details of the struggle with the English *see* ALFRED

GUTSCHMID, ALFRED, BARON VON (1835–1887), German historian and orientalist, was born on July 1, 1835 at Loschwitz (Dresden). After holding chairs at Kiel (1866), Konigsberg (1873), and Jena (1876), he was finally appointed professor of history at Tubingen, where he died on March 2, 1887. He devoted himself to the study of Eastern language and history in its pre-Greek and Hellenistic periods and contributed largely to the literature of the subject. Of his numerous works the best-known is his *Geschichte Irans* (Alexander the Great to the fall of the Arsacidae) (Tubingen, 1887). He wrote on Persia and Phoenicia in the 9th edition of the *Encyclopædia Britannica*. (*See* LANGUAGE AND WRITING.)

A collection of minor works entitled *Kleine Schriften* was published by F. Rühl at Leipzig (1889–94, 5 vols.), with complete list of his writings.

GUTS-MUTHS, JOHANN CHRISTOPH FRIEDRICH (1759–1839), German teacher and the principal founder of the German school system of gymnastics, was born at Quedlinburg on Aug. 9, 1759, and died on May 31, 1839. It was chiefly through his books on the subject that gymnastics came to occupy such an important position in the school system of Germany.

His principal works are *Gymnastik fur die Jugend* (1793); *Spiele zur Übung und Erholung des Korpers und Geistes fur die Jugend* (1796), *Turnbuch* (1817); *Handbuch der Geographie* (1810); and a number of books constituting a *Bibliothek fur Padagogik, Schulwesen, und die gesammte padagogische Literatur Deutschlands*



GUTTA, in architecture, one of the small, conical or cylindrical forms carved on the under side of the mutules (*q.v.*), or flat projections on the under side of the Doric cornice; they also appear beneath the upper member of the architrave (*q.v.*), directly below each triglyph (*q.v.*).

GUTTA PERCHA, the name applied to the evaporated milky fluid or latex furnished by several trees chiefly found in the islands of the Malay Archipelago

Botanical Origin and Distribution.—The best gutta percha of Malaya was chiefly derived from two trees belonging to the family Sapotaceae. They are *Palaquium Gutta*, now no longer cultivated and *P. oblongifolia*. Allied trees of the same genus and of the same family yield similar but usually inferior products. Among them may be mentioned species of *Payena*.

Gutta percha trees often attain a height of 70 to 100ft. and the trunk has a diameter of from 2 to 3 feet. They are stated to be mature when about thirty years old. The leaves of *Palaquium*, which are obovate-lanceolate, with a distinct pointed apex, occur in clusters at the end of the branches, and are bright green and smooth on the upper surface but on the lower surface are yellowish-brown and covered with silky hairs. The leaves are usually about 6in. long and about 2in. wide at the centre. The flowers are white, and the seeds are contained in an ovoid berry about 1in. long.

The gutta percha tree is almost entirely confined to the Malay Peninsula and its immediate neighbourhood. It includes a region within 6 degrees north and south of the equator and 93°–119° longitude, where the temperature ranges from 66° to 90° F. and the atmosphere is exceedingly moist. The trees may be grown from seeds or from cuttings.

Preparation of Gutta Percha.—The gutta is furnished by the greyish milky fluid, the latex, chiefly secreted in cylindrical vessels or cells in the cortex. Latex also occurs in the leaves of the tree and may be removed from the powdered leaves by the use of appropriate solvents, but the process is not practicable commercially. The latex flows slowly where an incision is made through the bark, but not nearly so freely as the india-rubber latex. On this account the Malays usually fell the tree to collect the latex, which is done by chopping off the branches and removing circles of the bark, forming cylindrical channels about an inch wide at various points about a foot apart down the trunk. The latex exudes and fills these channels, from which it is removed and converted into gutta by boiling in open vessels over wood fires. The work is usually carried on in the wet season when the latex is more fluid and more abundant. Sometimes when the latex is thick water is added before boiling. The best results are said to be obtained from mature trees which furnish about 2 to 3lb. of gutta.

The Chinese and Malays appear to have been acquainted with the characteristic property of gutta percha of softening in warm water and of regaining its hardness when cold, but this plastic property seems to have been utilized only for ornamental purposes, the construction of walking-sticks, of knife handles and whips, etc. The brothers Tradescant brought samples of the curious material to Europe about the middle of the 17th century.

Characters and Properties.—Gutta percha appears in commerce in the form of blocks or cakes of a dirty greyish appearance, often exhibiting a reddish tinge, and just soft enough to be indented by the nail. It is subject to considerable adulteration. It is solid, fibrous in texture, hard and inelastic, but not brittle at ordinary temperature, becomes plastic when immersed in hot water or otherwise raised to a temperature of about 65°–66° C.—in the case of gutta of the first quality, the temperature of softening being dependent on the quality of the gutta employed. In this condition it can be drawn out into threads, but is still inelastic. On cooling again the gutta resumes its hardness without becoming brittle. In this respect gutta percha differs from india-rubber or caoutchouc, which does not become plastic and unlike gutta percha is elastic. This property of softening on heating and solidifying when cooled again, without change in its original properties, enables gutta percha to be worked into various forms, rolled into sheets or drawn into ropes. The specific gravity of the best gutta percha lies between 0·96 and 1. Gutta percha is dissolved by the liquids which dissolve rubber such as carbon disulphide and chloroform, and light petroleum when hot. Gutta percha is not affected by alkaline solutions or by dilute acids. Strong sulphuric acid chars it when warm, and nitric acid effects complete oxidation. When exposed to air and light, gutta percha rapidly deteriorates, oxygen being absorbed, producing a brittle resinous material.

Chemical Composition.—Chemically, gutta percha is a mixture of several constituents. The proportions in the crude material are not constant. For electrical purposes it should have a high insulating power and dielectric strength and a low inductive capacity; the possession of these properties is influenced by the resinous constituents present.

The principal constituent of the crude material is a hydrocarbon of the empirical formula C_5H_8. It is therefore isomeric with the hydrocarbon of caoutchouc. Accompanying this are at least two oxygenated resinous constituents—albanes and fluavils—which can be separated from the gutta by solvents. Pure gutta is not dissolved by ether and light petroleum in the cold, whereas the resinous constituents are removed by these liquids. The true gutta exhibits in an enhanced degree the valuable properties of gutta percha, and the commercial value of the raw material is frequently determined by ascertaining the proportion of true gutta percha. When distilled at a high temperature, gutta percha like india-rubber is resolved into a mixture of simpler hydrocarbons, isoprene (C_5H_8) and hydrocarbons of higher boiling point containing $C_{10}H_{16}$ and $C_{30}H_{48}$. Alban has been described as a mixture of resins, white in colour and soluble in hot alcohol. Fluavil is a yellow amorphous resin which dissolves in cold alcohol.

Trade in Gutta Percha.—The imports of gutta percha and balata into the United Kingdom for home consumption in recent years have been in centals of 100 lb., as follows:

1925	96,300	1926	74,700	1927	42,000

The fall in imports shown in these figures was continued in 1928.

GUTTER, in architecture, a horizontal channel or trough contrived to carry away the water from a flat or sloping roof to its discharge down a vertical pipe or through a spout or gargoyle; more specifically, but loosely, the similar channel at the side of a street. In Greek and Roman temples the cymatium of the cornice was the gutter, and the water was discharged through the mouths of carved lions' heads. In mediaeval work the gutter rested on the top of the wall or on a corbel table, and the water was discharged through gargoyles. Sometimes, however, a parapet or pierced balustrade was carried outside the gutter. In many buildings the parapet is only a continuation of the wall below, and the gutter is set back and carried in a trough resting on the lower end of the roof timbers. The most practical form is an eaves gutter which projects more or less in front of the wall and is secured to and carried by the rafters of the roof. In French Renaissance work the gutter is frequently concealed behind a rich cresting in stone, lead or copper at the edge of the main cornice. (*See* also LIGHT CASTINGS INDUSTRY.)

GUTZKOW, KARL FERDINAND (1811–1878), German novelist and dramatist, was born on March 17, 1811 at Berlin. In 1832 he published anonymously at Hamburg his *Briefe eines Narren an eine Närrin*, and in 1833 appeared at Stuttgart *Maha-Guru, Geschichte eines Gottes*, a fantastic and satirical romance. In 1835 he went to Frankfort, where he founded the *Deutsche Revue*. In the same year appeared *Wally, die Zweiflerin*, an attack on marriage which marks the beginning of the revolt of "Young Germany" against romanticism. He was violently attacked by Wolfgang Menzel (*q.v.*), and the Federal Diet condemned Gutzkow to three months' imprisonment and decreed the suppression of all he had written or might yet write. During his term of imprisonment at Mannheim, Gutzkow wrote his treatise *Zur Philosophie der Geschichte* (1836). On his release he produced *Richard Savage* (1839), a play which immediately made the round of all the German theatres. Of his numerous other plays a few have kept a place in the German repertory. In 1847 Gutzkow went to Dresden, where he succeeded Tieck as literary adviser to the court theatre. Meanwhile he had written the novels *Seraphine* (1838) and *Blasedow und seine Söhne* (1838), a satire on the educational theories of the time. Between 1850 and 1852 appeared *Die Ritter vom Geiste*, which may be regarded as the starting-point for the modern German social novel. *Der Zauberer von Rom* is a powerful study of Roman Catholic life in southern Germany. Gutzkow then established a journal on the model of Dickens' *Household Words*, entitled *Unterhaltungen am häuslichen Herd* (1852–62). He died on Dec. 16, 1878. Gutzkow exerted a powerful influence on the opinions of modern Germany; and his works reflect the intellectual and social struggles of his time.

An edition of Gutzkow's collected works appeared at Jena (1873–76, new ed., 1879). E. Wolff has published critical editions of Gutzkow's *Meisterdramen* (1892) and *Wally die Zweiflerin* (1905). His more important novels have been frequently reprinted. For Gutzkow's life *see* his various autobiographical writings such as *Aus der Knabenzeit* (1852), *Rückblicke auf mein Leben* (1876), etc. For an estimate of his life and work *see* J. Proelss, *Das junge Deutschland* (1892); H. H. Houben, *Studien über die Dramen Gutzkows* (1908); *Gutzkow-Funde* (1901), and other monographs on various aspects of Gutzkow; E. Metis, *Karl Gutzkow als Dramatiker* (1915).

GÜTZLAFF, KARL FRIEDRICH AUGUST (1803–1851), German missionary to China, was born at Pyritz in Pomerania on July 8, 1803. After serving as a missionary in Java and Siam, he went to China, and there translated the Bible into Chinese, published a Chinese monthly magazine, and wrote in Chinese various books on subjects of useful knowledge. In 1834 he published a *Journal of Three Voyages along the Coast of China in 1831, 1832 and 1833*. He was appointed in 1835 joint Chinese secretary to the English commission, and during the opium war of 1840–42 and the negotiations connected with the peace his knowledge of the country and people made him extremely useful. Gützlaff in 1844 founded an institute for training native missionaries. He died at Hong Kong on Aug. 9, 1851.

Gützlaff also wrote *A Sketch of Chinese History, Ancient and Modern* (London, 1834), and a similar work published in German at Stuttgart in 1847; *China Opened* (1838); and the *Life of Taou-Kwang* (1851; German edition published at Leipzig in 1852). There is a complete collection of his Chinese writings in the Munich library.

GUY, THOMAS (1644–1724), founder of Guy's hospital, London, was the son of a lighterman and coal-dealer at Southwark. After an apprenticeship of eight years with a bookseller, he, in 1668, began business on his own account. He dealt largely in Bibles, which were poorly and incorrectly printed in England. These he at first imported from Holland, but subsequently obtained from the University of Oxford the privilege of printing. He died on Dec. 17, 1724. In 1707 he built three wards of St. Thomas's hospital. He erected Guy's hospital, leaving for its endowment £219 449, and endowed other charities. He was M.P. for Tamworth from 1695 to 1707.

See *A True Copy of the Last Will and Testament of Thomas Guy, Esq.* (1725), C. Knight, *Shadows of the Old Booksellers*, pp. 3–23 (1865), S. Wilkes and G. T. Bettany, *A Biographical History of Guy's Hospital* (1892).

GUYAU, JEAN MARIE (1854–1888), French philosopher, was born on Oct. 28, 1854, at Laval and died on March 31, 1888, at Mentone. Ill-health required him to resign his professorship at the Lycée Condorcet and to live in the French Sudan where he devoted himself to questions of aesthetics, ethics and religious philosophy. His chief works are: *Mémoire sur la Morale utilitaire, depuis Epicure jusqu'à l'école anglaise* (1878, 7th ed. 1913); *Esquisse d'une morale sans obligation ni sanction* (1885, 2nd. ed. 1890) and *L'irréligion de l'avenir* (1887, 7th ed. 1904).

See H. Höffding, *Modern Philosophers* (1905), G. Aslan, *La morale selon Guyau* (1906), and E. Bergmann, *Die Philosophie Guyaus* (1912).

GUYNEMER, GEORGES (1894–1917), French aviator, born in Paris on Dec. 24, 1894, was the most famous of all the aviators on the French side in the World War. His courage, his gaiety, his 53 victories over enemy aviators, and his death in a battle in the air above Poelcapelle on Sept. 11, 1917 made him a popular hero. For the story of his brief life *see* H. Bordeaux, *Le chevalier de l'air, Guynemer* (1919).

GUY OF WARWICK, English hero of romance. Guy, son of Siward or Seguard of Wallingford, by his prowess in foreign wars wins in marriage Félice (the Phyllis of the well-known ballad), daughter and heiress of Roalt, earl of Warwick. Soon after his marriage, seized with remorse for the violence of his past life, he leaves his wife and fortune to make a pilgrimage to the Holy Land. After years of absence he returns in time to deliver Winchester for King Aethelstan from the invading northern kings, Anelaph (Anlaf or Olaf) and Gonelaph, by slaying in single fight their champion, the giant Colbrand. Local tradition fixes the duel at Hyde Mead near Winchester. Making his way to Warwick he becomes one of his wife's bedesmen, and retires to a hermitage in Arden, only revealing his identity at the approach of death. The versions of the Middle English romance of Guy which we possess are adaptations from the French, and open with a long recital of Guy's wars in Lombardy, Germany and Constantinople. The kernel of the tradition evidently lies in the fight with Colbrand, which may represent an historical fact. If so, the Anlaf of the story is probably Olaf Tryggvason, who, with Sweyn of Denmark, harried the southern counties of England in 993 and pitched his winter quarters in Southampton. Winchester was saved, however, not by the valour of an English champion, but by the payment of money. This Olaf was not unnaturally confused with Anlaf Cuaran or Havelok (*q.v.*). Guy's Cliffe, near Warwick, where in the 14th century Richard de Beauchamp, earl of Warwick, erected a chantry, with a statue of the hero, does not correspond with the site of the hermitage as described in the romance. The bulk of the legend is obviously fiction.

The French romance (Harl. ms. 3,775) is described by Émile Littré in *Hist. litt. de la France* (xxii., 841–851, 1852). A French prose version was printed in Paris, 1525, and subsequently (*see* G. Brunet, *Manuel du libraire, s.v.* "Guy de Warvich"); the English metrical romance exists in four versions, dating from the early 14th century; the text was edited by J. Zupitza (1875–76) for the E.E.T.S. (extra series, Nos. 42, 49, 59). The popularity of the legend is shown by the numerous versions in English, such

as *Guy of Warwick*, translated from the Latin of Girardus Cornubiensis (*fl.* 1350) into English verse by John Lydgate between 1442 and 1468. *See* also an article by S. L. Lee in the *Dictionary of National Biography*.

GUYON, JEANNE MARIE BOUVIER DE LA MOTHE (1648–1717), French quietist writer, was born of good family at Montargis on April 13, 1648. She attended various convent schools, and in 1664 married a rich invalid of the name of Guyon, many years her senior. Twelve years later he died, leaving his widow with three small children and a considerable fortune.

Her attraction towards the mystical life was developed by her spiritual director, Father Lacombe, a Barnabite monk of weak character and unstable intellect, and from 1681 the two rambled about together in Savoy and the south-east of France, spreading their mystical ideas. At last they excited the suspicion of the authorities; in 1686 Lacombe was recalled to Paris, put under surveillance, and was finally sent to the Bastille in 1687. He was presently transferred to the castle of Lourdes, where he died in 1715.

Meanwhile Madame Guyon had been arrested in 1688, but was delivered in the following year by her old friend, the duchesse de Béthune, who had become a power in the devout court-circle presided over by Madame de Maintenon. Before long Madame Guyon herself was introduced into this pious assemblage where she displayed her charm and eloquence. She became friendly with Fénelon, now a rising young spiritual director. Between 1689 and 1693 they corresponded regularly.

Meanwhile similar reports had strained her relationship with Madame de Maintenon, and to clear her orthodoxy, Madame Guyon appealed to Bossuet, who decided that her books contained "much that was intolerable, alike in form and matter." Madame Guyon promised to "dogmatize no more," and disappeared into the country (1693). In the next year she again petitioned for an inquiry, and was eventually sent to Bossuet's cathedral town of Meaux. She soon left without his leave, bearing with her a certificate of orthodoxy signed by him. Bossuet regarded this flight as an act of disobedience; in the winter Madame Guyon was arrested and shut up in the Bastille. There she remained till 1703. In that year she was liberated, on condition she would live on her son's estate near Blois, under the eye of a stern bishop. Here the rest of her life was spent in charitable and pious exercises; she died on June 9, 1717. In France she has often been reckoned an hysterical degenerate; in England and Germany she has as often roused enthusiastic admiration.

Bibliography.—Mme. Guyon's complete works appeared in 40 vols. (1767–91). There are English translations of her autobiography by T. T. Allen (2 vols., 1897), of her *Spiritual Torrents* by A. W. Marston (1908), of her *Mystical Sense of Sacred Scriptures* by T. W. Duncan (1872), of her *Method of Prayer* by D. Mactadyen (1902) and of her select poems by W. Cowper (1801). *See* T. C. Upham, *Life of Mme. Guyon* (new ed., 1905); M. Masson, *Fénelon et Mme. Guyon, Documents nouveaux et inédits* (1907) and E. Seillière, *Mme. Guyon et Fénelon* (1918). *See* also Quietism; and H. Delacroix, *Études d'histoire et de psychologie sur le mysticisme* (Paris, 1908).

GUYON, RICHARD DEBAUFRE (1803–1856), British soldier, general in the Hungarian revolutionary army and Turkish pasha, was born at Walcot, near Bath, in 1803. After receiving a military education in England and in Austria he entered the Hungarian hussars in 1823. At the outbreak of the Hungarian War in 1848, he re-entered active service as an officer of the Hungarian Honvéds, and he won great distinction in the action of Sukoro (Sept. 20, 1848) and the battle of Schwechat (Oct. 30). He served in important and sometimes independent commands to the end of the war, after which he escaped to Turkey. In 1852 he entered the service of the sultan. He was made a pasha and lieutenant-general without being required to change his faith, and fought in the campaign against the Russians in Asia Minor (1854–55). General Guyon died of cholera at Scutari on Oct. 12, 1856.

See A. W. Kinglake, *The Patriot and the Hero General Guyon* (1856).

GUYOT, ARNOLD HENRY (1807–1884), Swiss-American geologist and geographer, was born at Boudevilliers, near Neuchâtel, Switzerland, on Sept. 28, 1807. Before coming to the United States in 1848, he studied at the college of Neuchâtel and in Germany, where he began a lifelong friendship with Louis Agassiz. He was professor of geology and physical geography at Princeton from 1854 until his death on Feb. 8, 1884. He was ranked high as a geologist and meteorologist. His extensive meteorological observations in America led to the establishment of the U.S. weather bureau, and his *Meteorological and Physical Tables* (1852, revised edition 1884) were long standard. His text books and wall maps aided in popularizing and extending geological study in America.

As early as 1838 he undertook, at Agassiz's suggestion, the study of glaciers, from which he announced for the first time certain important observations relating to glacial motion and structure. Among other things he noted the more rapid flow of the centre than of the sides, and the more rapid flow of the top than of the bottom of glaciers; described the laminated or "ribboned" structure of the glacial ice, and ascribed the movement of glaciers to a gradual molecular displacement rather than to a sliding of the ice mass as held by de Saussure. He subsequently collected important data concerning erratic boulders.

His principal publications, in addition to text books, were: *Earth and Man, Lectures on Comparative Physical Geography in its Relation to the History of Mankind* (translated by Professor C. C. Felton, 1849); *A Memoir of Louis Agassiz* (1883); and *Creation, or the Biblical Cosmogony in the Light of Modern Science* (1884).

See James D. Dana's "Memoir" in the *Biographical Memoirs of the National Academy of Science*, vol. ii. (Washington, 1886).

GUYOT, YVES (1843–1928), French politician and economist, was born at Dinan on Sept. 6, 1843. Educated at Rennes, he took up the profession of journalism, coming to Paris in 1867. He was for some time editor-in-chief of *L'Indépendant du midi* of Nîmes, joined the staff of *La Rappel* on its foundation, and worked on other journals. He waged a keen campaign against the prefecture of police, for which he suffered six months' imprisonment. He entered the chamber of deputies in 1885 as representative of the first arrondissement of Paris and was *rapporteur général* of the budget of 1888. He was minister of public works from 1889 to 1892. He lost his seat in the election of 1893 owing to his militant attitude against Socialism. An uncompromising free-trader, he published *La Comédie protectionniste* (1905; Eng. trans. *The Comedy of Protection*); *La Science économique* (1st ed. 1881; 3rd. ed. 1907); *La Prostitution* (1882); *La Tyrannie socialiste* (1893), all three translated into English; *Les Conflits du travail et leur solution* (1903); *La Démocratie individualiste* (1907). Other important works are *Études de physiologie sociale* (6 vols., 1882–1905), and *La Gestion par l'état et les municipalités* (1913). Guyot died on Feb. 21, 1928.

GUYTON DE MORVEAU, LOUIS BERNARD, Baron (1737–1816), French chemist, was born on Jan. 4, 1737, at Dijon. He studied law at Dijon, and became advocate-general in the *parlement*, until 1782. He devoted his leisure to chemistry, and in 1772 published *Digressions académiques*, containing his views on phlogiston, crystallization, etc. An essay on chemical nomenclature in the *Journal de physique* for May 1782 was developed, with the aid of A. L. Lavoisier, C. L. Berthollet and A. F. Fourcroy, into the *Méthode d'une nomenclature chimique* (1787), the principles of which were adopted by chemists throughout Europe. He adopted Lavoisier's views on combustion and published his reasons in the first volume of the section "Chymie, Pharmacie et Metallurgie" of the *Encyclopédie méthodique* (1786), the chemical articles in which were written by him. In 1791 he was elected member of the Legislative Assembly, and in 1792 and 1795 of the Convention. He was master of the mint from 1800 to 1814. In 1811 he was made baron of the French empire. He died in Paris on Jan. 2, 1816.

In addition to many scientific papers, Guyton wrote *Mémoire sur l'éducation publique* (1762); a satirical poem entitled *Le Rat iconoclaste, ou le Jésuite croqué* (1763); *Discours publics et éloges* (1775–82); *Plaidoyers sur plusieurs questions de droit* (1785); and *Traité des moyens de désinfecter l'air* (1801), describing the disinfecting powers of chlorine, and of hydrochloric acid gas which he had successfully used at Dijon in 1773. With Hugues Maret (1726–1785) and Jean François Durande (d. 1794) he also published the *Élémens de chymie théorique et pratique* (1776–1777).

GUZMÁN BLANCO, ANTONIO (1829–1899), Venezuelan soldier and statesman, was born on Feb. 29, 1829, in Carácas. Venezuela, where his father, Antonio Leocardio Guzmán, had held important offices in the Governments of Bolívar and Páez. Guzmán Blanco received the degree of licenciate of jurisprudence in the university, and afterwards travelled in the United States, where he represented his country in several capacities, notably as secretary to the Venezuelan legation in Washington. In 1859 he returned to Venezuela to take part in a revolution under Gen. Falcón which was finally successful in 1863. Under the new Government he was vice president, minister of the treasury and minister for foreign affairs During the period from 1863 to 1868 he acted several times as president *ad interim*, as commander of the army, and as special finance commissioner to Europe, and displayed in each capacity extraordinary energy and ability. In 1868, while he was in Europe, the Falcón Government was overthrown. In Feb. 1870, he headed a counter revolt, set up a dictatorship (April 1870) and after more than two years of civil war, was elected constitutional president on Feb. 20, 1873. Re-elected in 1880, 1882 and 1886, though frequently away, he retained absolute control of the Government until 1888.

Guzmán Blanco's rule was arbitrary, his policy was corrupt and his methods were harsh, but under his régime, Venezuela experienced a renaissance. He reorganized the Government, asserted the national prestige, enforced security of life and property, placed the finances on a sound footing, broke the power of the church, established primary education, sponsored immigration, constructed railways and roads and spent immense sums on public works A revolt broke out, however, against him in the capital in 1889, during the presidency of Rojas-Paul Guzmán Blanco was in Europe, the Government repudiated his authority and the army deserted him. He never returned to Venezuela, and on July 30, 1899, died in Paris.

No authoritative life of Guzmán Blanco has yet appeared but interesting chapters on the man and his career will be found in W. E Curtis' *Venezuela* (New York, 1896); and Alfred Deberle's *The History of South America* (New York, 1899). (W. B. P)

GUZMICS, IZIDOR (1786–1839), Hungarian theologian, was born on April 7, 1786, at Vámos-Család He became a Benedictine, and after studying at Pesth, in 1816 settled at the monastery at Pannonhegy, where he devoted himself to dogmatic theology and literature, and contributed largely to Hungarian periodicals. In 1832 he was appointed abbot at Bakonybél. He died on Sept. 1, 1839. Guzmics' chief work is *Theologia Christiana fundamentalis et theologia dogmatica* (4 vols., Györ, 1828–29).

GWADUR, a port on the Mekran coast of Baluchistan, about 290 m. W. of Karachi. Pop. (1903) 5,000. In the last half of the 18th century it was handed over by the khan of Kalat to the sultan of Muscat, who still exercises sovereignty over the port, together with about 300 sq m. of the adjoining country. It is a place of call for the steamers of the British India Steam Navigation Company.

GWALIOR, one of the five leading Indian States, and the dominion of the Sindhia family of Mahrattas. The State consists of two well-defined parts which may roughly be called the northern and the southern. The former is a compact mass of territory, bounded north and north-west by the Chambal river, and wedged in between Rajputana and British territory The southern, or Malwa, portion is made up of detached or semi-detached districts, between which are interposed parts of other States, which again are mixed up with each other in bewildering intricacy. The two portions have a total area of 26,357 sq.m. Pop. (1921), 3,186,075.

Physical Characters.—The State may be divided into plain, plateau and hilly country. The plain country extends from the Chambal river southwards for about 80 m., with a maximum width from east to west of about 120 miles. This plain, though broken in its southern portion by low hills, has generally an elevation of only a few hundred feet above sea-level, and endures great heat, though the rainfall is good South of this tract there is a gradual ascent to the Central India plateau, and at Sipri the general level is 1,500 ft. above the sea; the elevation giving this region a moderate climate during the summer as compared with the plain country, while the winter is warmer and more equable. The hilly portion of the State lies in the Bhil country and comprises only the small district of Amjhera, among the Vindhya mountains. Of these three natural divisions the plateau possesses the most fertile soil, generally of the kind known as "black cotton," but the low-lying plain has the densest population. The State is watered by numerous rivers The Nerbudda, flowing west, forms the southern boundary. The greater part of the drainage is discharged into the Chambal, which forms the north-western and northern and eastern boundary. The Sind, with its tributaries the Kuwari, Asar and Sankh, flows through the northern division.

Crops and Industries.—The chief products are wheat, millets, pulses of various kinds, maize, rice, linseed and other oil-seeds, sugar-cane, cotton, tobacco, indigo, garlic, turmeric and ginger. The chief industry is cotton, and the State abounds in gins, presses and spinning factories. The late maharajah pursued an enlightened policy of developing the economic wealth of his State, by the encouragement of industries, the establishment of a fine irrigation system, and a network of light railways. The revenue of the State is about £1,400,000, and it lent three millions to the Government of India for railway construction. The State maintains a large force of imperial service troops, and the late maharajah saw service in the expedition to China. The present ruler is a minor, his salute is 21 guns.

Buildings.—Commanding the city and surrounding country is the magnificent fort, one of the most impressive of the mediaeval strongholds in India It crowns a precipitous isolated rock of sandstone, about 1½ m in length, but at no point more than 900 yd. broad, and averaging about 300 ft. in height. Its military strength is written in its long and chequered history; its chief interest now lies in the group of splendid palaces and temples which have grown up within its walls, and in the marvellous Jain sculptures on the rock-face below them Of the palaces, that which was built by Man Singh (1486–1516) exemplifies the best Hindu architecture of its class in India. Its massive towers and latticed battlements vie in beauty with the internal scheme of decoration in enamelled tiles The Karan palace, which adjoins it, is singularly interesting in the devices which the Hindu architect adopted to secure the effect of the Mohammedan vault, its domed roof being supported on eight carved ribs, which intersect and form a flat square. Between these two lies a third Hindu palace, and two others of less interest were added by Delhi emperors. The group is unequalled for picturesque beauty by anything in central India. Of the temples, the pair known as *Sas-bahu* (mother-in-law and daughter-in-law), date from A.D. 1093, and stand on richly carved plinths. The *Teli-ka-Mandir* (oilman's temple) is 11th century work, and was originally constructed as a Vishnavite shrine, but was afterwards converted to Saivite uses.

Of the Jain remains, the most striking are the unique series of sculptures excavated out of the solid rock under the fortress. There are caves and caverns, often occupied by ascetics; deep niches for statues; and several groups of gigantic figures One colossus is 57 ft. high; and the south-west group, occupying half-a-mile of cliff, has a number of figures from 20 to 30 ft. in height. From the accompanying inscriptions they appear to have been all constructed between A.D. 1441 and 1474, and they were badly mutilated 50 years later by order of the emperor Baber. The city consists of the old town, lying under the north end of the rock, and the new town of Lashkar to the south of the fort.

The old town is in decay, but has a beautiful mosque and the tomb of Ghaus Mohammed, a fine specimen of early Mogul architecture. Lashkar dates from the beginning of the 19th century, and has some handsome streets and buildings. Besides the maharaja's palaces and the houses of the chief nobles, there are the Victoria college, hospitals for men and women, a museum, paper mills and a printing press. A few miles east of the fort is the cantonment of Movar. Like the fort, it used to be garrisoned by British troops, but in 1886 was handed over to Gwalior in exchange for Jhansi fort and a strip of territory along the west of the Jhansi district. The population of the city as a whole was 80,387 in 1921.

History.—The Sindhia family, the rulers of the Gwalior state, belong to the Mahratta nation. Their first appearance in Central India was early in the 18th century in the person of Ranoji (d. 1745). In 1726, together with Malhar Rao Holkar, the founder of the house of Indore, he was authorized by the peshwa to collect tribute (*chauth*) in the Malwa districts He established his headquarters at Ujjain, which thus became the first capital of Sindhia's dominions.

Ranoji's son and successor, Jayapa Sindhia, was killed at Nagaur in 1759, and was succeeded by his son Jankoji Sindhia. But the real founder of the state of Gwalior was Mahadji Sindhia, a natural son of Ranoji, who, after narrowly escaping with his life from the terrible slaughter of Panipat in 1761 (when Jankoji was killed), obtained a re-grant of his father's possessions in Central India (1769). During the struggle which followed the death of Madhu Rao Peshwa in 1772 Mahadji seized every occasion for extending his power and possessions In 1775, however, when Raghuba Peshwa threw himself on the protection of the British, the reverses which Mahadji encountered at their hands—Gwalior being taken by Major Popham in 1780—opened his eyes to their power. By the treaty of Salbai (1782) it was agreed that Mahadji should withdraw to Ujjain, and the British retire north of the Jumna. Mahadji, who undertook to open negotiations with the other belligerents, was recognized as an independent ruler, and a British resident was established at his court. Mahadji, aided by the British policy of neutrality, now set to work to establish his supremacy over Hindustan proper Mahadji's disciplined troops made him invincible In 1785 he re-established Shah Alam on the imperial throne at Delhi. In 1788 he took advantage of the cruelties practised by Ghulam Kadir on Shah Alam, to occupy Delhi, where he established himself as the protector of the aged emperor. Though nominally a deputy of the peshwa he was now ruler of a vast territory, including the greater part of Central India and Hindustan proper, while his lieutenants exacted tribute from the chiefs of Rajputana.

Mahadji died in 1794, and was succeeded by his adopted son, Daulat Rao Sindhia, a grandson of his brother Tukoji When, during the period of unrest that followed the deaths of the peshwa, Madhu Rao II., in 1795 and of Tukoji Holkar in 1797, the Mahratta leaders fought over the question of supremacy, the peshwa, Baji Rao II., the titular head of the Mahratta confederation, fled from his capital and placed himself under British protection by the treaty of Bassein (December 31, 1802). This interposition of the British government was resented by the confederacy, and it brought on the Mahratta War of 1803. In the campaign that followed a combined Mahratta army, in which Daulat Rao's troops furnished the largest contingent, was defeated by General Arthur Wellesley at Assaye and Argaum in Central India; and Lord Lake routed Daulat Rao's European-trained battalions in Northern India at Agra, Aligarh and Laswari. Daulat Rao was then compelled to sign the treaty of Sarji Anjangaon (December 30, 1803), which stripped him of his territories between the Jumna and Ganges, the district of Broach in Gujarat and other lands in the south. By the same treaty he was deprived of the forts of Gwalior and Gohad; but these were restored by Lord Cornwallis in 1805, when the Chambal river was made the northern boundary of the state. By a treaty signed at Burhanpur in 1803 Daulat Rao further agreed to maintain a subsidiary force, to be paid out of the revenues of the territories ceded under the treaty of Sarji Anjangaon. When, however, in 1816 he was called upon to assist in the suppression of the Pindaris, though by the treaty of Gwalior (1817) he promised his co-operation, his conduct was so equivocal that in 1818 he was forced to sign a fresh treaty by which he ceded Ajmere and other lands.

Daulat Rao died without issue in 1827, and his widow, Baiza Bai (d. 1862), adopted Mukut Rao, a boy of eleven belonging to a distant branch of the family, who succeeded as Jankoji Rao Sindhia. His rule was weak and, in 1843, he was succeeded by another boy, adopted by his widow, Tara Bai, under the name of Jayaji Rao Sindhia The growth of turbulence and misrule now induced Lord Ellenborough to interpose, and a British force under Sir Hugh Gough advanced upon Gwalior (December 1843). The Mahratta troops were defeated simultaneously at Maharajpur and Punniar (December 29), with the result that the Gwalior Government signed a treaty ceding territory with revenue sufficient for the maintenance of a contingent force to be stationed at the capital. In 1857 the Gwalior contingent joined the mutineers; but the maharaja himself remained loyal to the British, and fled from his capital until the place was retaken and his authority restored by Sir Hugh Rose (Lord Strathnairn) on June 19, 1858. He was rewarded with the districts of Neemuch and Amjhera, but Gwalior fort was occupied by British troops and was only restored to his son in 1886 by Lord Dufferin. Jayaji Rao, who died in 1886, did much for the development of his state. He was created a G.C.S.I. in 1861, and subsequently became a counsellor of the empress, a G.C B. and C.I E.

His son, the maharaja, Madhava Rao Sindhia, G C S.I., was born in 1877. During his minority the state was administered for eight years by a council of regency. He was entrusted with ruling powers in 1894. The present ruler is H. H. Maharajah George Jivaji Rao Scindis Alijah Bahadur, born in 1916, who succeeded in 1925.

GWATKIN, HENRY MELVILL (1844–1916), English theological scholar, was born at Barrow-on-Soar, Leicestershire, on July 30, 1844, and was educated at Shrewsbury and St. John's College, Cambridge. In 1868 he became a fellow of St. John's, and in 1874 theological lecturer. He succeeded Creighton as Dixie professor of ecclesiastical history at Cambridge (1891). He died at Cambridge on Nov 14, 1916.

His chief works were *Studies of Arianism* (1882); *The Knowledge of God* (1906, the published version of his Gifford lectures); and *Early Church History* (1909).

GWEEDORE, a tourist resort of Co. Donegal, Ireland. The river Clady affords salmon and trout fishing To the east is Mt. Errigal (2,466 feet)

GWILT, JOSEPH (1784–1863), English architect and writer on architecture, was born at Southwark on Jan. 11, 1784, and died at Henley-on-Thames on Sept. 14, 1863. His most valuable work is his *Encyclopaedia of Architecture* (1842). He also wrote on philology and music. His principal buildings were Markree castle, near Sligo, Ireland, and St. Thomas's church at Charlton, Kent.

See Sebastian Gwilt, "Memoir of Joseph Gwilt," *R.I.B.A. Journal,* Feb. 15, 1864.

GWINNETT, BUTTON (*c.* 1735–1777), American merchant, patriot and signer of the Declaration of Independence, was born in Gloucester, England, probably in 1735, and removed to the Colony of Georgia in America sometime before 1765. On Feb. 2, 1776, he was elected a delegate from that colony to the Continental Congress, and as such signed the Declaration of Independence. His name is known to-day chiefly because his autographs are of extreme rarity, and collectors of the signers have forced their value to a high figure. Returning to Georgia he was a member of the convention to frame a new constitution for the State and speaker of the assembly. He was mortally wounded in a duel with Gen. Lachlan McIntosh, and died at his home on St Catherine's island on May 19, 1777.

See C. F. Jenkins, *Button Gwinnett* (1926).

GWYN, NELL (ELEANOR) (1651–1687), English actress, and mistress of Charles II., was born on Feb. 2, 1651, probably in an alley off Drury Lane, London, although Hereford also claims to have been her birthplace. Her father, Thomas Gwyn, appears to have been a broken-down soldier of a family of Welsh origin; her mother lived for some time with her daughter, and was drowned in 1679, apparently when intoxicated, in a pond at Chelsea. Nell Gwyn, who sold oranges in the precincts of Drury Lane Theatre, became an actress at the age of 15, through the influence of the actor Charles Hart and of Robert Duncan or Dungan, an officer of the guards who had interest with the management. Her first recorded appearance on the stage was in 1665 as Cydaria, Montezuma's daughter, in Dryden's *Indian Emperor,* a serious part ill-suited to her. In the following year she was Lady Wealthy in James Howard's comedy *The English Monsieur.* Pepys was delighted with the playing of "pretty, witty Nell," but

when he saw her as Florimel in Dryden's *Secret Love, or the Maiden Queen,* he wrote "so great a performance of a comical part was never, I believe, in the world before" and, "so done by Nell her merry part as cannot be better done in nature" (*Diary*, March 25, 1667). Her success brought her other leading rôles—Bellario, in Beaumont and Fletcher's *Philaster;* Flora, in Rhodes's *Flora's Vagaries*; Samira, in Sir Robert Howard's *Surprisal*; and she remained a member of the Drury Lane company until 1669, playing continuously save for a brief absence in the summer of 1667 when she lived at Epsom as the mistress of Lord Buckhurst, afterwards 6th earl of Dorset (*q.v.*). Her last appearance was as Almahide to the Almanzor of Hart, in Dryden's *The Conquest of Granada* (1670), the production of which had been postponed some months for her return to the stage after the birth of her first son by the king. As an actress Nell Gwyn was largely indebted to Dryden, who seems to have made a special study of her airy, irresponsible personality, and who kept her supplied with parts which suited her She excelled in the delivery of the *risqué* prologues and epilogues which were the fashion.

It was, however, as the mistress of Charles II. that she endeared herself to the public. Partly, no doubt, her popularity was due to the disgust inspired by her rival, Louise de Kéroualle, duchess of Portsmouth, and to the fact that, while the Frenchwoman was a Catholic, she was a Protestant But very largely it was the result of exactly those personal qualities that appealed to the monarch himself. She was *piquante* rather than pretty, short of stature, and her chief beauty was her reddish-brown hair. She was illiterate, and with difficulty scrawled an awkward E G. at the bottom of her letters, written for her by others. But her frank recklessness, her generosity, her invariable good temper, her ready wit, her infectious high spirits and amazing indiscretions appealed irresistibly to a generation which welcomed in her the living antithesis of Puritanism "A true child of the London streets," she never pretended to be superior to what she was, nor to interfere in matters outside the special sphere assigned her; she made no ministers, she appointed to no bishoprics, and for the high issues of international politics she had no concern. She never forgot her old friends, and, as far as is known, remained faithful to her royal lover from the beginning of their intimacy to his death, and, after his death, to his memory.

Of her two sons by the king, the elder was created Baron Hedington and earl of Burford and subsequently duke of St Albans; the younger, James, Lord Beauclerk, died in 1680, while still a boy. The king's death-bed request to his brother, "Let not poor Nelly starve," was faithfully carried out by James II., who paid her debts from the Secret Service fund, provided her with other moneys, and settled on her an estate with reversion to the duke of St. Albans She died in November 1687, and was buried on the 17th, according to her own request, in the church of St. Martin-in-the-Fields, her funeral sermon being preached by the vicar, Thomas Tenison, afterwards archbishop of Canterbury, who said "much to her praise" Tradition credits the foundation of Chelsea Hospital to her influence over the king.

See Peter Cunningham, *The Story of Nell Gwyn,* edited by Gordon Goodwin (1903); A. I. Dasent, *Nell Gwyn* (1924)

GWYNIAD, a species of the Salmonid genus *Coregonus,* inhabiting Bala lake in Wales, nearly identical with the powan of Loch Lomond and the schelly of Ullswater and Haweswater. The snout is truncated and the lower jaw included, as in related species from Scandinavia and Central Europe. (*See* WHITEFISH, SALMON AND SALMONIDAE.)

GYANTSE, one of the large towns of Tibet. It lies south-east of Shigatse, 130 m. from the Indian frontier and 145 m. from Lhasa. Its central position at the junction of the roads from India and Bhutan with those from Ladakh and Central Asia leading to Lhasa makes it a considerable distributing trade centre. Its market is the third largest in Tibet, coming after Lhasa and Shigatse, and is especially celebrated for its woollen cloth and carpet manufactures. Here caravans come from Ladakh, Nepal and upper Tibet, bringing gold, borax, salt, wool, musk and furs, to exchange for tea, tobacco, sugar, cotton goods, broadcloth and hardware. In the British expedition of 1904 Gyantse was one of the first towns occupied, and by the treaty of the same year a British trade agent is stationed here

GYGES, founder of the third or Mermnad dynasty of Lydian kings, reigned 687–652 B.C. according to H. Gelzer, 690–657 B.C. according to H Winckler. As a youth, he was sent by the Lydian king Sadyattes to fetch Tudo, the daughter of Arnossus of Mysia, whom the Lydian king wished to make his queen On the way Gyges fell in love with Tudo, and to escape punishment, assassinated Sadyattes and seized the throne The civil war which ensued was finally ended by an appeal to the oracle of Delphi and the confirmation of the right of Gyges to the crown by the Delphian god Further to secure his title he married Tudo. Under him the Troad was conquered, Colophon captured from the Greeks, Smyrna besieged and alliances entered into with Ephesus and Miletus The Cimmerii, who had ravaged Asia Minor, were beaten back, and an embassy was sent to Assurbani-pal at Nineveh (*c.* 650 B.C.) in the hope of obtaining his help against the barbarians The Assyrians, however, were otherwise engaged, and Gyges turned to Egypt, sending troops to assist Psammetichus in shaking off the Assyrian yoke (660 B.C.). A few years later he fell in battle against the Cimmerii, and was succeeded by his son Ardys

See C. Muller, *Fragmenta historicorum Graecorum*, iii.; R. Schubert, *Geschichte der Konige von Lydien* (1884), M. G. Radet, *La Lydie et le monde grec au temps de Mermnades* (1892–93); H. Gelzer, "Das Zeitalter des Gyges" (*Rhein. Mus.*, 1875); H Winckler, *Altorientalische Forschungen*, i. (1893).

GYLIPPUS, a Spartan general of the 5th century B.C.; he was the son of Cleandridas, who had been expelled from Sparta for accepting Athenian bribes (446 B.C.) and had settled at Thurii. When Alcibiades urged the Spartans to send a general to take charge of the defence of Syracuse, Gylippus was appointed, and his arrival was undoubtedly the turning point of the struggle (414–413) When he arrived the Syracusans were on the point of negotiating for a surrender, but Gylippus at once took vigorous measures His first move was to block the completion of the Athenians' encircling wall Later he organized assistance among the other Sicilian cities, and was responsible for the decisive step of attacking the Athenian fleet in the harbour Persisting in this policy in spite of an early reverse, he turned defence into attack. According to Thucydides, who is probably right, he wished to spare the Athenian commanders when they were captured, in order to take them to Sparta Later, entrusted with a large sum by Lysander to deliver to the ephors, he embezzled it, and went into exile when discovered

See Thucydides, vi 93. 104, vii; Plutarch, *Nicias*, 19, 21, 27, 28, *Lysander*, 16, 17, Diodorus, xiii 7, 8, 28–32; Polyaenus, i 39 42. *See* SYRACUSE (for the siege operations), commentaries on Thucydides and the Greek histories.

GYLLEMBOURG-EHRENSVÄRD, THOMASINE CHRISTINE, BARONESS (1773–1856), Danish author, was born on Nov. 9, 1773, at Copenhagen Her maiden name was Buntzen. Before she was 17 she married the famous writer P A Heiberg. Their son was afterwards illustrious as the poet and critic J. L. Heiberg. In 1800 her husband was exiled, and she obtained a divorce, marrying in Dec. 1801 the Swedish Baron K. F. Ehrensvärd, himself a political fugitive Her second husband, who presently adopted the name of Gyllembourg, died in 1815. In 1822 she followed her son to Kiel, where he was professor, returning with him to Copenhagen in 1825 Her most famous work is *En Hverdags historie* (*An Everyday Story*). On July 2, 1856, she died in her son's house at Copenhagen For English readers no closer analogy can be found than between her and Mrs Gaskell, and *Cranford* might well have been written by the witty Danish authoress.

See J. L. Heiberg, *Peter Andreas Heiberg og Thomasine Gyllembourg* (1882), and L. Kornelius-Hybel, *Nogle Bemaerkninger om P. A. Heiberg og Fru Gyllembourg* (1883).

GYLLENSTJERNA, JOHAN, COUNT (1635–1680), Swedish statesman, began his political career at the diet which assembled on the death of Charles X (1660). An aristocrat by birth and inclination, he was nevertheless a true patriot and demanded the greatest sacrifices from his own order in the national interests. He laboured zealously for the recovery of the crown lands, and in

the Upper House he was the spokesman of the gentry against the magnates, whose inordinate privileges he would have curtailed or abolished. His adversaries vainly endeavoured to gain him by favour, for as court-marshal and senator he was still more hostile to the patricians who followed the policy of Magnus de la Gardie. Thus he opposed the French alliance which de la Gardie carried through in 1672, and consistently advocated economy in domestic and neutrality in foreign affairs. On the outbreak of the war in 1675 he loyally supported the young Charles XI., whose indispensable counsellor he became. Indeed, it may be said, that the political principles which he instilled into the youthful monarch were faithfully followed by Charles during the whole of his reign. In 1679 Gyllenstjerna was appointed the Swedish plenipotentiary at the peace congress of Lund. The alliance which he then concluded with Denmark bound the two northern realms together in a common foreign policy, and he sought besides to facilitate their harmonious co-operation by every means in his power. In 1680, after bringing home Charles XI.'s Danish bride from Copenhagen, he was appointed governor-general of Scania (Skane), but died a few weeks later

See M. Höjer, *Öfversigt af Sveriges yttre politik under aren 1676–1680* (Upsala, 1875). (R. N. B.; X.)

GYMKHANA, a display of miscellaneous sports, originally at the military stations of India. The word would seem to be a colloquial remodelling of the Hindustani *gend-khana*, ball-house or racquet-court, by substituting for *gend* the first syllable of the word "gymnastics." The first meetings consisted of horse and pony races at catch weights. To these were soon added a second variety, originally called the *pāgŏl* (funny races), the one generally known outside India, which consisted of miscellaneous races and competitions of all kinds, some serious and some amusing, on horseback, on foot and on bicycles.

GYMNASTICS AND GYMNASIUM, terms signifying respectively a system of physical exercises practised either for recreation or for the purposes of promoting the health and development of the body, and the building where such exercises are carried on.

The Gymnasium in Greece.—The gymnasium of the Greeks was originally the school where competitors in the public games received their training, and was so named from the circumstances that these competitors exercised naked (γυμνός). The gymnasium was a public institution as distinguished from the palaestra, which was a private school where boys were trained in physical exercises, though the term palaestra is also often used for the part of a gymnasium specially devoted to wrestling and boxing. The athletic contests for which the gymnasium supplied the means of training and practice formed part of the social life of the Greeks from the very earliest times; and accordingly special buildings were provided by the State and their management entrusted to public officials. The regulation of the gymnasium at Athens is attributed by Pausanias (i 39.3) to Theseus. Solon made several laws on the subject; but according to Galen it was reduced to a system in the time of Cleisthenes. Ten *gymnasiarchs*, one from each tribe, were appointed annually. These performed in rotation the duties of their office, which were to maintain and pay the persons who were training for public contests, to conduct the games at the great Athenian festivals, to exercise general supervision over the morals of the youths, and to adorn and keep up the gymnasium. This office was one of the ordinary λειτουργίαι (public services), and great expense was entailed on the holders. Under them were ten *sophronistae*, whose duty was to watch the conduct of the youths at all times, and especially to be present at all their games. The practical teaching and selection of the suitable exercises for each youth were in the hands of the *paedotribae* and *gymnastae*, the latter of whom also superintended the effect on the constitution of the pupils, and prescribed for them when they were unwell. The *aleiptae* oiled and rubbed dust on the bodies of the youths, acted as surgeons, and administered the drugs prescribed. According to Galen there was also a teacher of the various games of ball. The gymnasia built to suit these various purposes were large buildings, which contained not merely places for each kind of exercise, but also a stadium, baths, covered porticos for practice in bad weather, and outer porticos where the philosophers and men of letters read public lectures and held disputations.

The gymnasium of the Greeks did not long remain an institution exclusively devoted to athletic exercises. It soon began to be applied to other uses even more important. The development arose naturally through the recognition by the Greeks of the important place in education occupied by physical culture, and of the relation between exercise and health. The gymnasium accordingly became connected with education on the one hand and with medicine on the other. Due training of the body and maintenance of the health and strength of children were the chief part of earlier Greek education. Except the time devoted to letters and music, the education of boys was conducted in the gymnasia, where provision was made, as already mentioned, for their moral as well as their physical training. As they grew older, conversation and social intercourse took the place of the more systematic discipline. Philosophers and sophists assembled to talk and to lecture in the gymnasia, which thus became places of general resort for the purpose of all less systematic intellectual pursuits, as well as for physical exercises. In Athens there were three great public gymnasia—Academy, Lyceum and Cynosarges—each of which was consecrated to a special deity with whose statue it was adorned; and each was rendered famous by association with a celebrated school of philosophy. Plato's teaching in the academy has given immortality to that gymnasium; Aristotle conferred lustre on the lyceum; and the cynosarges was the resort of the cynics. Plato, when treating of education, devotes much consideration to gymnastics (*see* especially *Rep* iii and various parts of *Laws*); and according to Plato it was the sophist Prodicus who first pointed out the connection between gymnastics and health. Having found such exercises beneficial to his own weak health, he formulated a method which was adopted generally, and which was improved by Hippocrates. Galen lays the greatest stress on the proper use of gymnastics, and throughout ancient medical writers we find that special exercises are prescribed as the cure for special diseases.

The Gymnasium in Rome.—The Greek institution of the gymnasium never became popular with the Romans, who regarded the training of boys in gymnastics with contempt as conducive to idleness and immorality, and of little use from a military point of view; though at Sparta gymnastic training had been chiefly valued as encouraging warlike tastes and promoting the bodily strength needed for the use of weapons and the endurance of hardship. Among the Romans of the republic, the games in the Campus Martius, the duties of camp life, and the enforced marches and other hardships of actual warfare, served to take the place of the gymnastic exercise required by the Greeks. The first public gymnasium at Rome was built by Nero and another by Commodus. In the middle ages, though jousts and feats of horsemanship and field sports of various kinds were popular, the more systematic training of the body which the Greeks had associated with the gymnasium fell into neglect, while the therapeutic value of special exercises as understood by Hippocrates and Galen appears to have been lost sight of. Rousseau, in his *Émile*, was the first in modern times to call attention to the injurious consequences of such indifference, and he insisted on the importance of physical culture as an essential part of education. It was probably due in some measure to his influence that F. L. Jahn and his followers in Germany, encouraged by the Prussian minister Stein, established the *Turnplätze*, or gymnastic schools, which played an important part during the War of Liberation, and in the political agitations which followed the establishment of the German confederation by the Congress of Vienna. The educational reformers Pestalozzi and Froebel emphasized the need for systematic physical training in any complete scheme of education.

Modern Developments.—The later development of the classical gymnasium (when it had become the school of intellectual culture rather than of exclusively physical exercise), and not the original idea, has been perpetuated in the modern use of the word in Germany, where the name "gymnasium" is given to

the highest grade of secondary school, and the association of the word with athleticism has been entirely abandoned. On the other hand, in England, France and elsewhere in Europe, as well as in America, the history of the word has been precisely the reverse; the connection of the gymnasium with philosophy and mental culture has been dropped, and it indicates a building exclusively intended for the practice of physical exercises. But whereas the Greeks received training in the gymnasium for contests which are now designated as *athletic sports* (*q.v.*), gymnastics in the modern sense is a term restricted to such exercises as are usually practised indoors, with or without the aid of mechanical appliances, as distinguished from sports or games practised in the open air.

It was not until near the end of the 19th century that gymnastics were recognized in England as anything more than a recreation; their value as a specifically therapeutic agent, or as an article in the curriculum of elementary schools, was not realized. More recently, however, educationists have urged with increasing insistence the need for systematic physical training, and their views received greater attention when evidence of deterioration in the physique of the people began to accumulate. During the first decade of the 20th century more than one commission reported to parliament in England in favour of more systematic and general physical training being encouraged or even made compulsory by public authority Voluntary associations were formed for encouraging such training and providing facilities for it Gymnastics had already for several years been an essential part of the training of army recruits with exceedingly beneficial results, and gymnasia had been established at Aldershot and other military centres. Physical exercises, although not compulsory, obtained a permanent place in the code for elementary schools in Great Britain; and much care has been taken to provide a syllabus of exercises adapted for the improvement of the physique of the children. These exercises are partly gymnastic and partly of the nature of drill; they do not in most cases require the use of appliances, and are on that account known as "free movements," which numbers of children go through together, accompanied whenever possible by music. On the other hand, at the larger public schools and universities there are elaborate gymnasia equipped with a great variety of apparatus, the skilful use of which demands assiduous practice; and this is encouraged by annual contests between teams of gymnasts representing rival institutions.

Gymnastic Apparatus.—The appliances vary to some extent in different gymnasia, some of the more complicated requiring a greater amount of space and involving a larger cost than is often practicable But where these considerations are negligible, substantial uniformity is to be found in the equipment of gymnasia not designed for specifically medical purposes The simplest, and in many respects the most generally useful, of all gymnastic apparatus is the dumb-bell It was in use in England as early as the time of Elizabeth, and it has the advantage that it admits of being exactly proportioned to the individual strength of each learner, and can be adjusted in weight as his strength increases The exercises that may be performed with the dumb-bell, combined with a few simple drill-like movements, give employment to all parts of the body and to both sides equally Dumb-bell exercises, therefore, when arranged judiciously and with knowledge, are admirably suited for developing the physique, and are extensively employed in schools both for boys and girls. The bar-bell is merely a two-handed dumb-bell, and its use is similar in principle. The Indian club is also in use in most gymnasia; but the risk of overstraining the body by its unskilful handling makes it less generally popular than the dumb-bell All these appliances may be, and often are, used either in ordinary schoolrooms or elsewhere outside the gymnasium. The usual fixed sorts of apparatus, the presence of which (or of some of them) in a building may be said to constitute it a gymnasium, are the following: a leaping-rope; a leaping-pole; a vaulting-horse; a horizontal bar, so mounted between two upright posts that its height from the ground may be adjusted as desired; parallel bars, used for exercises to develop the muscles of the trunk and arms; the trapeze consisting of a horizontal bar suspended by ropes; the bridge ladder; the plank; the inclined plane; swinging rings; the prepared wall; the horizontal beam

Before the end of the 19th century the therapeutic value of gymnastics was fully realized by the medical profession; and a number of medical or surgical gymnasia came into existence, provided with specially devised apparatus for the treatment of different physical defects or weaknesses The exercises practised in them are arranged upon scientific principles based on anatomical and physiological knowledge; and these principles have spread thence to influence largely the practice of gymnastics in schools and in the army. A French medical writer enumerates seven distinct groups of maladies, each including a number of different complaints, for which gymnastic exercises are a recognized form of treatment; and there are many malformations of the human body, formerly believed to be incurable, which are capable of being improved if not entirely corrected by regular gymnastic exercises practised under medical direction

Cure of Physical Defects.—The value of gymnastics both for curing defects, and still more for promoting health and the development of normal physique, is recognized even more clearly on the continent of Europe than in Great Britain. In Germany, the Government not only controls the practice of gymnastics but makes it compulsory for every child and adult to undergo a prescribed amount of such physical training In France, also, physical training by gymnastics is under State control; in Sweden, Denmark, Switzerland, Italy, Russia, systems more or less distinct enjoy a wide popularity; and in Finland gymnastics are practised on lines that exhibit national peculiarities The Finns introduce an exceptional degree of variety into their exercises as well as into the appliances devised to assist them; women are scarcely less expert than men in the performance of them; and the enthusiasm with which the system is supported produces the most beneficial results in the physique of the people International gymnastic contests have become a feature of the revived Olympic games (*see* ATHLETIC SPORTS), and in those held at Athens in 1906 a team of Danish ladies took part in the competition and proved by their skilful performance that gymnastics may be practised with as much success by women as by men

Influence of the Olympic Games.—The undoubted influence of the revived Olympic games upon the modern development of athletic sports and exercises has not greatly affected gymnastics, perhaps because of the already high state of efficiency reached prior to the revival The International Gymnastic Federation, which has but one affiliated nation outside Europe, *i.e.*, the United States, was founded in 1881, and 20th century efforts have tended rather to consolidation and perfection than to extension and progress One important feature was the foundation, in 1923, of an international federation for the promotion of the educative, instead of the executive, branch of the art. Both federations have their British affiliations, that to the Fédération Internationale de Gymnastique being the Amateur Gymnastic Association and that to the Fédération Internationale de Gymnastique Educative being the Ling Association

The enormous development of athletic sports throughout most of the European countries has not caused gymnastics to suffer; the great festivals at Nuremberg, Leipzig, Frankfort, and in Sweden, France and Switzerland continue to attract thousands of gymnasts Perhaps the name which should most laudably be connected with this development is that of Gen. Sir Viktor Balck, of Stockholm, who was awarded the G C B for the value of his suggestions in the training of British soldiers and sailors. His system of Swedish gymnastics has proved its efficacy and success all over the world and has largely contributed to the high national standard of health enjoyed by the Scandinavian races. On the continent of Europe the gymnastic movement is national, in Great Britain, and to a lesser extent in the United States (*q.v.*), interest in gymnastics is individual. The repetitive character, the absence of the competitive spirit, perhaps also the collective discipline so necessary, appear to have too little in common with the Anglo-Saxon character for gymnastics ever to arouse the enthusiasm which prevails in the European countries The inclusion

of gymnastic competitions at the Olympic games has not appreciably affected the situation. The most practical form of exercises taught in national gymnasia is undoubtedly to be found in Japan, where the ancient art or science of defence (and offence) known as ju-jutsu has proved of the greatest service to the police and others, and has gradually been recognized in other parts of the world as indispensable to complete physical equipment. (*See* ATHLETICS; OLYMPIC GAMES.)

The chief work on the ancient gymnastics is Krause, *Gymnastik und Agonistik der Hellenen* (1841). Of more recent works mention may be made of Becker-Goll, *Charicles*, n.; Brugsma, *Gymnasiorum apud Graecos descriptio* (1855); Petersen, *Das Gymnasium der Griechen* (1858); A. S Wilkins, *National Education in Greece* (1873); L. Grasberger, *Erziehung und Unterricht in klassischen Altertum* (1881); Jager, *Gymnastik der Hellenen* (1881); J. P. Mahaffy, *Old Greek Education* (1883); E Paz, *Histoire de la gymnastique* (1886), Wickenhagen, *Antike und moderne Gymnastik* (1891). *See* also N Laisné, *Gymnastique pratique* (1879); Collineau, *La Gymnastique* (1884); *L' Hygiène à l'Ecole* (1889); P de Coubertin, *La Gymnastique utilitaire* (1905); H. Nissen, *Rational Home Gymnastics* (Boston, 1903). (X)

The United States.—Gymnastics were first taught in America by two pupils of Jahn, in 1825, Charles Follen and Charles Beck, who copied closely the equipment and methods of the German Turnplatz They were soon diverted to other pursuits, and the movement instituted by them languished, until, in 1860, Dio Lewis, with his "New Gymnastics," demonstrated light and free exercises with barbells, wooden dumbbells, bean bags and rings to admiring audiences He emphasized the value of light exercise as opposed to the heavy gymnastics of the early German pioneers, and founded a short-lived institute for training teachers; but his interest soon turned to other fields, and in 10 years the life of the movement was almost extinct

The great emigration from Germany about 1848 brought with it the Turners and in every German community a *Turngemeinde* was founded Their gymnastic societies became centres of propaganda for physical education, especially for the schools, and the Normal school now at Indianapolis was one of the first to train teachers in the tradition of German gymnastics for the public schools. About 1870 the Young Men's Christian Association began to consider the body as well as the soul, and in 1875 they founded what is now the International Y M C A. training college at Springfield, Mass., for training teachers to carry on the work, not only in the Y M C A of America and abroad but also in schools and colleges In 1879 the Hemenway gymnasium was opened at Harvard, equipped with Dudley A Sargent's apparatus, by which the bars and trapezes could be adapted to the weakest as well as the strongest by means of pulley weights. Class-work was replaced by individual advice

The Swedish system was introduced to America by Baron Nils Posse, and the Boston Normal School of Gymnastics was founded about 1889 Other schools followed, but this became the main source of supply for teachers of Swedish gymnastics For the next 20 years the relative merits of Swedish and the German gymnastics formed a favourite field of debate at the Annual Conventions of the American Physical Education Association.

About the beginning of the 20th century college after college began to require gymnastics as part of the regular course, and a change came over the equipment and courses of instruction But the revival of athletic sports modified the programme and made it approach much more closely to the traditional Greek ideal of exercise. With the recognition of physical education as part of the curriculum it has become possible to allow a wide latitude in the form of exercise taken by all students who are physically sound, and the rudiments of such exercises as boxing, wrestling and team games can be taught to classes like gymnastic drill. The more proficient pass on to more strenuous personal competition, the others taking their gymnastic training in movements that they find more interesting than the more artificial drill which characterizes the German and Swedish gymnastics. The defective student is provided for by individual corrective exercises for his special needs.

Gymnasiums, swimming pools and playgrounds have been established in the crowded parts of the city, with expert instructors Gymnastic classes and organized games form an important part of the activities of these recreation centres.

The most potent influence in extending physical education has been the passing of State laws making physical training part of the regular curriculum in the public schools. This occurred in response to the amount of physical inefficiency revealed by recruits during the World War. New York began this movement in 1916 and California in 1917, and similar laws have been passed (1928) in 35 States. This legislation has brought to a focus the question of adequate training for teachers to carry out the provisions of the act. The Normal schools first in the field were mostly proprietary, but they are becoming affiliated with colleges which have degree-granting power. State Normal schools are conducting two- or three-year courses and many colleges and universities are giving four-year courses in physical training. These courses are rapidly becoming standardized and include instruction in anatomy, physiology and psychology, and hygiene, practice in gymnastics, dancing and athletics and teaching, together with the literary and other cultural subjects necessary to put the teachers of physical education on the same educational level as the others on the staff.

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(R. T. McK.)

GYMNOSOPHISTS, the name given by the Greeks to certain ancient Hindu philosophers who pursued asceticism to the point of regarding food and clothing as detrimental to purity of thought (Lat. *gymnosophistae*, from Gr. γυμνός, σοφιστής "naked philosophers"). From the fact that they often lived as hermits in forests, the Greeks also called them *Hylobioi* (*cf.* the *Vāna-prasthās* in Sanskrit writings). Diogenes Laërtius (ix. 61 and 63) refers to them, and asserts that Pyrrho of Elis, the founder of pure scepticism, came under their influence, and on his return to Elis imitated their habits of life, to what extent does not appear. Strabo (xv. 711, 714) divides them into Brahmans and Sarmans (or Shamans). *See* JAINS.

GYMNOSPERMS. All living seed-bearing plants are divided into two groups, the Gymnosperms and the Angiosperms (*q.v.*), and it is certain that these two groups are only distantly related, if indeed they are directly related at all. The primary distinction between the two lies in the fact that, at the time of pollination, the ovule (or rudimentary seed) is freely exposed, and the pollen deposited on it (or very rarely near it) in Gymnosperms (indicating plants with naked seeds), but in Angiosperms is wholly enclosed in an ovary, on a specialized part of which (the stigma) the pollen is deposited. There are other important differences, both in anatomy and in reproductive structures. In particular the prothallus (or embryo-sac) is a much larger and more massive structure in Gymnosperms than in Angiosperms, and (with the exception of two tropical genera) the female organ characteristic of the group is a large archegonium similar in structure and development to the much smaller archegonium found in all mosses and ferns and their allies, but of which no trace is found in Angiosperms. As regards anatomical features no companion cells are found in the phloem of Gymnosperms, nor, except in one division, are true vessels met with in the wood.

Although no other living plants besides Gymnosperms and true flowering plants (Angiosperms) have seeds, yet fossil representatives of the club mosses are known which possess such structures. These plants are, however, so clearly and definitely related to the club mosses (Lycopodineae) on other grounds, and not to the Gymnosperms, that it is not necessary to discuss them further. (*See* PTERIDOPHYTA and PALAEOBOTANY: *Palaeozoic.*)

The Gymnosperms are of special interest on account of their great antiquity, which far exceeds that of the true flowering plants, and as comprising different types which carry us back to the Palaeozoic era and to the forests of the coal period. It is not surprising in a group of such antiquity to find that some divisions are wholly extinct. There are, in all, seven of these divisions of which three are extinct, one is represented by a single living species, the maidenhair tree, common enough in cultivation but

almost extinct in the wild state, and three are flourishing living divisions, though only one of these, the Coniferales (pines, cedars, larches, firs, yews, etc.) is a really large and important division of existing plants

The seven divisions of the Gymnosperms show many indications of fairly close relationship and this appears to indicate that the whole group had a common origin, though this view is not by any means certain and is not universally accepted. If we accept the view that all the Gymnosperms had a common origin then there can scarcely be any doubt that the group from which they were evolved was the Filicales or true ferns, the resemblance between the latter and the most primitive division of Gymnosperms, the Pteridospermae or Cycadofilicales, being very striking. (*See* PALAEOBOTANY: *Palaeozoic.*)

Although the reproductive structures of the Gymnosperms are often described as "flowers," it seems better to avoid this term, as implying a resemblance, which scarcely exists, to the "flowers" of Angiosperms The term "cone" will, therefore, be used throughout this article in preference to "flower," except in the case of the highest division, the Gnetales, where the resemblance to Angiosperms is more obvious

The seven divisions of Gymnosperms are as follows.—

I. PTERIDOSPERMAE or CYCADOFILICALES Wholly extinct. (*See* PALAEOBOTANY: *Palaeozoic*)

II. CYCADALES. A living division, also represented in the Mesozoic.

III. BENNETTITALES Wholly extinct (*See* PALAEOBOTANY. *Mesozoic*)

IV GINKGOALES Mostly extinct, with a single living species

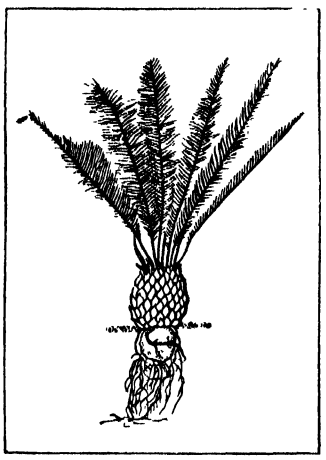
V. CORDAITALES Wholly extinct. (*See* PALAEOBOTANY: *Palaeozoic.*)

VI CONIFERALES. By far the largest and most important division of living Gymnosperms

VII. GNETALES Includes only three genera, with no known fossil representatives, but with some characters very suggestive of Angiosperms

No further reference will be made here to the extinct divisions of Gymnosperms

The living Gymnosperms agree in the following characters. Woody plants Cones unisexual, monoecious or dioecious Perianth not present except in Gnetales Ovules naked, usually borne on leaf-like structures. The single megaspore enclosed in the nucellus becomes filled with tissue (prothallus) before fertilization (partially only or not at all in *Gnetum*); the microspore develops at least four nuclei (usually four to six) of which two are the male cells, very large and actively motile in Cycads and *Ginkgo*, much smaller and only motile in so far as they are passively carried by the pollen tube, in Coniferales and Gnetales



FROM LOTSY, "VORTRAGE UBER BOTANISCHE STAMMESGESCHICHTE" (FISCHER)

FIG 1.—ENCEPHALARTOS GHELLINCKII

Some account will now be given in turn of each of the four living divisions

CYCADALES

General.—This division includes nine genera and over 80 species. It consists of plants with tuberous or columnar stems, seldom branched, often clothed with an armour of petiole bases as in the stems of ferns, and terminating in a crown of large pinnate leaves (bi-pinnate in one genus). The plants are dioecious, with the cones always compact, with numerous sporophylls spirally arranged on an axis, except in female plants of *Cycas*, which bear on the main stem a loose rosette of leaf-like sporophylls each bearing from 2 to 6 or 8 ovules.

The cycads are practically confined to tropical and subtropical regions and are fairly equally divided both between northern and southern and between eastern and western hemispheres *Zamia* includes over 30 species which extend from Southern Florida to Chili. *Cycas* has only about 16 species, but they range from Japan to Australia *Macrozamia* with 14 species is confined to Australia, while *Encephalartos* with 12 species is wholly South African. No other genus has more than three species *Dioon* and *Ceratozamia* are both restricted to South Mexico, and *Bowenia* to Australia,

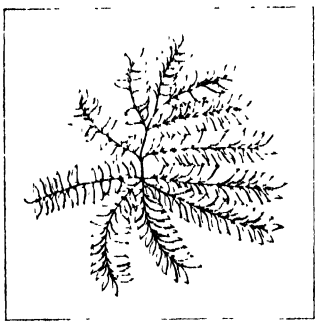


FIG 2.—BOWENIA SPECTABILIS FROND

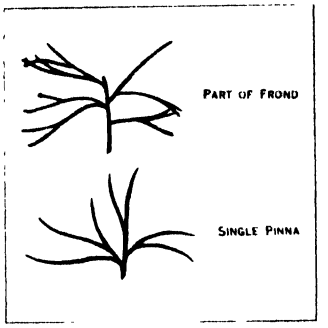


FIG 3 MACROZAMIA HETEROMERA

while *Microcycas* and *Stangeria* occur only in West Cuba and South Africa respectively

Externally some of the larger cycads closely resemble palms, others having an equally close resemblance to tree ferns, while so closely do the smaller species approximate to ferns in appearance (when not in cone) that *Stangeria* was actually first described (by Kunze in 1835) as a species of the fern *Lomaria*

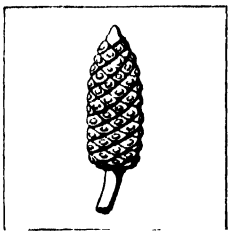
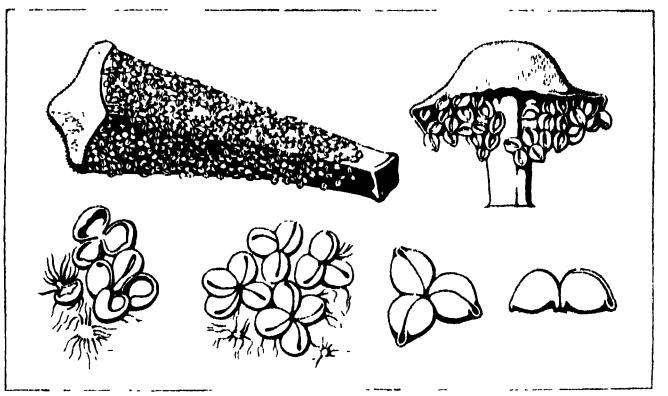


FIG 4.—ZAMIA OTTONIS

Cycads are characteristically very long lived and slow growing and certainly reach an age of upwards of a thousand years, probably much more

The armour of dead leaf bases found on the old stem (fig 1) is more particularly characteristic of the columnar forms, and is not found in *Bowenia* and *Stangeria* In the tuberous forms the stem is usually more or less subterranean, but may be very massive, like a gigantic carrot The leaves of *Cycas* consist of a long rachis bearing numerous linear leaflets, each with a single midrib and no other veins When young these leaflets are coiled up like the leaves of a fern In most other cycads the leaves are similar except that the leaflets contain a number of parallel veins, *e.g.*



AFTER ENGLER AND PRANTL, "DIE NATURLICHEN PFLANZENFAMILIEN" (ENGELMANN)

FIG 5.—MICROSPOROPHYLLS OF CYCADS

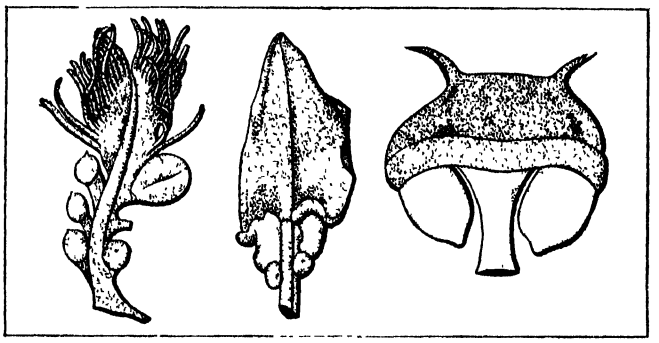
Dioon and *Encephalartos* *Stangeria* has only a few leaflets on the rachis and each is traversed by a midrib from which simple or forked veins pass off at a wide angle The leaves of *Bowenia* differ from those of other genera in being bi-pinnate (fig 2) It is only in *Cycas* that the young leaflets are conspicuously coiled, the remaining genera showing little or no trace of this character In *Macrozamia heteromera* the narrow pinnae are dichotomously branched almost to the base (fig. 3). In some forms, such as most of the species of *Encephalartos*, the margins of the leaflets are

spinous. In *Ceratozamia* the broad petiole base is characterized by the presence of two lateral spinous processes suggestive of stipules, and comparable with the stipules of Marattiaceous ferns.

Cones.—The "male" (or microsporangiate) cones of cycads (fig. 4) are very uniform in structure, and from one to a hundred may be produced in one season. Each consists of an axis bearing crowded, spirally disposed sporophylls, which are often wedge-shaped and angular, while in other cases they consist of a short, thick stalk terminating in a peltate expansion or prolonged upwards in the form of a triangular lamina (fig 5) The crowded sporangia (pollen-sacs) are found on the lower side of the sporophyll and are often arranged in more or less definite groups (or "sori"). The sporangia break open when ripe by a slit radiating from the centre of the sorus The sporangia are large, not unlike those of *Angiopteris* (a Marattiaceous fern) and their walls are several layers of cells in thickness. Each sporangium contains several oval spores which develop into pollen grains before they are set free. In this process each spore cuts off a small but persistent "prothallial cell," and immediately divides again to cut off an almost equally small "generative cell," the remaining nucleus, occupying the larger part of the spore cavity, being the "tube nucleus." In this 3-celled condition the pollen is shed

The female plants bear cones which in most genera occur singly in the centre of the crown, but in *Encephalartos*, *Bowenia* and *Macrozamia* from two to several may be found. In some cases these female cones reach an enormous size, that of *Encephalartos Caffer* being up to a yard in length and weighing as much as 100lb., while that of *Macrozamia Denisoni* may be as long, though its weight seldom exceeds 60lb. The smallest cones are those of *Zamia*, that of *Zamia pygmaea* being sometimes less than 3cm. in length. The sporophylls usually have some, often a close, resemblance to those of the male cone, and are clearly homologous with them.

The most primitive type is evidently *Cycas*, in which the sporophylls are arranged round the apex like a crown of foliage leaves and are definitely leaf-like in form In *C. revoluta* and *C. circinalis* each may produce several laterally attached ovules, but in *C. Normanbyana* the sporophylls are shorter and the ovules are reduced to two. In all other genera the cone is a much more definite and compact structure, but the sporophylls of *Dioon* and *Stangeria* terminate in a leaf-like up-turned process, and are clearly comparable with those of *Cycas*. In some of the remaining genera the sporophylls are shorter with thick peltate heads, and each bears two ovules on the lower surface (fig. 6) The young ovule consists of a spherical or ovoid rather massive nucellus, surrounded by a single investment (the integument) which is fused



FROM LOTSY, "VORTRAGE UBER BOTANISCHE STAMMESGESCHICHTE" (FISCHER)

FIG 6.—MEGASPOROPHYLLS OF CYCADS

with it except near the apex. The small round opening at the apex of the integument is known as the micropyle

Fertilization and Development.—The pollen is carried by the wind, or very rarely, perhaps, by small beetles or other insects, to the micropyle and lodges there Meanwhile the tip of the nucellus projects into the base of the micropyle in the form of a tiny beak, at the exact tip of which a fine hole appears, becoming somewhat wider below. This narrow but relatively deep hole, the "pollen chamber," being exactly below the centre of the micropyle, the pollen grains pass into it (or, in some cases at least, are drawn into it by the evaporation of a drop of liquid which oozes out from the micropyle at the time of pollination, as in conifers) and the tip of the pollen chamber, as well as the micropyle, closes and hardens, thus completely enclosing the pollen grains, of which from half a dozen to a dozen are usually found here. Later these develop pollen tubes as described below.

While these changes are going on, a large cell, the megaspore, makes its appearance in the central region of the nucellus, rapidly increases in size, and ultimately absorbs the greater part of the nucellus. Its nucleus divides repeatedly and cells are produced from the peripheral region inwards, which eventually fill the spore cavity with a homogeneous tissue, the prothallus From one to ten separate superficial cells at the apex of the prothallus now increase in size. Each cuts off a small cell at the top, which divides to form the small two-celled *neck* of the archegonium, the lower cell enlarging rapidly and becoming the egg-cell, its nucleus cutting off another small nucleus (which soon disappears) just before fertilization (fig 7) In *Microcycas* a very large number of archegonia (up to 200 exceptionally) are produced all over the prothallus

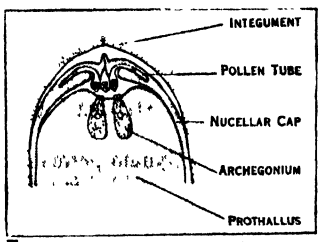


FIG 7.—SEMI-DIAGRAMMATIC LONGITUDINAL SECTION OF A PART OF CYCAD OVULE BEFORE FERTILIZATION

During the development of the prothallus the pollen chamber has enlarged both downwards and outwards, and eventually forms a fairly large chamber open below to the archegonia, which themselves lie at the bottom of a shallow depression in the apex of the prothallus, the "archegonial chamber." Each pollen grain at once begins to put out a tube which grows laterally into the nucellus just below its outer surface The apical part of the nucellus is almost the only part remaining by this time, and is known as the "nucellar cap." Close inspection of the outer surface of the nucellar cap reveals several dark lines radiating from the beak outwards for about 2mm and these mark the positions of the pollen tubes. The "tube nucleus" of the pollen grain passes into, and remains in, the pollen tube, while the pollen grain hangs suspended by its tube in the pollen chamber (fig. 7). The "generative cell" divides to form another small sterile cell, the "stalk cell" and a much larger cell the "body cell," which continues to enlarge (as does that part of the tube to which the grain is attached) and finally divides once more into two equal hemispherical cells, in each of which a single very large and actively motile *spermatozoid* is produced (fig 8). (In *Microcycas* 8 to 10 body cells and 16 to 20 sperms are formed in each pollen tube.) In the course of the last division two small bodies known as "blepharoplasts" make their appearance just outside the nucleus, and after division is complete one of them remains in each spermatozoid where it gradually gives rise to a spiral band which passes round and round the outside of each sperm while from the outside of the band innumerable fine hair-like cilia are produced which, by their active movements, enable the sperms to swim about, first in the two cells within which they are formed, then in the part of the pollen tube adjacent to the grain after the cell walls break down, and finally in the film of moisture covering the archegonial chamber, after the bursting of the pollen tube. At last one penetrates the neck cells of an archegonium and so finds its way into the egg cell, where the sperm nucleus slips from its ciliated sheath of protoplasm and swiftly passes down to fuse with the large egg nucleus.

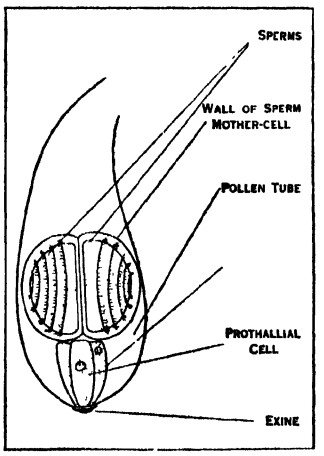


FIG. 8.—CYCAD POLLEN TUBE WITH SPERMS IN MOTHER CELLS

It is noteworthy that cycad sperms are the largest known in either plants or animals, and the only ones big enough to be definitely seen under ordinary lighting conditions, and while still living, with the naked eye, the largest of them reaching a diameter of more than a quarter of a millimetre. It is no less remarkable that sperms had been observed repeatedly in every other great group of both plants and animals (excepting *Ginkgo*) many years before they were ever seen in cycads, although the discovery of motile sperms in Gymnosperms had been predicted nearly 50 years earlier by the great German botanist Hofmeister. They were actually seen for the first time in *Cycas* in 1896 by a Japanese botanist, S. Ikeno, and shortly afterwards in *Zamia* by H. J. Webber, and since that time they have been carefully studied in most of the other genera.

Following fertilization, the fusion nucleus divides repeatedly till from 250 to about 1,000 nuclei are scattered through the protoplasm of the archegonium. These nuclei tend to be more closely aggregated at the base, and cell walls first appear in this region, thus forming a tissue at the base of each fertilized archegonium. An ephemeral tissue may also form throughout the archegonium, as happens in most genera, subsequently breaking down to form a cavity, or the centre of the archegonium may become a large vacuole at an earlier stage, as in *Cycas*. In either case the structure thus formed constitutes the proembryo. A compact group of cells at the extreme base forms the actual embryo, and the cells immediately above these elongate very much and eventually form a very long coiled and tangled suspensor which carries the embryo deep into the prothallus where it grows to about three-quarters of the length of the latter and absorbs about one-quarter of its tissue.

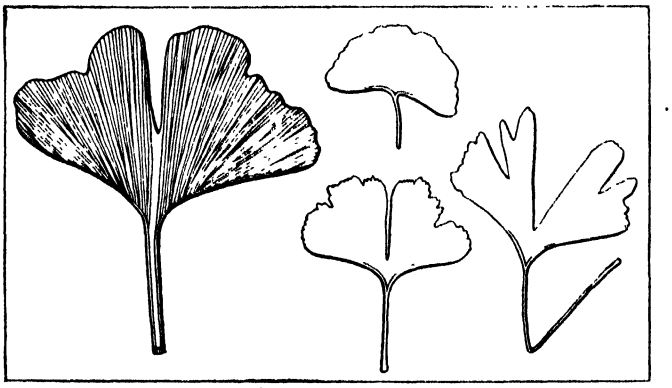
The mature embryo consists of an axis (the hypocotyl) terminated, at the end next to the suspensor, by a rudimentary root (the radicle) enclosed in a hard covering, the coleorhiza, and bearing at the other end a pair of large seed leaves or *cotyledons*, often fused together at their tips, and enclosing between them a minute terminal bud, the plumule. The integument of the ovule has now become the *testa* of the seed and is differentiated into three layers, an outer, thick, fleshy and brightly coloured one, in the inner part of which several vascular strands run up from the base, a thin hard woody layer, and a very thin inner fleshy layer containing a second set of vascular strands

Anatomy.—The anatomy of the cycads presents many features of interest. Only a brief reference to one or two of the most striking of these is possible here. The wood is rather soft and laxly arranged and occupies a relatively small part of the thickness of the stem, though the vascular cylinder very slowly increases in thickness in the same manner as in woody Dicotyledons. Sometimes, as in *Cycas*, there is a double ring of vascular strands. In connection with the leaves two strands often branch off from the central cylinder on the opposite side to a leaf, pass spirally round in the cortex in opposed directions and pass into the petiole of that leaf, where they break up into a larger number of strands. This arrangement of leaf trace strands is peculiar to cycads, and the strands themselves are often known as girdles. For further anatomical details reference may be made to *The Living Cycads* by C. J. Chamberlain.

Classification.—Something has already been said about the characteristic features of certain genera. It will, however, be convenient to conclude with a key to all the genera, and the usual classification of the Cycadales, as follows:—

Division Cycadales. Only family Cycadaceae.
Tribe A. Female plant with separate leaf-like sporophylls on the main stem. Leaflet with a midrib only. Cycadeae. *Cycas.*
Tribe B. Sporophylls always in compact cones. Zamieae.
Sub-tribe I. Leaflet with midrib and lateral veins. Stangerieae.
Stangeria.
Sub-tribe II. Leaflet with several parallel veins Euzamieae.
a. Leaves bi-pinnate. *Bowenia.*
b. Leaves simply pinnate.
(i.) Megasporophylls (Carpels) with a terminal leafy part.
*Ovules on a cushion-like placenta. *Dioon.*
**Ovules sessile. *Encephalartos.*
(ii.) Megasporophylls peltate.
*Sporophyll terminating in two horns. *Ceratozamia.*
**Sporophyll with a spinous projection in the centre. Leaflets usually forked. *Macrozamia.*
***Megasporophyll flat outside
†Microsporophyll not peltate *Microcycas*
††Microsporophyll peltate like the carpel (fig. 4). *Zamia.*

Recently some very interesting hybrids have been obtained by crossing various species of *Zamia* with others of the same genus and with species of *Encephalartos* and *Macrozamia*.

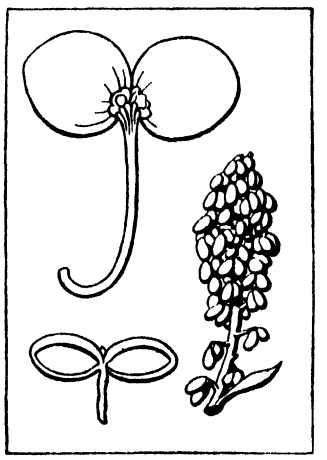


FROM ENGLER AND PRANTL, "DIE NATÜRLICHEN PFLANZENFAMILIEN (ENGELMANN)

FIG 9.—GINKGO LEAF SHOWING VEINS

GINKGOALES

Ginkgo biloba, the maidenhair tree, is the solitary survivor of this ancient stock. As already mentioned it is almost extinct, but a few presumably wild trees have been recorded by travellers in parts of China. It is commonly cultivated in gardens of the far east, and is often also grown in North America and Europe and elsewhere. The trees are dioecious and may reach a height of 30 metres; they are freely branched and of pyramidal shape, with a smooth grey bark. The leaves (fig. 9) have a long slender petiole terminating in a fan-shaped lamina which may be entire or two-lobed or subdivided into several narrow segments. The veining is very characteristic and like that of many ferns, *e.g., Adiantum;* the lowest vein in each half of the lamina follows a course parallel to the edge, and gives off numerous branches, which usually fork as they spread in a palmate manner towards the leaf margin. The foliage leaves occur either scattered on long shoots of unlimited growth or crowded at the apex of short shoots (spurs), some of which may subsequently elongate into long shoots

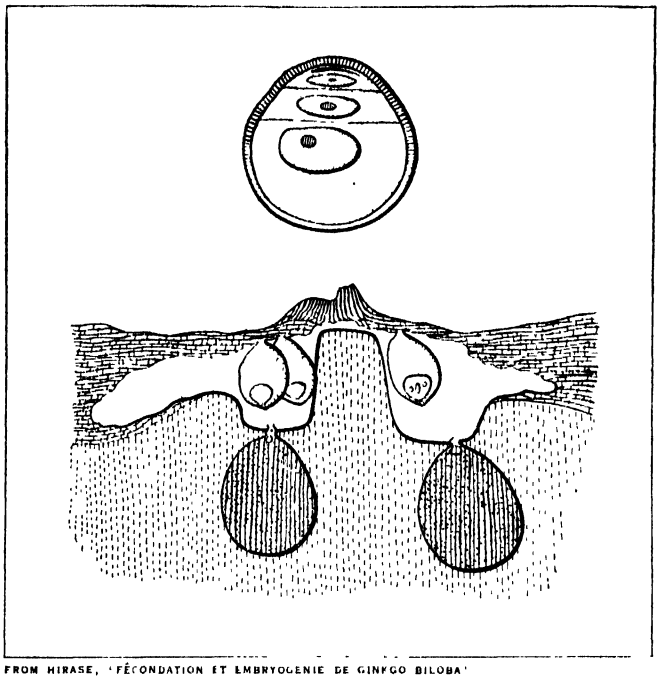


FROM "ANNALS OF BOTANY," BY SEWARD AND GOWAN

FIG. 10.—MALE SPOROPHYLL OF GINKGO

The "cones," which are very unlike those of cycads and much reduced in comparison, are borne, usually several together, on spur shoots, in the axils of scale leaves. The "male" cone consists of a stalked central axis bearing a number of loosely disposed sporophylls. Each of these is formed of a slender stalk terminating in a small knob, from the inner side of which two (rarely three or four) ovoid sporangia hang obliquely (fig. 10) Each sporangium opens by a longitudinal slit, as in cycads (fig 10). The first cell cut off by the microspore is a small and ephemeral prothallial cell. Subsequently all the same cells are produced as in cycads (fig. 11), and in the same order, but besides the extra prothallial cell there are some minor differences in the later development, *e.g.*, the pollen tube is freely branched, the tube nucleus eventually passes back into the grain, which it does not do in cycads, and the two sperms are somewhat smaller than those of cycads, though their shape and structure are precisely the same.

The "female cone" has the form of a long naked peduncle, bearing a single ovule on either side of the apex (fig. 10), the base of each being enclosed by a small saucer-shaped structure, the collar, which probably represents a sporophyll. The young ovule is very similar to that of cycads, a large pollen chamber occupying the apex of the nucellus The early development of the prothallus takes place as in cycads, but eventually a short thick vertical col-



FROM HIRASE, 'FÉCONDATION ET EMBRYOGENIE DE GINKGO BILOBA'

FIG 11 – GINKGO OVULE AT TIME OF AND AFTER POLLINATION

umn grows up from the centre and supports the remains of the nucellar cap, which develops much in the same manner as in cycads (fig 11) There are usually only two archegonia The sperms were first observed in 1898 by a Japanese botanist, S. Hirase. The proembryo is similar to that of cycads, and the general organization of the embryo and its relation to the seed are almost identical except that no suspensor is formed. The ripe seed is brownish yellow in colour, about the size of a small plum, and with the same layers in the testa as in cycads The middle woody layer has usually two (sometimes three) longitudinal ridges. The seed falls soon after (rarely before) fertilization and before the embryo is fully developed.

The anatomical structure of *Ginkgo* is very similar to that of conifers, and the presence of a few large and much elongated secretory sacs in the pith of the stem is a specific character, while the two leaf traces passing direct into the petiole are also characteristic.

In its more obvious characters *Ginkgo* agrees with the conifers, and before the discovery of the motile sperms it was generally regarded as one. But in most of its more recondite characters it shows a very marked similarity to the cycads and may perhaps be more nearly related to them than to any other division of the Gymnosperms. In any case it is clearly intermediate in the sum of its characters between the cycads and the conifers, as well as showing distinct evidence of relationship with the fossil division Cordaitales, and is one of the links in the chain of evidence which goes to support the view that all the Gymnosperms had a common origin and a Filicinean ancestry.

CONIFERALES

General.—The plants included in this, the largest and most important, division of Gymnosperms are a less homogeneous assemblage of forms than the cycads, and include approximately 46 genera with about 470 species. While the cycads are all included in a single family of two tribes, the conifers may be conveniently distributed among five families, which agree, generally, in the following characters:—They are copiously branched trees or shrubs, frequently of pyramidal form (as illustrated by the conventional "Christmas tree"—invariably a conifer). The leaves are always simple, and small compared with the size of the plant, usually linear, or short and scale-like, and generally persisting for more than one year. The plants are monoecious, *e.g.*, *Pinus*, or dioecious, *e.g.*, *Juniperus*, *Taxus*, and the cones are never terminal on the main stem. There is no perianth. The very regular monopodial branching is, perhaps, the most striking character of the majority of the conifers, of which a good example is seen in the giant Californian redwood, *Sequoia* (*Wellingtonia*) *gigantea*, the largest of the Gymnosperms, often seen in cultivation. Other conifers of this typical habit are many pines and firs, the monkey puzzle tree (*Araucaria imbricata*), the Norfolk Island pine (*Araucaria excelsa*), and the cedars and larches, several species exceeding 150ft. in height. The yews and junipers and some other conifers grow as bushes, which in place of a main mast-like stem possess several repeatedly branched leading shoots. Dwarf forms are sometimes met with under arctic, alpine or other unfavourable conditions. Probably the smallest of these dwarf conifers is *Dacrydium laxifolium*, found on New Zealand moors, which may bear seed when only 2m high. Artificially dwarfed specimens of some species are commonly cultivated by the Japanese.

Leaves.—Nearly all conifers are evergreen and retain their leaves for from three to ten years; the larch (*Larix*), however, sheds its leaves each autumn, and those of the Chinese larch (*Pseudolarix Kaempferi*), which is also deciduous, turn a bright yellow before falling. In the swamp cypress (*Taxodium distichum*) the tree assumes a rich brown colour in the autumn, and sheds its leaves with the branchlets which bear them. Deciduous branches occur also in some other species. The leaves of conifers are usually characterized by their small size, *e g*, the needle form represented by *Pinus*, *Cedrus*, *Larix*, etc., the linear flat or angular leaves, appressed to the branches, of *Thuja*, *Cupressus*, *Libocedrus*, etc.; all of which have a single median vein. The flat and comparatively broad leaves of *Araucaria imbricata*, *A. Bidwillii*, and a few species of the southern genus *Podocarpus*, are traversed by several parallel veins, as are the still larger leaves of *Agathis*, which may reach a length of several inches. In addition to the foliage leaves several genera also possess scale leaves of various kinds, represented by bud-scales in *Pinus*, *Picea*, etc., which frequently persist for a time at the base of a young shoot which has pushed its way through the yielding cap of protecting scales, while in some conifers the bud-scales adhere together, and after being torn near the base are carried up by the growing axis as a thin brown cap. The cypresses, Araucarias and some other conifers, have no true bud-scales; in some species, *e.g*, *Araucaria Bidwillii*, the occurrence of small foliage leaves, which have functioned as bud-scales, at intervals on the shoots, affords a measure of seasonal growth. The occurrence of long and short shoots is a characteristic feature of pines, cedars and larches. In *Pinus* the needles occur in pairs, or in clusters of three or five at the apex of small and inconspicuous short shoots of limited growth (spurs). The spur is enclosed at its base by a few scale leaves, and is borne on a branch of unlimited growth in the axil of a scale leaf. In some junipers, cypresses, etc., in which small leaves appressed to the stem are normal in adult plants, examples occur in which these leaves are replaced by the slender needle-like leaves, standing out more or less at right angles to the branch, which are characteristic of the seedling stage. Such cases are often

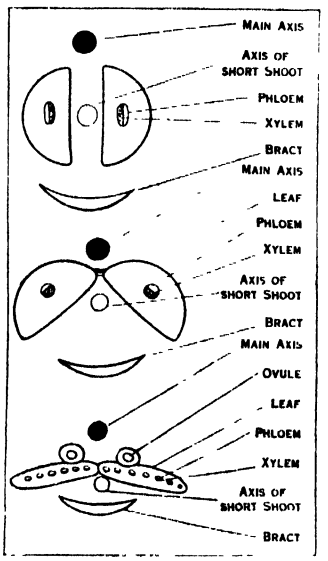
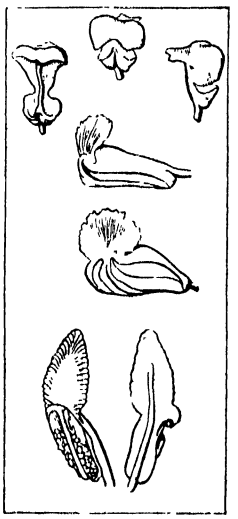


FIG 12—(A) NORMAL SHORT SHOOT OF PINUS. (B) "DOUBLE NEEDLE" OF SCIADOPITYS. (C) OVULIFEROUS SCALE OF LARIX OR PINUS

seen in cultivation, and are usually named "Retinospora," though this name does not denote a true genus, but merely the persistent juvenile forms of *Thuja*, *Juniperus*, *Cupressus*, and other trees of the same type.

A remarkable and unique leaf is found in the umbrella pine (*Sciadopitys verticillata*). These leaves are produced singly on whorls of spur shoots and bear traces, in the grooved surface and in the possession of two separate veins, of an origin from pairs of needle leaves. A peculiarity of these leaves is the inverse orientation of the vascular tissue; each of the two veins has its phloem next the upper, and the xylem towards the lower, surface of the leaf; this unusual position of the xylem and phloem is explained by regarding the needle of *Sciadopitys* as composed of a pair of leaves on a short shoot, fused by their upper margins (fig 12). The short shoots of the cedar and larch are stouter structures bearing an indefinite number of leaves, and are not shed with the leaves as are the spurs of pines and *Sciadopitys*. In the genus *Phyllocladus* (New Zealand, etc.) there are no green foliage leaves, but in their place flattened branches (phylloclades) borne in the axils of small scale leaves The cotyledons are usually two in number in conifers, but occasionally more, as in cedars and pines, reaching as many as 15 in the last named



FROM ENGLER AND PRANTL "DIE NATURLICHEN PFLANZENFAMILIEN" (ENGELMANN)

FIG 13.—VARIOUS CONIFER MICROSPOROPHYLLS

Cones.—A typical "male" cone consists of a central axis bearing from less than a dozen to a very large number of sporophylls which usually follow the leaf arrangement, *i.e.*, they are generally spirally arranged except in most of the Cupressaceae where they are opposite or whorled The sporophyll (fig. 13) is composed of a slender stalk, terminating in a knob or scale and bearing from two to 15 pollen-sacs on its lower surface. The larger number of sporangia (6 to 15) are characteristic of *Araucaria* (fig 13) and *Agathis* in which the sporangia are also peculiar in their large size and in being long, narrow and free. They may thus be compared to the sporangia of the horse-tails (*Equisetum*). In the yew (*Taxus*) the stalk is attached to the centre of a large more or less circular expansion bearing four to eight pollen-sacs on its inner surface, but which are also fused with the stalk, not hanging freely like those of *Araucaria*. The sporangia usually open by a longitudinal, occasionally by a transverse, slit

The structure of the "female" cone differs considerably in the five families of conifers which are as follows.—

I.	ARAUCARIACEAE.	2 genera and about 18 species.
II.	PODOCARPACEAE.	7 genera and about 100 species.
III.	PINACEAE.	10 genera and about 200 species.
IV.	CUPRESSACEAE.	22 genera and about 110 species.
V.	TAXACEAE.	5 genera and about 12 species.

In the first family—Araucariaceae—the female cone, especially when young, has often a close resemblance to the male, and may be interpreted as homologous with it. On this view it is regarded as an axis bearing a large number of sporophylls, closely packed and spirally arranged. Each sporophyll consists of a scale-like basal part and a terminal up-turned leafy part—the lamina. Embedded in the scale with its apex facing the cone axis is a single large ovule. The nucellus is long and narrow and projects beyond the micropyle. In *Araucaria* (but not in *Agathis*) a *ligule* projects from the upper surface of the scale beyond the base of the ovule.

In the Podocarpaceae the cone is often much reduced, ranging from an axis with a small number of sporophylls, each bearing an inverted ovule, as in *Microcachrys*, *Saxegothea* (fig. 15), and some species of *Dacrydium*, to the form found in other species of *Dacrydium* and in *Podocarpus*, where the number of fertile scales is reduced to two or one, small in comparison with the large inverted ovules. In the latter case, broadly speaking, the cone practically consists eventually of one or two naked ovules, though traces of the subtending scales can always be found *Phyllocladus* and *Pherosphaera* are exceptional in having erect (not inverted) ovules. The ovules of the Podocarpaceae usually have a second, outer, integument, the epimatium, wholly or partially enclosing the inner (fig 15).

The female cones of the third family, Pinaceae, are better known, but much more difficult to interpret. To this family most of the common northern conifers belong, such as the pines, spruces, silver firs, cedars and larches. The last-named will serve as a type. Here the cone consists of an axis bearing a large number of closely set, spirally arranged *pairs* of scales. Of the two scales in each pair one is immediately above the other (*i.e.*, in its axil), the lower being bract-like and sterile and known as the carpellary scale or *bract scale*, the upper bearing the ovules (usually two) on its upper surface and being known therefore as the *ovuliferous scale*. The small ovules are fused to the surface of the scale at its proximal end, and lie with their micropyles facing the axis. In the very young cone the two sorts of scales are of similar size; after pollination the ovuliferous scale grows considerably, and is always thicker than the subtending bract scale. The latter, in the larch, at first grows in length faster than the former and so projects beyond the ovuliferous scale in the older cone, but in most cases the bract scales either remain quite abortive after pollination, as in the pine, or grow much more slowly than the ovuliferous scales, the latter alone showing on the outside of the cone. In both cases the scales fuse together externally after pollination, forming a continuous outer covering to the cone and effectually enclosing the ovules, which remain hidden until after the seeds are ripe, often for one, two or more years.

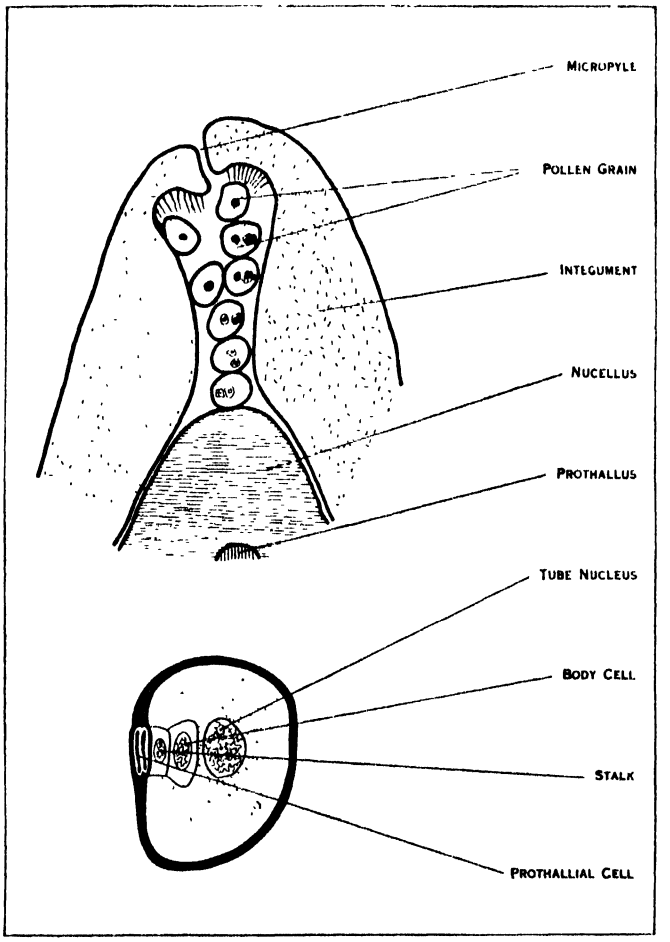


FIG. 14.—(A) MICROPYLE OF LARIX EUROPEA FULL OF POLLEN GRAINS: (B) SINGLE POLLEN GRAIN FROM MICROPYLE OF LARIX EUROPEA

It is not possible to explain here the various views which have been held as to the nature of the ovuliferous scale (the bract scale is clearly homologous with a subtending leaf) but that which

has been most generally accepted was due, in the first place, to Alexander Braun in 1842. He explained the ovuliferous scale as representing the two leaves of a spur shoot, fused (as in the double needle of *Sciadopitys*), by their posterior (adaxial) margins. The usual two ovules would thus be borne one on each leaf (sporophyll), as in the preceding families. This explanation also takes account of the *inverted vascular supply* of the ovuliferous scale, again paralleled in the leaf of *Sciadopitys* (fig. 12). In abnormal cones the ovuliferous scale is sometimes replaced by a dwarf shoot bearing two leaves, which lends further support to Braun's hypothesis.

In the next family, Cupressaceae, the more typical genera appear to have only one kind of scale, while others, belonging to the tribe Taxodioideae, often have a ligule-like structure on the upper surface of the scale (*e.g.*, *Cunninghamia*). The ovules are borne close to the base of the scale, and are usually erect, less commonly inverted. The number borne on one scale is very variable, but from three to seven is usual. Anatomical examination of the scale, however, always indicates the presence of *two sets of vascular strands of which the upper is inverted;* of which the most obvious explanation is that the cone scale represents the bract and ovuliferous scales of the Pinaceae partially or wholly fused together. There are certain difficulties in this apparently simple explanation, but nevertheless it is a generally accepted view.

In the last family, Taxaceae, the female cone is an even more reduced structure than in the Podocarpaceae, consisting usually of a very short axis bearing few or many scale leaves at its base and apparently terminating in a single erect ovule. In reality the apparently terminal ovule may be in the axil of one of the uppermost scales. The whole structure is so reduced that it is difficult, and perhaps unprofitable, to explain it in terms of the other four families, but at least it gives little indication of the complexity characteristic of Pinaceae and Cupressaceae. Unlike cycads, *Ginkgo* and the majority of other conifers the ovule has two integuments, the outer more or less fleshy, as in the red "aril" of the yew seed.

Fertilization and Development.—The structure of the pollen grain is not identical in the different families of conifers, the differences partly concerning the prothallial cells, which are from two to several in number and form a persistent tissue in both Araucariaceae and Podocarpaceae (except *Pherosphaera*), two and quite ephemeral in Pinaceae (except in *Sciadopitys* where they are absent), and entirely wanting in Cupressaceae and Taxaceae. The remaining divisions in the pollen grain and tube correspond to those in cycads and *Ginkgo*, *i.e.*, a tube nucleus and generative cell

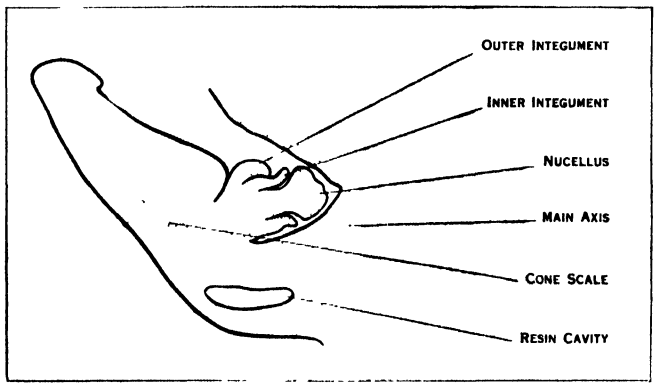


FIG. 15.—SCALE AND OVULE OF SAXEGOTHEA

are formed, after which the pollen is usually shed (though this may happen before these cells are differentiated as in *Widdringtonia* or after the division of the generative cell to form stalk and body cells as in *Larix* and most Pinaceae [fig. 14]). The pollen is carried by the wind to the neighbourhood of the ovule. In Araucariaceae it germinates on the scales of the female cone, the tube eventually growing into the nucellus; in *Saxegothea* (Podocarpaceae) it germinates on the stigma-like apex of the nucellus (fig. 15), and in most other conifers it is caught in the *pollination drop* which is extruded from the open micropyle of the young ovule and on evaporation of which the pollen is drawn down to the apex of the nucellus. The pollen tube at once begins to grow into the nucellus, but downwards, towards the prothallus, not laterally as in cycads, and into the tube pass, not only the tube nucleus but also, in all cases, the stalk nucleus and body cell. No

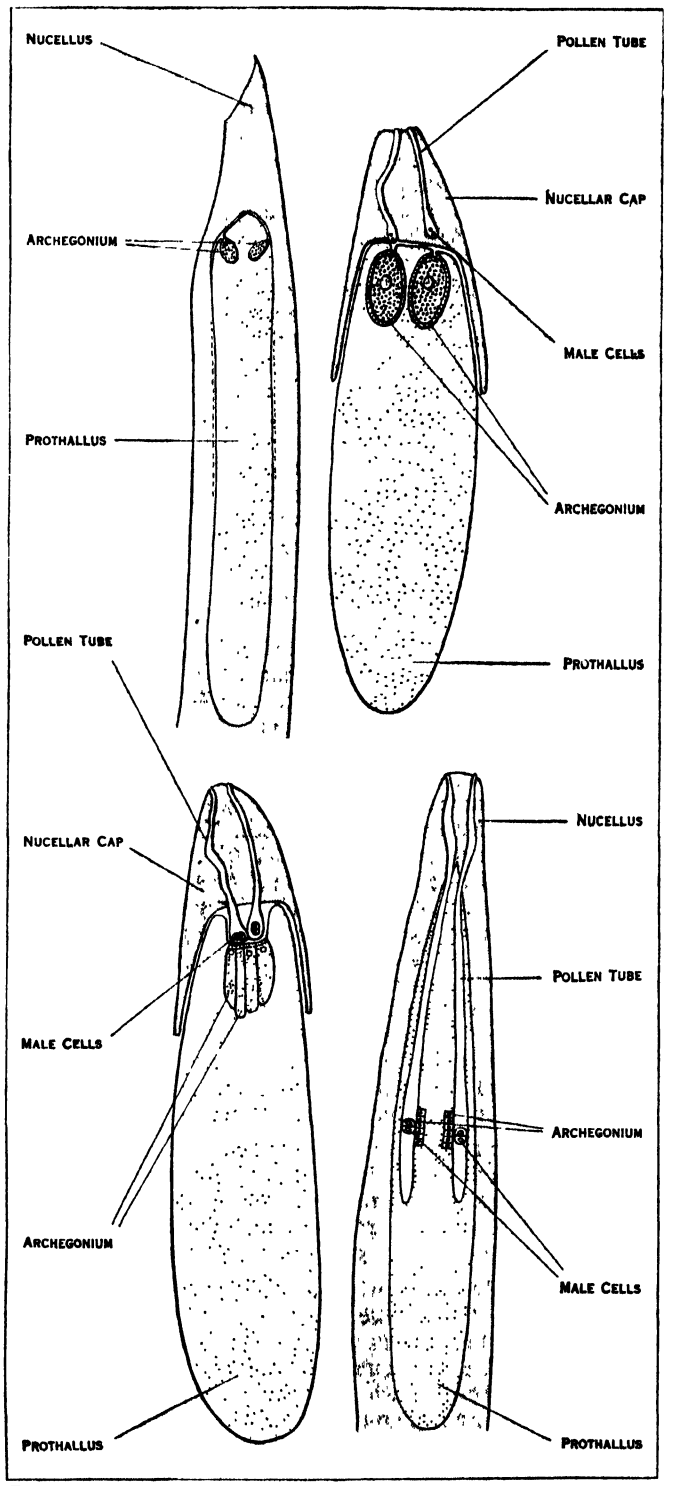


FIG. 16.—SEMI DIAGRAMMATIC LONGITUDINAL SECTIONS OF NUCELLUS (OR NUCELLAR CAP), ARAUCARIA

well organized pollen chamber is formed in the nucellus of conifers, but sometimes a few cells at its upper end break down and so produce a saucer-shaped depression (fig. 16). The body cell sooner or later divides to form two *non-motile* male cells, which in Cupressaceae are exactly equal and both functional, but in the other families are usually either slightly or markedly unequal, and only the larger functional.

In the young ovule a single functional megaspore develops, usually the lowest of a row of three or four, formed from a mother-cell as in cycads and practically all other seed plants. Exceptionally, as in *Taxus, Callitris* and *Pherosphaera,* two or more megaspores may begin to develop. The formation of the prothallus takes place almost exactly as in cycads, but it is smaller, usually much smaller, in the conifers, as are also the archegonia. The latter are few, and formed (as in cycads) from separate superficial cells at the apex in Podocarpaceae (except *Pherosphaera* and *Microcachrys*), Pinaceae and Taxaceae (fig 16); rather more numerous and more scattered, and more or less lateral, in *Pherosphaera* and in Araucariaceae (fig. 16), and in a single apical complex of 6 to 24 (all in contact with other archegonia of the group) in *Microcachrys* and in most Cupressaceae (fig. 16). In the remaining Cupressaceae, including *Sequoia* and the tribe Callitroideae, the archegonia are very small and numerous, usually deep-seated, and arranged in from one to several groups (in contact with each other in any one group) placed laterally along the prothallus, and never at, or very close to, the apex, which is usually pointed (fig. 16). The number of such archegonia may be up to about 60 in *Sequoia* or as many as 100 in *Widdringtonia.* A curious feature of these forms is that the size of the egg nucleus is about the same as that of the male nucleus at the time of fertilization, and in *Actinostrobus* (fig. 16) even the whole archegonium may be no larger than the male cell, so that we have here what practically amounts to a case of *isogamy*, of which no other example can be found in any plant of higher organization than the Algae and Fungi. It should be noted that in all conifers, in marked contrast with the preceding divisions, the male cells possess no cilia, and are carried by the growth of the pollen tube either into the archegonium itself or to a point very close to it. It is usual to describe the male cells as non-motile, but it is not clear that this is always strictly accurate as they may pass from the tube into the archegonium without being actually carried into it, which seems to imply some limited power of independent movement, possibly of an amoeboid nature. In the Araucariaceae, as in *Sequoia* and the Callitroideae, male and female nuclei are equal in size at the time of fertilization In most other conifers the male nucleus is distinctly smaller than the female, while in the family Pinaceae it is only about one-hundredth of the volume of the female nucleus.

In conifers the neck of the archegonium is always composed of more cells than the two characteristic of cycads, but the actual number varies widely, from about four in one tier to about a dozen or more in several tiers. Speaking generally it is less conspicuous in the Cupressaceae than in the other families.

The early development of the embryo varies a good deal in the different families. In *Araucaria* and *Agathis* 32 or more free nuclei are formed in the protoplasm of the archegonium. These nuclei then arrange themselves into a central group (of two tiers) and a peripheral enveloping layer, after which walls are laid down between them. The structure thus formed is the proembryo and completely fills the archegonium. The central group alone forms the embryo, the basal cells of the peripheral layer functioning as a protective cap while the cells nearest the neck elongate to form a suspensor.

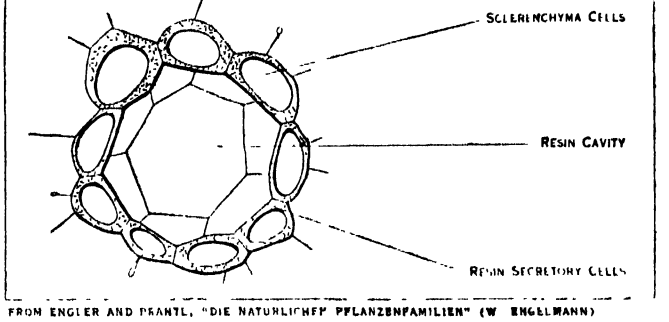
The case of the Pinaceae is best known. Here only four free nuclei are formed which pass to the base of the archegonium and there divide to form a basal layer of four *cells* and an upper tier of four *nuclei.* The latter repeat the process, resulting in two layers of cells and one of four nuclei above. Lastly the cells of the lowest tier divide once more giving *three* tiers of four cells each with one above of four nuclei. This is the structure of the proembryo and it occupies approximately the basal one-third or one-quarter of the archegonium. The tier of nuclei has no obvious function, the next tier may serve to prevent the suspensor cells growing back into the archegonial cavity, the lowest tier but one elongates enormously, forming the suspensor, while the basal tier forms the true embryo. The latter eventually becomes differentiated into a hypocotyl terminating in a radicle at the suspensor end and a whorl of, usually, several cotyledons at the other end, surrounding a central plumule. It sometimes happens that the four suspensor cells become separated from one another, along with the corresponding embryo cells, the latter then forming four separate embryos instead of one, though in any case not more than one embryo in a prothallus normally reaches maturity.

In the Podocarpaceae and in the more typical Cupressaceae (excluding *Sequoia* and the Callitroideae) proembryo development is similar to that in Pinaceae except that eight free nuclei are formed before cell formation and that the tiers are much less regular both in number and arrangement, the basal often consisting of only a single cell; and the embryo has usually only two cotyledons. In both cases the proembryo only occupies the basal part of the archegonium The family Taxaceae only differs from the two preceding in the fact that the proembryo *fills* the archegonium, with the exception that the genus *Cephalotaxus* develops a protective cap like that of Araucarians

In *Sequoia* and the Callitroideae cell formation takes place earlier than in any other forms (in *Sequoia* at the first division) and the proembryo fills the archegonium. The embryo develops from a single cell which may be that at the base of the archegonium (*Sequoia*) or may be cut off, at the end facing the base of the prothallus, from any of the lower cells of the proembryo (*Actinostrobus*) In either case the larger cell adjacent to the embryo cell becomes the suspensor.

In spite of these marked differences in the early embryo development there is a considerable uniformity in the structure of the seed in conifers In most cases the testa ripens dry and woody, as the outer fleshy layer of the cycads only develops to a very small extent and finally withers away. Within the testa the nucellus is scarcely noticeable except as the withered remains of the nucellar cap, while the prothallus is always packed full of starch and so becomes somewhat brittle The embryo normally lies symmetrically in the centre of the prothallus and is about two-thirds of its length and perhaps about one-tenth of its volume. In several conifers the seeds are winged, but while the wing is formed, in Pinaceae, from part of the tissue of the ovuliferous scale, in Cupressaceae (when present) it is part of the integument of the ovule (*e.g., Widdringtonia*). In Taxaceae and some Podocarpaceae the seeds have a fleshy covering, not always of the same nature, and in *Microcachrys* (Podocarpaceae) the cone scales themselves become fleshy, thus forming a "fruit" something like a small raspberry. In the juniper also (Cupressaceae) the fertile scales become fleshy, thus forming a berry-like "fruit."

Anatomy.—One of the most striking features of conifer anatomy is the occurrence of long cylindrical intercellular spaces lined with thin-walled, resin-secreting cells and known as resin-canals These are frequently present in all parts of the plant and are never entirely absent except in *Taxus* and in *Dacrydium laxifolium.* In the former isolated resin-secreting cells occur here and



FROM ENGLER AND PRANTL, "DIE NATÜRLICHEN PFLANZENFAMILIEN" (W. ENGELMANN)

FIG 17 - -RESIN CANAL IN PINUS SYLVESTRIS LEAF

there in the tissues, but in the latter even these appear to be lacking The resin canals are most frequently found in the cortex and have a characteristic structure, the epithelial cells which secrete the resin being in turn surrounded, as a rule, by a ring of much more conspicuous thick walled protecting cells (fig. 17). In many genera resin canals are also found in the wood, as in *Pinus*, while sometimes they are restricted to the cone axis, as in *Sequoia* They are nearly always present in the leaves, often below the vascular bundle. Although resin canals are a characteristic feature of the conifers they are by no means peculiar to them, being equally

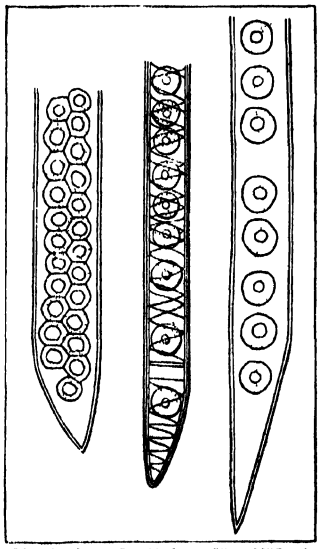
distinctive of some tropical families of flowering plants (*e.g.*, Anacardiaceae) and occasional plants outside those families such as sunflower and ivy.

The phloem always includes sieve tubes without associated companion cells (though phloem-parenchyma cells with albuminous contents are present, and with pitted areas chiefly on their lateral walls). In the Pinaceae the phloem consists solely of sieve tubes and phloem parenchyma, but in most other forms concentric cylinders of bast fibres occur in regular alternation with the functional phloem.

Coniferous wood is homogeneous in structure, consisting almost entirely of tracheids with circular (rarely polygonal) bordered pits on the radial walls. Xylem parenchyma is never abundant, but traces of it are present in many genera. In *Pinus* there is no wood parenchyma except in association with the numerous resin canals scattered through the wood. The medullary rays consist of a single layer of cells except in certain Pinaceae (where some of them are fusiform in section, enclosing a single horizontal resin canal) and have usually a complex structure. The margins, both upper and lower, of that part of the ray which lies in the xylem, are often composed of horizontally elongated tracheids with irregularly folded walls and bordered pits, while the central rows of cells are parenchymatous and thin-walled, but usually pitted. In the phloem the marginal ray tracheids are replaced by irregularly lobed albuminous cells.

Root.—The roots of many conifers possess a narrow band of primary tracheids with a group of slender protoxylem elements along either margin (diarch). In other cases the primary xylem is triarch or tetrarch (*Sequoia*) or even polyarch. An old root approximates closely to a stem in structure, but the annual rings are often less clearly marked and the tracheids larger and thinner-walled. The primary tissues are, of course, differently arranged, but are apt to become obliterated with age.

Stem.—The primary vascular bundles in a young conifer stem are collateral, and, like those of a Dicotyledon, they are arranged in a circle round a central pith and enclosed by a common endodermis. Secondary thickening begins at an early stage and continues throughout the life of the plant with seasonal variations and interruptions resulting in the normal appearance of clearly defined annual rings, as in most woody Dicotyledons. The differences of structure met with in conifer stems are sometimes affected by the conditions (including climate) under which they are grown, and are more often distinctive of species than of genera or families. There are, however, certain characters of the wood which are of greater significance. For instance the secondary tracheids of nearly all conifers (fig. 18) have a single row of separate bordered pits (rarely of two rows with the pits of the two rows opposite). This type of wood is distinctive of Podocarpaceae. Pinaceae and Cupressaceae. In *Araucaria* (fig. 18) and *Agathis* the bordered pits are in one, two or three rows on the radial walls and, being in contact, are polygonal in shape, and the pits of adjacent rows are alternate and not opposite. In *Taxus* (fig. 18) the normal type of bordered pit occurs, but in addition conspicuous spiral thickening-bands are met with. It is doubtless these which give to the wood of the yew its well-known strength and elasticity, recognized by the mediaeval English when they used it for their bows, which were the most efficient weapons of that period.



FROM A. & C. BAKER & SMITH, "PINES OF AUSTRALIA"

FIG. 18.—TRACHEIDS. ARAUCARIA (LEFT); TAXUS (CENTER); TYPICAL BORDERED PITS (RIGHT)

Leaf.—The cotyledons have each a single vascular strand except in *Podocarpus*, which has two, and in Araucarians where there are four or more. In the latter there are also several resin canals, one or two of which are also found in *Pinus*, though absent in most other forms. The adult leaves (fig. 20) have a single median vein except in *Agathis*, several species of *Araucaria* (fig. 20 C) and a few of *Podocarpus*, which have several parallel veins. In some pines (*e.g.*, *Pinus* and *Abies* [fig. 20]) this vein includes two vascular bundles, but in others, and in all Cupressaceae (fig. 20) and Taxaceae and in all podocarps, except the few species of *Podocarpus* already mentioned, there is only a single vascular strand. In *all* cases the leaf trace leaves the central cylinder as a single strand, unlike *Ginkgo* and the cycads, but in *Araucaria*, etc., this strand splits into several in its passage through the cortex. In most genera one or more resin canals are found in the leaf, and another equally distinctive feature is the presence, generally on the flanks of the vascular strand, of a few isodiametric tracheids known as "transfusion tracheids." Sometimes there are also horizontally elongated transfusion tracheids extending towards the leaf margin. A noteworthy feature is the common occurrence of hypodermal fibres, but their presence and extent is partly dependent on the light conditions under which their development takes place; *e.g.*, a pine needle grown in continuous light lacks the usual hypodermal fibres, as well as differing in some other details. In *Pinus* and *Cedrus* the homogeneous mesophyll is characterized by the infolding of the cell walls. In many leaves, such as those of *Abies* (fig. 20) and *Larix* there is both palisade and spongy parenchyma. In *Araucaria imbricata* (fig. 20) a palisade layer occurs in both upper and lower parts of the mesophyll, and resin canals are found between the veins, while in the multi-nerved species of *Podocarpus* (section *Nageia*) a canal occurs below each vein. This position (below the vein) is that usual for the single resin canal of many forms (fig. 20), while in *Larix*, *Abies*, etc., two canals run through the leaf parallel to the margins (fig. 20). Each stoma is normally sunk at the base of a pit (fig. 19), and the stomata are frequently arranged in rows, their position being marked by two or more bands of wax on the surface of the living leaf.

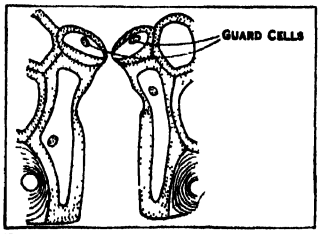


FIG. 19.—STOMA OF PINUS SYLVESTRIS

Geographical Distribution.—Most conifers grow in forests, either alone or mixed with angiospermous trees, forming one of the characteristic features of the vegetation in temperate and alpine regions. Since a large proportion of the cold temperate lands lies in the northern hemisphere it is easy to understand why the chief home of the Coniferales is in the north, where certain species occasionally extend into the arctic circle and beyond the tree limit, *e.g.*, *Juniperus nana*. The tree limit in northern Europe is chiefly marked by conifers (*Picea*, *Larix*, *Abies*, *Pinus*, etc.), and many are abundant in North America, such as *Juniperus virginiana*, *Taxodium* and several pines on the eastern side; *Pseudotsuga*, *Sequoia*, other pines, etc., on the west; while *Picea*, *Larix*, *Abies*, *Tsuga*, *Taxus* and *Pinus strobus* are characteristic forms throughout. In the Mediterranean region occur *Pinus maritima*, *P. pinea* and other species, cedars and cypresses. In Japan and China are a number of small endemic genera such as *Cryptomeria*, *Cunninghamia*, *Sciadopitys*, *Cephalotaxus* and *Pseudolarix*. In the Himalayas are *Cedrus*, *Taxus* and endemic species of *Abies*, *Pinus*, etc. Apart from high altitudes few conifers are found in the tropics, but various endemic types are met with in the south, of which *Podocarpus* is most widely distributed, while *Widdringtonia* is peculiar to South Africa and a considerable number of characteristic genera are found in Australasia, such as *Callitris*, *Agathis*, *Dacrydium*, *Microcachrys*, *Athrotaxis* and *Araucaria*, most of which are endemic. The last named, however, occurs in South America as well, where *Fitzroya* and *Saxegothea* are also met with, chiefly in the Andes.

Classification.—In conclusion a brief account of the characters of the five families and their tribes, and a key to the principal genera of each may be given:

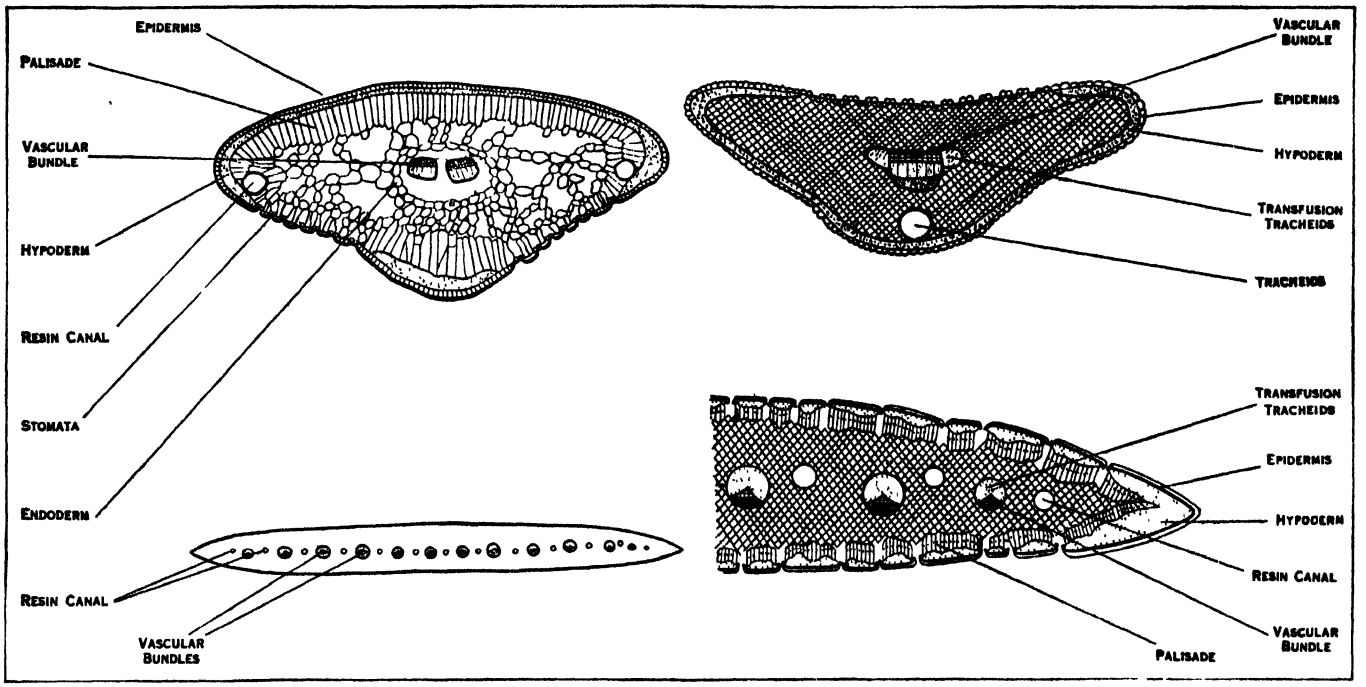


FIG. 20.—(A) LEAF OF ABIES PUNGENS. (B) JUNIPERIS COMMUNIS; (C) ARAUCARIA IMBRICATA; (D) PART OF ARAUCARIA IMBRICATA ON LARGER SCALE

I. ARAUCARIACEAE. Large trees. Both male and female cones rather large. Microsporophylls with numerous long, narrow, pendulous pollen sacs. Megasporophylls numerous, simple and bearing solitary ovules embedded in the tissue. Nucellus extending beyond the integument. Prothallus with separate scattered archegonia, usually more or less lateral. Several prothallial cells in the pollen grain. Tracheids with multiseriate pitting.

*Dioecious. Megasporophyll with a ligule. *Araucaria.*

**Monoecious. Megasporophyll without a ligule. *Agathis.*

II. PODOCARPACEAE. Trees, shrubs and small undershrubs, mostly dioecious. Megasporophylls not numerous in the cone, each bearing a single, usually inverted ovule. Male cones with spiral or sometimes whorled sporophylls, each with two pollen sacs. Pollen often winged, with a group of two or more persistent prothallial cells (except in *Pherosphaera*). Archegonia separate, each with its own jacket cells, as in Araucariaceae, but apical, not lateral (except in *Pherosphaera* and *Microcachrys*).

*Flat expanded branches and no true foliage leaves. Ovules erect. *Phyllocladus.*

**Normal foliage leaves.

†Megasporophylls solitary or in pairs, or a few very laxly arranged on a strobilus, but never joining to cover the more or less inverted ovules.

⊙Pollen winged. Ovules always fully inverted, on a swollen stalk and solitary or in pairs. *Podocarpus.*

⊙⊙Pollen not winged. Ovule sessile and not fully inverted. *Dacrydium.*

††Megasporophylls in a cone, growing together so as to enclose the ovules.

⊙Ovules more or less inverted. Epimatium present.

§Monoecious. Leaves needle-like. *Saxegothea.*

§§Dioecious. Leaves scale-like. *Microcachrys.*

⊙⊙Ovules erect and axillary. No epimatium. *Pherosphaera.*

III. PINACEAE. Trees and shrubs, usually monoecious. Male cones like those of Podocarpaceae, with two pollen sacs to each sporophyll. Female cone compact with many pairs of scales, the upper of each pair bearing two, or rarely more, ovules. Archegonia separate, each in its own jacket cells, as in Podocarpaceae.

A. Pollen with no prothallial cells. A single grooved leaf on each short shoot with two veins, one either side of the groove. Several ovules on the ovuliferous scale. Tribe 1. Sciadopitoideae. *Sciadopitys.* Except for the separate archegonia, could be equally well placed in the Cupressaceae.

B. Pollen with two ephemeral prothallial cells. Leaves with a single vein. Two ovules on each ovuliferous scale. Tribe 2. Abietoideae.

(i.) Leaves almost entirely borne on spur shoots.

*From one to five leaves (the number more or less constant in each species) on each short shoot. *Pinus.*

**A tuft of more than five leaves on each spur shoot.

†Leaves not deciduous. *Cedrus.*

††Leaves deciduous.

⊙Cone scales deciduous. Rim of micropyle spreading. Pollen winged. *Pseudolarix.*

⊙⊙Cone scales persistent. Rim of micropyle infolded. Pollen not winged. *Larix.*

(ii.) Leaves borne on branches of unlimited growth.

*Bract scales three-lobed, and projecting beyond the ovuliferous scales. Rim of the micropyle infolded. *Pseudotsuga.*

**Bract scales not three-lobed even when longer than the ovuliferous scales. Rim of the micropyle spreading.

†Cones pendulous. Cone scales persistent.

⊙Pollen sacs dehisce longitudinally. Pollen winged. Cones large. *Picea.*

⊙⊙Pollen sacs dehisce transversely. Pollen globose. Cones small. *Tsuga.*

††Cones erect. Cone scales deciduous. Bract scales often longer than the ovuliferous scales. Leaves flat. *Abies.*

IV. CUPRESSACEAE. Trees or shrubs, often dioecious. Only one kind of scale in the female cone as a rule, but sometimes with outgrowths on the upper surface. Number of fertile scales usually much smaller than in Pinaceae, often only from two to six or eight. Ovules inverted or more often erect, commonly more than two to each fertile scale. Archegonia in one or more *groups*, not solitary. Male cones small with usually three or more pollen sacs to each sporophyll. Pollen grain without prothallial cells. Leaves usually small, not infrequently dimorphic, as in *Juniperus chinensis*.

A. Leaves opposite or whorled. Ovules erect
(i.) Archegonia in a single apical group. Tribe 1. Cupressoideae.
*Cone scales ripening fleshy *Juniperus*.
**Cone scales ripening woody.
†Cone scales peltate. *Cupressus*.
††Cone scales not peltate.
°Cone scales imbricate.
α. Four or five seeds to each scale. *Thujopsis*.
β. Usually two seeds to each scale.
§Two fertile scales. *Libocedrus*.
§§Four fertile scales. *Thuja*.
°°Cone scales valvate. *Tetraclinis*.
(ii.) Archegonia never apical, but in one or more lateral groups, usually deep-seated Tribe 2. Callitroideae.
*Scales slightly imbricate (imperfectly known, may prove to belong to the preceding tribe). *Fitzroya*.
**Scales valvate.
†Fertile scales four in decussate pairs. *Widdringtonia*.
††Fertile scales six in alternating whorls of three.
°Cone with a number of sterile bracts at the base Fertile scales all equal. *Actinostrobus*.
°°No sterile bracts at base of cone Fertile scales unequal. *Callitris*.

B. Leaves spirally arranged
(i.) Archegonia in a single apical complex. Tribe 3. Taxodioideae.
*Leafy branchlets deciduous. *Taxodium*.
**Leaves, cone-scales deciduous. *Glyptostrobus*.
***Neither leaves nor branchlets deciduous.
†Seeds erect. *Cryptomeria*.
††Seeds inverted.
°Fertile scales with a narrow transverse membrane (ligule) above the seed. Leaves lanceolate. *Cunninghamia*.
°°Fertile scales with a transverse ridge above the seed. *Athrotaxis*.
(ii.) Archegonia never apical. Tribe 4 Sequoideae. *Sequoia*.

It is quite possible that tribes 3 and 4 above should be merged in tribes 1 and 2 respectively, the distinction based on the leaf arrangement being probably unimportant, and not always constant.

V. TAXACEAE. Small trees and shrubs, usually dioecious, with much reduced female cones often consisting of single naked erect ovules subtended by a number of bracts, the ovules usually with an outer fleshy integument. Archegonia as in Pinaceae. Male cones small with peltate or crested sporophylls each bearing from two to seven, or more pollen sacs. Pollen grains without prothallial cells. Leaves usually free and blade-like.

°One or two erect ovules borne on a small fleshy fertile scale which becomes abortive as the seeds ripen. No aril. *Cephalotaxus*.

**"Cone" reduced to a naked ovule. Aril present.
†Microsporophylls crested, with two to four pollen sacs. *Torreya*.
††Microsporophylls peltate with four to eight pollen sacs. *Taxus*.

GNETALES

These are perennial, normally dioecious plants with opposite simple leaves. The perianth of one or two whorls is distinctive, and sharply contrasts this division with other Gymnosperms. The cones are more complex than in other forms, consisting of an axis bearing decussate pairs of bracts or a number of superposed whorls of bracts, each whorl connate in a cup-like form. In either case the ovulate or staminate structures, which for convenience we may call "flowers," are axillary to these bracts. The flower always consists of one or two pairs of free or connate scales, the perianth, enclosing either a single ovule with a long projecting micropylar tube, or from one to six stamens It is evident that it is the *flowers* of Gnetales, especially the female flowers, which are equivalent to the cones of conifers (*e.g.*, compare the female cone of *Torreya*) and not the whole "*cone*," which might well be called a compound cone, and which is also comparable to the catkin-like inflorescence of certain flowering plants.

In their anatomy also the Gnetales show a marked resemblance to angiosperms, as, though the phloem remains typical of gymnosperms in general, true vessels, like those of the flowering plants, are associated with typical gymnospermous tracheids in the wood, and there are no resin canals

The division includes only three genera, which are so entirely unlike in appearance as to suggest at first sight that each must be regarded as the type of a separate family But detailed study of development and anatomy has indicated a very close similarity in the former respect between two of the genera, and at least a partial explanation of their complete dissimilarity in appearance, while emphasizing the divergence of the third. They are therefore considered here as forming *two* families, as follows:—

I EPHEDRACEAE Much branched small-leaved xerophytic shrubs Ovule with two integuments containing a prothallus with archegonia, similar to that of conifers *Ephedra*.

II. GNETACEAE Vegetative region of the plant unbranched or sparingly branched. Ovule with one or two integuments and containing a prothallus which does not form archegonia. Leaves large.

A. Tribe Welwitschioideae. Plant tuberous and chiefly underground, developing only two enormously long and straggling, parallel-veined leaves after the cotyledons. *Welwitschia*.

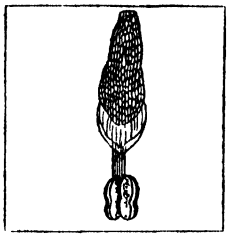
B. Tribe Gnetoideae. Plant a tree or large woody climber, with numerous net-veined leaves indistinguishable from those of ordinary dicotyledons. *Gnetum*.

It seems evident that *Ephedra*, both in general habit and in the possession of archegonia is intermediate in character between the conifers (having points of resemblance to both Cupressaceae and Taxaceae), and the Gnetaceae, while *Gnetum* has many points of similarity to the true flowering plants. Most botanists have hesitated (no doubt rightly) to look upon the Gnetaceae as the direct ancestors of the flowering plants, but it is not altogether unlikely that both may have originated from the same stock, which was perhaps not very different from *Gnetum*. It is indeed a very surprising fact that the geological history of the Gnetales is unknown.

Ephedra is the largest genus of Gnetales, with about 35 species, and the only one represented in Europe. It is confined to more or less arid warm-temperate and tropical regions and one species is common on sand dunes along parts of the Mediterranean coast. The finer branches are green; the surface of the long internodes is marked by fine longitudinal ribs; and at the nodes are borne pairs of small, partially connate scale leaves, the general appearance being similar to that of a stem of *Equisetum* or a twig of *Casuarina*. Some of the branches bear pairs of small cones in the axils of the scale leaves. The cone scales are broad and imbricate. Each male flower (fig. 21) consists of an inconspicuous

perianth, composed of two more or less concrescent bracts, enclosing an axis projecting beyond the perianth and terminating in two (sometimes more, up to six or eight) sporangia. The resemblance of this structure to a stamen is obvious, but it is no less clearly homologous with the microsporophyll of conifers.

The female flower is enveloped in a closely fitting perianth of two more or less connate bracts, as in the male flower. This perianth encloses a single ovule with two integuments, the inner, which is not more than two cells thick, prolonged upwards as a beak-like micropyle, the outer, which is thicker and later becomes woody, only reaching about half way up the micropylar beak. The micropyle secretes a pollination drop, as in conifers.

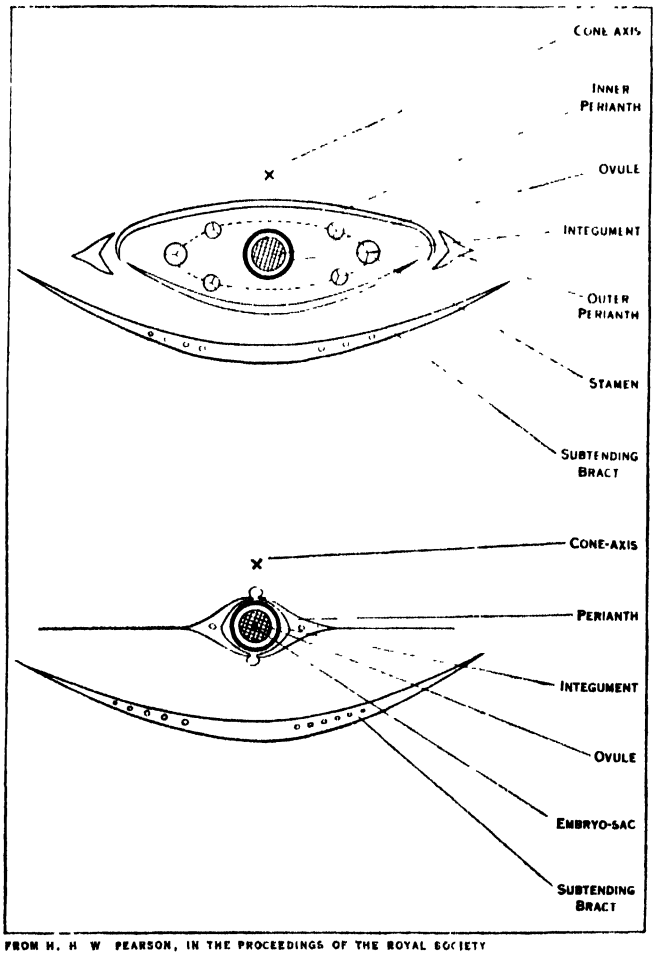


FROM ENGLER & PRANTL, "DIE NATURLICHEN PFLANZENFAMILIEN" (WM ENGLEMANN)

FIG. 21.—MALE FLOWER OF EPHEDRA FRAGILIS

A prothallus is organized exactly as in conifers, the two to five archegonia being developed from separate superficial cells at the apex, and having long, multicellular, necks. About the time when they first appear the tip of the nucellus begins to break down, this disorganization proceeding downwards until there is (when the archegonia are mature) a broad circular pollen chamber open to the top of the prothallus, thus permitting the pollen grains to rest on the necks of the archegonia. The development of the pollen grain is closely similar to that of *Larix* and it is shed in the 5-nucleate condition. Division of the body cell occurs immediately after pollination and the pollen tube forces its way between the neck cells and discharges its contents into the egg within a few hours. The fusion nucleus divides three times to form eight nuclei, some of which then become organized into walled cells, very loosely connected into a proembryo Each of these cells, after division of its nucleus, elongates and cuts off a small embryonal cell containing one of the two nuclei, the larger cell remaining, the suspensor, elongating rapidly to thrust the embryo cell deep into the prothallus tissue. The embryo cell divides to form an ovoid mass of cells of which those next to the suspensor elongate in succession giving rise to embryonal tubes which add to the length of the suspensor. The whole process is strongly reminiscent of what takes place in *Actinostrobus* among the conifers. This description applies more particularly to *Ephedra trifurca*, and it is uncertain how far the embryo development of other species agrees with it. In any case only one embryo matures.

Welwitschia.—*W. mirabilis* is the only species of this remarkable genus and is found in two isolated and restricted areas of the coastal desert region of Damaraland in South-west Africa It is by far the most remarkable member of the Gnetales not only in its habit but also both in the form of its flowers and the details of its development. Knowledge of these details is largely due to investigations carried out by H. H. W. Pearson. An adult plant has somewhat the form of a gigantic radish two to four feet in diameter, projecting less than a foot above the ground, and terminating in a long tap-root below. The two strap-shaped leaves trail along the ground to a length of 10ft. or more, and become split into a number of narrow thong-like strips. They retain the power of growth at the base throughout the life of the plant which probably exceeds 100 years. The characteristics of the plant accord well with the interesting suggestion that it may represent an "adult seedling." Numerous circular pits occur on the concentric ridges of the depressed and wrinkled crown, marking the positions of former inflorescences, new ridges subsequently appearing outside the old ones. The inflorescences have the form of dichasially branched stalks bearing the cones, from one to 20 in the female plant and up to 50 in the male. The female cone is about an inch long and scarlet in colour, the male smaller and more slender. Each consists of an axis bearing a large number of alternating pairs of overlapping bracts, in the axils of which are the flowers. The staminate flower (fig. 22) is enclosed by a perianth of two opposite pairs of bracts, surrounding a ring of six stamens united below but free above and each terminating in a trilocular anther. In the centre of the flower is an abortive ovule the integument of which projects upwards as a spirally twisted tube with a stigma-like expansion at its apex In the development of the pollen grain, a single prothallial nucleus is cut off, which disappears again about the time of pollination There are only two further divisions resulting in a tube nucleus and two male nuclei, the formation of a stalk cell which occurs without exception in all conifers, as well as in *Ephedra*, being omitted. There is evidence that pollination is effected by insect agency. The ovulate flower consists of an erect ovule with two investments of which the outer is winged and represents the perianth, formed of a pair of completely connate bracts, the inner being the integument which has the usual long tubular micropyle. (fig. 22). No pollen chamber is formed, but numerous pollen tubes grow downwards in the nucellar cap The megaspore begins to develop as usual, becoming filled with protoplasm containing over 1,000 nuclei before walls appear. The latter divide the whole sac into multinucleate compartments, those in the micropylar end containing fewer and larger nuclei, any of which may function as eggs The remainder contain about a dozen nuclei each, all of which fuse together in the compartment, thus forming a tissue of uninucleate cells which then grows considerably and may be termed the endosperm The micropylar multinucleate cells put out long tubes which grow upwards into the nucellar cap, and into which the egg nuclei pass These ascending prothallial tubes meet, and fuse with the descending pollen tubes and at the point of



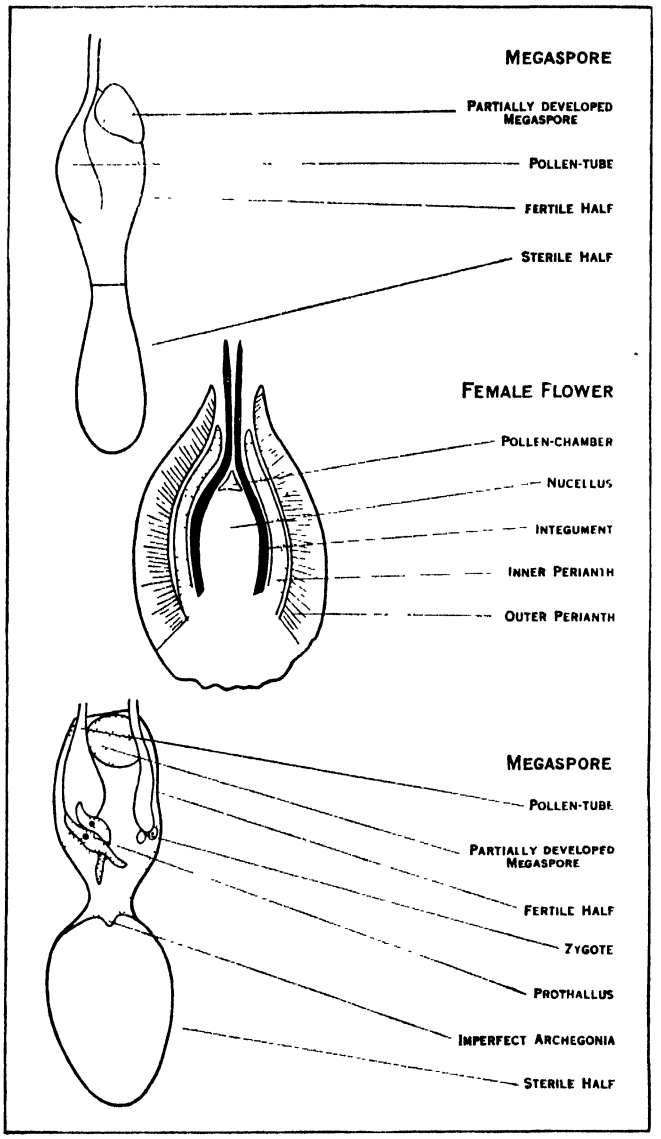
FROM H. H. W. PEARSON, IN THE PROCEEDINGS OF THE ROYAL SOCIETY

FIG. 22.—WELWITSCHIA CROSS-SECTION OF FLORAL STRUCTURES

fusion, fertilization occurs The fertilized egg forms a wall and elongates into a tube from which an embryo tip cell is cut off, the remainder of the tube being the suspensor which carries the embryo deep into the endosperm. The further development is similar to that in *Ephedra*, including the formation of embryonal tubes from the young embryo, but the divisions of the embryo are more regular and symmetrical.

Gnetum is represented by about 30 species, mostly climbers, found both in tropical America and in tropical regions of the Old World. The oval leaves are two or three inches long and are borne

in pairs at the swollen nodes. The cones are long and cylindrical and bear whorls of flowers at each node, accompanied by numerous sterile hairs, in the axils of cup-like concrescent bracts In a male inflorescence very numerous flowers may be found, up to about 3,000 in one species, while in a female spike the number of flowers probably does not reach 100. The staminate flower consists of a perianth of two concrescent bracts enclosing a



AFTER LOTSY IN THE "ANNALS DU JARDIN BOTANIQUE DE BINTENZORG" (E J BRILL)

FIG 23.—FEMALE FLOWER OF GNETUM

slender axis projecting above the perianth and terminating in two sporangia. The pollen appears to be formed in precisely the same manner as that of *Welwitschia*. Incomplete female flowers are often found in the male inflorescence containing ovules with one integument instead of two, but these rarely set seed A perfect female flower (fig. 23) consists of an ovule with three investments of which the outer is generally regarded as a perianth of two concrescent bracts. Of the other two the inner arises first and develops the long slender micropylar tube characteristic of all Gnetales and is followed by a much shorter outer covering, the outer integument. Several megaspores may begin to develop in a young ovule, but only one attains full size. In all species the embryo-sac, as in *Welwitschia*, becomes filled with numerous free nuclei, and in some species, probably in the large majority, fertilization occurs at this stage, the contents of pollen tubes being discharged into the embryo-sac, any of the nuclei near the micropylar end apparently functioning as eggs. The lower half of the sac then becomes partitioned (as in *Welwitschia*) into multinucleate "cells," the nuclei of each cell subsequently fusing so that an endosperm of uninucleate cells results, into which the developing embryos penetrate. Each zygote of *G. Gnemon* is stated to elongate and form a long tortuous multinucleate suspensor, from the lower end of which a small, also multinucleate, embryo cell is cut off. Walls are said to appear in this "cell" and so reduce it to a tissue of uninucleate cells. This account certainly does not apply to all species and requires confirmation.

In one or two species the lower half of the sac forms a firm endosperm tissue *before* fertilization, as first observed by J. P. Lotsy in 1899. The accuracy of this observation was questioned by J. M. Coulter in 1908, but it is probable that his preparations did not include the critical stages necessary for confirming or refuting Lotsy's statements, as the latter have since been shown by H. H. W. Pearson to be correct Coulter described a remarkable development of nutritive tissue, which he named pavement tissue, below the embryo-sac (which is also seen in one or two conifers), and concluded that this had been mistaken by Lotsy for tissue *inside* the embryo-sac.

The later development of the embryo is similar to that of *Welwitschia*, and in both genera a rod-like outgrowth is formed from the hypocotyl at its junction with the radicle, which serves as a feeder and draws nourishment from the endosperm during the germination of the seed.

The climbing species of *Gnetum* are characterized by the production of several concentric cylinders of wood and bast from as many successively formed cambium cylinders produced in the pericycle, as in *Cycas*.

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GYMPIE, a mining town of March county, Queensland, Australia, 107 m. N. of Brisbane, and 61 m. S. of Maryborough by rail. Pop. (1921) 8,769. Gympie became a municipality in 1880. Gold mines are worked in the district, which also abounds in copper, silver, antimony, cinnabar, bismuth and nickel.

GYNAECOLOGY, the name given to that branch of medicine which concerns the pathology and treatment of affections peculiar to the female sex.

Gynaecology is a very ancient branch of medicine. The papyrus of Ebers, one of the oldest known works on medicine (1550 B.C.), contains references to diseases of women, and it is recorded that specialism in this branch was known amongst Egyptian medical

practitioners. The Vedas contain a list of therapeutic agents used in the treatment of gynaecological diseases. The treatises on gynaecology formerly attributed to Hippocrates (460 B.C.) are now said to be spurious, but the wording of the famous oath shows that he was at least familiar with the use of gynaecological instruments. Writers of the Graeco-Roman period of medicine who have treated of this branch are Celsus (50 B.C.–A.D. 7), Soramus of Ephesus (A.D. 98–138) and Galen (A.D. 131–201), who devotes the sixth chapter of his work *De locis affectis* to gynaecological ailments. It is evident that during this period much of the gynaecological work was in the hands of female healers. Martial refers to these "*feminae medicae*" in his epigram on Leda. These women must not be confounded with the midwives, who are always described as "*obstetrices*." Throughout the Byzantine and Mediaeval periods of medicine, which comprise a period of more than a thousand years, gynaecology shared in the general sterility and even decadence which accompanied medical and all other branches of scientific learning; writers on gynaecology, like Oribasius (A.D. 325–403), were mere compilers of the work of their predecessors and practice was bound by ancient authority and tradition. The growth of interest in diseases of women during the Renaissance period (A.D. 1453–1600) is shown in the huge "Gynecia" or encyclopedia of gynaecology issued by Caspar Wolf of Zürich in 1566. In the seventeenth century what has been described as the first work on operative gynaecology in the modern sense was written by Hendrik van Roonhugze (1625?); it contains case reports on extra-uterine pregnancy and rupture of the uterus and the description of a scientific operation for vesico-vaginal fistula. Amongst contributions to gynaecology in the eighteenth century are William Hunter's proposal for excision of ovarian cyst and his description of retroversion of the uterus, Robert Houston's treatment of ovarian cysts by tapping, Matthew Baillie's description of dermoid cysts of the ovary and Joseph Recamier's invention of special specula

Operative gynaecology, as an independent speciality, had no real existence until the first half of the nineteenth century and its founders may be said to be Ephraim MacDowell (1771–1830) of Virginia and John Marion Sims (1813–1883) of South Carolina MacDowell performed his first ovariotomy (removal of an ovarian cyst by abdominal section) in 1809 Sims was a great surgical genius whose fame quickly spread over the whole civilized world because of his success in curing the hitherto incurable condition of vesico-vaginal fistula. In British surgery, ovariotomy became firmly established by the work of Charles Clay (1801–1893) of Manchester and Sir Spencer Wells (1818–1897) of London Other prominent British gynaecologists of this period were Sir James J. Simpson (1811–1870) of Edinburgh, who invented the uterine sound, and Lawson Tait (1845–1899) of Birmingham, who was the pioneer in operations on the Fallopian tubes, performed the first deliberate operation for ruptured extra-uterine pregnancy, and insisted on asepsis as distinguished from antisepsis in gynaecological operations.

Menstruation (*q.v.*).—At puberty, which in northern folk arrives at the age of from 13 to 15 years, the uterus and ovaries begin to undergo a complex and correlated series of changes which recur in monthly cycles and constitute the function of menstruation. Menstruation continues throughout the whole reproductive period of a woman's life, is arrested only by pregnancy, and ends at the time of the menopause, commonly known as the "change of life" (usually between 45 and 50 years of age). The double purpose of menstruation is to liberate an ovum (egg) from the ovary and to prepare the endometrium (the mucous membrane lining the uterine cavity) for the reception of such ovum should fertilization occur. The cycle of change which occurs in the ovary is known as *ovulation*, and that which occurs in the endometrium is chiefly concerned with the formation of the *menstrual decidua*. If fertilization occurs, the ovum becomes embedded in the prepared endometrium, where it continues to develop into a child, and further menstruation is arrested. If, on the other hand, fertilization does not occur, the menstrual decidua in due course becomes cast off and what is known as the *menstrual flow* occurs, after which the cycle of changes in the uterus and ovaries is repeated. The menstrual flow is the outward and visible sign of menstruation; it recurs, in the absence of pregnancy, about every 28 days, lasts about 5 days, and consists of a discharge from the uterus of 4 to 6 ounces of blood mixed with fragments of menstrual decidua and with mucus from the glands of the cervix. The cycle of change which occurs in the endometrium may thus be said to consist of alternate phases of building up and breaking down. During the building up phase, which occupies about 14 days, the menstrual decidua is formed by a gradual increase in thickness of the endometrium; this is followed by the menstrual flow or breaking down phase, and the cycle is completed by a phase of rest and repair. The stimulus to the uterine cycle is provided by ovulation, for if the ovaries be removed the endometrium remains permanently in the resting phase During ovulation an ovarian follicle (egg-chamber) ripens and ruptures, liberating an ovum; at the site of rupture a temporary yellow body (*corpus luteum*) forms, and recent work has shown that the internal secretion of this body provides the chemical stimulus to the uterine changes. The time relationship between the events in the ovarian and uterine cycles is as follows: the ovarian follicle ruptures about 14 days before the onset of the menstrual flow, reaches its full development about 7 days before the flow and begins to decline after the flow has begun. There is very little evidence for the belief that the right and left ovaries ovulate alternately.

Common Disorders.—These are: (1) amenorrhoea (absence of flow), (2) menorrhagia (excessive flow), (3) epimenorrhoea (too frequent flow), (4) irregular and scanty flow, (5) dysmenorrhoea (painful flow). Amenorrhoea may arise from physiological causes, such as pregnancy, lactation, the menopause The onset of the first menstrual flow may be delayed beyond the usual age, but if menstruation is delayed beyond the age of 17 or 18 medical advice should be sought, as there may be some developmental error in the uterus or vagina and the sooner this is discovered the better. Amenorrhoea of pathological origin may be due to error in growth or development of the reproductive organs, or to constitutional disease. Under developmental errors come those cases where menstruation occurs but the escape of menstrual fluid is prevented by the presence of a membrane obstructing the vaginal orifice (so called "imperforate hymen") or even by the absence of the vagina or by imperforation of the cervix uteri—("concealed menstruation"). The blood accumulates in the vagina or uterus, or both, and forms a swelling which gradually becomes larger. The uterus may fail to develop beyond the infantile state or may be completely absent, and in the latter case the amenorrhoea is permanent. Amongst constitutional causes may be mentioned chlorosis, secondary anaemia, tuberculosis, mental shock and strain, acute illness, and defective function of the thyroid or pituitary glands; in most of these the amenorrhoea is usually temporary. The treatment of amenorrhoea depends on the cause; in case of temporary amenorrhoea due to constitutional causes the flow can often be re-established by measures directed to improve the general health. It should be noted that menstruation (*i.e.*, ovulation and the formation of menstrual decidua) may occur with absence of menstrual flow, otherwise it is not possible to account for the occurrence of pregnancy during a period of amenorrhoea—a not uncommon event during the amenorrhoea of lactation.

Menorrhagia signifies excessive bleeding at the time of the menstrual flow, *but no irregular bleeding during the interval between the flows*. Amongst local causes are fibromyomata of the uterus, uterine polypi, excessive thickness of the endometrium, fibrosis and chronic subinvolution of the uterus, inflammation of the Fallopian tubes; amongst the many general causes are (a) diseases associated with plethora, such as chronic cardio-vascular disease, chronic renal disease (b) primary blood diseases, such as pernicious anaemia, leukaemia, purpura and haemophilia, (c) endocrinous diseases, especially hypo- and hyper-thyroidism (d) at puberty and again at the menopause there may be, for a time, excessive menstrual haemorrhage; but women should be warned that medical advice should be sought for haemorrhage at the time of the menopause as there may be a new growth of the uterus.

Irregular haemorrhage independent of menstruation is always symptomatic of uterine disease, and when occurring after the age of 30, and especially after the menopause, is often significant of cancer of the uterus. Irregular haemorrhage during early pregnancy means either threatened abortion or extra-uterine gestation. The treatment of any form of haemorrhage from the uterus depends on the cause and demands careful diagnosis. Amongst drugs which relieve certain forms of haemorrhage are ergot, pituitary extract, ovarian extract, calcium salts and parathyroid gland. The treatment of new growths and other local conditions is considered under the appropriate sections.

Too frequent or irregular menstruation is not uncommon and, so long as the flow is not profuse, has no particular significance; since the ovary is the pacemaker of the uterus in menstruation, the cause probably lies in irregular ovulation or other disturbed function of the ovary.

There are two varieties of menstrual pain or *dysmenorrhoea* (a) spasmodic (b) congestive. *Spasmodic dysmenorrhoea* is due to painful contractions of the uterus and the pain is severe and cramplike, beginning with the onset of the flow and lasting a few hours or a day, the pain is believed to be associated with the shedding of the menstrual decidua and the entire membrane can often be discovered in the discharge. In a few cases the uterus is poorly developed, but usually no abnormality can be detected. The treatment consists of rest, hot baths, and such anti-spasmodic drugs as phenazone, phenacetin, aspirin, atropine. If this fails the little operation of dilatation of the cervix often cures Cases which arise in later life are usually due to a submucous fibromyoma of the uterus; the treatment consists in removal of the tumour Congestive dysmenorrhoea is a severe aching which begins about a week before, and is relieved by, the flow; it is due to chronic inflammatory disease of the Fallopian tubes or of the uterus, or to uterine fibromyomata. The treatment consists in the surgical removal of the cause.

Infections of the Reproductive Organs.—About sixty per cent of infections are puerperal (after childbirth or abortion), about twenty per cent are gonorrhoeal, and the remainder are fortuitous infections, often secondary to a primary focus elsewhere, such as in the bowel (appendicitis, diverticulitis), the tonsils or the teeth; about five per cent of infections are due to the tubercle bacillus. In most puerperal infections, and in all gonorrhoeal, the infection is *ascending*, *i.e.*, the infection begins in the vulva, vagina, or cervix uteri and ascends upwards to the uterus, Fallopian tubes and peritoneum In other cases the bacteria are carried to the organs by the blood-stream (*haematogenous* infection). The infection may remain localized to the various organs, or the bacteria may gain the blood-stream in which they may multiply and cause the very grave condition known as septicaemia. (*See* SEPSIS.) The infective diseases which may be caused are vulvitis, vaginitis, cervicitis, endometritis, salpingitis, ovaritis and peritonitis; usually, especially in puerperal and gonorrhoeal infections, the condition is widespread. Syphilitic infection of the reproductive organs is considered elsewhere. (*See* VENEREAL DISEASES.)

Diseases of the External Genital Organs.—The vulva comprises several structures grouped together for convenience of description. (*See* REPRODUCTIVE SYSTEM) The affections to which these structures are liable may be classified as follows: (1) Injuries, either occurring during parturition or accidental; the commonest is rupture of the perineum, (2) Inflammation of the vulva or *vulvitis*. Simple vulvitis is due to want of cleanliness or to irritating discharges and in children may result from threadworms. Severe infective vulvitis is usually due to gonorrhoea The symptoms of vulvitis are heat, itching and throbbing, and the parts are red and swollen and bathed with discharge. In the gonorrhoeal variety the local inflammation is very severe, the discharge profuse and purulent and there is scalding pain on micturition. The treatment of simple vulvitis is rest in bed, cleanliness and bathing the vulva with warm antiseptic lotions. Gonorrhoeal vulvitis is almost invariably associated with infection of the urethra, vagina and cervix; the treatment, which is prolonged and requires an expert, consists chiefly in the precise application of a special antiseptic, such as two per cent acriflavine, to the above mentioned sites of infection. For obvious reasons, a complete cure must be obtained, and the infection must be prevented from spreading to the Fallopian tubes. (3) The vulva may become the seat of various cutaneous diseases the most important of which are eczema, erythema, herpes, furunculosis, tubercle, elephantiasis, leucoplakia and kraurosis. These diseases present the same characters as in other parts of the body. In leucoplakia the surface of the vulva becomes thickened and covered with white patches, and later cracks and ulcers appear; the disease is important because, if neglected, it is often the forerunner of cancer. (4) Tumours of the vulva, cysts of Bartholin's gland and vascular *caruncles* of the urethral orifice are the commonest. Any part of the vulva may be the seat of new growths, simple or malignant. *Pruritus* of the vulva is the name given to persistent itching of this part; it is a symptom more than a disease, and accompanies vulvitis and most of the conditions given under (4) above. It is a frequent accompaniment of diabetes and may be an early symptom of cancer; for these reasons it should not be disregarded.

Diseases of the Vagina.—The vaginal walls are kept moist by a thin opalescent fluid containing desquamated epithelium and cervical mucus; its acid reaction is due to the vaginal bacilli. When the vaginal secretion is excessive it is called *leucorrhoea* or "the whites." (1) Malformations. The vagina may be absent in whole or in part or may present a longitudinal septum. Occlusion of the lower end by a membrane prevents the escape of the menstrual flow and leads to the gradual distension of the vagina with blood ("haematocolpos"). (2) Prolapse of the vagina is a hernial protrusion of the pelvic contents through the opening in the pelvic floor muscles, the vaginal walls forming the covering of the protrusion; there is usually concomitant prolapse of the uterus ("utero-vaginal prolapse") Protrusion of the anterior wall by herniation of the bladder is called *cystocele*, and protrusion of the posterior wall by the rectum is called *rectocele*. Vaginal prolapse can be permanently cured by an operation; the palliative treatment is by vaginal pessaries. (3) Fistulae may form between the vagina and bladder, or vagina and rectum; they are usually the result of parturition and require closure by operation Fistulae may also form in the late stages of carcinoma of the cervix uteri (4) *Vaginitis*. (a) Simple catarrhal vaginitis is due to the same causes as simple vulvitis; occasionally in children it is important from a medico-legal aspect. (b) In gonorrhoea the vagina is infected together with the vulva and cervix; the vaginal walls are intensely red and covered with profuse yellow discharge The treatment is the treatment of gonorrhoea (c) Chronic vaginitis may follow the acute variety and may persist for a long time. The vagina is rarely the seat of tumours, but cysts are not uncommon.

DISEASES OF THE UTERUS

The uterus is functionally a very active organ; at puberty it grows into the pear shape characteristic of sexual maturity, at the menopause it shares in the general atrophy of the reproductive organs, during each menstruation its lining membrane undergoes great modification, during pregnancy it undergoes remarkable growth, and during the puerperium it undergoes an even more remarkable process of "involution." It is subject to many disorders: (1) *Errors in growth and development*. The uterus may be congenitally absent, may remain in the infantile state (*uterus foetalis*), or may fail to reach full maturity (*uterus pubescens*); these conditions cause such abnormalities in the menstrual and reproductive functions as amenorrhoea, scanty menstruation, dysmenorrhoea or sterility. The uterus may be completely or partially double (*uterus didelphys*, *uterus bicornis*). (2) *Displacements*. Normally the uterus is bent forwards (anteflexion) and turned forwards (anteversion). The chief displacements of the uterus are prolapse (downward displacement, popularly referred to as "falling of the womb") and retroflexion (backward bending). Prolapse is really a protrusion or hernia of the uterus through the opening between the muscles of the pelvic floor; the uterus is protruded along, and ultimately through, the vaginal canal and there is usually an associated prolapse of the vaginal walls (*q.v.*). In the early stage of prolapse the uterus remains

within the vagina; in the late stage the cervix lies outside the vulva and the vagina is completely inverted (complete prolapse or procidentia). The symptoms are a "bearing down" feeling, great discomfort and fatigue in walking and interference with micturition and defaecation. Prolapse is very rarely met with in women who have not borne children, and its eventual cause is the stretching and injury of the fasciae and muscles of the pelvic floor accompanying parturition; an inborn tendency doubtless exists in many women, but in some cases too hasty delivery of the child by midwifery forceps is blamable. The palliative treatment is by vaginal pessaries; but cure by operation is far preferable to the permanent wearing of these uncleanly devices The modern operation, which consists of a plastic repair of the pelvic floor, vaginal vault and perineum, gives the maximum of success with the minimum of risk. Retroflexion of the uterus (bending backwards) is always combined with retroversion (rotation backwards through a transverse axis); it may exceptionally occur as a congenital abnormality, but is nearly always acquired as the result of childbirth or abortion, or of inflammation of the Fallopian tubes. There is a great difference of opinion amongst gynaecologists as to the symptoms and effects of retroflexion, and as to the indications and methods of treatment So long as the displaced uterus is healthy and is not fixed by adhesions it is, with the occasional exceptions of dyspareunia and sterility, symptomless and harmless, and requires no treatment But when, as is sometimes the case, the uterus is in a state of chronic inflammation or subinvolution (*q.v.*), and is fixed by adhesions, it requires treatment for the relief of such symptoms as painful and profuse menstrual flow, dyspareunia, sterility or repeated abortions. Palliative treatment is by replacement and the insertion of a pessary, which is only possible when the uterus is not fixed. Curative treatment is by the operation of ventral suspension, which consists in suspending the body of the uterus or its ligaments to the anterior abdominal wall.

Inversion occurs when the uterus is turned inside out. It is only possible when the cavity is dilated, either after pregnancy or by a tumour. The greater number of cases are acute and follow immediately on delivery; acute inversion is accompanied by much shock and haemorrhage and has a very high mortality. Chronic inversion either results from the acute variety in untreated patients who have survived, or is due to the traction of a fundal intro-uterine tumour (usually a fibroid polypus). The symptoms of chronic inversion are haemorrhage and bladder troubles, and on examination a tumour is found in the vagina. Reduction of the condition is often difficult, particularly when it has lasted for a long time.

(3). *Inflammations, Acute and Chronic.*—These may be divided into inflammations of the cervix and inflammations of the body of the uterus, both of which may be acute or chronic. The majority of cases are due to puerperal infection or to gonorrhoea. A secondary infection by the bloodstream, especially from the streptococcus, may occur from a primary focus elsewhere. Pessaries in the vagina may cause infection, especially if not kept clean by douching and removed at intervals. Chronic inflammation of the cervix (cervicitis) is predisposed to by unhealed tears resulting from labour; it is commonly associated with what is known as an *erosion*, which is a red congested annular patch of mucous membrane. The symptoms of chronic cervicitis are a muco-purulent discharge. In acute cervicitis the cervix is red and swollen and a discharge of pus, in which the infecting germ may be discovered, pours from the cervical canal. The dangers are upward spread of the infection to the uterus, Fallopian tubes and peritoneum. The treatment of acute infections is rest in bed, vaginal douches and the application of strong antiseptics to the cervical canal. Chronic infections may be cured by the direct application of antiseptics; in cases associated with unhealed tears and erosion, a cure may be effected by excision of the diseased portion. Inflammation of the body of the uterus affects chiefly the lining membrane or endometrium and is known as *endometritis*. Acute endometritis is usually the result of puerperal or of gonorrhoeal infection. Acute puerperal endometritis is a very serious condition, due usually to infection with the streptococcus; the infection is very liable to spread to the tubes (acute salpingitis), peritoneum (acute peritonitis) or blood stream (septicaemia) Gonorrhoeal endometritis is always secondary to infection of the cervix; it is serious in so far as infection of the Fallopian tubes may follow Chronic endometritis may be interstitial or glandular and results from bacterial infection The chief types of interstitial endometritis are senile and tuberculous. Senile endometritis affects women after the menopause and causes a foul-smelling discharge, sometimes blood-stained. In such cases cancer of the body of the uterus must be excluded for the symptoms of the two conditions are closely similar. If the discharge cannot escape the uterus becomes distended with pus, forming a *pyometra*. Tuberculous endometritis is extremely rare and is usually due to spread from the tubes. Chronic glandular endometritis is characterized by very great thickening of the endometrium due to proliferation of the glands; the symptom is profuse menorrhagia, and relief can be obtained only by the operation of curetting. Inflammation of the whole uterus, muscular wall as well as endometrium, is known as *metritis*. Acute metritis is nearly always the result of puerperal infection and the symptoms and complications are similar to those of acute endometritis. Chronic metritis is the sequel to the acute variety; the uterus is enlarged and fibrous, and the chief symptom is menorrhagia about the time of the menopause. The menorrhagia in this case cannot be cured by curetting, because the endometrium is not thickened; the intra-uterine application of radium, however, acts like a charm possibly by causing an artificial menopause.

(4). *New Growths of the Uterus.*—The uterus is the commonest seat of new growths. (*See* TUMOURS) The innocent new growths comprise adenoma, fibromyoma, adenomyoma and polypi of various kinds; the malignant are carcinoma, sarcoma and chorionepithelioma. Adenomata usually assume a polypoid form, and occur both in the body and cervix; their symptom is uterine haemorrhage and their treatment is surgical Fibromyomata or "fibroids" are extremely common tumours, occurring especially in women between the ages of 35 and 50. They are believed to occur in about 25% of women over 35 years of age, but, happily, in the great majority of cases they are small and cause no symptoms. It is doubtful if they ever originate after the menopause. They are solid round or ovoid tumours, composed of a mixture of fibrous and muscular tissue, and are usually multiple. They begin as small seedlings in the wall of the uterus and may grow to an enormous size. According to the position which they occupy in the uterine wall they are divided into intramural, subperitoneal and submucous. The two latter may assume a polypoid form. Submucous fibroids and, to a less extent, intramural fibroids give rise to severe menorrhagia, and, if this is allowed to persist, the patient may get into a dangerous state of anaemia. At the menopause they share in the general atrophy of the uterus, and may almost disappear. Secondary changes are common in fibromyomata, and include mucoid degeneration, cyst-formation, fatty changes, necrobiosis ("red degeneration"), septic infection (sloughing fibroid), and sarcomatous change

The modes in which fibroids imperil life are haemorrhage (the commonest of all), septic infection, which is one of the most dangerous, impaction in the pelvis, twisting of the pedicle by rotation and intestinal and urethral obstruction During pregnancy they share in the growth of the uterus and increase greatly in size; but interference with pregnancy, such as abortion, is common. If growing from the cervix or lower part of the uterus they may obstruct labour and necessitate Caesarean Section (*q.v.*) Small symptomless fibromyomata, often discovered by accident, require no treatment, but should be watched. Fibromyomata of a certain size, or causing symptoms, require surgical treatment, which will be either hysterectomy (removal of the uterus) or myomectomy (removing the tumour and leaving the uterus) Hysterectomy is the easier and usually the safer operation; myomectomy is preferable when the patient is young and it is desired to preserve the function of childbearing Treatment by drugs or by electrical currents is, rightly, a thing of the past, but X-rays and radium have an important place The insertion of radium into the uterus is the ideal treatment for menorrhagia due to

small submucous fibroids, but is not suitable for tumours of any size. Haemorrhage from fibroids often ceases after several applications of X-rays; but this treatment is too uncertain in its action to compete with surgery except in cases in which an operation is for other reasons contraindicated.

(5). *Malignant Disease of the Uterus.*—The varieties of malignant disease met with in the uterus are carcinoma, sarcoma and chorionepithelioma malignum. The age at which women are most subject to carcinoma of the uterus is towards the decline of sexual life. Of 3,385 collected cases of cancer of the uterus 1,169 occurred between 40 and 50, and 856 between 50 and 60. In contradistinction to fibroid tumours it frequently arises after the menopause. It may be divided into cancer of the body and cancer of the neck (cervix). Cancer of the neck of the uterus is almost exclusively confined to women who have been pregnant. Predisposing causes are tears of the cervix, erosion and chronic cervicitis. The symptoms which induce women to seek medical aid are haemorrhage, foetid discharge, and, later, pain and cachexia. An unfortunate belief amongst the public that the menopause is associated with irregular bleeding and offensive discharges has prevented many women from seeking medical advice until too late. It cannot be too widely known that cancer of the cervix is in its early stages a purely local disease, usually curable by an operation or by radium So important is the recognition of this fact in the saving of life that the council of the British Medical Association published in 1909 in British and Colonial medical and nursing journals a special appeal to medical practitioners, midwives and nurses It will be useful to quote here a part of the appeal directed to midwives and nurses: "Cancer may occur at any age and in a women who looks quite well and who may have no pain, no wasting, no foul discharge and no profuse bleeding To wait for pain, wasting, foul discharge or profuse bleeding is to throw away the chance of successful treatment. The early symptoms of cancer of the womb are:—(1) bleeding which occurs after the change of life, (2) bleeding after sexual intercourse or after a vaginal douche, (3) bleeding slight or abundant, even in young women, if occurring between the usual monthly periods, and especially when accompanied by a bad-smelling or watery blood-tinged discharge, (4) thin watery discharge occurring at any age." On examination the cervix presents certain characteristic signs to touch and sight: hard nodules or definite loss of substance, extreme friability and bleeding after slight manipulation Cancer of the cervix may assume a proliferating type, forming the well known "cauliflower" excrescence. In the early stages, before the disease has spread to the surrounding tissues, cancer of the cervix is curable by operation The modern operation is that perfected by the late Professor Wertheim of Vienna, and consists in removal of the whole uterus, upper third of the vagina and as much of the surrounding tissues as possible. The operation is a severe one with a primary mortality of about ten per cent, but thirty to forty per cent of early cases may be expected to remain free from recurrence for five years or more. Treatment of early or "operable" cases of cancer of the cervix by radium gives better results than operation. The latest statistics, such as those published by Heyman, of the Stockholm Radium Institute, show that about fifty per cent of early cases may be expected to remain free from recurrence for five years or more. Radium treatment demands much skill and experience in order to give such good results. A very great advantage of radium treatment is that the primary mortality is about one per cent compared with the ten per cent or more associated with operative treatment. In advanced cases treatment by radium and X-rays must be relied upon to palliate, if not to cure. Cancer of the body of the uterus is rare before the forty-fifth year and is most frequent after the menopause. The majority of the patients are nulliparae. The signs are fitful haemorrhages after the menopause and an offensive discharge which is usually, but not always, blood-stained; the uterus is usually somewhat enlarged Removal of the uterus (hysterectomy) is the only treatment. Chorion epithelioma or chorionic cancer is a malignant disease with microscopic characters resembling the cells of the chorionic epithelium. It occurs in connection with recent pregnancy and particularly with the variety of abortion termed hydatidiform mole. It quickly ulcerates and infiltrates the uterine tissues, forming metastases with a rapidity unequalled by any other type of growth. Clinically it is recognized by the occurrence after pregnancy of violent haemorrhages and progressive cachexia. The growth is usually primary in the uterus but may be so in the Fallopian tubes or in the vagina. A few cases have been recorded unconnected with pregnancy. Immediate and wide removal of the affected organ is the only treatment. Sarcoma of the uterus may occur in the body and in the cervix. It occurs at an earlier age than carcinoma. It may originate either in the wall or endometrium of the healthy uterus, or as a secondary change in a fibromyoma of the uterus. Uterine enlargement and haemorrhage are the symptoms. The differential diagnosis is microscopic. Extirpation of the uterus is the only chance of prolonging life

Diseases of the Fallopian Tubes.—The Fallopian tubes or oviducts are liable to septic infection (acute and chronic *salpingitis*), tuberculosis, innocent and malignant new growths, and tubal pregnancy. Salpingitis is nearly always secondary to septic infection of the genital tract. The chief causes are septic endometritis following labour or abortion, gonorrhoea, infected fibromyoma, and cancer of the uterus. The right tube may be infected by appendicitis. In some cases the infection of the tubes appears to be accidental, probably the result of an infective focus elsewhere, such as the tonsils or respiratory tract. When the pus escapes from the tubes into the peritoneal cavity it causes local or general peritonitis. Even mild cases of salpingitis result in gluing together of the fimbriae and sealing of the ostium (the abdominal opening or mouth of the tube), and matting together of the tube and ovary by peritoneal adhesions. If the inflammation continues after the ostium is sealed, pus accumulates in the tube forming a tubal abscess or *pyosalpinx;* if the tube becomes distended with serous fluid it is termed a *hydrosalpinx.* Distension of the tube with blood is termed a *haematosalpinx* and is nearly always due to tubal pregnancy Acute salpingitis is a very severe illness, and is accompanied by high temperature, abdominal pain and tenderness, and much constitutional disturbance. The symptoms may become merged in those of general peritonitis. In chronic salpingitis there is a history of puerperal infection or gonorrhoea, followed by chronic pelvic pain, profuse menstruation and sterility; on examination the enlarged tubes may be felt. Acute salpingitis requires rest in bed in a propped-up posture (Fowler's posture), sedatives, hot fomentations and skilled nursing. Urgent symptoms and signs of spreading peritonitis may call for operation, chiefly for the purpose of peritoneal drainage. A pyosalpinx renders a woman an invalid and permanent relief can only be afforded by surgery. Tuberculous salpingitis is usually secondary to tuberculous infection in other parts, such as the lungs or peritoneum. The Fallopian tubes may be the seat of malignant disease; this is rarely primary but usually an extension of cancer of the uterus or ovaries. In *tubal pregnancy* the fertilized ovum becomes embedded in the tube instead of in the uterus It is believed that fertilization occurs normally in the tube, and that the ovum does not reach the embedding stage until it has arrived in the uterus. If the passage of the ovum down the tube is delayed it becomes embedded in the tube. The chief cause of such delay is kinking and adhesion of the tube as the result of former salpingitis, and this state of the tube is found in seventy-five per cent of cases of tubal pregnancy. The tubal ovum has a precarious existence, because of the eroding action of the chorionic villi on the thin tubal wall. One of two events soon occurs: either the ovum becomes separated and surrounded by blood, and in consequence dies, forming a *tubal mole;* or, the eroding villi completely perforate the tubal wall, resulting in rupture of the tube and profuse intraperitoneal haemorrhage After the formation of a tubal mole the tube undergoes spasmodic contractions and attempts to expel it through the abdominal ostium; this process, known as *tubal abortion,* is accompanied by violent attacks of pain and the escape of blood into the pelvic cavity. The blood is localized by adhesions and forms beside the tube a swelling of varying size known as a *pelvic haematocele.* Tubal pregnancy usually comes to an end by mole formation or rupture at about the sixth week. In rare cases the ovum continues to develop after rupture of the tube and may even continue to

full-term, the placenta gaining attachment to the pelvic or abdominal structures. The uterus in tubal pregnancy undergoes slight enlargement and always develops a decidua which is expelled when the pregnancy is disturbed. The signs of tubal pregnancy before rupture are amenorrhoea, pelvic pain and the presence of an enlarged tube. When rupture occurs there is sudden and severe pain with great shock and collapse; the haemorrhage is usually so severe as to imperil life. The more common event is, fortunately, mole formation with tubal abortion and the formation of a haematocele; the symptoms of this are spasmodic attacks of severe pain and irregular uterine haemorrhage and, sometimes, the passage of a decidual cast from the uterus; on examination the haematocele is felt as a swelling in the pelvis In all forms of tubal pregnancy the only treatment is abdominal section and removal of the affected tube; in rupture immediate operation is the only means of saving life. In those rare cases in which the placenta and foetus continue to develop until term, the child may be removed alive by abdominal section, but is often deformed and rarely survives for long.

Diseases of the Ovaries and Parovarium.—The changes which the ovaries undergo at puberty have already been described (*see* Menstruation); at the menopause they cease to function and undergo gradual atrophy. Congenital absence of the ovaries, except in association with some foetal monstrosity, is unknown. Prolapse of the ovary, a descent from its usual position into the pouch of Douglas, is usually associated with backward displacement of the uterus or with salpingitis and pyosalpinx, but it may occur independently from elongation of the utero-ovarian ligament. A prolapsed ovary is tender and painful and is one cause of dyspareunia (painful sexual intercourse). Inflammation of the ovary (oöphoritis) is (apart from tuberculous infection) seldom, if ever, primary, but is secondary to infection of the tubes or peritoneum, or, on the right side, to appendicitis The causes of oophoritis are therefore the same as those of salpingitis An ovarian abscess may form and may reach a large size Chronic oophoritis may follow the acute form; the capsule is thickened and the follicles cannot rupture, and the ovary becomes converted into a collection of tiny follicular cysts. This state is sometimes referred to as the "small cystic ovary" or the "cirrhotic ovary." The ovary is frequently the seat of cystic and solid tumours. Cystic tumours are far the commoner and are of several varieties The two commonest are the *pseudomucinous adenomatous cyst* which is multilocular, may arise at almost any age and may attain an enormous size, and the *epoophoric* cyst, which is unilocular and arises from the tubules in the hilum of the ovary; both are innocent and both are occasionally bilateral. The so-called *dermoid cyst*, really a teratoma, which may contain bone, teeth, hairs, sebaceous material, skin and many other tissues, is also common The *papillomatous cyst* may be semi-malignant and often gives rise to secondary implantations on the peritoneum; it is usually bilateral *Broad ligament cysts* are unilocular and may reach a large size; they originate from the rudimentary Wolffian tubules. *Fibroma* is the commonest innocent solid tumour. Malignant disease (carcinoma and sarcoma) is fairly frequent; carcinoma of the ovary may be primary, or, more commonly, secondary to cancer of the gastro-intestinal tract or breast. "Chocolate" or "tarry cysts" of the ovary arise from implanted endometrium (*"endometrioma"*); they are usually bilateral and are associated with dysmenorrhoea and sterility. Ovarian cysts seldom cause pronounced symptoms, but are liable to such grave complications as torsion of the pedicle, rupture and suppuration; they are all liable to undergo malignant change. The treatment of all varieties of ovarian tumour is removal as soon as possible.

Diseases of the Pelvic Peritoneum and Connective Tissue.—Women are peculiarly liable to peritoneal infections owing to the fact that the genital tract is in direct communication with the peritoneal cavity through the abdominal ostia of the Fallopian tubes. Consequently, any infection of the genital tract, by travelling upwards to the tubes may cause peritonitis. Nearly all these infections are the result either of childbirth and abortion or of gonorrhoea. Fortunately, the pelvic peritoneum has considerable powers of resistance, and nearly all peritoneal infections of genital origin become localized to the pelvic part of the peritoneal cavity. Pelvic peritonitis or perimetritis may proceed to abscess formation the most common situation for these pus-collections being in the pouch of Douglas; from thence they either burst into the rectum or bladder or are, more fortunately, evacuated by operation. Even if pelvic peritonitis resolves without abscess-formation it always leaves adhesions between the uterus, tubes, ovaries and the adjacent coils of intestine, resulting in abnormal position of the pelvic organs, sterility, dysmenorrhoea and other pelvic pain. General peritonitis of genital origin is comparatively rare; it may follow puerperal infection, but seldom, if ever, is the result of gonorrhoea. *Hydroperitoneum*, a collection of free fluid in the peritoneal cavity, may be due to many general causes but also to papillomatous or cancerous ovarian tumours *Pelvic cellulitis* or *parametritis*, a septic inflammation of the pelvic cellular tissue, chiefly at the bases of the broad ligaments, is usually the result of puerperal infection; the bacteria gain entrance to the cellular tissue through tears of the cervix uteri, such as are liable to result from difficult or instrumental labour The symptoms are chill, rise of pulse-rate and temperature, and intrapelvic pain On examination, there is tenderness and swelling on one or both sides of the pelvis beside the uterus, and the uterus becomes fixed and immovable in the exudate as if embedded in plaster of Paris The inflammation may undergo resolution if appropriately treated or may go on to suppuration, forming an extra-peritoneal abscess which may point in the vagina, rectum or bladder and occasionally in the groin If the pus can be localized an incision should be made and the abscess drained

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GYNANDROMORPH, a term used in biology to denote an intersex of the mosaic type, *i.e.*, one side or part of the body is male, the other female. A gynandromorph is to be distinguished from an hermaphrodite (*q.v.*) in which the entire animal is intermediate between male and female. Gynandromorphs occur in several groups of animals, notably in insects and birds, but not in mammals (*See* Sex.)

GYONGYÖS, a city of Hungary, situated at the foot of the Mátra mountains in the county of Heves Population (1920) 19,714. The Gyongyos river, rising in the Mátra mountains, flows by the city and thence south-east to join the Tarna, a subaffluent of the Danube. There are several churches, a large Franciscan college, hospital and gymnasium Near by is the open air sanitorium of Bene

GYÖNGYÖSI, ISTVÁN [Stephen] (1620–1704), Hungarian poet, was born of poor but noble parents in the county of Gömör, Hungary His abilities early attracted the notice of Count Ferencz Wesselényi, who in 1640 appointed him to a post of confidence in Fulek castle. Here he remained until 1653, when he married and became an assessor of the judicial board. In 1681 he was elected as a representative of his county at the diet held at Soprony (Oedenburg). From 1686 to 1693, and again from 1700 to his death in 1704, he was deputy lord-lieutenant of the county of Gömor Of his literary works the most famous is the epic poem *Murányi Venus* (Caschau, 1664), in honour of the wife of his benefactor Wesselenyi, Maria Szécsi, the heroine of Murány Among his later works the best known are *Rózsa-Koszorú*, or Rose-Wreath (1690), *Kemény-Janos* (1693), *Cupidó* (1695), or *Palinodia* (1695) and *Chariklia* (1700)

The earliest edition of his collected poetical works is by Dugonics (Pressburg and Pest, 1796); the best modern selection is that of Toldy, entitled *Gyongyósi István válogatott poétai munkái* (Select poetical works of Stephen Gyöngyösi, 2 vols., 1864–65).

GYÖR, a well-built Hungarian town, capital of a county of the same name, situated at the confluence of the Raab with an arm of the Danube, with the main stream of which it has communication by river steamers. The town occupies the site of the Roman *Arabona* and has always been an important regional centre and in earlier days a powerful fortress which the Turks

captured by treachery in 1594 but retained for four years only. Throughout history it has been regarded as the key to passage east and west as is exemplified by the French storming in 1809 and that by the Austrians in 1849. In the 11th century the town was made a Roman Catholic bishopric and its fine cathedral dating from the 12th century in origin, though rebuilt in 1639–54, has gathered around it many important expressions of spiritual leadership, *e.g.*, the seminary for priests.

The modern functions are based upon its position at the contact of the old alluvial plain and the drained marshes, and mixed farming has originated an active trade in cereals and horses, which is supplemented by milling, textile manufactures, linen and wool, and the distillation of spirits. Pop. (1920), 50,036. About 11 m. S.E. of Gyor on a spur of the Bakony Forest, lies the famous Benedictine abbey of Pannonhalma (Ger. *St. Martinsberg;* Lat. *Mons Sancti Martini*), one of the oldest and wealthiest abbeys of Hungary. It was founded by King St. Stephen, and the original deed from 1001 is preserved in the archives of the abbey. The present building is a block of palaces, containing a beautiful church, some of its parts dating from the 12th century, and is situated on a hill 1,200 ft high. In the convent there are a seminary for priests, a normal school, a gymnasium and a library of 120,000 volumes. The chief abbot has the rank of a bishop

GYP, the pen name of SIBYLLE GABRIELLE MARIE ANTOINETTE RIQUETI DE MIRABEAU, Comtesse de Martel de Janville (1850–), French writer, born at the château of Koetsal in the Morbihan. Her father served in the Papal Zouavas, and died during the campaign of 1860. Her mother, the comtesse de Mirabeau, contributed to the *Figaro* and the *Vie parisienne* under various pseudonyms, papers in the manner successfully developed by her daughter. Under the pseudonym of "Gyp" Madame de Martel married in 1869, sent to the *Vie parisienne*, and later to the *Revue des deux mondes*, a large number of social sketches and dialogues, afterwards reprinted in volumes. Her later work includes stories of a more formal sort differing but little from the shorter studies. The following list includes some of the best known of Madame de Martel's publications, nearly seventy in number: *Petit Bob* (1882); *Autour du mariage* (1883); *Ce que femme veut* (1883); *Le Monde à Côté* (1884), *Sans voiles* (1885); *Autour du divorce* (1886); *Dans le train* (1886); *Mademoiselle Loulow* (1888); *Bob au salon* (1888–89); *L'Education d'un prince* (1890); *Passionette* (1891); *Oh! la grande vie* (1891); *Une Élection à Tigre-sur-mer* (1890), an account of "Gyp's" experiences in support of a Boulangist candidate; *Mariage Civil* (1892); *Les bons docteurs* (1892); *Du haut en bas* (1893); *Mariage de chiffon* (1894); *Leurs ames* (1895); *Le Coeur d' Ariane* (1895); *Le Bonheur de Ginette* (1896); *Totote* (1897); *Lune de miel* (1898); *Israel* (1898); *L'Entrevue* (1899); *Le Pays des champs* (1900); *Trop de chic* (1900); *Le Friquet* (1901); *La Fee* (1902); *Un Mariage chic* (1903); *Un Menage dernier cri* (1903); *Maman* (1904); *Le Coeur de Pierrette* (1905); *L'amoureux de Lone* (1910). A number of these were adapted by the author into successful plays. From the first "Gyp," writing of a society to which she belonged, showed an intense faculty of observation, much skill in innuendo, a mordant wit combined with some breadth of humour, and a singular power of animating ordinary dialogues without destroying the appearance of reality. Her Parisian types of the spoiled child, of the precocious school-girl, of the young bride, and of various masculine figures in the gay world, have become noted, and many survive as faithful pictures of luxurious manners in the 19th century. Some of her later productions were inspired by a violent anti-Semitic and Nationalist bias. In 1901 Madame de Martel furnished a sensational incident in the Nationalist campaign during the municipal elections in Paris. Because of her political attitude she was kidnapped and made the victim of a considerable amount of horseplay

GYPSIES, a wandering folk, scattered through every European land, over the greater part of western Asia and Siberia; found also in Egypt and the northern coast of Africa, in America and even in Australia. No correct estimate of their numbers outside of Europe can be given, and even in Europe the information derived from official statistics is often contradictory and unreliable.

Popular Names.—The Gypsies are known principally by two names which can easily be traced to one or other of two distinct stems. The one group, embracing the majority of Gypsies in Europe, the compact masses living in the Balkan Peninsula, Rumania and Transylvania and extending also as far as Germany and Italy, are known by the name *Atzigan* or *Atsigan*, which becomes in time Tshingian (Turkey and Greece), Tsigan (Bulgarian, Servian, Rumanian), Czigany (Hungarian), Zigeuner (Germany), Zingari (Italian), the English word Tinker or Tinkler (the latter no doubt due to popular etymology) being perhaps a local transformation of the German *Zigeuner*. The second name, partly known in the East as an expression of contempt, is *Egyptian*; in England, Gypsy; in some German documents of the 16th century *Aegypter*; Spanish *Gitano*; modern Greek *Gyphtos* They are also known by the parallel expressions *Faraon* (Rumanian) and *Phárao Nephka* (Hungarian) or Pharaoh's people, which are only variations connected with the Egyptian origin. The habit of ascribing an Egyptian origin to people reputed to be possessed of magical powers has long persisted. The name, Egyptians, is derived from a peculiar tale which the gypsies spread when appearing in the west of Europe. They alleged that they had come from a country of their own called Little Egypt, either a confusion between Little Armenia and Egypt or the Peloponnesus.

In the Syriac version of the apocryphal Book of Adam, known as the *Cave of Treasures* and compiled probably in the 6th century occurs the passage: "And of the seed of Canaan were as I said the Aegyptians; and, lo, they were scattered all over the earth and served as slaves of slaves" (ed. Bezold, German translation, p. 25). No reference to such a scattering and serfdom of the Egyptians is mentioned anywhere else This must have been a legend, current in Asia Minor, and hence probably transferred to the swarthy Gypsies.

In France they are known as *Bohémiens*. Other names have been bestowed upon them, such as Walachi, Saraceni, Agareni, Nubiani, etc. They were also known as Tartars in Germany, or as "Heathen," *Heydens*. As to the origin of the name *Atzigan*, Miklosich derives the word from the Athinganoi, a name originally belonging to a peculiar heretical sect living in Asia Minor near Phrygia and Lycaonio, known also as the Melki-Zedekites. The members of this sect observed very strict rules of purity, as they were afraid to be defiled by the touch of other people whom they considered unclean. They therefore acquired the name of Athinganoi (*i.e.*, "Touch-me-nots"), who are described by Byzantine historians of the 9th century as sooth-sayers, magicians and serpent-charmers.

The Gypsies of Europe who, starting from the ancient Byzantine empire have travelled westwards and spread over Europe, America and Australia call themselves by the name of Rom, the woman being Romni and the stranger Gaži. Many etymologies have been suggested for the word Rom. Miklosich identified it with Doma or Domba, a low caste of Upper India This agrees with the view that "the language of European Gypsies" shows many points of correspondence with the dialect of Indian Gypsy tribes such as the Doms . . . The language of the Gypsies of Europe, however, points towards the extreme north-west of India and . . . the hypothesis might be hazarded that members of the same vagrant race from which the Indian Gypsies are descended come up to the north-west and remained there long enough to adapt their language to the practice prevailing among frontier tribes. Some of them passed on before this adaptation took place and became the ancestors of the Armenian Gypsies whose language does not point to the north-west frontier but rather to Hindustan. The bulk of these Gypsies later on brought their language, as modified among frontier tribes, to Europe, and became the ancestors of the Romany Chals (*Linguistic Survey of India*, vol. xi., 1922, p. 11). Another view, supported by a careful examination of phonetic data, is that the language is of the central group with evidence of a later migration to and contact with the north-west group of Sanskritic languages in India. Gaster suggested that having no home and no country of their own and no political

traditions and no literature, they would naturally identify themselves with the people in whose midst they lived, and called themselves Rom (cf. *Romaioi, Romanoi*), a natural name, and flattering to their vanity. This origin of the name would explain why it is limited to the European Gypsies.

HISTORY

Appearance in Europe.—The first appearance of Gypsies in Europe cannot be traced further back than the beginning of the 14th century.

At least three centuries before historical evidence proves the immigration of the genuine Gypsy, there had been wayfaring smiths, travelling from country to country. Their successors, the Gypsies, took up their crafts and probably assimilated a good proportion of these vagrants of the west of Europe. The name given to the former, who probably were Oriental or Greek smiths and pedlars, was then transferred to the new-comers. Hopf has proved the existence of Gypsies in Corfu before 1326. Before 1346 the empress Catherine de Valois granted to the governor of Corfu authority to reduce to vassalage certain vagrants who came from the mainland.

By the end of the 15th century they must have been settled for a sufficiently long time in the Balkan Peninsula and the countries north of the Danube, such as Transylvania and Walachia, to have been reduced to the same state of serfdom as prevailed in Corfu in the second half of the 14th century. At that time there must already have been in Walachia settled Gypsies treated as serfs, and migrating Gypsies plying their trade as smiths, musicians, dancers, sooth-sayers, horse-dealers, etc., for we find the voivode Alexander of Moldavia granting these Gypsies in the year 1478 "freedom of air and soil to wander about and free fire and iron for their smithy." But a certain portion, probably the largest, became serfs, to be sold, exchanged and inherited. The Gypsies followed at least four distinct pursuits in Rumania and Transylvania, where they lived in large masses. A goodly proportion of them were tied to the soil; in consequence their position was different from that of the Gypsies who had started westwards and who are nowhere found to have obtained a permanent abode for any length of time, or to have been treated, except for a very short period, with any consideration of humanity.

Their appearance in the West is first noted by chroniclers early in the 15th century. In 1414 they are said to have already arrived in Hesse. In 1418 they reached Hamburg, 1419 Augsburg, 1428 Switzerland. In 1427 they had entered France (Provence). A troupe is said to have reached Bologna in 1422, on a pilgrimage to Rome, undertaken for some act of apostasy. After this first immigration a second and larger one seems to have followed in its wake, led by Zumbel. The Gypsies spread over Germany, Italy and France between the years 1438 and 1512. About 1500 they must have reached England

The Act of Henry VIII. 22, c. 10 dealt with the Gypsy problem in England Albert Krantzius (Krantz), in his *Saxonia* (xi. 2), says that in the year 1417 there appeared for the first time in Germany a people uncouth, black, dirty, barbarous, called in Italian "Ciani," who indulge specially in thieving and cheating. They had among them a count and a few knights well dressed, others followed afoot. The women and children travelled in carts. They also carried with them letters of safe-conduct from the emperor Sigismund and other princes, and they professed that they were engaged on a pilgrimage of expiation for some act of apostasy. This people have no country and travel through the land. They live like dogs and have no religion although they allow themselves to be baptized in the Christian faith. They live without care and gather unto themselves also other vagrants, men and women. Their old women practise fortune-telling, and whilst they are telling men of their future they pick their pockets. He uses the name by which these people were called in Italy, "Ciani." Crusius, the author of the *Annales Suevici*, knows their Italian name *Zigani* and the French *Bohémiens*. Not one of these oldest writers mentions them as coppersmiths or farriers or musicians.

Later History.—Edicts were issued in many countries from the end of the 15th century onwards sentencing the "Egyptians" to exile under pain of death. In Edinburgh four "Faas" were hanged in 1611 "for abyding within the kingdome, they being Egiptienis," and in 1636 at Haddington the Egyptians were ordered "the men to be hangied and the weomen to be drowned, and suche of the weomen as hes children to be scourgit throw the burg and burnt in the cheeks." The burning on the cheek or on the back was a common penalty. In 1692 four Estremadura Gypsies caught by the Inquisition were charged with cannibalism and made to own that they had eaten a friar, a pilgrim and even a woman of their own tribe, for which they suffered the penalty of death In 1782 45 Hungarian Gypsies were charged with a similar crime, and when the supposed victims of a supposed murder could not be found on the spot indicated by the Gypsies, they owned under torture and said on the rack, "We ate them." Of course they were forthwith beheaded or hanged. The emperor Joseph II., author of one of the first edicts in favour of the Gypsies, ordered an inquiry into the incident; it was then discovered that no murder had been committed, except that of the victims of this monstrous accusation.

In 1907 a "drive" was undertaken in Germany against the Gypsies In 1904 the Prussian Landtag adopted unanimously a proposition to examine anew the question of granting peddling licences to German Gypsies; that on the 17th of February 1906 the Prussian minister issued special instructions to combat the Gypsy nuisance; and in various parts of Germany and Austria a special register was kept for the tracing of the genealogy of vagrant and sedentary Gypsy families.

In Rumania they were divided mainly into two classes, (1) *Robi* or Serfs, who were settled on the land and deprived of all individual liberty, being the property of the nobles and of churches or monastic establishments, and (2) the Nomadic vagrants. They were subdivided into four classes according to their occupation, such as the Lingurari (woodcarvers; lit. "spoon-makers"), Caldarari (tinkers, coppersmiths and ironworkers), Ursari (lit. "bear drivers") and Rudari (miners), also called Aurari (gold-washers), who used formerly to wash the gold out of the auriferous river-sands of Walachia A separate and smaller class consisted of the Gypsy *Lacshi* or *Vătrashi* (settled on a homestead or "having a fireplace" of their own). Each *shatra* or Gypsy community was placed under the authority of a judge or leader, these officials were subordinate to the *bulubasha* or *voivod*, who was himself under the direct control of the *yuzbasha* (or governor appointed by the prince from among his nobles). The *yuzbasha* was responsible for the regular income to be derived from the vagrant Gypsies, who were considered and treated as the prince's property. These voivodi or yuzbashi who were not Gypsies by origin often treated the Gypsies with great tyranny The *Robi* could be bought and sold, freely exchanged and inherited, and were treated as the negroes in America down to 1856, when their final freedom in Moldavia was proclaimed. In Hungary and in Transylvania the abolition of servitude in 1781–1782 carried with it the freedom of the Gypsies. In 1866 the Gypsies became Rumanian citizens. On Jan 6, 1906 the first Gypsy Congress was held in Sofia, for the purpose of claiming political rights for the Turkish Gypsies or Gopti as they call themselves.

RELIGION, HABITS AND CUSTOMS

Their religious views are a strange medley of the local faith, which they everywhere embrace, and some old-world superstitions which they have in common with many nations. Among the Greeks they belong to the Greek Church, among the Mohammedans they are Mohammedans, in Rumania they belong to the National Church. In Hungary they are mostly Catholics, according to the faith of the inhabitants of that country. They have no ethical principles and they do not recognize the obligations of the Ten Commandments There is extreme moral laxity in the relation of the two sexes, and on the whole they take life easily and are complete fatalists At the same time they are great cowards and they play the rôle of the fool or the jester in the popular anecdotes of eastern Europe There the poltroon is always a Gypsy, but he is good-humoured and not so malicious as

those Gypsies who had endured outlawry in the west of Europe

There is nothing specifically of an Oriental origin in their religious vocabulary In general their beliefs, customs, tales, etc., belong to the common stock of general folklore, and many of their symbolical expressions find their exact counterpart in Rumanian and modern Greek, and often read as if they were direct translations from these languages. The nomadic Gypsies carry on the ancient craft of coppersmiths, or workers in metal; they also make sieves and traps, but in the East they are seldom farriers or horse-dealers. They are far-famed for their music, in which art they are unsurpassed. The Gypsy musicians were the troubadours and minstrels of eastern Europe. Liszt ascribed to the Gypsies the origin of the Hungarian national music. This is an exaggeration. Equally famous is the Gypsy woman for her knowledge of occult practices. She is the real witch; she knows charms to injure the enemy or to help a friend. She can break the charm if made by others. They use either the local language of the natives in the case of charms, or a slightly Romanized form of Greek, Rumanian or Slavonic. The old Gypsy woman is also known for her skill in palmistry and fortune-telling by means of a special set of cards, the well-known Tarok of the Gypsies. They have also a large stock of fairy tales resembling in each country the local fairy tales, in Greece agreeing with the Greek, and in Rumania with the Rumanian fairy tales.

Physical Characteristics.—They are of small stature, varying in colour from the dark tan of the Arab to the whitish hue of the Serbian and the Pole. There are some white-coloured Gypsies, especially in Serbia and Dalmatia, who are often not easily distinguishable from the native peoples, except that they are more lithe and sinewy, better proportioned and more agile in their movements than the thick-set Slavs and the mixed race of the Rumanians, distinguishable by the lustre of their eyes and the whiteness of their teeth. Some are well built; others have the features of a mongrel race, due no doubt to intermarriage with outcasts of other races. The women age very quickly. They love display and Oriental showiness, bright-coloured dresses, ornaments, bangles, etc.; red and green are the colours mostly favoured by the Gypsies in the East. Along with a showy handkerchief or some shining gold coins round their necks, they will wear torn petticoats and no covering on their feet.

Social Structure.—There is evidence that among English Gypsies certain groups were matrilineal and others patrilineal Their marriage system did not preclude marriage with nieces (brother's daughter) with grand-daughters or half sisters though common parentage was long a bar. Marriages of aunt and nephew are rare. Cousin marriages were frequent. The ortho-cousin marriage occurred frequently. Matrilocal marriages are definitely recorded. In the cross cousin marriage the daughter of the maternal uncle was preferred. Polygamy was practised. The levirate is uncommon. The Sororate is known. The common rule required the elder sister to marry before the younger. Proofs of fitness were demanded of the man and of chastity from the girl Marriage was by elopement, ratified by a public ceremony—with the approval of the headman. The ceremony consisted of joining hands, or of eating a cake containing the blood of both parties, or of jumping over a branch or besom or tongs. The wife had to be lifted and carried to the tent for the consummation of the union. These rites can be illustrated from India and elsewhere, and are in part fertility rites, in part, protective For an account of the Gypsy language *see* ROMANY LANGUAGE.

BIBLIOGRAPHY.—The Gypsy Lore Society has published an elaborate bibliography which should be consulted for works on the origin, history, customs, institutions, language, etc., of the Gypsies. (M. G.)

American.—In spite of the fact that most of the descendants of the Gypsies who came in colonial times from Great Britain, Holland, Germany and France have been absorbed, there were probably in America in 1928 between 50,000 and 100,000 of Romani blood; and the number is increasing. The majority arrived during the last quarter of the 19th century. British Gypsies are fairly numerous in the United States and Canada, and differ little from those of the Old World. Since the decline of horse trading, their chief occupation has been that of fortune-telling; some have settled on farms, and others peddle oil-cloth, handmade baskets and rustic furniture. Some Hungarian Gypsy musicians dwell in houses. More than half use Romani as their native tongue. The largest group is at Braddock, Pennsylvania. However, Russian or Rumanian Gypsy singers and violinists are rare. Families of Turkish, Syrian, Bulgarian and Spanish gypsies are extremely scattered.

The majority of Gypsies in America might be vaguely classified as Vlach. There are two distinct varieties. The smaller is known as the *Karavlase* (black Vlachs), or *Baiaš* (gold-washers). What little Romani they speak has been picked up from Anglo-American gypsies. Rumanian is their "secret" tongue, though they lived in Serbia for a time before starting on their wide migrations. Of these a number are bear-leaders, and nearly all are fortune-tellers. The other variety forms the bulk of American Gypsies For lack of a better term we must call them the nomads. Among themselves they speak a relatively pure dialect of Romani; but the percentage of Rumanian loan-words would indicate that at one time they nomadized in Vlach countries. They may be met anywhere, from China to Africa; but nowhere as frequently as in the United States There are also large numbers in South America. They subdivide themselves into tribes: the *Mačváya,* so named from a region in northern Serbia, the *Kalderáš,* from their former profession as coppersmiths, *Rúsore, Ungéresore,* etc., from the countries where they lived longest before coming to America. In spite of slight differences of dialect and customs, these tribes are homogeneous, and mix with no other group, not even the *Baiaš.* They have their own courts (*romano-kris*), conducted in the manner of the Gypsy-like peoples of India Taboos are strictly enforced and punished by fines, or expulsion from the tribe, *mahrimé* (defilement, rejection)

The large silk kerchief, worn over the head by the married women, the necklaces of gold coins, the gay dresses, are distinctive. They travel by train and motor car and live by the fortune-telling of the women. Formerly most of them were coppersmiths. A few are professional musicians, and nearly all have a talent for music. They have preserved many stories and songs in their own language. In summer they live in tents; but during the cold months they move into the cities, where they live in stores Prosperity is tending to Americanize them; but like all Romanies they readily revert to age-old traits.

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GYPSUM, a common mineral consisting of hydrous calcium sulphate, $CaSO_4{\cdot}2H_2O$ named from the Gr. γύψος, a word used by Theophrastus to denote not only the raw mineral but also the product of its calcination, which was employed in ancient times, as it still is, as a plaster. When crystallized, gypsum is often called selenite, the σεληνίτης of Dioscorides, so named from σελήνη, "the moon," probably in allusion to the soft moon-like reflection of light from some of its faces, or, according to a legend, because it is found at night when the moon is on the increase. The granular, marble-like gypsum is termed alabaster (*q.v.*).

Gypsum crystallizes in the monoclinic system, the habit of the crystals being usually either prismatic or tabular; in the latter case the broad planes are parallel to the faces of the clinopinacoid. The crystals may become lenticular by curvature of certain faces. Twins are common, forming in some cases arrow-headed and swallow-tailed crystals. Cleavage is perfect parallel to the clinopinacoid, yielding thin plates, often diamond-shaped, with pearly lustre; these flakes are usually flexible, but may be brittle, as in the gypsum of Montmartre. Two other cleavages are recognized, but they are imperfect. Crystals of gypsum, when occurring in

clay, may enclose much muddy matter; in other cases a large proportion of sand may be mechanically entangled in the crystals without serious disturbance of form; whilst certain crystals occasionally enclose cavities with liquid and an air-bubble. A fibrous variety occurs in veins, often running through marls, with the fibres disposed at right angles to the direction of the vein. Such gypsum when cut and polished has a pearly opalescence, or satiny sheen, whence it is called satin-spar (*q.v.*).

Gypsum is so soft as to be scratched even by the finger-nail (H=1·5 to 2). Its specific gravity is about 2·3. The mineral is slightly soluble in water, one part of gypsum being soluble, according to G K. Cameron, in 372 parts of pure water at 26° C Waters percolating through gypseous strata, like the Keuper marls, dissolve the calcium sulphate and thus become permanently hard or "selenitic." Such water has special value for brewing pale ale, and the water used by the Burton breweries is of this character; hence the artificial dissolving of gypsum in water for brewing purposes is known as "burtonization" Deposits of gypsum are formed in boilers using selenitic water.

Pure gypsum is colourless or white, but it is often tinted, especially in the alabaster variety, grey, yellow or pink. By exposure to strong heat all the water may be expelled, and the substance then has the composition of anhydrite (*q.v.*). When the calcination, however, is conducted at such a temperature that only about 75% of the water is lost, it yields a white pulverulent substance, known as "plaster of Paris," which may readily be caused to recombine with water, forming a hard cement. The gypsum quarries of Montmartre, in the north of Paris, were worked in Tertiary strata, rich in fossils Gypsum is largely quarried in England for conversion into plaster of Paris, whence it is sometimes known as "plaster stone," and since much is sent to the Staffordshire potteries for making moulds it is also termed "potter's stone" The chief workings are in the Keuper marls near Newark in Nottinghamshire, Fauld in Staffordshire and Chellaston in Derbyshire It is also worked in Permian beds in Cumberland and Westmorland, and in Purbeck strata near Battle in Sussex. The principal American workings are in New York, California, Iowa, Kansas, Texas, Ohio, Oklahoma, Michigan, Wyoming, Nova Scotia and New Brunswick.

Gypsum frequently occurs in association with rock-salt, having been deposited in shallow basins of salt water. Much of the calcium in sea-water exists as sulphate; and on evaporation of a drop of sea-water under the microscope this sulphate is deposited as acicular crystals of gypsum In volcanic districts gypsum is produced by the action of sulphuric acid, resulting from the oxidation of sulphurous vapours, on lime-bearing minerals, like labradorite and augite, in the volcanic rocks: hence gypsum is common around solfataras Again, by the oxidation of iron-pyrites and the action of the resulting sulphuric acid on limestone or on shells, gypsum may be formed, whence its origin in most clays. Gypsum is also formed in some cases by the hydration of anhydrite, the change being accompanied by an increase of volume to the extent of about 60% Conversely gypsum may, under certain conditions, be dehydrated or reduced to anhydrite.

Some of the largest known crystals of selenite have been found in southern Utah, where they occur in huge geodes, or crystallined cavities, in deposits from the old salt-lakes. Fine crystals, sometimes curiously bent, occur in the Permian rocks of Friedrichroda, near Gotha, where there is a grotto called the Marien-glashöhle, close to Rheinhardsbrunn. Many of the best localities for selenite are in the New Red Sandstone formation (Trias and Permian), notably the salt-mines of Hall and Hallein, near Salzburg, and of Bex in Switzerland. Excellent crystals, usually of a brownish colour arranged in groups, are often found in the brine-chambers and the launders used in salt-works. Selenite also occurs in fine crystals in the sulphur-bearing marls of Girgenti and other Sicilian localities; whilst in Britain very bold crystals are yielded by the Kimeridge clay of Shotover Hill near Oxford Twisted crystals and rosettes of gypsum found in the Mammoth Cave, Kentucky, have been called "oulopholites" (οὖλος, "woolly"; φωλεός, "cave").

In addition to the use of gypsum in the making of Keene's cement, plaster of Paris, fireproof building blocks, wall and partition material, foundry cores, the mineral finds application as an agricultural agent in dressing land, and it has also been used in the manufacture of porcelain and glass. Formerly it was employed, in the form of thin cleavage-plates, for glazing windows, and seems to have been, with mica, called *lapis specularis*. It is still known in Germany as *Marienglas* and *Frauenеis*. Delicate cleavage-plates of gypsum are used in microscopic petrography for the determination of certain optical constants in the rock-forming minerals (R. H. Ra)

GYPSY MOTH, a European Liparid moth (*Porthetria dispar*) brought to the United States for experiment in 1869 but escaped from confinement, multiplied slowly, and eventually became a great woodland and orchard pest in New England In 1888 and 1889 it had become very abundant in the vicinity of Medford, Mass., and its identity with the European species was ascertained It was found to have spread over an area of nearly 400 sq m in the vicinity of Boston For ten years effective work was carried on by the State of Massachusetts, and the insect was kept under measurable control. The State discontinued its work in 1900, and by 1905 it had spread over an area of approximately 4,000 sq.m. In 1906 it was found in the States of New Hampshire and Rhode Island, and an appropriation was made by Congress in an attempt at its control by the Federal Government. Annual appropriations for this purpose have been continued by the Government since that time. The spread of the species has been retarded greatly, and the damage done by it has been much reduced By State and Federal quarantine measures, commercial spread has been prevented to a large extent Five centres of infestation have been found beyond New England, namely at Geneva, N.Y., Cleveland, O., in Westchester County, N.Y., at Rutherford, N J., and at Somerville, N J. All of these outbreaks have been exterminated except the last, and it is expected that the extermination of this outbreak will be accomplished soon. In the meantime, however, the insect has spread over all of Rhode Island, throughout the southwestern part of Maine, and by far the larger part of Connecticut, Massachusetts and New Hampshire, as well as rather more than half of Vermont At present a strenuous effort is being made by the Federal Government and by the State of New York to hold it within its present limits.

The adult female moth is a heavy-bodied, light coloured insect, with zigzag blackish marks on the wings. The body is so heavy that the female cannot fly It has a wing-spread of 2½ in. The male is much smaller, is dark in colour, and flies readily. The winter is passed in the egg stage. The eggs are laid in clusters of four hundred or more, on the bark of trees, on fence rails, fallen logs, under loose bark, in cavities in the trunks or branches and are sometimes placed on stones where they may be concealed from view Each cluster is covered with buff-coloured hair The eggs are laid during July, and hatch with the appearance of the leaves the following spring The young larvae feed rapidly and become full-grown early in July. They are ravenous eaters, and when they are numerous the trees may be stripped completely before the end of June The pupae, or chrysalids, into which the larvae are changed give out the adult moths after about ten days. There is one generation each year. The gypsy moth spreads commercially on nursery stock, young trees, lumber, stone or other products likely to be sent away. They also spread as newly hatched caterpillars, in which condition they are blown to considerable distances by the wind on warm sunny days. The insect is a very destructive enemy to mixed forests and to orchards. In New England thousands of trees have been killed. Apple and oak have suffered more than other species, but pine and other coniferous trees have been killed when mixed with deciduous growth. The remedial measures adopted after long investigation have consisted of spraying with a solution of arsenate of lead, banding the trees to prevent the climbing of the caterpillars, and treatment of the egg-masses with creosote Many species of parasites have been introduced from Europe, and certain of these, especially the Braconids and the Tachina flies, have proved reasonably effective. A predatory beetle known as *Calosoma sycophanta* has also been introduced to good effect. These imported natural enemies have been the means of aiding very considerably in the control of the insect. (*See*

Economic; SEX.)

See Farmers' Bulletin No. 1335 of the U.S. Department of Agriculture. (L. O. H.)

GYRO-COMPASS or **GYROSCOPIC COMPASS** is an instrument invented and developed in comparatively recent years. It was the outcome of an increasing need for a reliable compass which would not be subject to the troubles caused by the larger and larger masses of steel in ships. As gyroscopes and gyroscopic reactions became better understood, experiments along these lines resulted, finally, in the successful application of the gyroscope to obtain a compass which would indicate geographic north, and at the same time be immune from the magnetic disturbances inevitable on all steel ships. In 1911 the compass which now has had the widest adoption in shipping successfully completed its trials, first on a merchant ship operating between New York and Norfolk, Va., and then in the powder magazine of a torpedo boat destroyer. It was installed on a U.S. battleship and two "repeater" compasses were electrically connected to it, one used for steering and the other for taking bearings. It was soon found that the gyro-compass, on account of its integrity and its refusal to take up any of the yawing movements of the ship, afforded a base line from which graphic course records could be made and turret guns controlled in azimuth. Eventually the master gyro-compass became a most important factor of the gun control system. After the first successful trials, gyro-compasses were rapidly installed on battleships and submarines throughout the U.S. navy, and were further taken up by the British, Japanese, French, Italian and Russian navies in the order named; in the years following the war, the gyro-compass was also adopted by a majority of the important merchant fleets throughout the world.

In addition to the compass mentioned above, which is manufactured by the Sperry Gyroscope company in the borough of Brooklyn, New York city, a gyro-compass is also manufactured by the Anschutz company in Germany. Still later there has appeared a compass manufactured by S. G. Brown in Great Britain, and still more recently one made by the Arma company in New York. With each, the operation is based upon the same fundamental principles, the method in which the gyroscopic element (from which the compass obtains its directive force) is suspended being the chief difference. The Anschutz compass employs the flotation method, the Brown the so-called "oil pump" method, and the Arma the flotation method; while with the Sperry compass the weight of the sensitive element is supported by a mechanical method.

The Component Parts.—The compass first mentioned above consists, essentially, of a gyro wheel driven at moderately high speed by electricity, its auxiliary parts and compass card all supported in gimbals in a suitable housing or binnacle. The compass is in reality built up around the gyro wheel. When the compass is functioning normally, its spinning axis will lie in line with the true north-south meridian. The gyro wheel and shaft are supported in a housing called the rotor-case, which is fitted with the necessary oil reservoirs to supply lubrication to its main bearings for many months. The weight of the rotor-case is supported in turn in two ball bearings, one on either side, from a surrounding ring called the vertical ring, which lies in a vertical plane at right-angles to the gyro axis. The vertical ring is supported by means of a stranded wire suspension from the head of the compass at the centre of the compass card, and is suitably guided. In order to prevent lag due to friction, however, between the compass at the centre of the compass card, and is suitably guided. the vertical ring is suspended within an outer or "phantom" ring which is rigidly attached at the upper end to the compass card itself. The phantom element, including the compass card, is kept in line with the sensitive element by a reversible motor (called the azimuth motor) which is controlled through a trolley and contactor circuit and applies a small oscillation or "hunt" to the compass card. The weight of the card and phantom ring is supported on thrust bearings by the main frame. Surrounding the phantom ring is a frame called the ballistic, which is supported on ball-bearings carried on either side of the phantom ring. This ballistic frame contains reservoirs which are connected by tubes, so that the liquid is free to flow from one side to the other in a direction parallel to the gyro axis. The ballistic frame is connected to the rotor-case by means of an arm called the link, which fits over a bearing on the bottom of the case. It is through this connection that the force of gravity generated by the ballistic is applied to the sensitive element, causing the gyro axis to seek and maintain the meridian. Although the gyro-compass is absolutely free from magnetic variation and deviation, correction must be made for latitude and speed. The reason for this is that the progress of a ship over the earth's surface creates an effect on the gyro-compass similar to that resulting from the earth's rotation itself. If this movement of the ship is east or west, the effect upon the compass is nil, but if the ship moves north or south or in a direction which is a component of a north or south heading, the axis of the gyro is triflingly displaced from the axis of the earth by an amount depending upon the latitude, the speed of the ship and the direction of the heading. The error resulting from this displacement is automatically eliminated in the Sperry compass by means of a corrector so contrived as to utilize the very disturbing elements themselves to introduce the proper correction, so that all readings of the compass together with all repeaters and other instruments driven therefrom are true to the meridian

The main frame of the master compass is provided with a lubber-ring concentric with the compass card and rigid except for the small movement applied to it by the corrector mechanism described above. A lubber-line or base-line inscribed on this ring provides the necessary references, so that when the compass has been installed with the lubber-line parallel to the fore and aft line of the ship, the angle between the ship's head and the true geographic meridian may be read in degrees and fractions from the compass card. A transmitter forming a part of the compass transmits correct azimuth to all repeaters and other auxiliaries The master compass as described above, together with its subordinate parts, is supported in gimbal rings in a hollow, cylindrical body or binnacle. One form of the binnacle is provided with two sliding doors which can be unlatched from the top and lowered to provide access to the compass. The binnacle has a hinged cover with a large glass window so that the operation of the compass may be viewed with the dust-proof cover closed

A gyro-compass equipment usually includes a motor generator for converting the ship's supply current to alternating current of the proper characteristics to drive the gyro wheel, a control panel with suitable switches and meters for operating the equipment, and a number of repeater compasses for indicating the compass readings wherever required. To these more or less fundamental units other equipment is frequently added, such as a *course recorder* for automatically recording the ship's course, and the *gyro-pilot* which steers the ship automatically from the gyro-compass.

Method of Application.—On merchant vessels the master gyro-compass is usually placed below decks in a clean and dry compartment. A steering repeater fitted with a reading glass is located beside the ship's wheel and adjusted to suit the convenience of the helmsman. Bearing repeaters are mounted on the port and starboard wings of the bridge, and a repeater is often placed aft at the emergency steering station. Repeaters with bulkhead mounting may be used in the captain's stateroom and in the wireless room, and if the ship is equipped with a wireless direction-finder, a repeater compass is almost always used in conjunction with it to obtain accurate wireless bearings. The course recorder is located in the chartroom, where its record is available for inspection at all times by the captain and officers of the ship. While a magnetic compass is still standard equipment on every vessel, it is fast coming to be considered simply as a standby in case anything should go wrong with the gyro. The gyro-compass is an instrument capable of withstanding considerable rough treatment. It is not affected by the vibration of the ship's engines on account of the resilient support of the gyro. The gyro is likewise carefully balanced in such a way that it is not affected by the rolling and pitching of the ship.

Operating Principles.—The principles upon which the operation of the gyro-compass is based depend upon the fundamental

GYRO-COMPASS



BY COURTESY OF THE SPERRY GYROSCOPE COMPANY, INC.

THE GYRO-COMPASS: AUTOMATICALLY INDICATING TRUE COURSE FOR OCEAN VESSELS

1. Gyro-compass equipment for use on submarines: left, compass; right, electrical equipment
2. Sir Arthur Rostrom taking bearing on repeater
3. The Sperry Gyro-compass, merchant marine type
4. Complete Gyro equipment, capital naval vessels
5. Compass (top removed), showing card and corrector
6. Gyro-compass designed for the modern battleship
7. Recorder, gives the ship's course on time chart
8. Gyro-compass as used on many naval vessels

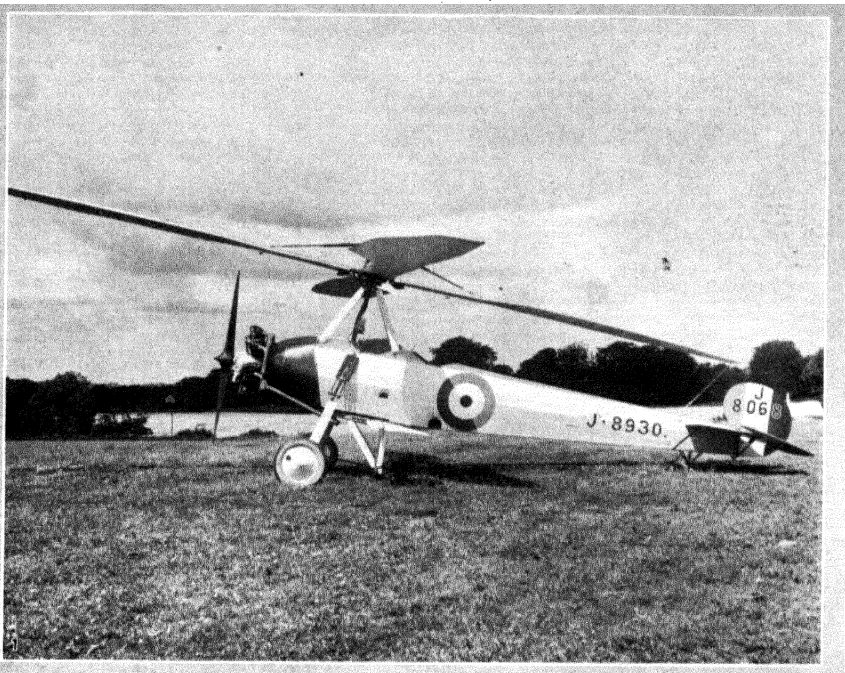
GYRO-COMPASS

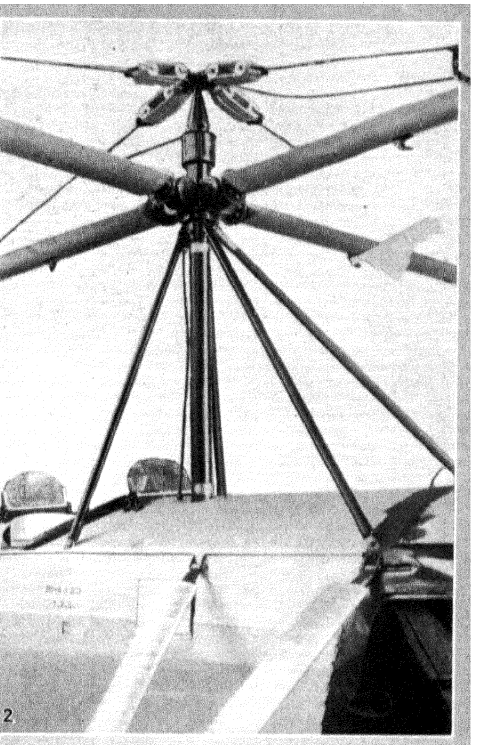


BY COURTESY OF THE SPERRY GYROSCOPE COMPANY, INC.

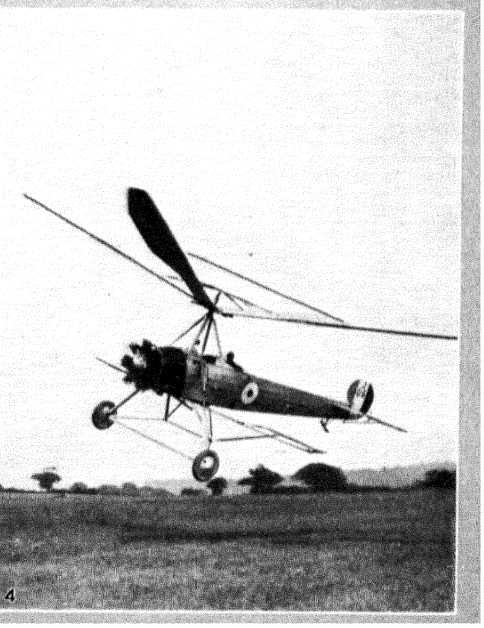
THE GYRO-PILOT OR AUTOMATIC STEERING MACHINE

Electrically operated from master Gyro-compass, located below decks. Moves the rudder in proper direction upon any departure of the ship from its charted course. Repeater shown in wheel house of a modern freight vessel: top, repeating compass; below, steering mechanism









PHOTOGRAPH, (3) INTERNATIONAL NEWS REEL

THE "AUTOGIRO" OR GYROPLANE

1. The de la Cierva Autogiro fitted with a 200 h.p. engine, with wings at rest. This type of aeroplane was originated in Spain between 1919 and 1924 by Juan de la Cierva. The wings rotate about an approximately vertical axis. No driving power is supplied to them mechanically, their rotation being dependent on the forward motion of the whole machine
2. Arrangement of axle of rotating wings on the "Autogiro." An essential feature is the hinging of each of the wings round an axis perpendicular to the spindle about which they all rotate
3. Señor de la Cierva, inventor of the Autogiro, landing at Le Bourget field, Paris, after a successful flight across the English Channel
4. The Autogiro in flight. The machine can be banked in the same way as an ordinary aeroplane. The "Autogiro" is capable of a minimum flying speed as low as 30 miles per hour. It can glide safely at so steep an angle that it appears to the eye to be descending vertically, and on touching the ground it stops within a few yards

characteristics of gyroscopic action, and may readily be observed with the aid of a small gyroscope model. A typical gyroscope may briefly be described as a spinning wheel, universally mounted; *i.e.*, the wheel shaft is so mounted in supporting rings that its axis is free to take up any position in space. On spinning the wheel in either direction it will be found to have assumed a *rigidity of direction of its axis and plane of rotation relative to space*. It can be carried about on its support in any manner without changing the direction of its axis relative to space. With the wheel still spinning, the gyro will exhibit another interesting trait. Apply a pressure against its supporting ring in a direction calculated to move the wheel about the horizontal axis; instead of moving in the direction of the applied force, the supporting ring will resist the pressure and move about the vertical axis—at right angles to the applied force. Similarly, if a pressure be applied about the vertical axis of the gyroscope, it will resist the pressure in this direction and move about the horizontal axis. This phenomenon is known as *precession*

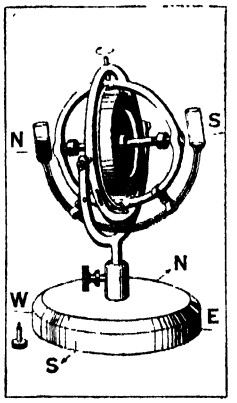


FIG. 1.—GYROSCOPE WITH A TUBE OF LIQUID STRAPPED TO THE FRAME FOR APPLIANCE OF FORCE OF GRAVITY

The gyro-compass exhibits the same characteristics as the simple model described above, within practical limits, only in the case of the gyro-compass the precessional movement is controlled by the force of gravity in the form of the ballistic previously alluded to. Otherwise it would merely be a gyroscope, without any north-seeking quality whatsoever. Returning now to the elementary gyroscope model, imagine it placed on the earth's surface at the equator with its spinning axis in an east-west direction. Because of the model's *rigidity-in-space* characteristic it will maintain its axis in the same plane with regard to space, though to an observer standing beside it on the earth's surface the end toward the east appears to tilt up as the earth revolves from west to east, moving the base of the gyroscope just as if it were moved by hand as described above. If left alone, the gyro axis would apparently make a complete revolution every 24 hours and, disregarding the effect of friction in the bearings, it would always have its axis in the original east-west plane.

Recalling the effect of precession on the revolving wheel, the natural force of gravity may now be applied by strapping a semicircular tube of liquid to the frame in which the wheel of the model is suspended (fig. 1). With the model placed in the same position as described above, with its axis in the east-west direction, as the earth revolves and the axis tilts in regard to the earth the liquid flows to the low side, which we will designate as *S*, thus applying a force about the horizontal axis of the gyro (fig. 2). Owing to the law of precession, however, this pressure causes the gyro to turn about the vertical axis, which it proceeds to do, until the opposite end of the axis, *N*, reaches and crosses the north-south meridian of the earth. As soon as it has crossed the meridian, the other end of the axis *S* commences to tilt up, the liquid flows to the low side *N* and reverses the precessional force, causing the gyro to precess back across the meridian. Thus the gyro axis will continue to oscillate across the meridian indefinitely, with the end of the axis designated as the north end *N* pointing toward the North Pole as it crosses the meridian.

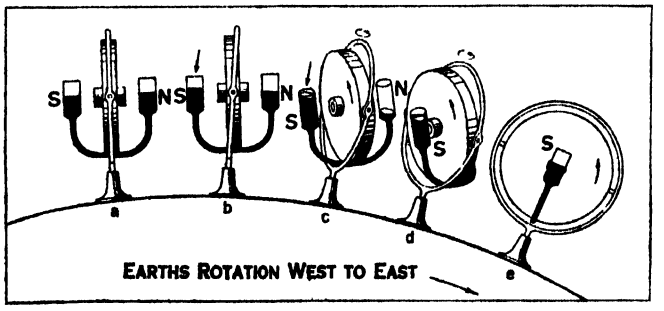


FIG. 2.—THE CYCLE OF MOVEMENTS OF THE GYROSCOPE STARTING FROM AN EAST-WEST POSITION, *a*, TO SETTLEMENT ON THE TRUE MERIDIAN, *e*, THUS FORMING A GYRO-COMPASS

In the case of the gyro-compass these oscillations are damped out and the gyro axis is caused to settle permanently on the meridian. The precessional force then, due to gravity, instead of acting only about the horizontal axis of the gyroscope also acts, in a much lesser extent, about the vertical axis. This small force about the vertical axis introduces (by the law of precession) a tilting movement about the horizontal which is counter to the natural tilt of the gyro axis as it approaches the meridian, and which in turn slows down or damps the precession of the gyro axis as it approaches the meridian. Thus its oscillations are damped on both sides of the meridian, and its axis will come to rest in a state of equilibrium on the meridian without outside aid, no matter where it happens to point when it is started up. (*See* NAVIGATION.) (E. A. Sp.)

See A. L. Rawlings, *The Gyro-Compass and its Deviations* (1928).

GYROPLANE, an aeroplane in which the wings are free to rotate about an approximately vertical axis. No driving power is supplied to them mechanically, their rotation being dependent on the forward motion of the whole machine. The type was originated in Spain between 1919 and 1924 by Sr de la Cierva. In his machine (the "Autogiro") an essential feature is the hinging of each of the wings about an axis perpendicular to the spindle about which they all rotate. They are prevented from collapsing upward by centrifugal force, but they have a flapping motion, of a frequency equal to that of the rotation (100 to 130 per min.), resulting in equalisation of the lift of the advancing and retreating wings, thus balancing the machine laterally. The speed of the wing tips, due to their rotation, is about twice the forward speed of the machine.

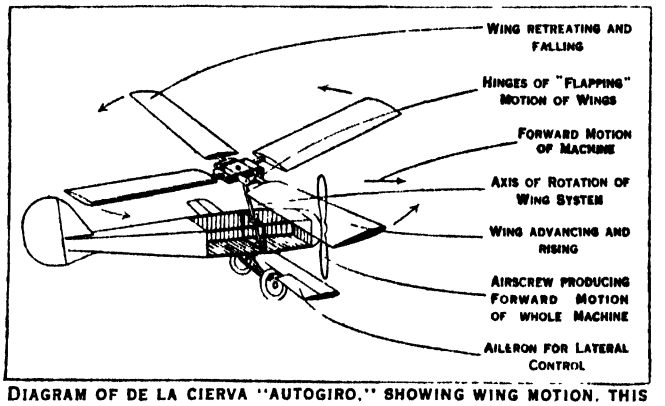


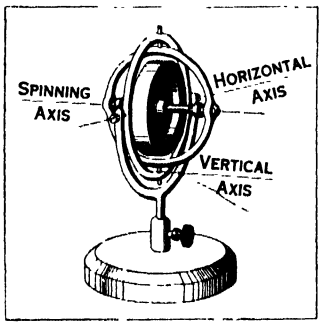
DIAGRAM OF DE LA CIERVA "AUTOGIRO," SHOWING WING MOTION. THIS IS THE ONLY EXAMPLE OF A PRACTICAL GYROPLANE

Although the "Autogiro" cannot hover, it is capable of a very low minimum flying speed, some 30m. per hour (equivalent to that of a conventional aeroplane with a wing area equal to the circle described by the wing tips) and there appears to be no "stall" as usually understood. It can glide safely at so steep an angle that it appears to the eye to be descending vertically. On touching the ground it stops after a few yards, and can thus land safely in a very small space. The essential risk of flight in normal aeroplanes is absent, and it is this feature which may be expected to justify its inventor's confidence in its future.

In speed and useful load the "Autogiro" appears to be somewhat inferior to a normal aeroplane. In taking off it is still dependent on initial rotation of the wings by external means, and a rather long run along the ground is needed before they attain sufficient speed for flight. There is however every reason to believe that at least some of these disadvantages of this type of aeroplane will be overcome, and that it will have a marked influence on the future of flying. (*See* also AEROPLANE; HELICOPTER; and *Journal Royal Aeronautical Society*, Jan 1926 and June 1927.)

GYROSCOPE, a rotating wheel universally mounted, *i.e.*, mounted in such a way that it is free to rotate about any axis. This definition is within the scientific meaning of the term, though differences of opinion exist as to the precise meaning of the word 'gyroscope.' Some writers use the term "gyrostat" to describe a rotatable wheel suspended with its freedom partly or wholly suppressed about one axis other than the axis of rotation. In almost every case where a gyroscope is applied to a practical purpose, its freedom is either restrained, or controlled in some manner in order to gain the desired result. One of the first instruments was that of Bohnenberger, which was constructed as early as 1810, and is described in Gilbert's *Annalen* for 1818 (vol. lx., p 60). It consisted of a heavy spheroid which could rotate, inside a circular ring, about its shorter axis,—the axis running on pivots situated at opposite ends of the ring's diameter. This ring with its contained spheroid was similarly made movable, inside a second ring, about an axis at right-angles to the axis of the spheroid. In the same way this second ring with its contents could rotate, inside a third ring, about an axis at right-angles to each of the others. From this it will be seen that the spheroid had all degrees of free rotation, one point only within it being fixed, viz., the intersection of the three axes

In 1836, in a paper read before the Royal Scottish Society of Arts, Edward Lang suggested an experiment with an instrument exactly similar to the gyroscope, by which the rotation of the earth on its axis could be directly proved He says: "While using Troughton's top an idea occurred to me that a similar principle might be applied to the exhibition of the rotation of the earth Conceive a large flat wheel, poised on several axes all passing directly through its centre of gravity, and whose axis of motion is coincident with its principal axis of permanent rotation, to be put in very rapid motion The direction of its axis would then remain unchanged But the directions of all surrounding objects varying, on account of the motion of the earth, it would result that the axis of the revolving wheel would appear to move slowly." This suggested experiment was actually carried out, in 1852, by Léon Foucault, probably without any knowledge of Lang's suggestion The name gyroscope was given to the instrument by Foucault at this time, and the experiment, repeated at the Liverpool meeting of the British Association, caused such a sensation that the gyroscope was brought to the notice of the public. In order to perform these early experiments successfully it was necessary to construct the instrument with the utmost exactness. Further difficulty hindered the development of the gyroscope, in that rotation could not be kept up for any length of time without functional interference causing the rotor to be inaccurate. Consequently, until comparatively recently, the gyroscope remained largely an instrument used only for demonstration purposes. It was not until the latter part of the 19th century, when G. M. Hopkins introduced the first electrically driven rotor, that the utility of the gyroscope could be fully realized.



BY COURTESY OF THE SPERRY GYROSCOPE CO

FIG. 1.—THE MOST FAMILIAR FORM OF ELEMENTARY GYROSCOPE FOR GENERAL STUDY. IT CAN SPIN WITH ITS AXES IN ANY DIRECTION

Fundamental Principles of the Gyroscope.— Gyroscopic phenomena are exhibited in all rotating bodies, but are more evident in those possessing large angular momentum. The angular momentum of a rotating body is dependent directly on the weight of the body, on the square of the distance at which the mass is situated from the axis of rotation and on the speed of rotation. It is therefore obvious that, for gyroscopic action to be pronounced, the spinning wheel should be heavy, the material should be disposed as far as practicable from the axis of rotation and the speed of rotation should be as high as feasible. A gyroscopic wheel should be well balanced, and mounted to permit rotation at high speed while free to move about any axis.

Elementary Gyroscope.—The ways in which gyroscopic wheels are mounted are various, and depend upon the duties they are to perform. The type illustrated in fig. 1 is the most familiar form for general study. This type of elementary gyroscope is a balanced wheel mounted so as to be free to spin with its axle in any direction, *i.e.*, it has three *degrees of freedom.* The three degrees of freedom of the elementary gyroscope (fig. 1) are the following: (1) The wheel is free to rotate (spin) about its "spinning" axis, the wheel's axle (2) The wheel (with its axle and axle bearings) is free to rotate about the "vertical" axis, which axis is in the plane of the wheel and intersects the spinning axis at right angles. (3) The wheel (with its axle, axle bearing, vertical axis and vertical axis bearings) is free to rotate about the "horizontal" axis, which axis intersects the vertical axis at right-angles at the intersection with the spinning axis. The spinning and vertical axes are always at right-angles to each other, as are also the horizontal and vertical axes, but the spinning axis may make any angle with the horizontal axis. The spinning axis may also be in any direction horizontally, and therefore in any direction relative to space.

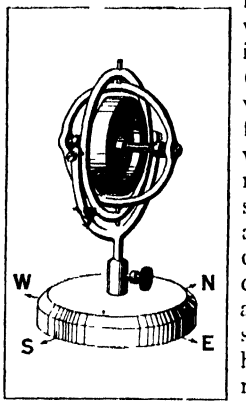


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FIG 2

Gyroscopic Properties and Rigidity.—All known gyroscopic phenomena and the application of the principles involved are dependent upon two properties of the elementary gyroscope; viz., (1) Rigidity in space (actually *gyroscopic inertia*). (2) Precession

Rigidity relative to space is illustrated by the following experiments and considerations: On spinning the gyro-wheel in either direction, it will be found to have assumed a rigidity of direction of its axle and plane of rotation relative to space. It can be carried about on its support, which may be turned in any direction, without alteration of the direction of its axis relative to space. If a gyroscope having complete freedom is so made that it can spin continuously and is sufficiently frictionless in its supports, it will, if used in the following manner, demonstrate its gyroscopic inertia, the property referred to as "rigidity in space." If such a gyroscope is set at the earth's equator, with its spinning axis horizontal in the east and west direction (*see* figs 2 and 3) and is spinning continuously, then the wheel, while spinning, will also apparently rotate about a horizontal axis which is at right-angles to the spinning axis This apparent rotation will proceed at the rate of one revolution in one day Actually, however, the gyro spinning axis has remained parallel to its original position in space, though the gyroscope has been carried along with the earth by the revolution of the latter about its polar axis Thus (fig 4) at the end of three hours the west end of the axle viewed looking north as above will be depressed 45°, and at the end of six hours it will be vertical (to the surface of the earth), having been carried through a quarter revolution in a quarter of a day. At the end of 12 hours it will again be horizontal but with its ends reversed, as viewed by the observer looking north; but actually the gyro axle will still be parallel to its original position in space and pointing in its original direction in space. At the end of one complete revolution of the earth the original position of the gyro axle is regained

This and similar gyroscopic phenomena are the result of the action of forces affecting the state of rest and motion of the gyroscope in the manner expressed by Newton's First Law of Motion, which states that every body continues in its state of rest or uniform motion in a straight line, unless it is compelled by forces to change that state. This law, as applied to a rotating wheel, may be expressed by stating that a rotating wheel tends to maintain the direction of its plane of rotation in space and the direction of its axis in space. A gyroscopic wheel at rest, or any balanced mass at rest with corresponding freedom to move, would show similar phenomena when moved about, if there were no friction. Friction cannot be eliminated entirely, but may be

reduced to a minimum by ball-bearing pivots, etc. (*see* BEARINGS). For a rotating wheel, friction can be reduced to an almost negligible amount in comparison with the forces necessary to disturb the plane of rotation. For a gyroscope with complete freedom, set spinning at either the North or South Pole of the earth, with the gyro axis horizontal, the latter will be at right-angles to the polar axis of the earth. As, however, the spinning gyroscope will maintain the direction of its plane of rotation in space and the direction of its axis in space, though the earth rotates under it, the gyro will have an apparent motion about the polar axis, so that the gyroscope appears to rotate about its vertical axis while spinning about its axle.

The apparent motion will be in a direction counter to the direction of rotation of the earth about its polar axis. The apparent motion of the gyroscope about its vertical axis will therefore appear clockwise as viewed looking toward the earth at the north

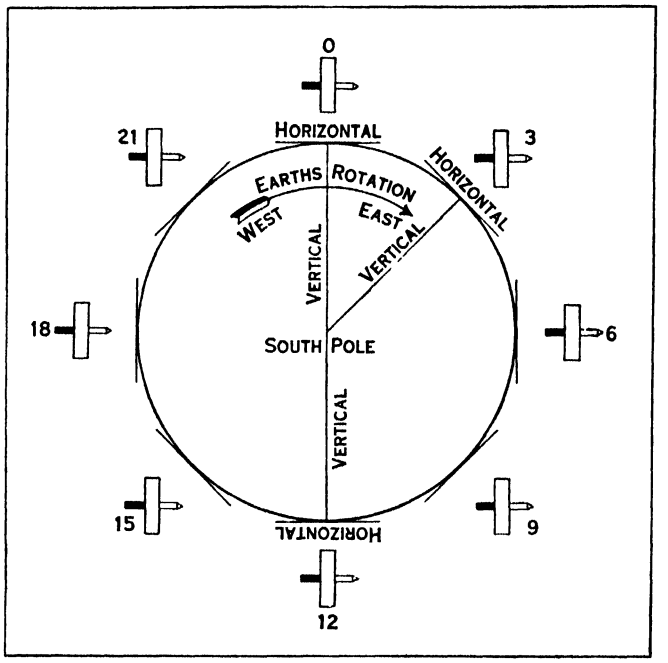

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FIG 3

pole, and counter-clockwise as viewed looking toward the earth at the south pole, the direction of view of the earth's rotation being the reverse at the South Pole to the direction of view at the North Pole It should be noted that, at the Poles, the apparent rotation is entirely about a vertical axis, but at the equator the apparent rotation is entirely about a horizontal axis. For a gyroscope with complete freedom, set spinning at some intermediate latitude, with the gyro axle horizontal and in the meridian, the gyro axle will neither be parallel to nor at right-angles to the earth's axis, but will be at an angle to it equal to the latitude, and therefore also at the equal angle to a line which passes through the centre of the gyroscope and is parallel to the polar axis of the earth as indicated in fig. 5.

Apparent Rotation—Rigidity of direction in space, or gyroscopic inertia, will therefore cause the gyro axis apparently to rotate about a line *A-B* (fig 4), passing through the centre of the gyroscope and parallel to the polar axis of the earth This apparent movement of the gyro axle, will be with a daily period and will be partly about the vertical line passing through the centre of the gyroscope and the centre of the earth, and partly about the "horizontal" axis of the gyroscope. This "horizontal" axis (*see* fig. 3) should not be confused with the gyro axis which is in the horizontal position (fig. 4) only momentarily during each day for the conditions assumed The earth's axis is, for the time, considered as fixed in direction in space and it serves as a convenient base-line from which to observe certain gyroscopic and directional phenomena.

Precession.—The gyroscopic property referred to as *precession* is displayed by a gyroscope when a force is applied to the gyroscope tending to change the plane of rotation of the spinning wheel Precession may be defined as follows, when a gyroscope is subjected to a force which tends to alter the direction of its axle in space, the force meets with great resistance, and the gyro wheel will turn about an axis at right-angles to the axis about which the force was applied, the movement being such as to

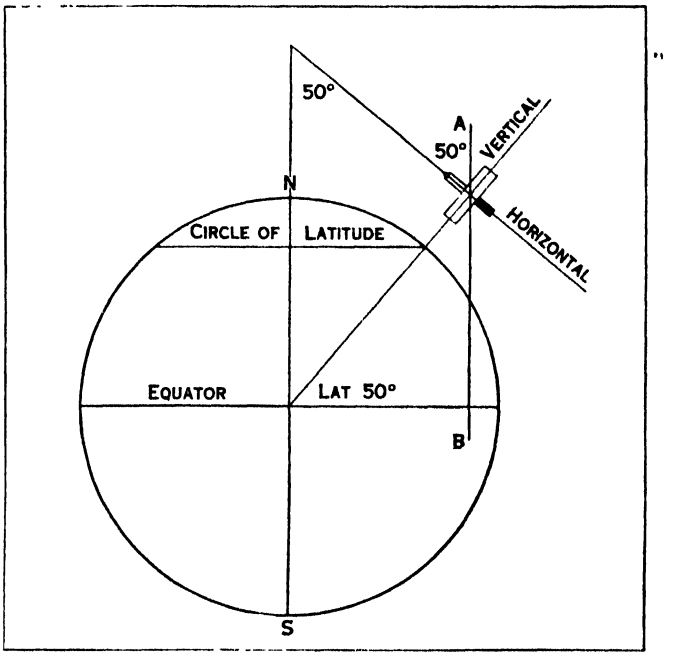

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FIG 4

place the plane and direction of spinning rotation of the wheel coincident with the plane and direction of the force by the shortest path

This property may be illustrated experimentally. Fig. 5 shows a wheel mounted so as to have three degrees of freedom and, for convenience of experiment, set with its spinning axis horizontal. On spinning the gyroscopic wheel in the direction indicated by the arrow *B* and applying force *F* to turn the gyroscope about the horizontal axis, it will be found that there is a great resistance to the force, and, instead of motion taking place in the direction of the applied force, that the wheel turns around in the direction of the arrow *P* and will continue to turn in that direction during application of the force until the plane of spin of the wheel coincides with the plane of the force. Then the wheel not only ceases to turn in the direction of the arrow *P*, but the resistance to the applied force *F* also ceases, and accordingly the gyro will be turned about its horizontal axis by the force *F*. Furthermore, the wheel will cease turning around in the direction of the arrow *P*, not only when the two planes coincide but also as soon as the application of the force is interrupted, though the axes have not reached a point of coincidence at that time. In other words, not only does precession cease at any stage on removal of the force but the gyroscope offers no further resistance to the impressed force once the plane of spinning rotation becomes coincident with that of the applied force. Reversing the direction of spin and repeating the experiment (fig 6), similar phenomena will be exhibited, except that the wheel turns in the opposite direction This precession is always about an axis at right-angles to the axis of the impressed force.

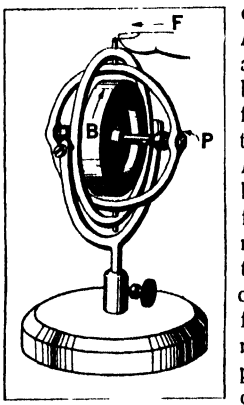

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FIG 5

Continuous Precession.—When the couple acting on the gyro system is arranged in such a way that it and the plane containing

it are caused to rotate with the precession, the latter becomes continuous. This is illustrated in fig. 7, showing a spinning gyro with horizontal axle and with a weight hung at one end of the axle. Instead of turning over under the pull exerted by gravitational force on the weight, as would be the case if the wheel were not spinning, the spinning wheel will turn about its axis, as indicated at *P* in fig. 7. The axis about which the wheel spins is at right angles to the axis of the applied force in the instance illustrated, and tends to set its plane of rotation into coincidence with the plane containing the applied force. As the weight, however, is carried around by the gyro frame, the wheel continues to chase the weight and continuous precession results. Precession will cease immediately upon removal of the weight. Reversal of the direction of spin reverses the direction of the precessional motion. Reversal of the direction of the applied force, by hanging the weight on the other end of the axle, reverses the direction of the precessional motion The direction of the precessional motion remains unchanged if both direction of spin and direction of applied force are reversed.

PRACTICAL APPLICATIONS

Gyro-compass.—In the case of the gyro-compass (*q.v.*), both the rigidity in space, and the precession characteristics of the gyroscope are utilized, but the sensitive or rotating element is harnessed by the force of gravity so that the spinning axis of the gyro is brought into line with the north-south axis of the earth and is caused to remain there. The gyro-compass is a necessity in naval work where the great masses of iron and steel seriously impair the accuracy of the magnetic compass and where a high degree of accuracy is required for gun fire control. The gyro-compass is also in use in practically every large merchant fleet in the world on account of the safety and added economy of navigation it affords. Vessels ranging from small power yachts to ocean liners use the gyro-compass.

Gyro-stabilizer for Ships.—In order to add materially to the pleasure and comfort of ocean travel, as well as to reduce the stresses and strains imposed on a ship's framework when rolling in a heavy sea, many different forms of apparatus have been devised. The only kind which has hitherto (1928) met with any great degree of success is the gyroscopic stabilizer, developed by Elmer A. Sperry. This stabilizer is a compact unit generally located below decks on the centre-line of the ship. It consists of a rotor of special steel and a supporting casing resting in horizontal "thwartships" gudgeon bearings, so that the rotor axle, when central, is vertical, with the ship on an even keel. The only apparent movement of the stabilizer other than the spinning of its rotor, is a tilting or precessing, fore and aft in the thwartships bearings. In so doing, however, the gyro exerts a righting force against the action of the wave as it tends to roll the vessel over. By dealing with each wave increment individually and by exerting a small counteracting force against it at just the right moment, the gyro-stabilizer quenches the force of each wave and never allows the vessel to build up more than three or four degrees roll.

The Sperry stabilizer is known as the "active" type, for its action is not limited to the rolling of the ship, but is artificially controlled by means of a precession motor which applies, through suitable gearing, an initial push to the gyro which causes it to respond at the very inception of roll. The precession motor is actuated through an electric circuit governed by a small and sensitive control gyro. The latter, by precessing slightly at the first inclination of the vessel to roll, closes a set of contacts which, through relays, starts the precession motor in the proper direction to apply an initial push to the stabilizing gyro. This push overcomes the static friction in the gudgeon bearings of the heavy wheel and allows it to act without delay. Once started, the force of the wave on the ship's hull keeps the big gyro precessing until the wave's energy is spent. The ship has remained upright, and as the wave passes beneath and tends to roll her in the other direction, the entire cycle is reversed, the stabilizing gyro precessing in the opposite direction and preventing the vessel from rolling back again Conversely, with the active type of gyro-stabilizer, the vessel may be artificially rolled in smooth water. This may be of considerable value in extricating her from a difficult position, or in working through ice fields. Among the stabilizers that have been built is one for a liner of 18,000 tons displacement. The rotor for this equipment is 13 ft. in diameter and weighs approximately 225,000 pounds. One of the smallest gyroscopic stabilizers built is that of a 65 ft. yacht, the rotor of which is only 28 in. in diameter.

Roll and Pitch Recorder.—This is an instrument to determine the amplitude of a vessel's roll and pitch and the period of these motions. It consists of a small gyroscope with controlling mechanism for two pens, one of which makes a record of the roll, the other of the pitch of the vessel. A sheet of recording paper is automatically drawn under the two pens, and a third operated by clockwork makes marks on the paper at fixed intervals of time. The instrument with its switches, connecting cord, etc., is contained in a box with carrying handle attached. It is designed to operate from the ship's lighting circuit, the rotor of the gyroscope being a self-contained direct current motor with commutator and brushes. The roll and pitch recorder makes use of a gyroscopic pendulum whose natural period is so long that the comparatively short period of the motion of the ship does not affect it. The stable reference plane thus established enables the amplitude of roll and pitch of the vessel to be accurately recorded on the moving strip of paper. The accuracy of this record and its corresponding time interval line enables comparisons to be made of the roll and pitch of a vessel under various conditions of loading, speed and sea. The charts are used by engineers in designing stabilizers to meet the requirements of certain ships, and as records of the operation of stabilizers after they have been installed.

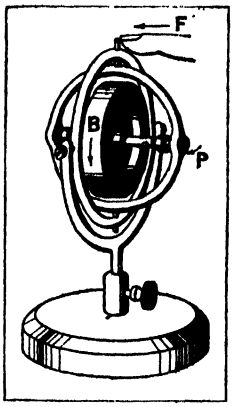

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FIG. 6

Gyroscopic Track Recorder.—Within more recent years the gyroscope has entered a new field of utility This was brought about by the advent of the Sperry gyro track recorder, which is used on railroads to determine the condition of the roadbed. In addition to recording differences of elevation of the two rails on both curved and straight sections of the track, accurate records are also made of the magnitude and exact location of rail spreads, rail depressions, the depth of low rail joints, and other inequalities in the roadbed at the time the track is subjected to the actual impact of the car passing over the rails at normal speed. The gyroscope is the only means yet developed of obtaining a stabilized vertical within the car, uninfluenced by the disturbing effects of the train's movements as it rounds a curve or changes its rate of motion. By utilizing the vertical-seeking properties of a pendulum and stabilizing it with a gyroscope, a means is provided for obtaining exact indications of the behaviour of the track as the heavy trucks pass over it.

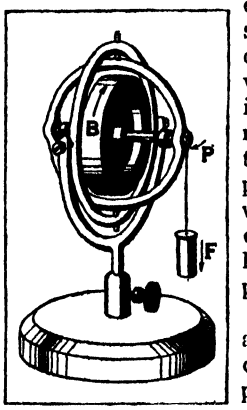

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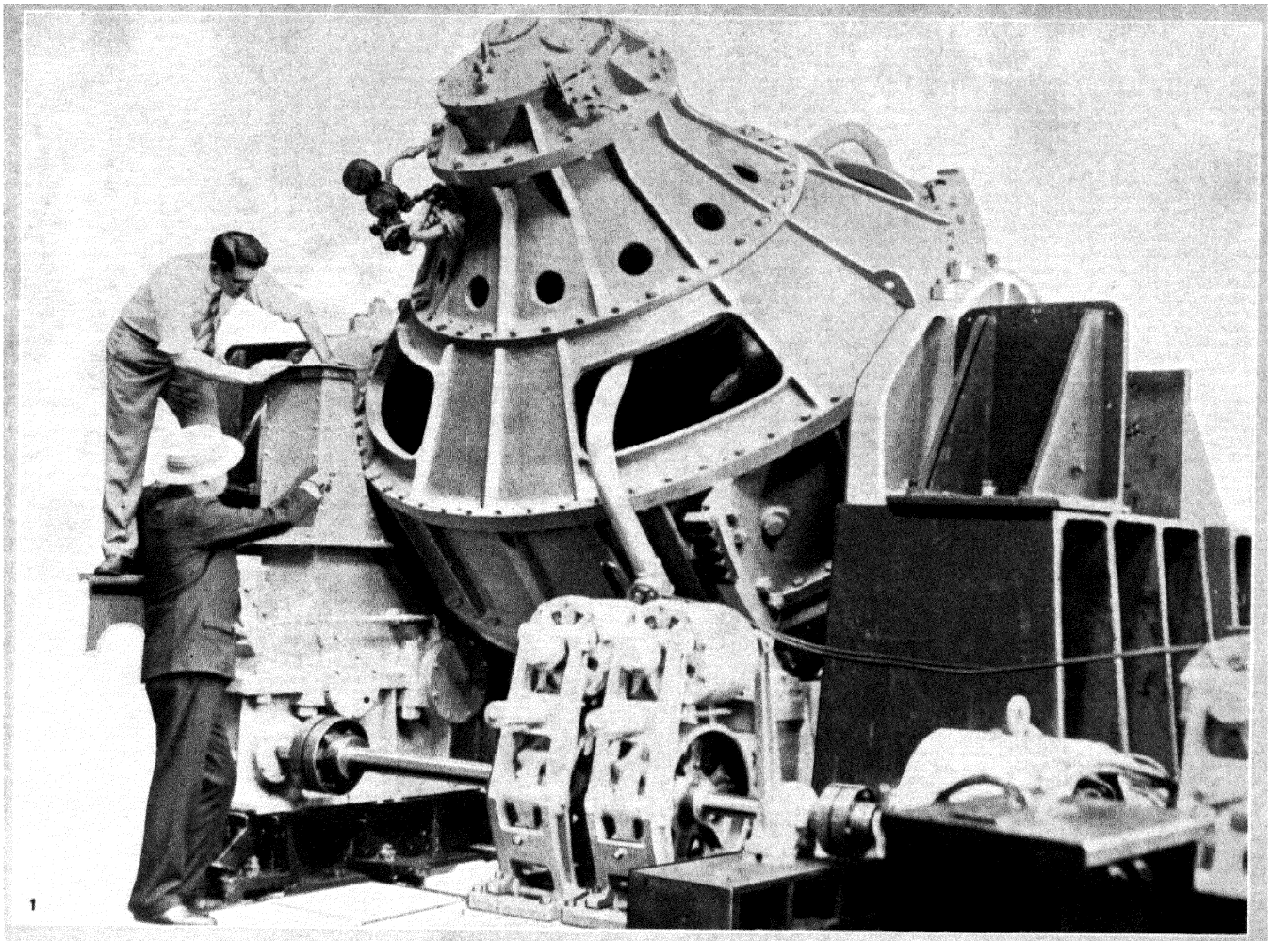
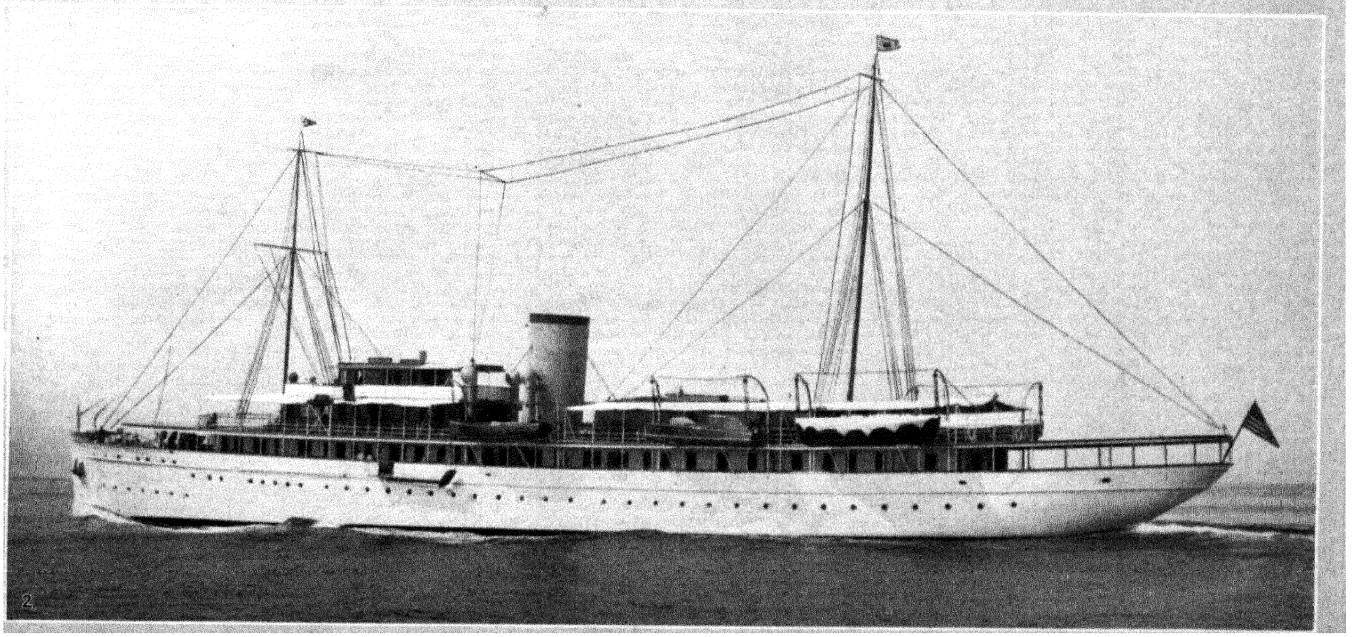
FIG. 7

Other Uses.—The gyroscope has been applied with considerable success in many other fields. In aviation an automatic pilot has been developed, which embodies one or more gyroscopes and serves to operate the aeroplane's controls automatically. A gyroscopic instrument used in many modern aeroplanes is the *turn and bank indicator* (*see* AERIAL NAVIGATION). The sensitive element consists of a small air-driven gyroscope operated by the vacuum produced by the venturi tube placed in the wind stream. The gyro is only $1\frac{1}{8}$ in. in diameter, weighs 6 oz., and revolves at 5,000 revolutions per minute. It is mounted in such a way that it reacts only to motion about a vertical axis, being unaffected by rolling and pitching.





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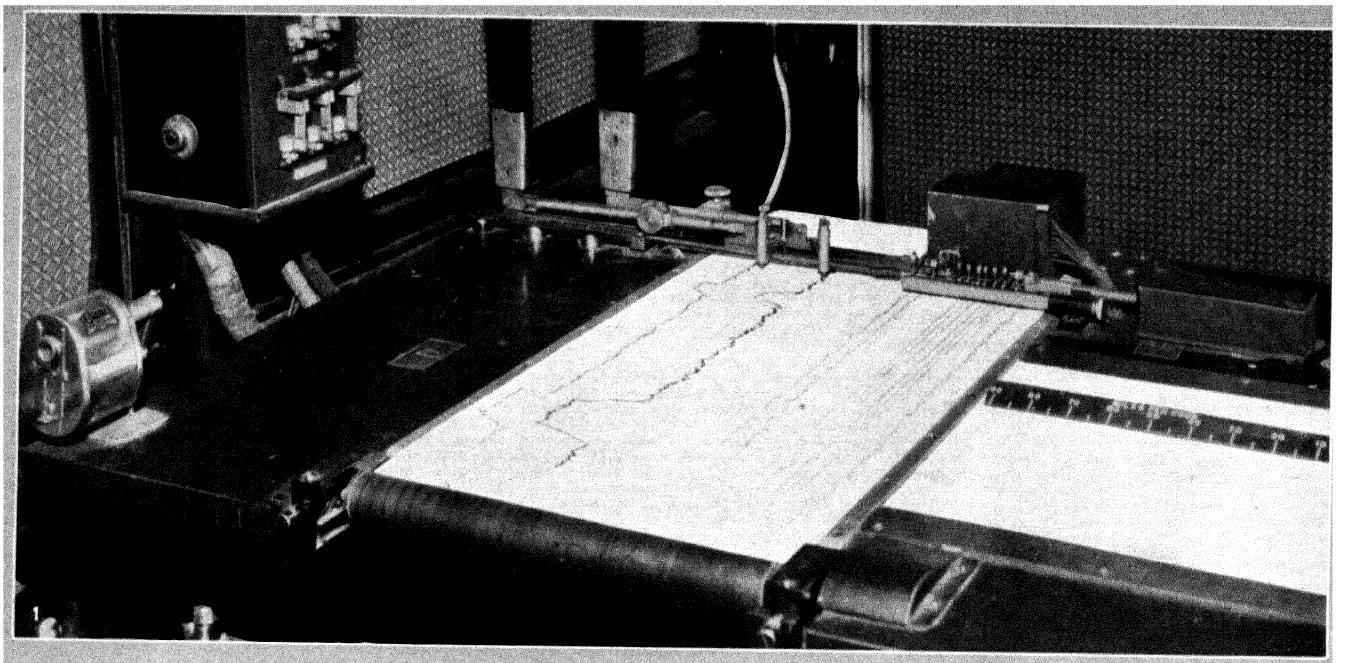
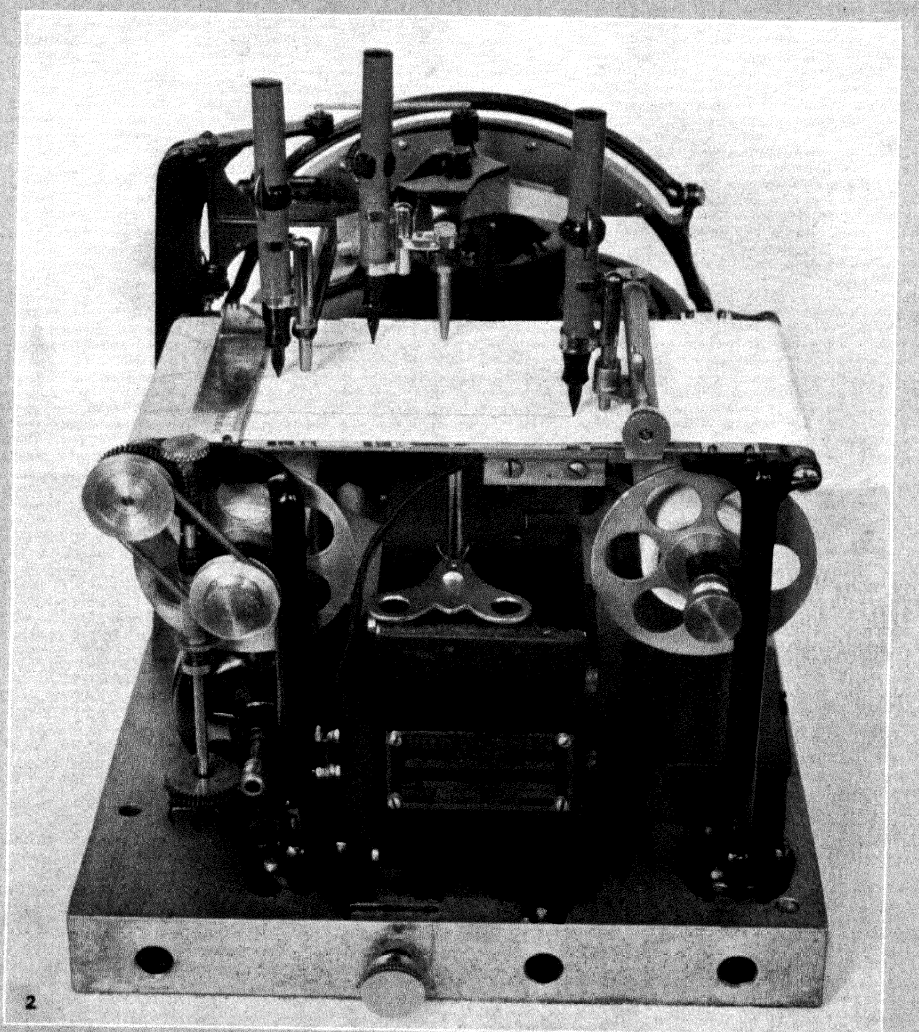
THE GYROSCOPIC SHIP STABILIZER TO PREVENT THE ROLLING OF OCEAN VESSELS

Sperry gyroscopic ship stabilizer (fig. 1) installed on the "Savarona" (fig. 2), a 294 ft. Diesel yacht of 2,300 tons displacement. This machine is one of the largest of its kind ever made for yachts. The gyro-stabilizer operates under the direction of a small, sensitive control gyroscope mounted on the corner of the base of main gyro-stabilizer. Both instruments contain rotors or spinning flywheels serving to balance hull of vessel. Control gyroscope responds instantly to slightest roll of ship, transmitting "precession" or counteracting motion to large gyroscope

GYROSCOPE





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SPERRY GYROSCOPIC RECORDERS FOR USE ON LAND AND SEA

1. Gyroscopic track recorder: Paper moves, with car recording the cross-level of track, including all irregularities affecting level of car

2. Gyroscopic roll and pitch recorder for ocean vessels. From left to right on chart table are roll recording pen, pitch pen, time pen

The gyro, by precessing in one direction or the other, actuates a pointer which moves over a graduated dial. One of these instruments was used by Lindbergh in his non-stop flight from New York to Paris in 1927.

Gyroscopes are used extensively in naval warfare to control torpedoes. The rotor of one of these instruments is given an initial spin (by means of compressed air) either just before or at the time when the torpedo is leaving the tube. It is designed to revolve at a high rate of speed for about 15 min., or as long as the torpedo continues to move through the water. The "rigidity of space" characteristic of the gyroscope only is employed in this case. The gyroscope, by means of air pressure, controls a small steering engine in the after part of the torpedo which actuates the rudders.

Many other auxiliary instruments, having gyroscopic control have been developed. For example there is, the Sperry *gyro-pilot*, operated electrically from the gyro-compass, which automatically steers all types of vessels with greater precision than a human helmsman and with the use of less rudder. There is the *course recorder*, also operated electrically from the gyro-compass, an instrument which provides a permanent, written record of every lateral movement of a ship's head from the moment the ship leaves the lock until her voyage is completed. (E. A. Sp.)

See R. F. Deimal, *Mechanics of the Gyroscope* (1928).

GYTHIUM, the harbour and arsenal of Sparta (some 30 m. distant), lay at the north-west extremity of the Laconian gulf, in a small fertile plain at the mouth of the Gythius. Its reputed founders were Heracles and Apollo, who frequently appear on its coins. In classical times it was a community of *perioeci*, politically dependent on Sparta. Subsequently it formed the most important of the Eleutherolaconian towns, a group of twenty-four, later eighteen, communities leagued to maintain their autonomy against Sparta and declared free by Augustus. The highest officer of the confederacy was the general.

Pausanias (iii. 21 f.) has a description of the town in the reign of Marcus Aurelius, the agora, the Acropolis, the island of Cranae (Marathonisi) where Paris celebrated his nuptials with Helen, the Migonium or precinct of Aphrodite Migonitis (occupied by the modern town of Marathonisi or Gythium), and the hill Larysium (Koumaro) rising above it. Extant remains are all of Roman date: the theatre and the buildings partially submerged by the sea are noteworthy.

The modern town is a busy port with a good harbour protected by Cranae, now connected by a mole with the mainland: it is the capital of the prefecture (*νομός*) of Laconia with a population (1917) 5,430.



H This letter corresponds to Semitic 𐤇 (cheth), Greek Η H (eta) In the eastern Greek alphabet the form with three horizontal bars was in use, but in the Chalcidic the more usual form was H. This form was taken over by the Latins. The Etruscan forms are 𐌇 and 𐌇. In the Umbrian alphabet there was a round form ⊘. The modern majuscule H is derived directly from the Latin.

The cursive Latin form 𝒽 resembled the modern minuscule, and the uncial form was ℎ. Both these forms result from writing the letter without taking pen from paper, the right-hand vertical bar being thus fore-shortened and the horizontal stroke rounded. From these came the Carolingian h and the modern minuscule *h*.

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	BC 1,200	𐤇
CRETAN	1,100-900	𐌇 H
THERAEAN	700-600	𐌇
ARCHAIC LATIN	700-500	(H)
ATTIC	600	𐌇
CORINTHIAN	600	𐌇
CHALCIDIAN	600	𐌇
IONIC	403	𐌇
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	H
URBAN ROMAN		H
FALISCAN		𐌇
OSCAN		𐌇
UMBRIAN		⊘
CLASSICAL LATIN AND ONWARDS		H

THE DEVELOPMENT OF THE LETTER "H" FROM THE PHOENICIAN THROUGH THE LATIN TO ITS PRESENT FORM

In the eastern Greek alphabet the letter, which in Semitic as well presumably as in the parent alphabet of both Etruscan and Greek, represented an aspirate, was employed for the long open *e*, while in the western it retained its character as an aspirate, standing for the Greek rough breathing, a far weaker sound than the Semitic aspirate. In the early Greek inscriptions from the island of Thera it is used in both capacities Its employment as a vowel is in conformity with the Greek habit of using letters of the Semitic alphabet which to them were superfluous to express their vowels which were not written in Semitic. The Greeks probably derived this arrangement from Asia Minor, and they carried it further. The letter passed from the Chalcidic into the Latin with the force of the aspirate, which it still retains. In the Romance languages the sound has disappeared, but the letter remains. (B. F. C. A.)

In music in the German nomenclature, H stands for B natural, while the letter B is used for B flat. This confusing arrangement dates back to earlier centuries when, to get the semitone in the right place (between the 3rd and 4th notes) in the hexachord beginning on F, a new B, half a tone lower than the normal B, was introduced. This lowered B was called B molle (soft) and indicated by a rounded B (*B rotundum*) to distinguish it from the square sign of the natural B (*B quadratum*). B rotundum was later adopted as a general sign in the form of a flat (♭) to indicate the lowering of a note by a semitone, while B quadratum became the sign, in the form of a natural (♮), for a note not so lowered; and in this way, from the resemblance of the latter sign to an H, this letter came to be adopted in Germany for the natural or unlowered, B In other words H is here really an erroneous and misleading form of what was originally a square-shaped B.

HAAG, CARL (1820–1915), a naturalized British painter, court painter to the duke of Saxe-Coburg and Gotha, was born at Erlangen in Bavaria, and trained in the academies at Nuremburg and Munich. He practised first as an illustrator and as a painter, in oil, of portraits and architectural subjects; but after he settled in England in 1847 he devoted himself to water colours. He painted landscapes of Tirolese and Dalmatian scenery, and in Great Britain many pictures of the life of the royal family at Balmoral. Towards the end of his professional career Carl Haag returned to Germany and died there in 1915

HAAKON (Old Norse *Hákon*), the name of several kings of Norway, of whom the most important are the following.—

HAAKON I., surnamed "the Good" (d 961), was the youngest son of Harald Haarfager. He was fostered by King Aethelstan of England, who brought him up in the Christian religion, and on the news of his father's death in 933 provided him with ships and men for an expedition against his half-brother Erik, who had been proclaimed king. On his arrival in Norway Haakon gained the support of the landowners by promising to give up the rights of taxation claimed by his father over inherited real property. Erik fled, and was killed a few years later in England His sons allied themselves with the Danes, but were invariably defeated by Haakon, who was successful in everything he undertook except in his attempt to introduce Christianity, which aroused an opposition he did not feel strong enough to face. He was killed at the battle of Fitje in 961, after a final victory over Erik's sons.

HAAKON IV., surnamed "the Old" (1204–1263), was declared to be the son of Haakon III., who died shortly before the former's birth in 1204. A year later the child was placed under the protection of King Inge, after whose death in 1217 he was chosen king; though until 1223 the church refused to recognize him, on the ground of illegitimacy, and the pope's dispensation for his coronation was not gained until much later. In the earlier part of his reign much of the royal power was in the hands of Earl Skule, who intrigued against the king until 1239, when he proceeded to

open hostility and was put to death. From this time onward Haakon's reign was marked by peace and prosperity, until in 1263 a dispute with the Scottish king concerning the Hebrides, a Norwegian possession, induced Haakon to undertake an expedition to the west of Scotland. A division of his army seems to have repulsed a large Scottish force at Largs (though the later Scottish accounts claim this battle as a victory), and, having won back the Norwegian possessions in Scotland, Haakon was wintering in the Orkneys, when he died on Dec. 15, 1263. A great part of his fleet had been scattered and destroyed by storms. The most important event in his reign was the voluntary submission of the Icelandic commonwealth. Worn out by internal strife fostered by Haakon's emissaries, the Icelandic chiefs acknowledged the Norwegian king as overlord in 1262. Their example was followed by the colony of Greenland.

HAAKON VII. (1872–), the second son of Frederick VIII., king of Denmark, was born on Aug. 3, 1872, and was usually known as Prince Charles of Denmark. When in 1905 Norway decided to separate herself from Sweden the Norwegians offered their crown to Charles, who accepted it and took the name of Haakon VII., being crowned at Trondhjem in June 1906. The king married Maud, youngest daughter of Edward VII., king of Great Britain and Ireland, their son, Prince Olav, being born in 1903.

HAARLEM, a town of Holland in the province of North Holland, on the Spaarne, having a junction station 11 m. W. of Amsterdam by rail. It is connected by electric and steam tramways with Zandvoort, Leiden, Amsterdam and Alkmaar. Pop. (1926) 111,242.

Haarlem, a prosperous place in the middle of the 12th century, received its first town charter from William II., count of Holland and king of the Romans, in 1245. It played a considerable part in the wars of Holland with the Frisians. In 1492 it was captured by the insurgent peasants of North Holland and was re-taken by the imperial stadholder, and deprived of its privileges. In 1572 Haarlem joined the revolt of the Netherlands against Spain, but in July 1573, after a seven months' siege, was forced to surrender to Alva's son Frederick, who exacted terrible vengeance. In 1577 it was re-captured by William of Orange and permanently incorporated in the United Netherlands.

Haarlem is the seat of the governor of the province of North Holland, and of a Roman Catholic and a Jansenist bishopric. It is a typical Dutch town, with numerous narrow canals and gabled houses. Of the ancient city gates the Spaarnewouder or Amsterdam gate alone remains. In the Frederiks Park is a pump-room supplied with a powerful chalybeate water from a spring, in the Haarlemmer Polder. In the central market place are the old Fleshers' Hall, built by Lieven de Key in 1603, and now containing the archives, the town hall, the old Stadsdoelen, where the burgesses met in arms and the *Groote Kerk* (Great Church). This last, dedicated to St. Bavo, dates from the late 15th and early 16th centuries. Its great length (460 ft.) and the height and steepness of its vaulted cedar-wood roof (1538) are very impressive. The choir-stalls and screen (1510) are finely carved, and of further interest are the ancient pulpit sounding-board (1432), some old stained glass, and the small models of ships, copies dating from 1638 of yet earlier models originally presented by the Dutch-Swedish Trading Company. The church organ, constructed in 1738, was long considered the largest and finest in existence. In the belfry are the *damiaatjes*, small bells presented to the town, according to tradition, by William I., count of Holland (d. 1222), the crusader. The town hall was originally a palace of the counts of Holland, begun in the 12th century, and some old 13th-century beams still remain; but the building was remodelled in the beginning of the 17th century. It contains a collection of antiquities and a picture gallery celebrated for its fine collection of paintings by Frans Hals. The town library contains several *incunabula* and a collection of early Dutch literature. At the head of the scientific institutions of Haarlem may be placed the Dutch Society of Sciences (*Hollandsche Maatschappij van Wetenschappen*), founded in 1752. Besides these there are the old weighhouse (1598) and the orphanage for girls (1608), originally an almshouse for old men, both built by the architect Lieven de Key of Ghent.

The staple industries of Haarlem have been greatly modified in the course of time. Cloth weaving and brewing declined in the beginning of the 16th century. A century later, silk, lace and damask weaving were introduced by French refugees, and became very important industries; but about the close of the 18th century this remarkable prosperity had also come to an end, and it was not till after 1830 that Haarlem began to develop the manufactures in which it is now chiefly engaged. Cotton manufacture, dyeing, printing, bleaching, brewing, making of paint, type-founding, and the manufacture of tram and railway carriages are among the more important of its industries. One of the printing establishments has the reputation of being the oldest in the Netherlands, and publishes the oldest Dutch paper, *De Oprugte Haarlemmer Courant*. Market-gardening, especially horticulture, is extensively practised in the vicinity, so that Haarlem is the seat of a large trade in Dutch bulbs, especially hyacinths, tulips, fritillaries, spiraeas and japonicas.

HAARLEM LAKE (Dutch *Haarlemmer Meer*), a commune of the province of North Holland, constituted by the law of July 16, 1855. It has an area of about 46,000 ac., and its population increased from 7,237 in 1860 to 16,621 in 1900. The commune was formerly a lake, which is said to have been a relic of a northern arm of the Rhine which passed through the district in the time of the Romans. In 1531 the Haarlemmer Meer and three smaller sheets of water in its vicinity had a united area of about 14,000 acres. The four lakes were formed into one by successive inundations and by 1647 the new Haarlem Lake had an area of about 37,000 acres, which a century later had increased to over 42,000 acres. As early as 1643 Jan Adriaanszoon Leeghwater proposed to endike and drain the lake; and similar schemes were brought forward from time to time. A furious hurricane in Nov. 1836 drove the waters as far as the gates of Amsterdam, and another on Christmas Day sent them in the opposite direction to submerge the streets of Leiden. In Aug. 1837 the king appointed a royal commission of inquiry; the scheme proposed by the commission received the sanction of the Second Chamber in March 1839, and in the following May the work was begun. A canal was first dug round the lake for the reception of the water and the accommodation of the traffic which had previously been carried on. As the water from the lake had no natural outfall pumping by steam-engines began in 1848, and the lake was dry by July 1852. The whole area of 42,096 ac. recovered from the waters brought in about £780,000, exactly covering the cost of the enterprise; so that the actual cost to the nation was only the amount of the interest on the capital. The soil is of various kinds, loam, clay, sand and peat; most of it is fertile, though in the lower portions there are barren patches where the scanty vegetation is covered with an ochreous deposit. Mineral springs occur containing a very high percentage of common salt; and a company was formed for working them. Corn, seeds, cattle, butter and cheese are the principal produce. Hoofddorp, Venneperdorp or Nieuw Vennep, Abbenes and the vicinities of the pumping-stations are the spots where the population has clustered most thickly.

HAAS, JOHANNES HUBERTUS LEONHARDUS DE (1832–1908), Dutch animal painter, was born at Hedel in North Brabant on March 25, 1832. He was a pupil of Van Oos at Haarlem, and settled in Brussels in 1857. His pictures of cattle grazing in flat pastureland under soft, dull skies are in the true Low Country tradition. He died at Königswinter on Aug. 4, 1908.

HAASE, FRIEDRICH (1827–1911), German actor, was born on Nov. 1, 1827, in Berlin, the son of a valet to King Frederick William IV., who became his godfather. He made his first appearance on the stage in 1846 in Weimar, afterwards acting at Prague (1849–51) and Karlsruhe (1852–55). He played in St. Petersburg, 1860–66, then was manager of the court theatre in Coburg, and in 1869 (and again in 1882–83) visited the United States. He was manager of the Stadt Theater in Leipzig from 1870–6, when he removed to Berlin, where he founded and managed Deutsches Theater. He retired from the stage in 1898. Haase's aristocratic appearance and elegant manner fitted him

specially to play high comedy parts. He died in Berlin on March 17, 1911.

See Simon, *Friedrich Haase* (Berlin, 1898).

HAASE, FRIEDRICH GOTTLOB (1808–1867), German classical scholar, was born at Magdeburg on Jan. 4, 1808, and died on Aug. 16, 1867, at Breslau, where he had been professor since 1840. He was one of the most successful teachers of his day.

He edited several classic authors: Xenophon (Λακεδαιμονίων πολιτεία, 1833); Thucydides (1840); Velleius Paterculus (1858); Seneca the philosopher (2nd ed., 1872, not yet superseded); and Tacitus (1855), the introduction to which is a masterful piece of Latinity. His *Vorlesungen uber lateinische Sprachwissenschaft* was published after his death by F. A. Eckstein and H. Peter (1874–80). *See* C. Bursian, *Geschichte der klassischen Philologie in Deutschland* (1883); G. Fickert, *Friderici Haasii memoria* (1868), with a list of works; T. Oelsner in *Rubezahl* (*Schlesische Provinzialblätter*), vii. Heft 3 (Breslau, 1868).

HAASE, HUGO (1863–1919), German Socialist leader, was born on Sept. 29, 1863, at Allenstein in East Prussia. At the outbreak of the World War he was parliamentary leader of the Social Democratic party in the Reichstag. As early as 1915 he demanded the cessation of the war, and in 1916 became the leader of the dissentients. The formal constitution of the new Independent Socialist party, of which he was the head, took place at a conference held at Gotha in 1917. He exercised a moderating influence upon the extreme section of the Independents, who at a later date (1920) joined the Communists. He was one of the commission of six who conducted the Government of the German Reich, in the name of the people, from Nov. 9 to Dec. 29, 1918. Faithful to the principles of his party he declined to take part in subsequent administrations which included representatives of the bourgeoisie. Haase died on Nov. 7, 1919, from wounds received in an attempt upon his life by a personal opponent while he was entering the Reichstag building.

HAAST, SIR JOHANN FRANZ JULIUS VON (1824–1887), German and British geologist, was born at Bonn on May 1, 1824. In 1858 he started for New Zealand to report on immigration possibilities. He assisted Hochstetter in his preliminary geological survey. The governments of Nelson and Canterbury then employed Haast to investigate the geology of those districts. He discovered gold and coal in Nelson, and carried on important researches with reference to the occurrence of *Dinornis* and other extinct wingless birds (Moas). His *Geology of the Provinces of Canterbury and Westland, N.Z.*, was published in 1879. He was the founder and director of the Canterbury museum at Christchurch. He was surveyor-general of Canterbury from 1861 to 1871, and professor of geology at Canterbury college. He was elected F.R.S. in 1867; and he was knighted in 1887. He died at Wellington, N Z., on Aug. 15, 1887.

HABABS, a nomadic pastoral people of Hamitic stock, living in the coast region north-west of Massawa. Physically they are Beja, by language and traditions Abyssinians. They were Christians until the 19th century, but are now Mohammedans. Their sole wealth consists in cattle.

HABAKKUK, the name borne by the eighth book of the Old Testament "Minor Prophets." Nothing is known of its writer, save what may be inferred from the book; legend connects him with Daniel ("Bel and the Dragon"). The book falls into three obvious parts, viz. (1) a dialogue between the prophet and God (i. 2–ii. 4); (2) a series of five woes pronounced on wickedness (ii. 5–ii. 20); (3) a poem describing the triumphant manifestation of God (iii.). There is considerable difficulty in regard to the interpretation of (1), on which that of (2) will turn; while (3) forms an independent section, to be considered separately.

In the dialogue the prophet cries to God against continued violence and injustice, though it is not clear whether this is done *within* or *to* Israel (i. 2–4). The Divine answer declares that God raises up the Chaldaeans, whose formidable resources are invincible (i 5–11). The prophet thereupon calls God's attention to the tyranny which He apparently allows to triumph and declares his purpose to wait till an answer is given to his complaint (i. 12–ii. 1). God answers by demanding patience, and by declaring that the righteous shall live by his faithfulness (ii. 2–4).

The interpretation of this dialogue which first suggests itself is that the prophet is referring to wickedness *within* the nation, which is to be punished by the Chaldaeans (*i.e.*, the Babylonians) as a Divine instrument; in the process the tyranny of the instrument itself calls for punishment, which the prophet is bidden to await in patient fidelity. On this view of the dialogue the subsequent woes will be pronounced against the Babylonians, and the date assigned to the prophecy will be about 600 B.C., *i.e.*, soon after the battle of Carchemish (605 B.C.) when the Babylonian victory over Egypt inaugurated a period of Babylonian supremacy which lasted till Babylon was overthrown by Cyrus in 538 B.C. It is strange, however, that the prophet should pass so abruptly in a single dialogue from the wickedness of Israel to that of Babylon, thus destroying his primary emphasis; moreover, the wickedness of i. 2 *seq.* and of i. 12 *seq.* seems identical. Possibly i. 5–11 is a misplaced earlier prophecy, whilst i. 2–4, 12 *seq.* refers to the Babylonian oppression of Israel (Giesebrecht, Nowack, Wellhausen), or it is a part of the Divine answer, following ii. 4, which would make the Babylonians the Divine instrument for punishing *Assyrian* tyranny (Budde). Duhm's theory (followed by Sellin) refers the whole book to the time of Alexander the Great, by the violent emendation of "Chaldaeans" to "Chittim" (= Greeks).

The most striking characteristic of the poem (iii.) lies in the superscription ("A prayer of Habakkuk the prophet, set to Shigionoth"), the subscription ("For the chief musician, on my stringed instruments"), and the insertion of the musical term "Selah" in three places (v. 3, 9, 13). These liturgical notes make extremely probable the supposition that the poem has been taken from some collection like that of our present book of Psalms. The poem begins with a prayer that God will renew the historic manifestation of the exodus, which inaugurated the national history and faith; a thunderstorm moving up from the south is then described, in which God is revealed (3–7); it is asked whether this manifestation, whose course is further described, is against nature only (8–11); the answer is given that it is for the salvation of Israel against its wicked foes (12–15); the poet describes the effect in terror upon himself (16) and declares his confidence in God, even in utter agricultural adversity (17–19). There is nothing in this fine poem to connect it with the conception of the Chaldaeans as a Divine instrument. It is the nation that speaks through the poet (*cf.* v. 14), but at what period of its post-exilic history we have no means of inferring.

In regard to the theological teaching of the book: (1) the poem (iii.), though possibly latest in date, claims first consideration, because it avowedly moves in the circle of primitive ideas, and supplicates a Divine intervention, a direct and immediate manifestation of the transcendent God. He is conceived as controlling or overcoming the forces of nature; and though an earlier mythology has supplied some of the ideas, yet, as with the opening chapters of Genesis, they are transfigured by the moral purpose which animates them, the purpose to subdue all things that could frustrate the destiny of God's anointed (v. 13). The closing verses strike that deep note of absolute dependence on God, which is the glory of the religion of the Old Testament and its chief contribution to the spirit of the Gospels. (2) The prophecy of the Chaldaeans as the instruments of the Divine purpose involves a different, yet related, conception of the Divine providence. The philosophy of history, by which Hebrew prophets could read a deep moral significance into national disaster, and turn the flank of resistless attack, became one of the most important elements in the nation's faith. If the world powers were hard as flint in their dealings with Israel, the people of God were steeled to such moral endurance that each clash of their successive onsets kindled some new flame of devotion. Through the Chaldaeans, God worked a work which required centuries of life and literature to disclose its fulness (i. 5). (3) When we turn from this view of the Chaldaeans to the denunciation of their tyranny in "taunt songs" (ii. 5–20), we have simply a practical application of the doctrine of Divine government. God, being what He is, at once moral and all powerful, the immoral life is doomed to overthrow, whether the immorality consist in grasping rapacity, proud self-aggrandizement, cruel exaction, exulting triumph or senseless idolatry. (4) Yet, because the doom so often tarries, there arises the problem of the suffer-

ing of the innocent and the upright. How can God look down with tolerance that seems favour on so much that conflicts with His declared will and character? This is the great problem of Israel, finding its supreme expression for all time in the book of Job (*q.v.*). In that book the solution of the problem of innocent suffering lies hidden from the sufferer, even to the end, for he is not admitted with the reader to the secret of the prologue; it is the practical solution of faithfulness resting on faith which is offered to us. So here, with the principle of ii. 4, "the righteous shall live by his faithfulness." The different application of these words in the New Testament to "faith" is well known (Rom. i. 17; Gal. iii. 11; Heb. x. 38) though the difference is apt to be exaggerated by those who forget how much of the element of "faithfulness" lies in Paul's conception of "faith." In G. A. Smith's words, "as Paul's adaptation, 'the just shall live by faith,' has become the motto of evangelical Christianity, so we may say that Habakkuk's original of it has been the motto and the fame of Judaism: 'the righteous shall live by his faithfulness.'"

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(H. W. R.)

HABBANIA: *see* BAKKARA.

HABDALA: *see* KIDDŪSH AND HABDĀLA.

HABEAS CORPUS, in English law, a writ issued out of the High Court of Justice commanding the person to whom it is directed to bring the body of a person in his custody before that or some other court for a specified purpose.

There are various forms of the writ, of which the most famous is that known as *habeas corpus ad subiiciendum*, the well-established remedy for violation of personal liberty. This is now the only important form of writ though there were originally many others. From the earliest records of the English law no free man could be detained in custody except on a criminal charge or conviction or for a civil debt while the writ is a remedial mandatory writ—"of right," it is not "of course," and is granted only on application to the High Court or a judge thereof, supported by a sworn statement of facts setting up at least a probable case of illegal confinement. It is addressed to the person in whose custody another is detained, and commands him to bring his prisoner before the court immediately after the receipt of the writ, together with the day and cause of his being taken and detained, to undergo and receive (*ad subiiciendum et recipiendum*) whatsoever the court awarding the writ "may consider of concerning him in that behalf."

Writs of *habeas corpus* were issued before the Great Charter. The writ *de odio et atiâ* was used as early as the 12th century to prevent imprisonment on vexatious appeals of felony, and this writ is specifically mentioned in Article 36 of Magna Carta which provides that it shall issue gratuitously, and "not be refused." It played an important part in enabling a person to avoid trial by battle and obtain trial by jury. In the case of imprisonment on accusation of crime the writ issued from the court of king's bench (or from the chancery), and on its return the court judged of the legality of the imprisonment, and discharged the prisoner or admitted him to bail or remanded him to his former custody according to the result of the examination.

By the time of Charles I. the writ was fully established as the appropriate process for checking illegal imprisonment by inferior courts or by public officials. But it acquired its full and present constitutional importance by legislation.

In Darnel's case (1627) the judges held that the command of the king was a sufficient answer to a writ of *habeas corpus*. The House of Commons thereupon passed resolutions to the contrary, and after a conference with the House of Lords the measure known as the Petition of Right was passed (1627, 3 Car. I. c. i.) which, *inter alia*, recited (s. 5) that, contrary to the Great Charter and the good laws and statutes of the realm, divers of the king's subjects had of late been imprisoned without any cause shown, and when they were brought up on *habeas corpus ad subiiciendum*, and no cause was shown other than the special command of the king signified by the privy council, were nevertheless remanded to prison, and enacted "that no freeman in any such manner as is before mentioned be imprisoned or detained." By the Act of 1641 abolishing the Star Chamber, the right to a *habeas corpus* was given to test the legality of commitments by command or warrant of the king or the privy council.

The Act of 1679.—The reign of Charles II was marked by further progress towards securing the freedom of the subject from wrongful imprisonment. Lord Clarendon was impeached, *inter alia*, for causing many persons to be imprisoned against law and to be conveyed in custody to places outside England.

Though the authority of the courts had been strengthened it was still rendered insufficient by reason of the insecurity of judicial tenure, the fact that only the chancellor (a political as well as a legal officer) and the court of king's bench had undoubted right to issue the writ, and the inability or hesitation of the competent judges to issue the writ except during the legal term, which did not cover more than half the year. A series of bills was passed through the Commons between 1668 and 1675, only to be rejected by the other House. In Jenkes's case (1676), Lord Chancellor Nottingham refused to issue the writ in vacation in a case in which a man had been committed by the king in council for a speech at Guildhall, and could get neither bail nor trial. In 1679, but rather in consequence of Lord Clarendon's arbitrary proceedings than of Jenkes's case, a fresh bill was introduced which passed both Houses and became the famous Habeas Corpus Act of 1679 (31 Car. II. c. 2). The passing of the act was largely due to the experience and energy of Lord Shaftesbury, after whom it was for some time called. The act, while a most important landmark in the constitutional history of England, in no sense creates any right to personal freedom, but is essentially a procedure act for improving the legal mechanism by means of which that acknowledged right may be enforced. It declares no principles and defines no rights, but is for practical purposes worth 100 articles guaranteeing constitutional liberty.

In the manner characteristic of English legislation the act is limited to the particular grievances immediately in view and is limited to imprisonment for criminal or supposed criminal matters, leaving untouched imprisonment on civil process or by private persons. It enacts in substance as follows: (1) When a writ of *habeas corpus* is directed to a sheriff or other person in charge of a prisoner, he must within 3, 10 or 20 days, according to the distance of the place of commitment, bring the body of his prisoner to the court, with the true cause of his detainer or imprisonment—unless the commitment was for treason or felony plainly expressed in the warrant of commitment. (2) If any person be committed for any crime—unless for treason or felony plainly expressed in the warrant—it shall be lawful for such person or persons (other than persons convicted or in execution by legal process) *in time of vacation*, to appeal to the lord chancellor as a judge, who shall issue a *habeas corpus* returnable immediately, and on the return thereof shall discharge the prisoner on giving security for his appearance before the proper court, unless the party so committed is detained upon a legal process or under a justice's warrant for a non-bailable offence. Persons neglecting for two terms to pray for a *habeas corpus* shall have none in vacation. (3) Persons set at large on *habeas corpus* shall not be recommitted for the same offence unless by the legal order and process of the court having cognizance of the case. (4) A person committed to prison for treason or felony shall, if he requires it, in the first week of the next term or the first day of the next session of oyer and terminer, be indicted in that term or session or else admitted to bail, unless it appears on affidavit that the witnesses for the Crown are not ready; and if he is not indicted and tried in the second term or session after commitment, or if after trial he is acquitted, he shall be discharged from imprisonment. (5) No inhabitant of England (except persons contracting, or, after conviction for felony, electing to be transported) shall be sent prisoner to Scotland,

Ireland, Jersey, etc., or any place beyond the seas. Stringent penalties are provided for offences against the act.

A judge delaying *habeas corpus* forfeits £500 to the party aggrieved. Illegal imprisonment beyond seas renders the offender liable in an action by the injured party to treble costs and damages to the extent of not less than £500, besides subjecting him to the penalties of *praemunire* and to other disabilities. "The great rank of those who were likely to offend against this part of the statute was," says Hallam, "the cause of this unusual severity." Indeed as early as 1591 the judges had complained of the difficulty of enforcing the writ in the case of imprisonment at the instance of magnates of the realm. The effect of the act was to impose upon the judges under severe sanction the duty of protecting personal liberty in the case of criminal charges and of securing speedy trial upon such charges when legally framed; and the improvement of their tenure of office at the revolution, coupled with the veto put by the Bill of Rights on excessive bail, gave the judicature the independence and authority necessary to enable them to keep the executive within the law and to restrain administrative development of the scope or penalties of the criminal law; and this power of the judiciary to control the executive, coupled with the limitations on the right to set up "Act of State" as an excuse for infringing individual liberty is the special characteristic of English constitutional law

The *habeas corpus ad subiiciendum* was sometimes used in cases of illegal detention in private custody. In 1758 questions arose as to its application to persons in naval or military custody, including pressed men, which led to the introduction of a bill in parliament and to the consultation by the House of Lords of the judges. (*See* Wilmot's *Opinions*, p. 77) In the same year the writ was used to release the wife of Earl Ferrers from his custody and maltreatment. But perhaps the most interesting instance of that period is the case of the negro Somerset (1771), who was released from a claim to hold him as a slave in England.

The Act of 1816 (56 Geo. III. c. 100), does not touch cases covered by the Act of 1679. The object of it was to deal with cases of persons unlawfully detained in private custody. It enacts (1) that a writ of *habeas corpus* shall be issued in vacation time in favour of a person restrained of his liberty otherwise than for some criminal or supposed criminal matter (except persons imprisoned for debt or by civil process); (2) that though the return to the writ be good and sufficient in law, the judge shall examine into the truth of the facts set forth in such return, and if they appear doubtful the prisoner shall be bailed; (3) that the writ shall run to any port, harbour, road, creek or bay on the coast of England, although not within the body of any county. The last clause was intended to meet doubts on the applicability of *habeas corpus* in cases of illegal detention on board ship.

It will appear from the foregoing statement that the issue and enforcement of the writ rests on the common law as strengthened by the acts of 1627, 1640, 1679 and 1816, and subject also to the regulations as to procedure contained in the *Crown Office Rules*, 1906. The effect of the statutes is to keep the courts always open for the issue of the writ. It is available to put an end to all forms of illegal detention in public or private custody. In the case of the Canadian prisoners (1839) it was used to obtain the release of persons sentenced in Canada for participating in the rebellion of 1837, who were being conveyed throughout England in custody on their way to imprisonment in another part of the empire, and it is matter of frequent experience for the courts to review the legality of commitments under the Extradition Acts and the Fugitive Offenders Act 1881, of fugitives from the justice of a foreign State or parts of the king's dominions outside the British Isles.

Suspension of the Act.—In times of public danger it has occasionally been thought necessary to "suspend" the Habeas Corpus Act, 1679, by special and temporary legislation. This was done in 1794 (by an act annually renewed until 1801) and again in 1817, as to persons arrested and detained by his majesty for conspiring against his person and Government. The same course was adopted in Ireland in 1866 during a Fenian rising. It has been the practice to make such acts annual and to follow their expiration by an act of indemnity. In cases where martial law exists the use of the writ is *ex hypothesi* suspended during conditions amounting to a state of war within the realm or the British possession affected (*e.g.*, the Cape Colony and Natal during the South African War), and it would seem that the acts of courts martial during the period are not the subject of review by the ordinary courts. The so-called "suspension of the Habeas Corpus Act" bears a certain similarity to what is called in Europe "suspending the constitutional guarantees" or "proclaiming a state of siege," but "is not in reality more than suspension of one particular remedy for the protection of personal freedom."

A principle of the highest importance to the liberty of the subject was laid down by the House of Lords in the case of *Cox* v. *Hakes* (1890), 15 A.C. 506, and further extended in the leading case of *Ex parte Art O'Brien* (1923), A.C. 603. This principle is that an appeal against the refusal of the writ may be taken by the applicant right up to the House of Lords, but that an appeal by the Crown against the grant of the writ by the divisional court cannot be taken any further. In other words, once the writ is granted, the Crown cannot delay its operation or keep the applicant in custody by attempting to prosecute an appeal. Furthermore it has been decided that it is no answer to the writ to plead that the person detained is no longer in the actual physical custody of the defendant; for example, mere power or control over a child is sufficient to justify the issue of the writ (*Barnardo* v. *Ford*, 1892, A.C. 326).

Ireland.—The common law of Ireland as to the writs of *habeas corpus* is the same as that in England. The writ has in past times been issued from the English court of king's bench into Ireland; but does not now so issue. The acts of 1803 and 1816 already mentioned apply to Ireland. The Petition of Right is not in terms applicable to Ireland. The Habeas Corpus Act 1679 does not apply to Ireland; but its equivalent is supplied by an act of 1781–82 of the Irish parliament (21 and 22 Geo III. c. 11). Since the establishment of the Irish Free State, an appeal against the refusal of the writ does not lie to the House of Lords but to the judicial committee of the privy council.

Scotland.—The writ of *habeas corpus* is unknown to Scots law, nor will it issue from English courts into Scotland. Under a Scots Act of 1701 (c. 6) provision is made for preventing wrongous imprisonment and against undue delay in trials. It was applied to treason felony in 1848. The right to speedy trial is now regulated by s. 43 of the Criminal Procedure Scotland Act 1887. These enactments are as to Scotland equivalent to the English Act of 1679 Under the Court of Exchequer Scotland Act 1856 (19 and 20 V. c. 56) provision is made for bringing before the court of session persons and proceedings before inferior courts and public officers—which is analogous to the powers to issue *habeas corpus* in such cases out of the English court of exchequer (now the revenue side of the king's bench division).

British Possessions.—The Act of 1679 expressly applies to Wales, Berwick-on-Tweed, Jersey and Guernsey, and the Act of 1816 also extends to the Isle of Man. The court of king's bench has also issued the writ to the king's foreign dominions beyond seas, *e.g.*, to St. Helena, and so late as 1861 to Canada (Anderson's case 1861, 30 L.J.Q.B. 129). In consequence of the last decision it was provided by the Habeas Corpus Act 1862 that no writ of *habeas corpus* should issue out of England by authority of any court or judge "into any colony or foreign dominion of the Crown where the Crown has a lawfully established court of justice having authority to grant or issue the writ and to ensure its due execution in the 'colony' or dominion" (25 and 26 V. c. 20). The expression "foreign dominion" is meant to apply to places outside the British Isles, and does not include the Isle of Man or the Channel islands. (See *re Brown*, 1864, 33 L.J.Q.B. 193.) It does not apply to British protectorates because they are not "dominions" of the Crown (*R.* v. *Crewe*, 1910, 2 K.B. 576). But the writ runs everywhere within the king's territorial dominions. Wherever, as is usually the case, the High Court of a colony or of a province of British India is vested with the same jurisdiction as the king's bench, that court has power to issue

the writ. An appeal from a refusal of the writ may be made to the judicial committee of the privy council. (W. F. C.; X.)

United States.—The common law of *habeas corpus* was inherited as part of the common law of the American States. The Federal Government as well as the States have founded their procedure upon the principles set forth in the Act of 1679, most States specifically adopting its features by statutory enactment. The writ, as under the English system, is available to contest detention by public or private authority. The power of the court issuing it extends only to inquire into the jurisdiction of the court, administrative tribunal, or person detaining the prisoner, the legal sufficiency of the proceedings taken against him, or the validity of the judgment or order of commitment. No State or Federal court can issue the writ beyond the territorial limits of its jurisdiction. The esteem with which the writ is regarded is illustrated by the embodiment of the provision in the Federal Constitution as well as in the Constitutions of most States that the privilege of the writ "shall not be suspended unless when in cases of rebellion or invasion the public safety may require it." It is generally thought that the power to suspend the writ is vested in the legislative rather than the executive department of government. Acting under such a theory during the Civil War, Congress in 1863 granted the president the power of suspension whenever in his judgment the public safety demanded it. The proper exercise of such judgment by the president was held by the Supreme Court in Milligan's Case (4 Wall. 2) to be subject to judicial review. In instances State supreme courts have regarded the privilege suspended by the State executives' proclamation that an insurrection existed in specified territory.

State courts have no power to issue the writ for the discharge of persons held under claim or colour of authority of any officer or court of the United States inasmuch as the Federal Government when acting within its sphere is supreme. Originally U.S. courts could not issue the writ to inquire into the cause of commitment by State courts. In 1833, however, due to the nullification movement in South Carolina resulting in resistance to the enforcement of Federal revenue laws, Congress extended the authority of the Federal courts to inquire into any commitment for an act done in pursuance of a law of or authority under the United States. During the controversy over the Canadian boundary in 1842 this power was extended to authorize inquiry into the commitment of any foreign citizen for an act done under authority of a foreign State whose validity depended upon international law. In 1847 the power was again extended to all cases where a person was restrained of liberty in violation of the Constitution, laws or treaties of the United States. This, however, does not permit the Federal courts to obstruct the administration of justice in State courts whenever the accused claims that he is restrained in violation of a Federal right. The State courts being themselves bound by the U.S. Constitution, laws and treaties as the "supreme law of the land" can ordinarily be entrusted to determine the Federal right, and in case the determination by contrary to the accused's contention he may resort by writ of error or *certiorari* to the U.S. Supreme Court. It is thus only in cases of peculiar urgency that the Federal court will interfere in the first instance by *habeas corpus*. Such interference being an extremely delicate matter the Supreme Court has limited the issuance of *habeas corpus* to cases that concerned the authority or operations of the Federal Government, its obligations under international law to other nations or the vindication of a fundamental right in danger of violation before resort may be had to usual methods of appeal.

The various States have divergent views as to the accused's right of appeal from an order denying the issuance of habeas corpus. The right where denied by judicial decision has commonly been granted by statute. It is also customary to provide by statute for a similar right of appeal on the part of the State. The original jurisdiction of the U.S. Supreme Court being limited by the Constitution, it cannot issue the writ as an original matter except in cases within that jurisdiction. But in exercise of its appellate jurisdiction it may issue the writ to inquire into the validity of a detention under the authority of an inferior court to determine whether such court has acted without jurisdiction or exceeded its authority. (J. M. La.)

HABENARIA, a genus of plants of the orchid family (Orchidaceae), comprising in its most inclusive sense some 500 temperate and tropical species, of which the frog orchis (*H. viridis*), scented orchis (*H. conopsea*) and butterfly orchis (*H. bifolia*) are native to the British Isles. In North America some 40 species occur, among which are the purple-fringed orchis (*H. psychodes*), the white-fringed orchis (*H. blephariglottis*), the ragged orchis (*H. lacera*), the prairie fringed orchis (*H. leucophaea*), the yellow-fringed orchis (*H. ciliaris*), the white bog orchis (*H. dilatata*), the round-leaved orchis (*H. orbiculata*), the slender white orchis (*H. elegans*) and the western green orchis (*H. unalaschensis*). (*See* Orchids.)

HABER, FRITZ (1868–), German chemist, was born in Breslau on Dec. 9, 1868. He studied at the universities of Berlin and Heidelberg and at the technical high schools at Charlottenburg and Carlsruhe. He was then appointed staff professor at Berlin university and afterwards became director of the Kaiser Wilhelm institute for physical chemistry and electrochemistry. He made a special study of thermodynamic technical gas reactions, and also made experiments in connection with the synthesis of ammonia (*q.v.*) and the influence of very high pressures and high temperatures. During the World War he studied the gases used in warfare and their effective frustration by gas masks and chemical means. He conducted particularly important researches in collaboration with Bosch, which led to the establishment of the Haber-Bosch method for the production of ammonia from atmospheric nitrogen. (*See* Nitrogen, Fixation of.) On the purely chemical side Haber made a thorough study of the electrolytic reduction of nitrobenzene under various conditions, and has carried out other electrochemical investigations.

His works include *Grundriss der technische Elektrochemie* (1898); *Thermodynamik technische Gasreaktionen* (1905; English edition, 1908), *Beitrag zur Kenntnis der Metalle* (1919), *Über die Synthese des Ammoniaks*, *Die Chemie im Kriege* (1922); *Fünf Vorträge aus den Jahren 1920–23: Über die Herstellung des Ammoniaks aus Stickstoff und Wasserstoff* (1924).

HABERDASHER. A tradesman who sells by retail small articles used in the making or wearing of dress, such as sewing cottons or silks, tapes, buttons, pins and needles, and the like. The sale of such articles is not generally carried on alone, and a "haberdashery counter" usually forms a department of drapers' shops. The word is of obscure origin. The Haberdashers' company is one of the greater Livery companies of the City of London. Originally a branch of the mercers, the fraternity took over the selling of "small wares," which included not only articles similar to those sold as "haberdashery" now, but such things as gloves, daggers, glass, pens, lanterns, mousetraps, and the like. They were thus on this side connected with Milliners. On the other hand there was early a fusion with the old gild of the "Hurers," or cap makers, and the hatters, and by the reign of Henry VII. the amalgamation was complete. There were long recognized two branches of haberdashers, the haberdashers of "small wares," and haberdashers of hats (*see* Livery Companies).

HABERL, FRANZ XAVER (1840–1910), German musician and writer on music, was born at Ober Ellenbach, Bavaria, on Apr. 12, 1840. He was educated and ordained at Passau, and in 1862 was appointed Kapellmeister of the cathedral and musical director of the two seminaries. From 1867–1871 he was in Rome. He then settled at Regensburg, where he established the school of ecclesiastical music. In 1879 he became honorary canon of the cathedral of Palestrina and founded the Palestrina Society. He died at Regensburg on Sept. 5, 1910, having been domestic prelate to the Pope since 1907. Haberl's research in 16th century music is of cardinal importance. In connection with the Palestrina Society he completed the editing of Palestrina's works in thirty-two volumes, recovering many of the lost compositions and bringing out the whole work in time to celebrate the tercentenary of the composer's death in 1894. He then began to prepare a similar edition of Lassus. His contributions to the *Bausteine zur Musikgeschichte*, the *Cäcilien-Kalendar* (later, *Kirchenmusikalisches Jahrbuch*), and the *Monatshefte für Musikgeschichte* are invaluable to students of musical history. Of

special importance is his thematic catalogue of the Sistine Choir archives in Eitner's *Monatshefte* (1888). He was also a member of the commission for the publication of the *Denkmäler Deutscher Tonkunst*. Among his publications are the *Lieder-Rosenkranz* (1866), a selection of Frescobaldi's organ works (1889), and the *Magister choralis* (1865), which has run through many editions and exists in six languages.

HABERLANDT, GOTTLIEB (1854–), Austrian botanist, born at Ungarisch-Altenburg on Nov. 28, 1854, was director (1910–23) of the plant-physiology department of Berlin university. From 1916 onwards he edited the *Beiträge zur allgemeinen Botanik*. He travelled in the Dutch East Indies to study tropical botany (*see* his *Eine botanische Tropenreise*, 1893; 3rd ed., 1926). He published many important works on plant physiology; his later work deals more especially with the sensitiveness of plants to external impressions. (*See* his *Sinnesorgane im Pflanzenreich zur Perzeption mechanischer Reize*, 1901; 2nd ed., 1906, etc.)

HABERMANN, HUGO FREIHERR VON (1849–), German painter, was born at Dillingen on June 15, 1849. He studied at the Munich academy under Piloty, the leading representative of the realist school in Germany, from 1871 to 1878, and afterwards visited Italy, Paris and Brussels. Since 1905 he has been a professor at the Academy, Munich. While still under the influence of Piloty he painted "The Monk" (1875), "Piloty's studio" (1876) and two portraits of his brother, all of which are in the New State gallery, Munich. His sensibility to colour was extraordinary and he gradually developed a superb technique. "Child of Sorrow" and the portraits of Frau von Torri (1886) and of his mother (1899) are interesting examples of his different phases. Later he became famous for his female nudes—"Frauenakt," "Liegender Modellnakt" (Munich, 1897) and others, which are remarkable for their easy pose and smooth finish. Above all he is a great stylist.

HABINGTON, WILLIAM (1605–1654), English poet, was born at Hendlip Hall, Worcestershire. He was educated at St. Omer. He married about 1632 Lucy, second daughter of Sir William Herbert, first Baron Powys, the lady whom he addressed in lyrical poems entitled *Castara* (1634). In 1635 appeared a second edition enlarged by three prose characters, 14 new lyrics and eight touching elegies on his friend and kinsman, George Talbot. The third edition (1640) contains a third part consisting of a prose character of "A Holy Man" and 22 devotional poems. He also wrote a *Historie of Edward the Fourth* (1640), *The Queene of Arragon* (1640), a tragi-comedy, revived at the restoration; and *Observations upon History* (1641). He died on Nov. 30, 1654.

The Queene of Arragon was reprinted in Dodsley's "Old Plays," vol. ix. (1825); *Castara* was edited by Charles Elton (1812), and by E. Arber with a compact and comprehensive introduction (1870) for his "English Reprints."

HABIT, condition of body or mind, especially one that has become permanent or settled by custom or persistent repetition, hence custom, usage (Lat. *habitus*, from *habere*, to have, hold, or, in a reflective sense, to be in a certain condition). In botany and zoology the term is used both in the above sense of instinctive action of animals and tendencies of plants, and also of the manner of growth or external appearance of a plant or animal. From the use of the word for external appearances comes its use for fashion in dress, and hence as a term for a lady's riding dress and for the particular form of garment adopted by the members of a religious order.

HABITAT, in botany and zoology, the term for the locality in which a particular species of plant or animal thrives.

HABITUAL OFFENDERS. An habitual criminal is one whom the ordinary legal punishments fail to touch, and for whose prevention special measures have to be taken, it being recognized that it is better for the community that seclusion, with proper training, should reduce the chance of further criminal undertakings. By the Prevention of Crime Act, 1908, power was given to the British courts to pass on habitual criminals a sentence of preventive detention in addition to one of penal servitude. The charge of being an habitual criminal has to be inserted in the indictment on which the offender is to be tried, and this cannot be done without the consent of the director of public prosecutions and after certain notice has been given to the officer of the court trying the prisoner and to the offender himself. A person cannot be found guilty of being an habitual criminal unless the jury finds on evidence that, since attaining the age of 16, he has, at least three times previously to the crime charged in the indictment on which he is being tried, been convicted of a "crime," and that he is leading persistently a dishonest or criminal life; or that he, on previous conviction, has been found an habitual criminal and sentenced to preventive detention. "Crime" means any felony, or uttering or possessing counterfeit coin; or obtaining goods or money by false pretences; or the offence of conspiracy to defraud; or any misdemeanour under s. 28 of the Larceny Act, 1916. There is an appeal to the court of criminal appeal, and the sentence of preventive detention takes effect immediately after the sentence of penal servitude. There is power for the secretary of State to discharge on licence, and the sentence of preventive detention must be reviewed by the secretary of State every three years. That the habitual offender is not quite irredeemable has been demonstrated by the experience of Camp hill in England, to which men are sent, and of the women's prison at Liverpool. Men released on licence are placed under the charge of the Central Association for the Aid of Discharged Convicts, and women under the charge of the Aylesbury Association. (*See* RECIDIVISM.) (W. DE B. H.)

United States.—The American practice with respect to the penal treatment of the habitual offender is not easy to summarize in a brief statement. With 49 independent jurisdictions—that of the Federal Government and those of the 48 States—each going its own way, only slightly affected by the example of its sister commonwealths and with tides of feeling swaying the annual or biennial legislative sessions, there is constant change and little uniformity in the resultant penal legislation. The recent recrudescence of banditry and crimes of violence in large cities, together with the general though unwarranted conviction that crime in general is on the increase, has found expression in more drastic penal legislation in many States. This has naturally been directed mainly at the habitual offender who is in the foreground of the picture. The definition of the habitual offender is substantially the same as that of the English act, a convict who has had three previous convictions of felony, but the penalty is far more severe. For a generation the courts of criminal jurisdiction in most of the States have had the power, in their discretion, to commit such an offender to a State prison, the equivalent of penal servitude in England, for life. As the judges have, in fact, rarely exercised this power, several of the States, following the lead of New York, have made such a sentence mandatory. This tendency to curb the judicial discretion has been further manifested in setting a much higher minimum term of imprisonment for second and third offenders. While it is true that preventive detention is an important objective of this legislation, its primary purpose is its assumed deterrent effect. Its excessive severity has already created a powerful public sentiment working for its repeal. (*See* PENOLOGY; RECIDIVISM.) (G. W. KI.)

HABSBURG or **HAPSBURG,** the name of the family from which sprang the dukes and archdukes of Austria after 1282, kings of Hungary and Bohemia after 1526, and emperors of Austria after 1804. They were Roman emperors from 1438–1806, kings of Spain 1516–1700, and held innumerable other dignities.

The name Habsburg was derived from the castle of Habsburg, or Habichtsburg (hawk's castle) on the Aar, near its junction with the Rhine, which was built in 1028 by Werner, bishop of Strassburg, and his brother-in-law, Count Radboto. The founder of the house was probably one Guntram the Rich, who has been identified with much probability with a Count Guntram who was involved in a rebellion under Otto I. Radboto's son Werner (d. 1096) and grandson Otto were called counts of Habsburg. Otto's nephew Werner (d. 1167) was father of Albert (d. 1199), who was count of Zürich and landgrave of Upper Alsace. His son Rudolph acquired Laufenburg and the protectorate over the "Waldstätte"

(Schwyz, Uri, Unterwalden and Lucerne). On his death in 1232, his two sons Albert and Rudolph partitioned his lands. The line of Habsburg-Laufenburg, Rudolph's descendants, became extinct in 1415, having previously sold back Laufenburg and other districts to the senior branch (Habsburg-Habsburg). Albert, founder of this branch, who died in 1239, had married Hedwig of Kyburg (d. 1260). Their son was Rudolph I. (*q.v.*), elected German king 1273.

Henceforward the history of the family of Habsburg is synonymous with that of their dominions. The present article will confine itself to stating the chief events in the history of the family as such. The attached genealogical tables show the ramifications of the family; its chief members are noticed in separate articles.

The earlier Habsburgs vested the government and enjoyment of their domains, not in individuals but in all male members of the family in common. Thus Rudolph I., as emperor, bestowed Austria and Styria on his two sons Albert and Rudolph, in common. By a family ruling of 1283, Rudolph renounced his share; but the question arose again after Albert's death. Owing partly to the representations of the Estates, a system of condominium was adopted, and the partition again avoided. In 1364 Rudolph made a fresh family compact with his younger brothers, which, while admitting the principle of equal rights, vested the rule and chief position *de facto* in the head of the house; but after his death, the partition was actually effected (agreement of Neuberg, 1379). Albert III. took the duchy of Austria, his brother Leopold III. Styria, Carinthia and the Tyrol, for himself and his descendants. Titles, arms and banner remained common to both lines, fiefs of the empire (Alsace) were held in condominium, and on the extinction of either male line, its dominions were to pass to the other.

This policy of partition was one of the main causes of the decline of Austria in the later Middle Ages. While the Austrian line was perpetuated only by one son in each generation until it became extinct on the death of Ladislaus Postumus in 1457, the domains then passing to the Styrian line, the latter had been again subdivided into an Inner Austrian and a Tyrolean line. The Emperor Frederick III. (*q.v.*) first acted, in his capacity as senior member of full age of his house, as regent both for Ladislaus Postumus in Austria and for Sigismund in the Tyrol; and as all the collateral lines now died out, his son Maximilian reunited all the Habsburg possessions in his own person

During the period 1282–1493 the Habsburgs increased their dominions and dignities in many directions The title of German king, held by Rudolph I., was held again by Albert I. (*q.v.*) from 1298–1308. Frederick the Fair, who assumed the title 1314–22, was the nominee of a minority of electors, and it then passed from the family until reassumed by Albert II. (*q.v.*) in 1438. From this date onward the titles of German king and Roman emperor remained in the Habsburg family uninterruptedly, with the single exception of the reign of Charles Albert, elector of Bavaria (1742–45), until their extinction. To the duchies of Austria and Styria, which the sons of Rudolph I. received in 1282, they and their successors were able to add the Tyrol, Vorarlberg, Carinthia, Carniola, and Gorizia. By the *privilegium maius* of 1453, they received a special status in the empire and the title of archduke (*q.v.*). On the other hand, a long series of reverses deprived them of practically all their possessions in Switzerland (Morgarten 1315, Sempach 1356, "perpetual peace" of 1474), and they were unable to retain the coveted crowns of Bohemia and Hungary. The crown of Bohemia, bestowed by Albert I. on his son Rudolph in 1306, was lost on Rudolph's death in the following year. It was again bequeathed, together with that of Hungary, to Albert II. by his father-in-law Sigismund of Luxemburg in 1437; but Albert died in 1439 and both crowns were lost when his son, Ladislaus Postumus, died unmarried in 1437.

Hitherto the Habsburgs had been identified only with the conduct of their Austrian dominions, which, if increasing in extent, had certainly not added to their prosperity since the days of the Babenbergers; and with the somewhat equivocal title of German king and Roman emperor. Maximilian I. (*q.v.*) opened up a new era for his house. He restored and consolidated his Austrian dominions; and by his marriage with the heiress of Charles the Bold of Burgundy, increased them by a second family domain on the other flank of the empire, consisting, as finally delimited, of the Netherlands, Artois, and the Franche Comté His efforts to secure a foothold in Italy, after his second marriage with Bianca Sforza, daughter of the Duke of Milan, proved unsuccessful; but he more than compensated for many disastrous wars by the brilliance of his marriage policy. His only son, Philip I. (*q.v.*), married Joanna, daughter of Ferdinand and Isabella of Spain, and died in 1506, leaving two sons, Charles and Ferdinand. Charles succeeded his father in the Netherlands in 1506 and his grandfather in Spain in 1516, becoming the emperor Charles V. (*q.v.*) on Maximilian's death in 1519. At the same time he succeeded to all the Habsburg dominions; but by the Treaty of Brussels (1522) he assigned to his brother Ferdinand (*see* FERDINAND I, Roman Emperor) the Austrian dominions. In the same year Ferdinand married Anne, daughter of Wladislaus, king of Hungary and Bohemia; and when his childless brother-in-law, King Louis, was killed at Mohacs (1526), he laid claim to Bohemia and Hungary both by right of his wife and by treaty. In each case the Estates denied the validity of the hereditary title; but those of Bohemia elected Ferdinand king in 1526. In Hungary he was also elected, but a counter-party elected John Zapolya (*q.v.*), with whom Ferdinand made a treaty in 1538, receiving north-western Hungary and the succession (afterwards repudiated) to Zapolya's dominions.

The Habsburgs had now reached the summit of their power. The prestige which belonged to Charles as head of the Holy Roman empire was backed by the wealth and commerce of the Netherlands and of Spain, and by the riches of the Spanish colonies in America. In Italy he ruled over Sardinia, Naples and Sicily, which had passed to him with Spain, and the duchy of Milan, which he had annexed in 1535; to the Netherlands he had added Friesland, the bishopric of Utrecht, Gröningen and Gelderland, and he still possessed Franche-Comté and the fragments of the Habsburg lands in Alsace and the neighbourhood. Add to this Ferdinand's inheritance, the Austrian archduchies and Tirol, Bohemia with her dependent provinces, and a strip of Hungary, and the two brothers had under their sway a part of Europe the extent of which was great, but the wealth and importance of which were immeasurably greater.

When Charles V. abdicated he was succeeded as emperor, not by his son Philip, but by his brother Ferdinand. Philip became king of Spain, ruling also the Netherlands, Franche-Comté, Naples, Sicily, Milan and Sardinia, and the family was definitely divided into the Spanish and Austrian branches. For Spain and the Spanish Habsburgs the 17th century was a period of loss and decay, the seeds of which were sown during the reign of Philip II. (*q.v.*). The northern provinces of the Netherlands were lost practically in 1609 and definitely by the treaty of Westphalia in 1648; Roussillon and Artois were annexed to France by the treaty of the Pyrenees in 1659, Franche-Comté and a number of towns in the Spanish Netherlands by the treaty of Nijmwegen in 1678. Finally Charles II. (*q.v.*), the last Habsburg king of Spain, died childless in Nov. 1700, and by the peace of Rastatt (1714) which terminated the War of the Spanish Succession, Spain passed from the Habsburgs to the Bourbons. However, the Austrian branch of the family received the Italian possessions of Charles II, except Sicily, which was given to the duke of Savoy, and also the southern Netherlands, which are thus often referred to as the Austrian Netherlands; and retained the duchy of Mantua, which it had seized in 1708. In 1717 it received Sicily in exchange for Sardinia; but in 1735 had to cede Novara, Tortona and the two Sicilies, receiving in return the duchies of Parma and Piacenza.

In the Austrian line fresh partitions were effected during the 16th and 17th centuries; but after 1665 this disastrous policy was finally abandoned in favour of that of primogeniture throughout the Austrian dominions.

The Thirty Years' War deprived the Habsburgs of Alsace, came near to ruining the empire, and forced the Habsburgs to devote themselves more and more exclusively to their family dominions. After breaking the resistance of the nobles, Ferdinand II. (*q.v.*)

I. Habsburg

Kings of the Germans are in italic capitals
Emperors are underlined twice
Kings of Spain are underlined once

GUNTRAM THE RICH (d. 950?)
LANZELIN
RADBOTO
WERNER, Count of Habsburg (d. 1096)
OTTO, Count of Habsburg
WERNER (1141–67)
ALBERT THE RICH (d. 1199), Count of Zurich
RUDOLPH THE OLD (d. 1232) m. Agnes, dau. of Gottfried von Staufen

Habsburg Line
ALBERT THE WISE (d. 1240) m. Hedwig of Kyburg
RUDOLPH I. (d. 1291) m. Anne of Hohenberg

Laufenberg Line
RUDOLPH THE YOUNGER
COUNTS OF LAUFENBERG TILL 1490

ALBERT I. (d. 1308)
HARTMANN (d. 1281)
RUDOLPH II.

RUDOLPH III. (d. 1307) K. of Bohemia
FREDERICK I. the Fair (d. 1330)
LEOPOLD I. (d. 1326)
ALBERT II. the Wise (d. 1356) m. Joanna von Pfirt
OTTO (d. 1339)
JOHN THE PARRICIDE (d. 1315)

RUDOLPH IV. (d. 1365) K. of Bohemia
FREDERICK III. (d. 1362)
ALBERT III. (d. 1395), Arch-D. of Austria, m. Beatrice of Nuremberg
LEOPOLD III. (d. 1386), acquired Styria and the Tirol
MARGARET (d. 1366)
FREDERICK II. (d. 1344)
LEOPOLD II. (d. 1344)

ALBERT IV. (d. 1414)
WILLIAM (d. 1406)
LEOPOLD IV. (d. 1411)
ERNEST THE LION (d. 1424)
FREDERICK IV. (d. 1439)

ALBERT II. (V.) (d. 1439)
MARGARET (d. 1486) m. Frederick II. of Saxony
FREDERICK III. (V.) (d. 1493), Fred. IV. K. of the Germans
ALBERT VI. (d. 1463)
SIGISMUND (d. 1496)

ANNA (d. 1462) m. William III. D. of Saxony
ELISABETH (d. 1503) m. Casimir III., K. of Poland
LADISLAUS POSTUMUS (d. 1457)
MAXIMILIAN I. (1459–1519) m. Maria of Burgundy
PHILIP I. (1478–1506) D. of Burgundy, K. of Spain, m. Joanna of Castile
KUNIGUNDE (d. 1520)

ELEANOR (d. 1558)
CHARLES V. (d. 1527) m. Isabella of Portugal (Charles I. K. of Spain)
ANNE OF BOHEMIA AND HUNGARY m. Ferdinand I. (d. 1566)

PHILIP II. (1527–98) m. Anne, Dau. of Maximilian II.
MARIE (d. 1603) m. Maximilian II.
MARGARET m. D. of Parma
JOHN OF AUSTRIA
MAXIMILIAN II. (1527–76), Arch-D. of Austria, m. Maria, dau. of Charles V.
ANNE m. Albert V. of Bavaria
FERDINAND I. (1529–95)
CHARLES (1540–90)

DON CARLOS (d. 1568)
ISABELLA (d. 1633)
CATHERINE (d. 1630) m. Charles Emmanuel of Savoy
PHILIP III. (1578–1621) m. Margaret of Styria
RUDOLPH I. (1552–1612)
MATTHIAS (1557–1619)
MAXIMILIAN (d. 1618)
ALBERT (d. 1621)
FERDINAND II. (1578–1637)
LEOPOLD (1630–65)

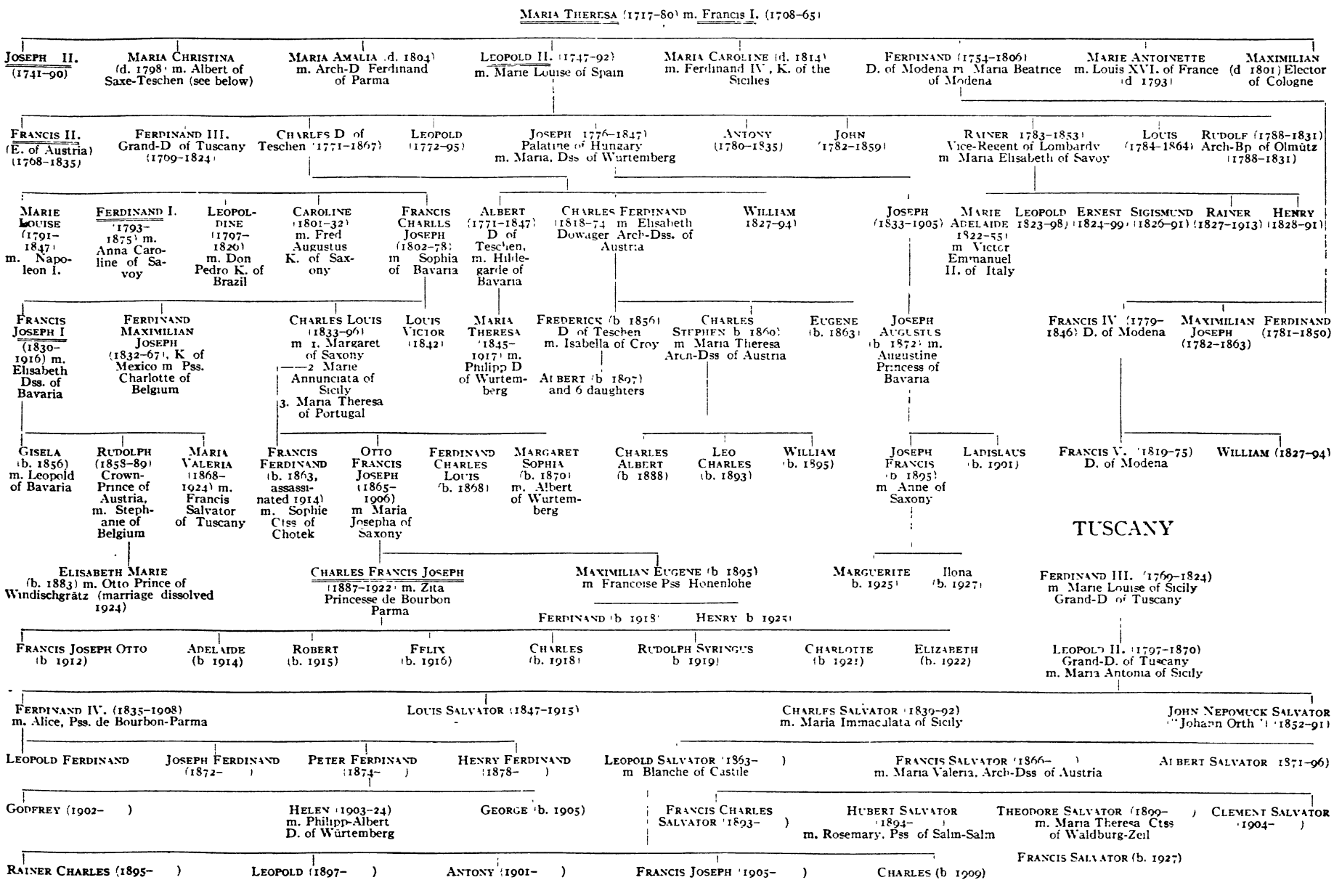
ANNA MARIA m. Louis XIII. of France
PHILIP IV. (1605–65)
ISABELLA OF (1) m. France
m. (2) Maria Anne, dau. of Ferdinand III.
MARIE (d. 1646) m. Ferdinand III. (1608–57)
LEOPOLD WILLIAM (d. 1614)
FERDINAND CHARLES (1628–62)
SIGISMUND FRANCIS (1630–65)

MARIA THERESA (1638–83) m. Louis XIV. of France
CHARLES II. (1661–1700)
MARGARET THERESA (d. 1673)
(1) m. LEOPOLD I. (1640–1705) m. (2) CLAUDIA FELICITAS (1653–76) m. (3) Eleanor of Pfalz-Neuburg

LOUIS, DAUPHIN (1661–1711)
MARIA ANTONIA (1669–92) m. Maximilian Emmanuel of Bavaria
JOSEPH I. (1678–1711)
CHARLES VI. (1685–1740)

PHILIP V. of Bourbon (1683–1746)
JOSEPH FERDINAND (1692–99)
MARIA JOSEPHA (1699–1757) m. Frederick Augustus of Saxony
MARIA AMALIA (1701–56) m. Charles Albert of Bavaria
MARIA THERESA (1717–80) m. Francis I. d. of Lotharingia

II. HOUSE OF HABSBURG-LORRAINE



declared the thrones of Bohemia (1627) and Moravia (1628) hereditary in his dynasty. Half a century later the Turks were driven back out of Hungary. The Diet of Pressburg (1687) recognized the male line of the Habsburgs in primogeniture as hereditary kings of Hungary; the Peace of Karlovitz (1699) gave them *de facto* possession of most of Hungary, including Transylvania, which had already accepted their rule The Banat was added in 1718

Leopold I. (*q v*) had made arrangements with his two sons, Joseph and Charles, for a fresh partition of the Spanish and Austrian dominions. The former were, however, lost to the Habsburgs after the War of the Spanish Succession. Joseph I. (*q v.*) died without male issue, and Charles VI. (*q.v.*), who succeeded him as emperor in 1711, was also without sons. In 1713 he issued (as an unilateral expression of his will, communicated to his Privy Council) his wish that all his dominions should form an indivisible whole, and should pass as such to his male descendants in primogeniture, after them to his female descendants, after them to Joseph's daughters, after them to the other branches of his family. This "Pragmatic Sanction," the most famous of the Habsburg dynastic instruments, was that by which their relation within the dynasty and with their subjects were regulated until the fall of the dynasty. The formal acceptance of it was received in various forms by the Estates of all Charles' dominions from 1720 onward; it was publicly promulgated in 1724, and guaranteed by the imperial diet in 1731 and by the main European powers severally. With Charles' death in 1740, the true line of the Habsburgs became extinct; but his daughter, Maria Theresa (*q v*), who in 1736 had married Francis Stephen, duke of Lorraine (*see* FRANCIS I) succeeded him, becoming founder of the house of Habsburg-Lorraine The Pragmatic Sanction was respected within her dominions, but not outside them. Maria Theresa lost most of Silesia to Prussia, but later acquired part of Poland, while in Italy she surrendered Parma and Piacenza to Spain and part of Milan to Sardinia but acquired Tuscany through her husband. Under Joseph II. (*q v.*) the Innviertel and the Bukovina were gained, and the Polish frontier revised, but the Netherlands rebelled successfully.

The Habsburgs emerged from the many changes brought about during the Napoleonic era shorn of the Netherlands, but in possession of Galicia and Lodomeria, Salzburg, Dalmatia and the kingdom of Lombardy-Venetia. The title of Holy Roman emperor had been abandoned by Francis II in 1806, but in 1804 he had assumed the title of emperor of Austria as Francis I. (*q.v.*). In addition, the family of Habsburg possessed certain lands in Italy which formed no part of the Austrian empire. These were the grand duchy of Tuscany, which passed on the death of the emperor Francis I., by special arrangement, to his younger son Leopold, and after his succession to the empire as Leopold II. (*q.v.*) to a third brother, Ferdinand, under whose rule and that of his son Leopold it remained until incorporated in the kingdom of Sardinia in 1859; and the duchy of Modena, acquired by the emperor Leopold II.'s younger son Ferdinand by his marriage with Mary Beatrice d'Este, which was also lost in 1859 The Modena-d'Este line of the Habsburgs became extinct with the death of Francis V. (*q.v.*) in 1875.

Francis I. was succeeded as emperor by his son Ferdinand I. (*q v.*), who abdicated after the revolution of 1848 in favour of his young nephew Francis Joseph (*q.v.*). In the course of his long reign, Francis Joseph lost the Lombard-Venetian kingdom to Italy (1859, 1866), but acquired Bosnia and the Hercegovina (mandate of occupation 1877, annexation 1908). In 1867 his relations with Hungary were reorganised under the Compromise of that year; while in 1915 the title of "Austrian empire" was granted to his remaining dominions. A remarkable but short-lived extension of the Habsburg dominions was formed by the assumption in 1863 of the title of Emperor of Mexico by Francis Joseph's brother Maximilian (*q.v.*).

Fall of the Habsburgs.—Francis Joseph was succeeded in 1916 by his great-nephew Charles I. (*q v.*). At that time his subjects still protested loyalty to the dynasty; but during the collapse of Oct. 1918, consequent on the World War, the Poles, Ruthenians, Czechoslovaks and Yugoslavs repudiated his authority. On Oct. 27 Count Andrássy, the Austro-Hungarian foreign minister, accepted President Wilson's demands "regarding the rights of the peoples of Austria-Hungary, particularly those of the Czechoslovaks and Yugoslavs." The states of Poland, Yugoslavia and Czechoslovakia soon after came formally into being, and although Charles never renounced his sovereign rights in these territories, the Habsburg family afterwards made no serious claim to reassert them The treaties of Saint Germain and Trianon perpetuated the boundaries of these States, and confirmed Italy and Rumania in the possession of their parts of the former Habsburg monarchy.

There remained only German-Austria and Hungary. On Nov. 11, 1918, Charles issued a proclamation in which he stated:

> Still, as ever, filled with unchanging love towards all my peoples, I will not oppose my person as an obstacle to their free development. I recognise in advance the decision which German-Austria will take on its future form of State. The people has assumed the government through its representatives. I renounce any share in the affairs of State. At the same time I remove my Austrian Government from its office.

The provisional Government of German-Austria proclaimed a republic on the following day. On March 12, 1919, following the elections, the first national assembly repeated this declaration. Charles, however, refused to abdicate in his own name and that of his dynasty. Thereupon the national assembly, by decree of April 2, 1919, banished all Habsburgs from Austria and confiscated the family property for the benefit of the war invalids. Habsburgs who renounced all rights other than those of private citizens were, however, allowed to live unmolested in Austria, and several of them did so. The legitimist movement in Austria has been very weak since these events. Austrian republicans claim that Charles's acceptance in advance of the republic was equivalent to a renunciation of the throne.

Charles issued a similar proclamation to Hungary on Nov. 13 which Karolyi answered by proclaiming the Hungarian republic on Nov. 16. When, however, the Right regained power in Hungary after Karolyi's and Kun's régimes, it proceeded by Act I. of 1920 to abolish all legislation passed by these two Governments. Hungary, therefore, reverted to the status of a kingdom, and controversy arose whether or not Charles's action had annulled the pragmatic sanction.

On Feb. 2, 1920, during the discussions on the draft treaty of Trianon, the Allied and Associated Powers declared that a Habsburg restoration in Hungary would be a matter of international concern and that they would neither recognise nor tolerate such a restoration. They attempted to insist on Hungary's styling herself a republic, but finally, in view of the objections raised by the Hungarian delegation, compromised on the word "Hungary."

Charles returned to Hungary and attempted to assert his claim on March 27 and Oct. 20, 1921 (*see* HUNGARY). After the second coup, under pressure from the Powers and the Little Entente, the Hungarian Parliament passed a decree (Nov. 3, 1921) whereby the sovereign rights of Charles and the pragmatic sanction were declared forever abrogated and the right of the Hungarian nation to elect its king by free choice restored. On Nov. 10 Hungary addressed a note to the Powers consenting only to elect its king in agreement with the Powers and accepting the notes of Feb. 2 and April 3, 1921. The Legitimist party, however, continued to look on Otto, Charles's eldest son, as the legitimate king after Charles's death on April 1, 1922.

Despite their unique career, the Habsburgs produced no statesman of great ability, with the exception of Charles V., and perhaps of Joseph II. Several members of the family displayed marked traces of insanity, and during the last century of their rule they were proverbial for their scandals and eccentricities. With hardly an exception, they were strongly conservative and intensely convinced upholders of the monarchical tradition. From the 16th century onward, they were nearly all extreme supporters of the Catholic idea; the title of Apostolic Majesty, which they wore as kings of Hungary, represented a very real attitude. The few exceptions—Joseph II., the Crown Prince Rudolph, and "Johann Orth"—all came to mysterious and unhappy ends. The

family tradition was exceedingly strict among them to the last, as was well exemplified when the Archduke Francis Ferdinand (*q.v.*) contracted his morganatic marriage. They owed their position chiefly to outward circumstance and to a series of marriages so adroit and successful as to give rise to the proverb *"Bella gerant alii, tu, felix Austria, nube"* (Let others wage war, do you, happy Austria, marry) As a family they succeeded in amassing great wealth, the fortunes accumulated by the Modena and d'Este branch and their heirs being particularly brilliant. After the fall of their dynasty they lost all valuables and estates owned in virtue of their rank. The income of the senior branch of the family was left very small.

For the origin and early history of the Habsburgs *see* G de Roo, *Annales rerum ab Austriacis Habsburgicae gentis principibus a Rudolpho I. usque ad Carolum V. gestarum* (Innsbruck, 1592, fol.); M. Herrgott, *Genealogia diplomatica augustae gentis Habsburgicae* (Vienna, 1737–1738); E. M. Fürst von Lichnowsky, *Geschichte des Hauses Habsburg* (Vienna, 1836–1844); A. Schulte, *Geschichte der Habsburger in den ersten drei Jahrhunderten* (Innsbruck, 1887); T. von Liebenau, *Die Anfänge des Hauses Habsburg* (Vienna, 1883); W. Merz, *Die Habsburg* (Aarau, 1896); W. Gisi, *Der Ursprung der Häuser Zähringen und Habsburg* (1888); and F. Weihrich, *Stammtafel zur Geschichte des Hauses Habsburg* (Vienna, 1893). For the history of the Habsburg monarchy *see* Langl, *Die Habsburg und die denkwurdigen Stätten ihrer Umgebung* (Vienna, 1895); and E. A. Freeman, *Historical Geography of Europe* (1881). (C. A. M)

HACHETTE, JEANNE, French heroine. Jeanne Lainé, or Fourquet, called Jeanne Hachette, was born about 1454, and is known solely for an act of heroism which on June 27, 1472, saved Beauvais when it was on the point of being taken by the troops of Charles the Bold, duke of Burgundy. The town was defended by only 300 men-at-arms, commanded by Louis de Balagny A Burgundian man-at-arms had actually planted a flag upon the battlements, when Jeanne, axe in hand, flung herself upon him, hurled him into the moat, tore down the flag, and revived the drooping courage of the garrison. Louis XI. instituted a procession in Beauvais called the Procession of the Assault, and married Jeanne to her chosen lover Colin Pilon, loading them with favours.

See Georges Vallat, *Jeanne Hachette* (Abbeville, 1898).

HACHETTE, LOUIS CHRISTOPHE FRANÇOIS (1800–1864), French publisher, was born at Rethel in the Ardennes on May 5, 1800. In 1826 he established in Paris a publishing business for the issue of works adapted to improve the system of school instruction, or to promote the general culture of the community. He published manuals in various departments of knowledge, dictionaries of modern and ancient languages, educational journals, and French, Latin and Greek classics annotated with great care by the most eminent authorities After 1850, in conjunction with other partners, he published a cheap railway library, scientific and miscellaneous libraries, an illustrated library for the young, libraries of ancient literature, of modern foreign literature, and of modern foreign romance, a series of guide-books and a series of dictionaries of universal reference. In 1855 he also founded the popular weekly, *Le Journal pour tous.* Hachette died on July 31, 1864.

HACHURE, the term (French for "hatching") for the conventional lines used in hill or mountain shading upon a map (*q.v.*) to indicate the slope of the surface, the depth of shading being greatest where the slope is steepest. The method is less accurate than that of contour lines, but gives an indication of the trend and extent of a range or mountain system, especially upon small-scale maps.

HACIENDA, a Spanish term for a landed estate. It is commonly applied in Spanish America to a country estate, on which stock-raising, manufacturing or mining may be carried on, usually with a dwelling-house for the owner's residence upon it. It is thus used loosely for the country house or farm, or for the mining works or offices so situated.

HACKBERRY, a name given to the fruit of *Celtis occidentalis,* belonging to the family Ulmaceae, to which also belongs the elm (*Ulmus*). It is also known under the name of "sugar-berry," "beaver-wood" and "nettle-tree." The hackberry tree is of middle size, attaining from 60 to 80 ft. in height (though sometimes reaching 130 ft.), and with the aspect of an elm The leaves are ovate in shape, with a very long taper point, rounded and usually very oblique at the base, usually glabrous above and soft-pubescent beneath. The soft filmy flowers appear early in the spring before the expansion of the leaves The fruit is oblong, about half to three-quarters of an inch long, of a reddish or yellowish colour when young, turning to a dark purple in autumn This tree is found in North America in deep shady forests bordering river banks from Canada (where it is very rare) to the southern states. The fruit has a sweetish and slightly astringent taste, and is largely eaten in the United States The seeds contain an oil like that of almonds. The bark is tough and fibrous like hemp, and the wood is heavy, soft, fragile and coarse-grained, and is used for making fences and furniture. The root has been used as a dye for linens.

HACKENSACK, a town of New Jersey, U.S.A., on the Hackensack river, 13 m N of Jersey City, served by the Erie Railroad company; the county seat of Bergen county. The population was 17,667 in 1920 (20% foreign-born white, nearly half from Italy) and was estimated locally at 26,500 in 1928. The town rises gradually from the bank of the river to a ridge commanding good views to the south and east. It is principally a suburban residential community, but it has various manufacturing industries (including paper and silk mills, iron works, wall-paper and jewelry factories) with an output in 1925 valued at $5,157,467. Hackensack was settled by the Dutch about 1640, and was named after the Hackensack Indians of the region, whose chief Oritany was a friend of the whites.

HACKER, ARTHUR (1858–1919), English painter, was born in London on Sept. 25, 1858, the son of Edward Hacker, a line engraver. He became a student at the Royal Academy schools in 1876, and from 1880–81 worked at the *atelier* Bonnat, Paris, subsequently travelling widely both in Europe and in North Africa The best known of his paintings are "Her Daughter's Legacy," "The Mother" and "The Cloud"; his "Annunciation" (1892) was bought by the Chantrey trustees. He became A.R.A. in 1894 and R.A. in 1910. Hacker also became well known as a portrait painter. He died in London on Nov. 12, 1919.

HACKETT, JAMES HENRY (1800–71), American actor, was born in New York In 1826 he went on the stage, where he soon established a reputation as a player of eccentric character parts. As Falstaff he was no less successful in England than in America. At various times he went into management, and he was the author of *Notes and Comments on Shakespeare* (1863).

His son, JAMES KETELTAS HACKETT (1869–1926), born at Wolfe Island, Ont., also became an actor and had considerable success in romantic and Shakesperian parts. He died in Paris on Nov. 8, 1926.

HACKLÄNDER, FRIEDRICH WILHELM VON (1816–1877), German novelist and dramatist, was born at Burtscheid near Aix-la-Chapelle on Nov 1, 1816. A short period of service in the Prussian army resulted in his *Bilder aus dem Soldatenleben im Frieden* (1841). After a journey to the east, he was appointed secretary to the crown prince of Wurttemberg. In 1857 he founded, in conjunction with Edmund von Zoller, the illustrated weekly, *Über Land und Meer* In 1859 Hackländer was appointed director of royal parks and public gardens at Stuttgart; he died on July 6, 1877

Hackländer was a voluminous writer; the most complete edition of his works is the third, published at Stuttgart in 1876, in 60 volumes There is a good selection in 20 volumes (1881). See *Roman meines Lebens* (2 vols., 1878), and H Morning, *Erinnerungen an F. W. Hackländer* (1878).

HACKNEY, a north-eastern metropolitan borough of London, England, bounded W. by Stoke Newington and Islington, and S. by Shoreditch, Bethnal Green and Poplar, and extending N. and E. to the boundary of the county of London. Pop. (1921), 222,142. In the 13th century the name appears as Hackenaye or Hacquenye, but the derivation is doubtful. Roman and other remains have been found in Hackney marshes. The bishop of London was lord of the manor from 1290 to 1550, when it was granted to Thomas, Lord Wentworth. In 1697 it came into the hands of the

Tyssen family. Extensive property in the parish also belonged to the priory of the Knights Hospitallers of St. John of Jerusalem at Clerkenwell. From the 16th to the early 19th century there were many fine residences in Hackney. The neighbourhood had at one time an evil reputation as the haunt of highwaymen. It is a poor and populous district. The borough includes the districts of Clapton in the north, Homerton in the east, and Dalston and part of Kingsland in the west. On the east lies the valley of the Lea, which flows in several branches, and is bordered, immediately outside the borough, by the reservoirs of the East London waterworks. In these low lands lie the Hackney Marshes (338 acres), and the borough also contains part of Victoria park and the Hackney Commons. The only historic building is the tower of the ancient parish church of St. Augustine, with the chapel of the Rowe family. The parliamentary borough of Hackney comprises north, central and south divisions, each returning one member

HACKNEY, originally a riding-horse (from Fr. *haquenée*, an ambling horse or mare, especially for ladies to ride; the English "hack" is simply an abbreviation). Now, however, the hackney is bred for driving as well as riding (*see* HORSE: *Breeds*). From the hiring-out of hackneys, the word came to be associated with employment for hire (so "a hack," or "drudge"), *e.g.*, hackney-chair, hackney-boat. The hackney-coach, a coach with four wheels and two horses, was a hired public conveyance (*see* CARRIAGE).

HADAD, the name of a Syrian deity, is met with in the Old Testament as the name of several human persons; it also occurs in compound forms like Benhadad and Hadadezer. The divinity primarily denoted by it is the storm-god who was known as Addu Ramman. The word Hadadrimmon (Zechariah xii. 11) has been a subject of much discussion According to the older interpreters, the mourning for something that occurred at a place called Hadadrimmon (Maximianopolis) in the valley of Megiddo is meant, the event alluded to being generally held to be the death of Josiah. More recently it has been thought that Hadadrimmon is another name for Adonis (*q.v.*) or Tammuz, the allusion being to the mournings by which the Adonis festivals were usually accompanied.

HADDINGTON, EARL OF, a Scottish title bestowed in 1627 upon Thomas Hamilton, earl of Melrose (1563–1637). Thomas was a lawyer who became a lord of session as Lord Drumcairn in 1592. He was on very friendly terms with James VI., and was one of the eight men, called the Octavians, who were appointed to manage the finances of Scotland in 1596. Hamilton became secretary of State for Scotland (1612), and received a barony in 1613. In 1616 he became lord president of the court of session, and in 1619 was created earl of Melrose, a title exchanged in 1627 for that of earl of Haddington After the death of James I. the earl resigned his offices, but served Charles I. as lord privy seal. He died on May 29, 1637. James referred familiarly to his friend as *Tam o' the Cowgate,* his Edinburgh residence being in this street.

The earl's eldest son THOMAS, the 2nd earl (1600–1640), was a covenanter and a soldier. His sons, THOMAS (d. 1645) and JOHN (d. 1669), became respectively the 3rd and 4th earls of Haddington, and John's grandson THOMAS (1679–1735) succeeded his father CHARLES (*c.* 1650–1685) as 6th earl in 1685, although he was not the eldest but the second son. Charles had married Margaret (d. 1700), the heiress of the earldom of Rothes. It was agreed that the two earldoms should be left separate; thus the eldest son John became earl of Rothes while Thomas became earl of Haddington. Thomas died on Nov. 28, 1735.

THOMAS (1780–1858), 9th earl, was made a peer of the United Kingdom as Baron Melros of Tyninghame, a title which became extinct upon his death. He was lord-lieutenant of Ireland (1834–35) under Sir Robert Peel, and in Peel's second administration (1841–1846) was first lord of the admiralty and then lord privy seal. At his death (Dec. 1, 1858) the earldom passed to his kinsman, GEORGE BAILLIE (1802–1870), a descendant of the 6th earl. This nobleman took the name of Baillie-Hamilton, and his son GEORGE (1827–1917) became 11th earl of Haddington in 1870. In 1917 he was succeeded by his grandson.

See *State Papers of Thomas, Earl of Melrose,* published by the Abbotsford Club in 1837, and Sir W. Fraser, *Memorials of the Earls of Haddington* (1889).

HADDINGTON, royal, municipal and police burgh, parish and county town, East Lothian, Scotland. Pop. (1921) 4,053. It is situated on the Tyne, 18 m. E. of Edinburgh by the L.N.E.R. On the right bank of the river lies the old suburb of Nungate, interesting as having contained the Giffordgate, where John Knox was born, and where also are the ruins of the pre-Reformation chapel of St. Martin. St. Mary's church is a 13th century cruciform Decorated building in red sandstone. The nave, restored in 1892, is used as the parish church, but the choir and transepts are roofless, though otherwise kept in repair. In a vault is a fine monument in alabaster, consisting of the recumbent figures of John, Lord Maitland of Thirlestane (1545–1595), chancellor of Scotland, and his wife, with a laudatory sonnet by James VI. In the same vault John, duke of Lauderdale (1616–82), is buried. In the choir is the tombstone which Carlyle erected over the grave of his wife, Jane Baillie Welsh (1801–1866), a native of the town. Before the county buildings, in Tudor style, stands a monument to George, 8th marquess of Tweeddale (1787–1876), who once drove the mail from London to Haddington without taking rest. The corn exchange, next to that of Edinburgh, is the largest in Scotland The Knox Memorial Institute was erected in 1879 to replace the old and famous grammar school, where John Knox, William Dunbar, John Major and possibly George Buchanan and Sir David Lindsay were educated. In Hardgate Street is "Bothwell Castle," the town house of the earl of Bothwell, where Mary Queen of Scots rested on her way to Dunbar. The leading industries are the manufactures of woollens, brewing, corn milling, iron founding and coach-building

The burgh is the retail centre for a large district, and its grain markets, once the largest in Scotland, are still of considerable importance. Haddington was created a royal burgh by David I. It also received charters from Robert Bruce, Robert II. and James VI. In 1139 it was given as a dowry to Ada, daughter of William de Warenne, earl of Surrey, on her marriage to Prince Henry, only son of David I. Alexander II was born there in 1198. Lying in the direct road of the English invaders, the town was burned by King John in 1216 and by Henry III. in 1244. Fortified in 1548 by Lord Grey of Wilton, the English commander, it was besieged next year by the Scots and French, who forced the garrison to withdraw.

HADDOCK (*Gadus aeglefinus*), a fish distinguished from its relative, the cod, by the smaller mouth and the blackish lateral line. From Iceland it ranges southward on both sides of the Atlantic, in the North sea it constitutes nearly half the total weight of fish taken in the trawl. It feeds mainly on molluscs and crustaceans. It grows to a length of 3 ft. but specimens of this size are exceptional.

HADDONFIELD, a borough of Camden county, New Jersey, 6 m. S.E. of Camden, on the Pennsylvania railroad The population was 5,646 in 1920 (87% native white) and was estimated locally at 11,500 in 1928 It is a residential suburb, with several manufacturing industries, including potteries and a factory making nautical instruments. The borough was settled in 1713, by Elizabeth Haddon, and incorporated in 1875.

HADEN, SIR FRANCIS SEYMOUR (1818–1910), English surgeon and etcher, was born in London on Sept. 16, 1818, the son of Dr. Charles Haden, and was himself a surgeon by profession. Aided by Sir W. R. Drake, he founded the Royal Society of Painter-Etchers and Engravers, and was its president until 1880. In 1843–44, with his friends Duval, Le Cannes and Col. Guibout, he had travelled in Italy and made his first sketches from nature. He studied the works of the great original engravers, Dürer, Lucas van Leyden and Rembrandt. These studies, besides influencing his original work, led to his important monograph on the etched work of Rembrandt. By lecture and book, and with the aid of the memorable exhibition at the Burlington Fine Arts Club in 1877, he endeavoured to give a just idea of Rembrandt's work, which he clearly expressed in his monograph, *The Etched Work of Rembrandt critically reconsidered,* privately printed in 1877,

and in *The Etched Work of Rembrandt True and False* (1895).

Haden's own plates are remarkable for a fine original treatment of landscape subjects; they are free and open in line, clear and well divided in mass, and express a noble and dignified style of his own. Even when working from a picture Haden's personality dominates the plate, as for example in the large plate he etched after J. M. W. Turner's "Calais Pier," which is a classical example of what interpretative work can do in black and white. Of his original plates, more than 250 in number, one of the most notable was the large "Breaking up of the Agamemnon." An early plate, rare and most beautiful, is "Thames Fisherman." "Sub Tegmine" was etched in Greenwich park in 1859; and "Early Morning—Richmond," full of the poetry and freshness of the hour, was done, the artist has said, actually at sunrise. One of the rarest and most beautiful of his plates is "A By-Road in Tipperary"; "Combe Bottom" is another; and "Shere Mill Pond" (both the small study and the larger plate), "Sunset in Ireland," "Penton Hook," "Grim Spain" and "Evening Fishing, Longparish," are also notable examples of his genius. A catalogue of his works was begun by Sir William Drake and completed by N. Harrington (1880). During later years Haden began to practise the sister art of mezzotint engraving, with a measure of the success that he had already achieved in pure etching and in dry point. He was knighted in 1894, and died on June 1, 1910

Other books by Haden not already mentioned are *Études à l'eau forte* (1865), *About Etching* (1878–79), *The Art of the Painter-Etcher* (1890).

HADENDOA: *see* BEJA

HADERSLEV, a town of Denmark in the province of North-Slesvig Pop. (1925) 14,326. It lies in a valley on the Hadersleben fjord, which is about 9 m in length, and communicates with the Little Belt, and is also an important railway junction. The beautiful church of St. Mary dates from the 13th century. The industries are iron-founding, tanning, and the manufacture of tobacco and gloves. The harbour is only accessible to small vessels

Hadersley is first mentioned in 1228, and received municipal rights from Duke Waldemar II in 1292 It suffered considerably during the wars between Slesvig and Holstein in the 15th century In Nov. 1864 it passed with Slesvig to Prussia, returning to Denmark with North-Slesvig by the plebiscite held in 1920 under the terms of the Treaty of Versailles.

HADFIELD, SIR ROBERT ABBOTT (1859–), British metallurgist, was born in Sheffield Nov. 29, 1859. Educated at Sheffield Collegiate school, at an early age he interested himself in metallurgy, subsequently becoming chairman of Hadfields, Ltd., Hecla and East Hecla Works, Sheffield, and director of other important companies. In 1883 he patented his process for the production of manganese steel (*see* IRON AND STEEL) and became famous as the inventor and improver of various metallurgical processes, including low hysteresis steel and many other special ferrous alloys. He became a member of many scientific committees, and was president of the Iron and Steel Institute (1905–07), of the Faraday Society (1914–20), and of the Society of British Gas Industries (1917–18), besides being master cutler of Sheffield 1899–1900 In 1908 he was knighted, the following year became F.R.S., and was created a baronet in 1917. Sir Robert received many honours from scientific and learned societies. He published over 160 scientific and technical papers of considerable importance. His book *Metallurgy and Its Influence on Modern Progress: with a survey of Education and Research* (1925) is a standard work of reference.

HADFIELDS, LIMITED originated in Hadfields' Steel Foundry Company, founded by the late Mr. Robert Hadfield in 1872. This private concern was registered in 1888 as Hadfields' Steel Foundry Company, Ltd. In 1913 its title was changed to Hadfields', Ltd., and the share capital was raised to £2,500,000 in March 1920.

Before the World War the company employed some 5,000 to 6,000 workpeople, during the war about 15,000, and after the war from 4,000 to 6,000. The Sheffield works occupy an area of 210ac., and their equipment includes 21½m. of railways, 300 cranes, 1,200 machine tools, 40 presses ranging up to 2,000 tons capacity, electrically driven rolling mills (one of 11,000 max h.p.) for dealing with alloy steels, including manganese and other special steels; also open-hearth, electric and other furnaces capable of producing about 150,000 tons of steel per annum. The floor area of the works is 51 acres Hadfields introduced the 51-hour week in 1891; in 1894 there was a further reduction to 48 hours per week In both instances, the reduction of hours was effected without any decrease of wages Other welfare work includes the provision of canteens, the support of ambulance work, the equipment of a sports ground, and the encouragement of social functions amongst the workpeople. (L. C M.)

HADHRAMAUT, a province on the south coast of Arabia, bounded west by Yaman, east by Oman and north by the Great South desert. Its actual limits are vague, but are generally understood to include the Mahra and Qara country between 51° and 56° E, where the desert and the coastal range come close down to the sea.

The main body of the province lies west of 51° E, where its main feature, a long and exceedingly fertile Wadi, known by different names in its various sections, but conveniently styled Wādī Hadhramaut as a whole, runs into the sea This Wadi rises in the highlands of south-west Arabia about 45° E, and extends eastward for 400 m in a gentle curve, receiving numerous affluents from the northern slopes of a mountain range which extends eastward from the Yaman and attains in parts, a height of 8,000 feet. Between this range and the sea is a coastal plain of varying width, scored by the channels of Wadis rising on its southern slopes The principal ports are Makalla and Shihr, which are the centres of a considerable trade carried on between the interior and India, Java, etc. There are also a number of fishing villages along this coast, while the valleys of the coastal plain support some fertile oases irrigated by springs and seasonal torrents.

The southern escarpment of the main range is steeper than the northern slope, which forms a plateau descending to the main Wādī beyond it The most westerly settlement in the latter is Shabwa, a former capital, now almost buried by the advancing sand Further east lies a group of important oasis-settlements, of which the chief are Shibam, Saiyun and Tarim in the main Wadi; and Hauta near its junction with Wadi Duwan. Besides these there are numerous settlements, both in the main Wadi and its affluents, with prosperous palm-groves and other cultivation, which practically ceases below Qasm, the most easterly settlement of any importance At some distance east of Qasm stands the shrine of Nabi Hud, a pre-Islamic saint, whose grave is an important centre of pilgrimage A similar shrine is that of Nabi Salih in Wadi Sirr, near Shibam. Except after rain, there is no running water in the Hadhramaut valleys, but springs and wells are numerous, and the principal crops are dates, wheat, millet, indigo and tobacco of excellent quality known as Hummi, which is widely exported.

The Mahra country, mainly desert, is ruled by a sultan residing at the coastal village of Kishin and, until 1886, owning the island of Socotra, now under British protection The mountains of this tract, and of the adjacent Qara district, come close down to the coast, and rise in parts to 4,000 feet. They are, in places, covered with gum-bearing forests producing myrrh and frankincense. This tract was visited and surveyed by the Bents in 1894, who found Sabaean ruins near Dhafar, and a remarkable harbour at Khor Raury, possibly the Moscha of antiquity.

The name of Hadhramaut is of great antiquity, and occurs in Genesis as Hazarmaveth and Hadoram, sons of Joktan. Greek accounts of the incense country contain mention of Adramytta and Chadramotites The province certainly enjoyed great prosperity and a highly advanced civilization in ancient times, as evidenced by numerous ruins found in Wadi Duwan and 'Adim. Its people are, in the main, of Qahtan or south Arabian stock, though the population contains a large element of Saiyids (descendants of the Prophet through his grandson, Husain) and other immigrants of northern stock, as well as a considerable mixture of African (originally and to some extent still, slave) blood.

The total population of the tract may be about 150,000, or

rather more if all the Badawin are included. The Saiyids, organized in families, each under a Munsib, are regarded as the religious leaders, and constitute a sort of aristocracy, owning much land but cultivating it through slaves or hired labourers. The tribesmen, partly nomad and partly settled, are divided into two main sections—the Qaaiti being by far the larger, and the Kathiri. The latter, formerly the more powerful, occupy Saiyun, Tarim and their dependent settlements. The Qaaiti, a branch of the Yafa tribe in south-west Arabia, originally came in at the invitation of the Saiyids to protect them from marauding tribes, but have become the virtual rulers of the whole country, with their capital at Makalla The chiefs of this tribe have long enjoyed a special hereditary status as jamadar or commander-in-chief of an Arab levy maintained by the Indian State of Hyderabad. Many of these tribesmen seek service in this levy, while the Kathiris, since the beginning of the 19th century, have emigrated on a large scale to Java and Sumatra. A large share of the trade of Makalla and Shihr is in the hands of Parsees and other Indians.

Until the World War our knowledge of the province was mainly derived from the Bents and Leo Hirsch (who reached Tarim in 1893), but in 1919 much fresh information was collected by Captain W. H Lee-Warner, who entered the country on a mission to the Kathiri sultans on behalf of the British Government. At Ghail Ba Wazir he found the chief centre of the Hummi tobacco cultivation and, following up Wadi Himam, he broke new ground From Quwaira he followed the whole length of the Wadi Duwan and, visiting Shibam, had an interview with the Kathiri leaders at Hazm, beyond it. Unable to proceed further, he retraced his steps by the same route

At this time the Dutch Government was considering the prohibition of further Arab immigration into Java, owing to seditious activities on the part of the Kathiri elements already there, and there is little doubt that the inland settlements of the province had been profitably engaged during the war in smuggling supplies to the Turks in Yaman. The Qaaiti sultan, Yhalib Ibn Awadh Ibn Umar, who died in 1924, was a staunch supporter of Great Britain, and a man of progressive tendencies An endemic feud between him and the Kathiri sultan had been patched up by a treaty in 1918, but Lee-Warner was impressed by the conviction that progress in the Hadhramaut could only be assured by the elimination of the Kathiri sultans, whose tyranny and rapacity were the subject of much local complaint, while their intrigues made for unrest in the Qaaiti territory. In both sections of the province the executive administration is in the hands of hereditary Wazirs, who are thus the virtual, though not the nominal rulers.

The revenue of the Qaaiti sultan amounted, in 1919, to 340,000 dollars (Maria Theresa), of which 105,000 dollars accrued from the farming of the tobacco-purchase monopoly. In 1919–20 further light was thrown on the Hadhramaut by O H. Little (*The Geography and Geology of Makalla*, Cairo, 1925), who made a geological reconnaissance of great value of the coastal plain and southern slopes of the mountain range between Ghail Ba Wazir and Wadi Hajr, south of 14° 45′ N He does not appear to have penetrated into or beyond the mountain range, but within the limits of his survey we have as complete a picture of an important district as any that has ever been made in any part of Arabia.

The xenephobia of the Hadhramaut people has always jealously guarded the country from the intrusion of European explorers, but the few who have penetrated into its recesses have enabled us to form a fairly complete idea of the whole, though the Hadhramaut still provides an immense field for future enterprise.

(H St J. B. P.)

HADING, JANE (1859–), French actress, whose real name was Jeanne Alfrédine Tréfouret, was born on Nov 25, 1859, at Marseilles, where her father was an actor at the Gymnase. She was trained at the local Conservatoire and was engaged in 1873 for the theatre at Algiers, and afterwards for the Khedivial theatre at Cairo, where she played, in turn, coquette, soubrette and *ingénue* parts When she returned to Marseilles she sang in operetta, besides acting in *Ruy Blas* Her Paris début was in *La Chaste Suzanne* at the Palais Royal, and she was again heard in operetta at the Renaissance In 1883 she had a great success at the Gymnase in *Le Maitre de forges*. In 1884 she married Victor Koning (1842–94), the manager of that theatre, but divorced him in 1887. In 1888 she toured America with Coquelin. Her later répertoire included *Le Demi-monde*, Capus's *La Châtelaine*, Maurice Donnay's *Retour de Jérusalem*, *La Princesse Georges* by Dumas *fils*, and Émile Bergerat's *Plus que reine*.

HADITH. The name given to a compilation of the teachings and life of the prophet Mohammed, which with the Koran forms the supreme authority on matters connected with the Mohammedan religion and legislation. This enormous literature of traditions, which was primarily meant for personal guidance and edification, has coloured the whole method and fabric of Moslem thought. (*See* ISLAM and MOHAMMEDAN LAW.)

HADLEIGH, a market town in Suffolk, England; 70 m. N.E. from London, the terminus of a branch of the L N.E. railway. Pop. of urban district (1921) 3,038. Hadleigh, called by the Saxons Heapde-leag, appears in Domesday Book as Hetlega. About 885 Aethelflaed, with the consent of Aethelred, her husband, gave Hadleigh to Christ Church, Canterbury. The dean and chapter of Canterbury have held it since the Dissolution In the 17th century Hadleigh was famous for the manufacture of cloth, and was incorporated in 1618. It was constituted a free borough under the title of the mayor, aldermen and burgesses of Hadleigh. In 1635, in a list of the corporate towns of Suffolk to be assessed for ship money, Hadleigh is named as third in importance It declined after the plague in 1636 and in 1687 was deprived of its charter An unsuccessful attempt to recover it was made in 1701 There is evidence of the existence of a market here as early as the 13th century. James I., granted fairs on Monday and Tuesday in Whitsun week, and confirmed an ancient fair at Michaelmas and a market on Monday It lies on the Brett, a tributary of the Stour. The church of St. Mary is Perpendicular, with an Early English tower and Decorated spire. The Rectory Tower, a turreted gate-house of brick, dates from 1495 The gild-hall is a Tudor building. Matting and malting are important trades Hadleigh was one of the towns in which the woollen industry was started by Flemings and survived until the 18th century

HADLEY, ARTHUR TWINING (1856–), American political economist and educator, president of Yale university, was born in New Haven (Conn.), on April 23, 1856, the son of James Hadley, the philologist He graduated at Yale in 1876 as valedictorian, having taken prizes in English, classics, and astronomy; he studied history and political science at Yale and in Berlin; was a tutor at Yale in 1879–83, instructor in political science in 1883–86, professor of political science in 1886–91, professor of political economy in 1891–99, and dean of the Graduate school in 1892–95; and in 1899 became president of Yale university—the first layman to hold that office

He retired as president emeritus in 1921 but continued to act as director of various railroads. He was commissioner of the Connecticut bureau of labour statistics in 1885–87. As an economist he first became widely known through his investigation of the railway question and his study of railway rates, which antedated the popular excitement as to rebates. His *Railroad Transportation, its History and Laws* (1885) became a standard work, and appeared in Russian (1886) and French (1887); he testified as an expert on transportation before the Senate committee which drew up the interstate commerce law; and wrote on railways and transportation for the Ninth and Tenth Editions (of which he was one of the editors) of the *Encyclopædia Britannica*, for Lalor's *Cyclopaedia of Political Science, Political Economy, and Political History of the United States* (3 vol., 1881–84), for *The American Railway* (1888), and for *The Railroad Gazette*, of which he was associate editor in 1887–89, and other periodicals. His idea of the broad scope of economic science, especially of the place of ethics in relation to political economy and business, is expressed in his writings and public addresses In 1907–08 he was Theodore Roosevelt professor of American History and Institutions in the University of Berlin, and in 1914 and in 1922 he lectured at various English universities. Among his publications

are: *Economics: an Account of the Relations between Private Property and Public Welfare* (1896); *The Education of the American Citizen* (1901); *The Relations between Freedom and Responsibility in the Evolution of Democratic Government* (1903); *Undercurrents in American Politics* (1915); *Economic Problems of Democracy* (1923); and *The Conflict between Liberty and Equality* (1925).

HADLEY, HENRY KIMBALL (1871–), American composer, was born in Somerville (Mass.), on Dec. 20, 1871 He studied in Boston and Vienna In 1904 he went to Germany, where he was Kapellmeister at the Mainz Opera House for two seasons, and in 1909 produced his opera *Safie*. Hadley toured Europe in 1908 as a guest conductor, presenting his tone poem *Salome*, after Oscar Wilde's tragedy. He was conductor of the Seattle Symphony Orchestra (1909–11) and of the San Francisco Symphony Orchestra (1911–15) and became associate conductor of the N Y. Philharmonic Orchestra in 1921. He has composed four other grand operas: *A Night in Old Paris*, *Azora* (Chicago Opera Company), *Bianca* (Society of American Singers), and *Cleopatra's Night* (Metropolitan Opera House); ode music for the Worcester (Mass.) Festival (60th anniversary) and *Resurgam* for the Cincinnati Festival, 1923, in addition to four symphonies, overtures and cantatas, five tone poems, ballet suites and more than 150 songs. In 1923 he conducted his *Resurgam* in London, and his tone poem *The Ocean* in Stockholm and Amsterdam, while in 1927 he went by invitation to South America, when he directed performances of his own symphonic works at Buenos Aires

HADLEY, JAMES (1821–1872), American scholar, was born March 30, 1821, in Fairfield (N Y). He graduated from Yale in 1842, studied in the theological department of Yale, and in 1844–45 was a tutor in Middlebury college. Then at Yale he was tutor, assistant professor, and professor of Greek, from 1851 until his death in New Haven, Nov. 14, 1872. Although he knew many ancient and modern languages, he published little He was also an able mathematician.

His most original written work was an essay on Greek accent, published in a German version in Curtius's *Studien zur griechischen und lateinischen Grammatik*. Hadley's *Greek Grammar* (1860; revised by Frederic de Forest Allen, 1884) long held its place in American schools In 1873 were published his *Introduction to Roman law* (ed by T. D. Woolsey) and his *Essays, Philological and Critical* (ed by W. D Whitney).

See the memorial by Noah Porter in *The New Englander*, vol. xxxii., p. 35–55 (Jan. 1873); and the sketch by his son, A. T. Hadley, in *Biographical Memoirs* of the National Academy of Sciences, vol. v. (1905), p. 247–254.

HADOW, SIR WILLIAM HENRY (1859–), British scholar and musician, was born at Ebrington, Glos , Dec. 27, 1859 He was educated at Malvern and Worcester College, Oxford, and after taking his degree remained at Oxford as a tutor and fellow of his college In 1909 he became principal of Armstrong College, Newcastle, retaining this post until 1919, when he became vice-chancellor of Sheffield University. He was in 1918 appointed assistant director of education for the troops by the War Office and also worked for the Y.M.C.A. He was knighted in 1918 and was made a C.B.E. in 1920. In 1922 he became Stevenson Lecturer to the University of Glasgow and in 1927 he presided over a committee which investigated the possibilities of adult education by means of broadcasting.

Sir Henry Hadow first took up the study of music at Darmstadt in 1882. When his *Studies in Modern Music* appeared (vol i. Berlioz, Schumann, Wagner, 1894; vol. ii. Chopin, Dvořák, Brahms, 1895), they were received with enthusiasm as representing a layman's wider outlook on, and keen insight into, subjects usually left to professional writers on music. In *A Croatian Composer* (1897) he contributed a valuable theory on the Slavonic origin of Haydn's melodic material. He also wrote *Sonata Form* (1896); the volume "The Viennese Period" (1904) in *The Oxford History of Music*, of which he was the editor; *Citizenship* (1923); and *Music* (1924) in the Home University Library. His compositions include songs, piano pieces and incidental music to Robert Bridge's *Demeter* (1905).

HADRIA [mod. *Atri* (*q.v.*)], an ancient town of Picenum, belonging to the Praetuttii. It became a colony of Rome in 290 B.C. and remained faithful to Rome. The family of Hadrian came from here. The crypt of the cathedral of the modern town was originally a large Roman cistern; another forms the foundation of the ducal palace; and in the eastern portion of the town there is a complicated system of underground passages for collecting and storing water.

HADRIAN (PUBLIUS AELIUS HADRIANUS), Roman emperor A.D. 117–138, was born on Jan. 24, A.D. 76, at Italica in Hispania Baetica, where his ancestors, originally from Hadria in Picenum, had been settled since the time of the Scipios. On his father's death in 85 or 86 he was placed under the guardianship of two fellow-countrymen, his kinsman Ulpius Trajanus (afterwards the emperor Trajan), and Caelius Attianus (afterwards prefect of the praetorian guard). He spent the next five years at Rome, but at the age of fifteen he returned to his native place and entered upon a military career. Trajan sent for him to Rome in 93, and after filling the usual minor civil posts he started serious military service as tribune to the IInd legion, stationed at Buda-Pesth (95). He spent four years on that frontier, being sent to Trajan with the army's congratulations in 97, and returned to Rome with Trajan in 99. In 100 the Empress Plotina arranged a marriage between him and Vibia Sabina, Trajan's great-niece. In 101 Hadrian was quaestor, in 105 tribune of the people, in 106 praetor. He served with distinction in both Dacian campaigns; in the second Trajan presented him with a valuable ring which he himself had received from Nerva, a token of regard which seemed to designate Hadrian as his successor. In 107 Hadrian was *legatus praetorius* of lower Pannonia, in 108 *consul suffectus*, *legatus* in the Parthian campaign (113–117), in 117 *consul designatus* for the following year, in 119 consul for the third and last time only for four months. When Trajan, owing to a severe illness, decided to return home from the East, he left Hadrian in command of the army and governor of Syria. On Aug 9, 117, Hadrian, at Antioch, was informed of his adoption by Trajan, and, on the 11th, of the death of the latter at Selinus in Cilicia. Whether he ever was formally adopted cannot be established. The army and the senate confirmed his succession, and he took office with danger threatening the empire on nearly every side.

Emperor.—Hadrian's first important act was to abandon as untenable the conquests of Trajan beyond the Euphrates (Assyria, Mesopotamia and Armenia), a recurrence to the traditional policy of Augustus. Mesopotamia and Assyria were given back to the Parthians, and the Armenians were allowed a king of their own. Some time after this there arose trouble in Dacia from the Roxolani. Whether Hadrian set out from Antioch to suppress it, or whether he had by then already reached Rome, is disputed. In any case, while he was in Dacia occurred the conspiracy of the four consulars, generals of Trajan's, discontented at the abandonment of the conquests of the last reign. The four were killed by order of the senate, and Hadrian left Turbo with a joint command of Dacia and Pannonia and hurried to Rome, where the affair had created an atmosphere of suspicion. He threw the responsibility for the executions upon the prefect of the praetorian guard, and swore that he would never punish a senator without the assent of the entire body, to which he expressed the utmost deference and consideration. Trajan's scheme for the "alimentation" of poor children was carried out upon a larger scale under a special official called *praefectus alimentorum*.

Travels Round the Empire.—The record of Hadrian's journeys[1] through all parts of the empire forms the chief authority for the events of his life down to his final settlement in the capital during his last years. They can only be briefly touched upon here. His first great journey probably lasted from 121 to 126. After traversing Gaul he visited the Germanic provinces on the Rhine, and crossed over to Britain (spring, 122), where he built the great rampart from the Tyne to the Solway, which bears his name.

[1]The chronology of Hadrian's journeys—indeed, of the whole reign—is confused and obscure. In the above the article by von Rohden in Pauly-Wissowa's *Realencyclopädie* has been followed. Webster's (*see* Bibliog.) is the most important discussion.

(*See* BRITAIN: *Roman.*) This part of the journey was mainly occupied with military inspections.. He returned through Gaul into Spain, and then proceeded to Mauretania, where he suppressed an insurrection. A war with the Parthians was averted by a personal interview with their king (123). From the Parthian frontier he travelled through Asia Minor and the islands of the Aegean to Athens (autumn, 125), where he introduced various political and commercial changes, was initiated at the Eleusinia, and presided at the celebration of the greater Dionysia. After visiting Central Greece and Peloponnesus, he returned by way of Sicily to Rome (end of 126). The next year was spent at Rome, and, after a visit to Africa, which produced measures for the encouragement of African agriculture, he set out on his second great journey (September 128). He travelled by way of Athens, where he completed and dedicated the buildings (*see* ATHENS) begun during his first visit, chief of which was the Olympieum. In the spring of 129 he visited Asia Minor and Syria, where he invited the kings and princes of the East to a meeting at Samosata; Chosroes of Parthia declined. Having passed the winter at Antioch, he set out for the south (spring, 130). He ordered Jerusalem to be rebuilt (*see* JERUSALEM) under the name of Aelia Capitolina, and made his way through Arabia to Egypt, where he restored the tomb of Pompey at Pelusium with great magnificence. After a short stay at Alexandria he took an excursion up the Nile, during which he lost his favourite Antinous. From Egypt Hadrian returned through Syria to Europe (his movements are obscure), but was obliged to hurry back to Palestine (spring, 133) to deal with the Jewish revolt that broke out in 132. (*See* art. JEWS; also E. Schürer, *Hist. of the Jewish People,* Eng. tr., div. 1, vol. ii. p. 288; and S. Krauss in *Jewish Encyc. s.v.* "Hadrian.") For a while he probably commanded in the field himself, then in 134, leaving the conduct of affairs in the hands of Julius Severus, he returned to Rome. The remaining years of his life were spent partly in the capital, partly in his villa at Tibur. His health now began to fail, and it became necessary for him to choose a successor. There were rumours that Servianus would be appointed, but he and his grandson Fustus were put to death in 136. Why, is not known. Against the advice of his relatives and friends he adopted L. Ceionius Commodus under the name of L. Aelius Caesar, who was in a feeble state of health and died on Jan. 1, 138, before he had an opportunity of proving his capabilities. Hadrian then adopted Arrius Antoninus (*see* ANTONINUS PIUS) on condition that he should adopt M. Annius Verus (afterwards the emperor Marcus Aurelius) and the son of L. Aelius Caesar, L. Verus (afterwards co-emperor). Hadrian died at Baiae on July 10, 138.

Work of the Reign.—He was without doubt one of the most capable emperors who ever occupied the throne, and devoted his great and varied talents to the interests of the state. One of his chief objects was the abolition of distinctions between the provinces and the mother country, finally carried out by Caracalla, while at the same time he did not neglect reforms that were urgently called for in Italy. Provincial governors were kept under strict supervision; extortion was practically unheard of; the *ius Latii* was bestowed upon several communities; special officials were instituted for the control of the finances; and the emperor's interest in provincial affairs was shown by his personal assumption of various municipal offices. New towns were founded and old ones restored; new streets were laid out, and aqueducts, temples and magnificent buildings constructed. In Italy itself the administration of justice and the finances required special attention. Four *iuridici* of consular rank were appointed for Italy, who took over judicial functions formerly exercised by local magistrates. The judicial council (*consiliarii Augusti,* later called *consistorium*), composed of persons of the highest rank (especially jurists), became a permanent body of advisers, although merely consultative. Roman law owes much to Hadrian, who instructed Salvius Julianus to draw up an *edictum perpetuum,* to a great extent the basis of Justinian's *Corpus iuris.* (*See* M. Schanz, *Geschichte der römischen Literatur,* iii. p. 167.) In the administration of finance, in addition to the remission of arrears already mentioned, a revision of claims was ordered to be made every fifteen years, thereby anticipating the "indictions." (*See* CALENDAR; CHRONOLOGY.) Direct collection of taxes by imperial procurators was substituted for the system of farming, and a special official (*advocatus fisci*) was instituted to look after the interests of the imperial treasury. The gift of "coronary gold" (*aurum coronarium*), presented to the emperor on certain occasions, was entirely remitted in the case of Italy, and partly in the case of the provinces. The administration of the postal service throughout the empire was taken over by the state, and municipal officials were relieved from the burden of maintaining the imperial posts. Humane regulations as to the treatment of slaves were strictly enforced; the master was forbidden to put his slave to death, but was obliged to bring him before a court of justice; if he ill-treated him it was a penal offence. The custom of putting all the household to death when their master was murdered was modified. In military matters Hadrian was a strict disciplinarian, but his generosity and readiness to share their hardships endeared him to the soldiers. During his reign an advance was made in the direction of creating an organized body of servants at the disposal of the emperor by the appointment of equites to important administrative posts, without their having performed the *militiae equestres.* (*See* EQUITES.) Among the magnificent buildings erected by Hadrian mention may be made of the following: In the capital, the temple of Venus and Roma; his splendid mausoleum, which formed the groundwork of the castle of St. Angelo; the pantheon of Agrippa; the Basilica Neptuni; at Tibur the great villa 8 m. in extent, a kind of epitome of the world, with miniatures of the most celebrated places in the provinces. Athens, however, was the favourite site of his architectural labours; here he built the temple of Olympian Zeus, the Panhellenion, the Pantheon, the library, a gymnasium and a temple of Hera.

Hadrian was fond of the society of learned men—poets, scholars, rhetoricians and philosophers—whom he alternately humoured and ridiculed. His taste, however, was curious; he preferred Cato the elder, Ennius and Caelius Antipater to Cicero, Virgil and Sallust, the obscure poet Antimachus to Homer and Plato. As a writer he displayed great versatility. He composed an autobiography, published under the name of his freedman Phlegon; wrote speeches, fragments of two of which are preserved in inscriptions (a panegyric on his mother-in-law Matidia, and an address to the soldiers at Lambaesis in Africa). In imitation of Antimachus he wrote a work called *Catachannae,* probably a kind of miscellanea. The Latin and Greek anthologies contain about a dozen epigrams under his name. The letter of Hadrian to the consul Servianus (in Vopiscus, *Vita Saturnini,* 8) is no longer considered genuine. Hadrian's celebrated dying address to his soul may here be quoted.—

> Animula vagula, blandula
> Hospes comesque corporis,
> Quae nunc abibis in loca
> Pallidula, rigida, nudula;
> Nec, ut soles, dabis jocos?

Character.—The character of Hadrian exhibits a mass of contradictions, well summed up by Spartianus (14. 11). But it is doubtful whether a good deal of this was not rather due to the defeated imaginations of his contemporaries, whom his reserved nature entirely baffled. Whatever his real character was like, the Empire under him enjoyed its golden age. The permanent marks he left, in addition to his legal and administrative reforms, were the towns he built all over the empire, and his contribution to the frontier system.

The chief ancient authorities for the reign of Hadrian are: the life by Aelius Spartianis in the *Scriptores historiae Augustae* (*see* AUGUSTAN HISTORY and bibliography); the epitome of Dio Cassius (lxix.) by Xiphilinus; Aurelius Victor, *Epit.* 14, probably based on Marius Maximus; Eutropius viii. 6; Zonaras xi. 23; Suidas, *s.v.* 'Αδριανός: and numerous inscriptions and coins, The autobiography was used by both Dio Cassius and Marius Maximus. Modern authorities: C. Merivale, *Hist. of the Romans under the Empire,* ch. lxvi.; H. Schiller, *Geschichte der römischen Kaiserzeit,* i. 2, p. 602 (1883); J. B. Bury, *The Student's Roman Empire* (1893), where a concise table of the journeys is given; P. von Rohden, *s.v.* "Aelius" (No. 64) in Pauly-Wissowa's *Realencyklopädie,* i. 1 (1894); J. Dürr, *Die Reisen des Kaisers Hadrian* (1881); F. Gregorovius, *The Emperor Hadrian* (Eng. tr. by Mary E. Robinson, 1898); A. Hausrath,

Neutestamentliche Zeitgeschichte, iii. (1874); W. Schurz, *De mutationibus in imperio ordinando ab imp. Hadr. factis*, i. (Bonn, 1883); J. Plew, *Quellenuntersuchungen zur Geschichte des Kaisers Hadrian* (Strassburg, 1890); O. T. Schulz, "Leben des Kaisers Hadrian," *Quellenanalysen* [of Spartianus' *Vita*] (1904); E. Kornemann, *Kaiser Hadrian und der letzte grosse Historiker von Rom* (1905); W. Weber, *Untersuchungen zur Geschichte des Kaisers Hadrianus* (1908); H. F. Hitzig, *Die Stellung Kaiser Hadrians in der römischen Rechtsgeschichte* (1892); C. Schultess, *Bauten des Kaisers Hadrian* (1898); G. Doublet, *Notes sur les oeuvres littéraires de l'empéreur Hadrien* (Toulouse, 1893); J. B. Lightfoot, *Apostolic Fathers*, ii. 1, 476 *seq.*; Sir W. M. Ramsay, *Church in the Roman Empire*, pp. 320 *seq.*; V. Schultze, in Herzog-Hauck's *Realencyklopädie*, vii. 315; histories of Roman literature by Teuffel-Schwabe and Schanz. On Aelius Caesar, see *Class Quart.*, 1908, i. *See* also B. W. Henderson, *Life and Principle of the Emperor Hadrian* (1923); M. I. Rostovtzev, *Social and Economic History of the Roman Empire* (1926).

HADRIAN'S WALL, the name usually given to the remains of the Roman fortifications which defended the northern frontier of the Roman province of Britain. It extends from Wallsend on the estuary of the Tyne to Bowness on the Solway, cir. 73½ English miles, and was erected by order of the Emperor Hadrian under Platorius Nepos, governor of Britain cir. A.D. 122–126. The complete work was not built to a single plan, but reached its final form (probably within the years stated) by three stages: (1) a series of detached forts, each holding 500 men, four miles apart, on an average, lying in front (to the north) of an earthwork (the *"Vallum"*) which served as a visible delimitation of the civil frontier of Rome; (2) the enlargement of certain of these forts to hold 1,000 men; (3) the connection of the forts by a stone wall, and the provision of smaller fortified posts at every mile (*"Mile-castles"*) with intervening turrets. This wall was designed rather as a fortified sentry beat than as a defensive fortification. At certain points traces have been found of a wall of turf, which preceded the stone wall; this has yet to be elucidated fully, but may be a temporary step in the development between stages 2 and 3. No definite evidence has yet been found that the wall was held by the Romans after A.D. 383. *See* further BRITAIN: *Roman.*

HADRUMETUM, a town of ancient Africa on the southern extremity of the *sinus Neapolitanus* (mod. Gulf of Hammamet) on the east coast of Tunisia. The site is partly occupied by the modern town of Susa (*q.v.*). The form of the name Hadrumetum varied much in antiquity; the Greeks called it Ἀδεύμης, Ἀδεύμητος, Ἀδεαμύτης, Ἀδεάμητος: the Romans *Adrumetum, Adrimetum, Hadrumetum, Hadrymetum*, etc.; inscriptions and coins gave *Hadrumetum*. The town was a Phoenician colony founded by Tyrians long before Carthage (Sallust, *Jug.* 19). It became subject to Carthage, but lost none of its prosperity. Often mentioned during the Punic Wars, it was captured by Agathocles in 310, and was the refuge of Hannibal and the remnants of his army after the battle of Zama in 202. During the last Punic War it gave assistance to the Romans; after the fall of Carthage in 146 it received an accession of territory and the title of *civitas libera* (Appian, *Punica*, xciv.; *C.I.L.* i. p. 84). Caesar landed there in 46 B.C. on his way to the victory of Thapsus (*De bello Afric.* iii.; Suetonius, *Div. Jul.* lix.).

In the organization of the African provinces Hadrumetum became a capital of the province of Byzacena. It was a busy port and the centre of a fertile country. Trajan made it a Latin colony under the title of *Colonia Concordia Ulpia Trajana Augusta Frugifera Hadrumetina;* a dedication to the emperor Gordian the Good, found at Susa gives these titles to the town, and at the same time identifies it with Susa. Quarrels arose between Hadrumetum and its neighbour Thysdrus in connection with the temple of Minerva situated on the borders of their respective territories (Frontinus, *Gromatici*, ed. Lachmannus, p. 57); Vespasian when pro-consul of Africa had to repress a sedition among its inhabitants (Suetonius, *Vesp.* iv.; Tissot, *Fastes de la prov. d'Afrique*, p. 66); it was the birthplace of the emperor Albinus. At this period Hadrumetum was after Carthage, the most important town in Roman Africa. Its bishops are mentioned at the councils of 258, 348, 393 and even later. Destroyed by the Vandals in 434 it was rebuilt by Justinian and renamed Justinianopolis (Procop. *De aedif.* vi. 6). After the Arabic invasion of the 7th century the place became the haunt of pirates. The Arabic geographer Bakri gave a description of the chief Roman buildings which were standing in his time (Bakri, *Descr. de l'Afrique*, tr. by de Slane, p. 83 *et seq.*). The modern town of Susa, despite its commercial prosperity, occupies only a third of the old site.

There remains a fragment of the fortifications of the Punic town and of the substructions of the Byzantine acropolis, the circus, the theatre, the water cisterns and of other buildings, notably an interesting Byzantine basilica. In the ruins have been found numerous columns of Punic inscriptions, Roman inscriptions and mosaic, among which is one representing Virgil. In the large Christian catacombs are numerous sarcophagi and inscriptions painted or engraved of the Roman and Byzantine periods. There are also Punic and Pagan-Roman cemeteries. The town had no Punic coins, but under the Roman domination there were coins from the time of the Republic. These are of bronze and bear the name of the city in abbreviations, HADR or HADRVM accompanying the head of Neptune or the Sun. We find also the names of local duumvirs. Under Augustus the coins have on the obverse the imperial effigy, and on the reverse the names and often the effigies of the pro-consuls. After Augustus the mint was closed.

AUTHORITIES.—A. Daux, *Recherches sur l'origine et l'emplacement des emporia phéniciens dans le Zeugis et le Byzacium* (Paris, 1869); Ch. Tissot, *Géographie comparée de la province romaine d'Afrique*, ii. p. 149; Cagnat, *Explorations archéol en Tunisie* (2nd and 3rd fasc., 1885); Lud. Müller, *Numismatique de l'Afrique ancienne*, ii. p. 51; *Atlas archéol. de Tunisie* (4th fascicule, with the plan of Hadrumetum).

HAECKEL, ERNST HEINRICH (1834–1919), German biologist, was born at Potsdam on Feb. 16, 1834. He studied medicine and science at Wurzburg, Berlin and Vienna under such men as Johannes Muller, R. Virchow and R. A. Kolliker. In 1862 he became professor of comparative anatomy and director of the zoological institute at Jena, where a chair of zoology was created for him in 1865. At Jena he spent his life, with the exception of the time devoted to various tours. As a field naturalist Haeckel's extraordinary power and industry were displayed in his publications on *Radiolaria* (1862), *Siphonophora* (1869), *Monera* (1870) and *Calcareous Sponges* (1872), as well as several *Challenger* reports, viz. *Deep-Sea Medusae* (1881), *Siphonophora* (1888), *Deep-Sea Keratosa* (1889) and *Radiolaria* (1887).

Meanwhile he had become the first German biologist to give a wholehearted adherence to the doctrine of organic evolution, and Darwin himself believed that Haeckel's enthusiastic propagandism was the chief factor of the success of the doctrine in Germany. His *General Morphology* (1866) was a suggestive attempt to work out the practical application of evolution to its final results. *Natürliche Schöpfungsgeschichte* (1867, 10th ed. 1902, Eng. trans. 1892) laid particular stress on the "fundamental biogenetic law" that ontogeny recapitulates phylogeny, that the organism in its development is to a great extent an epitome of the form-modifications undergone by the successive ancestors of the species in the course of their historic evolution. Haeckel's well-known "gastraea" theory is an outcome of this generalization. He divided animal creation into the Protozoa or unicellular animals, and the Metazoa or multicellular animals. In the Metazoa the single primitive egg-cell is transformed by cleavage into a globular mass of cells (*morula*), which first becomes a hollow vesicle and then changes into the *gastrula*. The simplest multicellular animal resembles this gastrula with its two primary layers, ectoderm and endoderm, and the earliest hypothetical form of this kind, from which the higher animals are probably descended, may be called the "gastraea."

Haeckel was the first to draw up a genealogical tree of the relationship between the various orders of animals. His efforts in this direction culminated in the paper he read before the fourth International Zoological Congress, held at Cambridge in 1898, when he traced the descent of the human race in 26 stages from organisms like the still-existing *Monera*, simple structureless masses of protoplasm, and the unicellular *Protista*, through the chimpanzees and the *Pithecanthropus erectus*, which he regarded as the link between primitive man and the anthropoid apes.

Haeckel's attempt to apply the doctrine of evolution to the problems of philosophy and religion appeared in *Die Welträtsel* (1899, Eng. trans. *The Riddle of the Universe*, 1900). Adopting an uncompromising monistic attitude, he asserted the essential unity of organic and inorganic nature. For him the chemico-physical properties of carbon in its complex albuminoid compounds are the sole and the mechanical cause of the specific phenomena of movement which distinguish organic from inorganic substances, and the first development of living protoplasm, as seen in the *Monera*, arises from such nitrogenous carbon-compounds by spontaneous generation. Psychology he regarded as merely a branch of physiology. Every living cell has psychic properties, and the psychic life of multicellular organisms is the sum-total of the psychic functions of the cells of which they are composed. Moreover, just as the highest animals have evolved from the simplest forms of life, so the highest human faculties have evolved from the soul of animals. Consequently Haeckel denied the immortality of the soul, the freedom of the will, and the existence of a personal God.

Although Haeckel occupies no serious position in the history of philosophy, there can be no doubt that he was very widely read in his own day, and that he is very typical of the school of extreme evolutionist thought. He died at Jena on Aug. 8, 1919.

Haeckel's other works include: *Die systematische Phylogenie* (1894), which has been pronounced his best book; *Anthropogenie* (1874, 5th ed. 1903, Eng. trans. 1879), dealing with the evolution of man; *Über unsere gegenwärtige Kenntnis vom Ursprung des Menschen* (1898, Eng. trans. 1898); *Der Kampf um den Entwickelungsgedanken* (1905, Eng. trans. 1906); books of travel such as *Indische Reisebriefe* (1882, 6th ed. 1922) and *Aus Insulinde* (1901); *Kunstformen der Natur* (1904) and *Wanderbilder* (1905), reproductions of his oil paintings and water-colours.

See W. Bölsche, *E. Haeckel. Ein Lebensbild* (Dresden, 1900, Eng. trans. 1906); Breitenbach, *E Haeckel* (Odenkirchen, 1904); W. May, *Ernst Haeckel; Versuch einer Chronik seines Lebens und Werkens* (Leipzig, 1909); K. Hauser, *E. Haeckel . . . seine Bedeutung fur den Geisteskampf der Gegenwart* (1920). H. Schmidt has edited the *Erinnerungen und Briefe der Liebe* (1927).

HAEMATITE or **HEMATITE,** a mineral consisting of ferric oxide Fe_2O_3 (corresponding to 70% of iron). The name is derived from the Gr. αἷμα, "blood," in allusion to its typical colour, whence the mineral is also called *red iron-ore*. When crystallized it is often black; but the powdered mineral shows the characteristic red colour. It crystallizes in the hexagonal system with rhombohedral symmetry. Cleavage, imperfect. Hardness, 6. Sp.g, 5·2. Lustre, metallic Nearly opaque. The brilliant lustre of the steel grey crystallized variety, often in tabular form, has given it such names as *specular iron-ore, looking-glass ore, iron-glance*. When in very thin scales and plates it is known as *micaceous iron-ore*. Scales of specular ore occur on the surface of lavas in volcanic districts. This is no doubt a sublimation product formed by the inter-action of steam and ferric chloride. Haematite is often compact or massive with a mammillated surface and an internal fibrous structure (*pencil-ore*). A reniform variety is known as *kidney-ore*. Much haematite occurs in an earthy form, when it is termed *soft red ore*. *Red ochre* or *reddle* is an earthy variety used for the preparation of the pigment having the same name. *Rouge* is another preparation made from haematite. On account of its high iron content and freedom from phosphorus, haematite constitutes a valuable iron-ore (*q.v.*). (F. H. Ha)

HAEMATOCELE, the medical term for a localized collection of blood, particularly in the tunica vaginalis or cord. It is usually the result of a sudden blow or severe strain, but may arise from disease. At first it forms a smooth, fluctuating, opaque swelling, but later becomes hard and firm. In chronic cases the walls of the tunica vaginalis undergo changes. The treatment of a case seen soon after the injury is directed towards keeping the patient at rest, elevating the parts, and applying an evaporating lotion or ice-bag. In chronic cases it may be necessary to lay open the cavity and remove the coagulum.

HAEMATOPODIDAE: *see* Oyster-catcher.

HAEMOPHILIA, the medical term for a condition of the blood, particularly deficiency of blood platelets, and possibly also of the vascular system, often running in families, the members of which are known as "bleeders," characterized by a disposition towards bleeding, whether with or without the provocation of an injury to the tissue. When this bleeding is spontaneous it comes from the mucous membranes, especially from the nose, but also from the mouth, bowel, and bronchial tubes. Slight bruises are apt to be followed by extravasations of blood into the tissues; the swollen joints (knee especially) of a bleeder are probably due, in the first instance, to the escape of blood into the joint cavity or synovial membrane. It is always from the smallest vessels that the blood escapes, and may do so in such quantities as to cause death in a few hours. Haemophilia occurs almost exclusively in males but is transmitted by the females of a family.

HAEMORRHAGE, a general term for an escape of blood from a blood-vessel (*see* Blood). It commonly results from injury, as the tearing or cutting of a blood-vessel, but certain forms result from disease, as in haemophilia, scurvy, and purpura. The chief varieties of haemorrhage are *arterial, venous,* and *capillary*. Bleeding from an artery is of a bright red colour, and escapes from the end of the vessel nearest the heart in jets synchronous with the heart's beat. Bleeding from a vein is of a darker colour; the flow is steady, and the bleeding is from the distal end of the vessel. Capillary bleeding is a general oozing from a raw surface. By *extravasation of blood* is meant the pouring out of blood into the areolar tissues, which become boggy. This is termed a *bruise* or *ecchymosis*. *Epistaxis* is a term given to bleeding from the nose. *Haematemesis* is vomiting of blood, the colour of which may be altered by digestion, as is also the case in *melaena*, or passage of blood with the faeces, in which the blood becomes dark and tarry-looking from the action of the intestinal fluids. *Haemoptysis* denotes an escape of blood from the air-passages. *Haematuria* means passage of blood with the urine.

Cessation of bleeding may take place from natural or from artificial causes. Natural arrest of haemorrhage arises from (1) the coagulation of the blood itself, (2) the diminution of the heart's action as in fainting, (3) changes taking place in the cut vessel causing its retraction and contraction. In the surgical treatment of haemorrhage minor means of arresting bleeding are: cold, which is most valuable in general oozing and local extravasations; very hot water, 130° to 160° F, a powerful haemostatic; position, such as elevation of the limb, valuable in bleeding from the extremities; styptics or astringents applied locally, as perchloride of iron, tannic acid, and others, the most valuable being suprarenal extract. In arresting haemorrhage temporarily the chief thing is to press directly on the bleeding part. The pressure to be effectual need not be severe, but must be accurately applied. If the bleeding point cannot be reached, the pressure should be applied to the main artery between the bleeding point and the heart. In small blood-vessels pressure will be sufficient to arrest haemorrhage permanently. In large vessels it is usual to pass a ligature round the vessel and tie it with a reef-knot. Apply the ligature, if possible, at the bleeding point, tying both ends of the cut vessel. If this cannot be done, the main artery of the limb must be exposed by dissection at the most accessible point between the wound and the heart, and there ligatured.

Haemorrhage has been classified as—(1) primary, occurring at the time of the injury; (2) reactionary, or within 24 hours of the accident, during the stage of reaction; (3) secondary, occurring at a later period and caused by faulty application of a ligature or septic condition of the wound. In severe haemorrhage, as from the division of a large artery, the patient may collapse and death ensue from syncope. In syncope stimulants and strychnine may be given, but they should be avoided until it is certain the bleeding has been properly controlled, as they tend to increase it. Transfusion of blood directly from the vein of a healthy person to the blood-vessels of the patient, and infusion of gum, glucose or saline solution into a vein, may be practised (*see* Shock). In the congenital condition known as *haemophilia* (*q.v.*) it is difficult to stop the flow of blood.

The effects of haemorrhage within the body are widespread, and immediate as well as delayed. As an immediate effect of loss of blood the volume of fluid within the blood-vessels and therefore

the amount entering and leaving the heart is diminished. This change of volume is rectified within a few seconds or minutes by (1) contraction of the arterioles and (2) passage of fluid from the tissues into the capillaries and venules. Hence the original volume is rapidly re-established, but the blood, for a time, is more dilute than formerly. Of the delayed changes the most noticeable concern the blood corpuscles. Young and it may be nucleated red corpuscles are found in the circulating blood and the number of leucocytes, particularly the polynuclear variety, is raised above the normal. In the bone marrow there are signs of great activity, the tissue being bright red and highly cellular. The blood pressure in the great arteries remains approximately at its normal level until about one-third of the original amount of blood has been lost, and then it falls abruptly.

HAEMORRHOIDS or **HEMORRHOIDS,** commonly called *piles*, swellings formed by the dilatation of veins of the lowest part of the bowel, or of those just outside the margin of its aperture. The former, *internal piles*, are covered by mucous membrane; the latter, *external piles*, are just beneath the skin. As the veins of the lining of the bowel become dilated they form definite bulgings within the bowel, and, at last increasing in size, escape through the anus when a motion is being passed. Growing still larger, they may come down spontaneously when the individual is standing or walking, and they are apt to be a grave source of pain or annoyance Eventually they may remain constantly protruded—nevertheless, they are still *internal* piles because they arise from the interior of the bowel. Though a pile is sometimes solitary, there are usually several of them They are apt to become inflamed, and the inflammation is associated with heat, pain, discharge and general uneasiness; ulceration and bleeding are also common symptoms, hence the term "bleeding piles" The *external pile* is covered by the thin, dark-coloured skin of the anal margin Severe pressure upon the large abdominal veins may retard the upward flow of blood to the heart and so give rise to piles; this is apt to happen in the case of disease of the liver, malignant and other tumours within the pelvis or abdomen, and pregnancy. Probably the anatomical arrangement of veins at the lower end of the rectum and habitual constipation are predisposing causes of piles It is often said the exciting cause may be vigorous straining at stool or exposure to damp, as from sitting on the wet ground, but there is little solid evidence for the statements. Piles are often only a symptom, and in their treatment this fact should be kept in view; if the cause is removed the piles may disappear. Moreover, if they indicate the existence of cancer of the rectum the whole aspect of the case is altered The appearance of piles or of haemorrhage assumed to be from piles for the first time in a person of middle age or over is highly suggestive of the major disease Sometimes when a pile has been protruded, as during defaecation, it is tightly grasped by spasmodic contraction of the circular muscular fibres which guard the outlet of the bowel, and it then becomes swollen, engorged and extremely painful; the strangulation may be so severe that the blood of the vessels coagulates and the pile mortifies. This, indeed, is nature's attempt at curing a pile, but it is distressing, and, as a rule, it is not entirely successful.

The palliative treatment of piles consists in obtaining a daily and easy action of the bowels, in rest, cold bathing, astringent injections, lotions and ointments The radical treatment consists in their removal by operation, but this should not be contemplated until palliative treatment has failed. If, for one reason or another, no operation is to be undertaken, and the piles are troublesome, relief may be afforded by warm sponging and by sitz-baths, the pile being gently dried afterwards by a piece of soft linen, smeared with vaseline, and carefully returned into the bowel. Under surgical advice, cocaine or morphia may be brought in contact with the tender parts, either in the form of lotion, suppository or ointment. If, as often happens, blood coagulates in the vein of an external pile, the small, hard, tender swelling may be treated with anodyne fomentations, or it may be rendered insensitive by the ether spray and opened by a small incision, the clot being turned out. Diathermic treatment is often useful. The usual operation consists in strangling the pile by ligatures.

HAEMOSPORIDIA. Parasitic single-celled animals (Protozoa) which live in the red blood-corpuscles of vertebrates, and gradually destroy them. We find, therefore, among the Haemosporidia the causes of many maladies, including the organisms which cause the various kinds of malaria. (*See* PROTOZOA.)

HĀFIZ. Shams-ud-din Mohammed, better known by his *takhallus* or *nom de plume* of Hāfiz, one of the most famous writers of Persian lyrical poetry, was born at Shiraz, the capital of Fars, in the early part of the 8th century of the Mohammedan era (*c.* AD 1300) The exact date of his birth is uncertain, but he attained a ripe old age and died in 791 AH (AD. 1388), as given in the chronogram which is engraved on his tomb He early devoted himself to the study of poetry and theology, and also became learned in mystic philosophy, which he studied under Shaik Mahmūd 'Attār, chief of an order of dervishes Hāfiz afterwards enrolled himself in the same order and became a professor of Koranic exegesis in a college which his friend and patron Haji Kiwam-ud-din, the vizier, specially founded for him This was probably the reason of his adopting the sobriquet of Hāfiz ("one who remembers"), which is technically applied to any person who has learned the Koran by heart The restraints of an ascetic life seem to have been very little to Hāfiz's taste, and his loose conduct and wine-bibbing propensities drew upon him the severe censure of his monastic colleagues In revenge he satirizes them unmercifully in his verses, and seldom loses an opportunity of alluding to their hypocrisy Hāfiz's fame as a poet was soon rapidly spread throughout the Mohammedan world. He was, like most Persians, a Shi'ite by religion, believing in the transmission of the office of Imām (head of the Muslim Church) in the family of Ali, cousin of the prophet, and rejecting the *Hadith* (traditional sayings) of Mohammed, which form the Sunna or supplementary code of Mohammedan ceremonial law. One of his odes which contains a verse in praise of Ali is engraved on the poet's tomb, but is omitted by Sudi, the Turkish editor and commentator, who was himself a rigid Sunnite

His principal work is the *Dīwān*, that is, a collection of short odes or sonnets called *ghazals*, and consisting of from five to sixteen *baits* or couplets each, all the couplets in each ode having the same rhyme in the last hemistich, and the last couplet always introducing the poet's own *nom de plume* Hāfiz was a professed dervish and Sūfi, and his *ghazals* were in all probability published from a *takia*, and arranged with at least a view to Sufiistic interpretation. At the same time it is ridiculous to suppose that the glowing imagery, the gorgeous and often tender descriptions of natural beauties, the fervent love passages, and the roystering drinking songs were composed in cool blood or with deliberate ascetic purpose The beauty of Hāfiz's poetry is that it is natural It is the outcome of a fervent soul and a lofty genius delighting in nature and enjoying life; and it is the poet's misfortune that he lived in an age and amongst a people where rigid conventionality demanded that his free and spontaneous thoughts should be recast in an artificial mould

Besides the *Dīwān*, Hāfiz wrote a number of other poems; the Leipzig edition of his works contains 573 *ghazals* (forming the *Dīwān*), 42 *kiṭ'as* or fragments, 69 *rubā'iyāt* or tetrastics, 6 *masnaviyat* or poems in rhyming couplets, 2 *kasāid*, idylls or panegyrics, and 1 *mukhammes* or poem in five-line strophes Other editions contain several *tar ji'-band* or poems with a refrain The whole *Dīwān* was translated into English prose by H. Wilberforce Clarke in 1891. Other selections are by S. Robinson (1875), A. Rogers (1889), J. H. McCarthy (1893) and Gertrude L. Bell (1897). The principal German versions are by von Hammer Purgstall (1812); a rhyming and rhythmical translation of a large portion of Hāfiz's works by Vincenz von Rosenzweig of Vienna (Vienna, 1858), which contains also the Persian text and notes; *Der Diwan des Schemseddin Muhammed Hafis*, by G. H. F. Nesselmann (Berlin, 1865), in which the rhyming system of the original is limited. Besides these, the reader may consult d'Herbelot, *Bibliothèque orientale*, article "Hafiz"; Sir William Ouseley's *Oriental Collections* (1797–1798), *A Specimen of Persian Poetry, or Odes of Hafiz*, by John Richardson (London, 1802); *Biographical Notices of Persian Poets*, by Sir Gore Ouseley

(Oriental Translation Fund, 1846); and an excellent article by Professor E. B Cowell in *Macmillan's Magazine* (No. 177, July 1874); J. A. Vullers, *Vitae poëtarum Persicorum* (1839, translated from Daulatshah); S. Robinson, *Persian Poetry for English Readers* (1883). The best edition of the text perhaps that edited by Hermann Brockhaus of Leipzig (1854–1856). *See* also H Ethé in *Grundriss der iranischen Philologie*, ii. (Strassburg, 1896); P. Horn, *Geschichte der persischen Literatur* (Leipzig, 1901).

HAFNIUM is the name given by its Danish discoverers (D. Coster and G. von Hevesy) to a metallic element which always occurs in close association with zirconium; symbol Hf, atomic number 72, atomic weight 178·6 The chemists, G. Urbain and A. Dauvillier, on the grounds of an indication of the element obtained by the former, claim the privilege of naming it *Celtium*, and references to this discussion are given under that heading. The high melting point and electronic emissivity of hafnium are the reasons for the recent issuance of two patents for its use in lamp filaments, particularly in radio tubes

The properties of this element and its compounds are so similar to those of zirconium and its compounds that separation of the two is a matter of great difficulty, and its discovery has made necessary the revision and correction of all existing data on zirconium because all salts of zirconium are contaminated with from 1% to 5% of hafnium

See J. H. de Boer, *Z Anorg. Chem.*, 150, p 210 (1926); von Hevesy, *Das Element Hafnium* (Berlin, 1927); O Honigschmidt and E. Zintl *Berichte*, 58, p 453 (1925).

HAFSTEIN, HANNES THORDUR (1861–1922), Icelandic statesman and poet, was born on Dec 4, 1861. As a young man he became known as a lyrical poet In 1901 he was elected a member of the Althing, and soon became a leader of the Home Rule party. It was chiefly owing to his influence that Denmark consented, in 1903, to the transfer of the residency of the minister for Iceland from Copenhagen to Reykjavik. On Jan. 31, 1904, Hafstein was appointed to this office and inaugurated a new era of practical reform His first work was to arrange a telegraphic cable to Great Britain and a net of telegraphs and telephones all over the island. His efforts, however, were hampered by the extremists, who demanded greater political independence from Denmark. Their obduracy led to his resignation in 1908. On the victory of the Home Rulers in 1911, Hafstein again became minister in 1912, but had to resign in 1914 after new and fruitless efforts to effect reconciliation. He lived, however, to see the full reconciliation between the two countries in 1918, and the recognition of Iceland as an independent State in union with Denmark. He died on Dec. 13, 1922.

HAFṬĀRA (lit. *conclusion*), the second or prophetic lesson (also called *Shelemta*) which ended the ancient service. These were shorter in the days of Jesus (Luke iv. 16) than at present and were accompanied by exegesis A Spanish translation still accompanies the *Hafṭāra* of the Fast of Ab in London.

Bibliography.—For *Hafṭāra* blessings *see* S. Singer's prayer book pp 148–149 and I. Abrahams' notes in annotated edition (London, 1928). For list of *Hafṭaroth* see *Jew. Enc.* (s.v.). For the history of the *Hafṭara see* I. Abrahams, *Studies in Pharisaism*, i., ch i., I Elbogen, *Jud-Gottesdienst* (Frankfurt-a-M., 1924); A Büchler, *Jew Quart. Rev.*, v. 464 *sqq.* (question of triennial cycle); G. F. Moore, *Judaism*, i., 300 *sqq.* (Harvard, 1927).

HAG, a word common during the 16th and 17th centuries for a female demon or evil spirit, and so particularly applied to harpies and fairies of classical mythology, and also to witches. (Ger. *Hexe*, fr. O.E. *haegtesse*.) The name is also used of an eel-like parasitic fish, *Myxine*, allied to the lamprey; of a kind of light said to appear at night; of a copse (north England and Scotland), and of a cutting in the peat of a bog.

HAGEDORN, FRIEDRICH VON (1708–1754), German poet, was born on April 23, 1708, at Hamburg, where his father was Danish minister. He was educated at the gymnasium of Hamburg, and at Jena. Returning to Hamburg in 1729, he became unpaid private secretary to the Danish ambassador in London, where he lived till 1731. In 1733 he was appointed secretary to the so-called "English Court" (*Englischer Hof*) in Hamburg, a trading company founded in the 13th century. He died on Oct. 28, 1754. Hagedorn is the first German poet who bears unmistakable testimony to the nation's recovery from the devastation wrought by the Thirty Years' War. His light and graceful love-songs and anacreontics, with their undisguised *joie de vivre*, introduced a new note into the German lyric; his fables and tales in verse are hardly inferior in form and in delicate persiflage to those of his master La Fontaine, and his moralizing poetry re-echoes the philosophy of Horace. He exerted a dominant influence on the German lyric until late in the 18th century.

The best edition of Hagedorn's works is by J. J. Eschenburg (5 vols., Hamburg, 1800). Selections of his poetry with an excellent introduction in F. Muncker, *Anakreontiker und preussisch-patriotische Lyriker* (Stuttgart, 1894). *See* also H. Schuster, *F. von Hagedorn und seine Bedeutung für die deutsche Literatur* (Leipzig, 1882); W. Eigenbrodt, *Hagedorn und die Erzählung in Reimversen* (1884).

HAGEN, FRIEDRICH HEINRICH VON DER (1780–1856), German philologist, was born at Schmiedeberg, Brandenburg, on Feb. 19, 1780, and died at Berlin, where he was professor of German literature, on June 11, 1856. His numerous editions of old German poetry, notably his *Minnesinger* (Leipzig, 1838–56, 4 vols. in 5 parts), *Gesamtabenteuer* (Stuttgart, 1850, 3 vols.) and *Das Heldenbuch* (Leipzig, 1855), aroused new interest in the subject.

His correspondence with C. G. Heyne and G. F. Benecke was published by K. Dziatzko (Leipzig, 1893).

HAGEN, JOHANNES GEORG (1847–), German astronomer, was born at Bregenz on March 6, 1847. He was educated at Feldkirch, Ditton Hall, Munster and Bonn; and became director of Georgetown observatory, Washington, D C. He left there in 1906, since when he has been director of the observatory of the Vatican, Rome. His chief work has been the study and classification of variable stars. He has also examined the dark nebulae by visual observation, and in 1920 invented the isotomeograph. His publications include. *Synopsis of Higher Mathematics*, and *Aggiunte alle carte dell' Atlas Stellarum variabilium* (Rome, 1920).

HAGEN, a town of Germany, in the Prussian province of Westphalia. Pop. (1925) 99,294. It lies at the confluence of the Ennepe with the Volme, 15 m N E of Elberfeld, on the main line to Brunswick and Berlin, and at the junction of important railway lines, connecting it with the principal towns of the Westphalian iron district. Hagen has extensive iron and steel works, large cotton print works, manufactures of leather, paper, tobacco, and iron and steel wares, sugar, breweries and distilleries. There are large limestone quarries in the vicinity and also an alabaster quarry.

HAGENAU: *see* Haguenau.

HAGENBACH, KARL RUDOLF (1801–1874), German church historian, was born on March 4, 1801 at Basel, where his father was a practising physician, and died there on June 7, 1874. In 1824 he became professor extraordinarius at Basel, and in 1829 professor ordinarius of theology. He supported "mediation theology" (*Vermittelungstheologie*), based upon the fundamental conceptions of Herder and Schleiermacher. Hagenbach was much less revolutionary than were many others of his school. He sought to maintain the old confessional documents, and to make the objective prevail over the purely subjective manner of viewing theological questions

His works include *Encyclopädie u. Methodologie der theol. Wissenschaften* (1833); *Lehrbuch der Dogmengeschichte* (1840–41, 5th ed., 1867, English trans., 1850); *Vorlesungen über die Kirchengeschichte von der ältesten Zeit bis zum 19ten Jahrhundert* (7 vols., 1868–72).

See E. Stähelin, *Karl Rudolf Hagenbach* (1875).

HAGENBACH, PETER VON (*c* 1420–1474), Burgundian courtier and governor of Alsace. A member of a noble family of the Sundgau, he was in 1453 in the service of Duke John I. of Cleves. After serving under various princes he joined the court of Charles the Bold (*q.v.*), duke of Burgundy, in 1469, and was made governor of the territories on the upper Rhine mortgaged to him by Sigismund of Austria. His government in Alsace was harsh and the towns of Rheingelden, Seckingen, Laufenburg and Waldshut rose in revolt against him Other towns joined in the revolt Hagenbach, who had no help from Charles except a few

Picard soldiers, was seized on April 10, 1474, at Breisach, and imprisoned. Meanwhile Sigismund appeared at Basle to recover the mortgaged territories. The allies were determined on the death of the hated Hagenbach. He was tortured on May 5, and on May 9 was brought before a court at Breisach drawn from Strasbourg, Basle and other cities. He was condemned to death and beheaded the same evening.

HAGENBECK, CARL (1844–1913), wild-animal collector and dealer, was born at Hamburg In 1848 his father purchased some seals and a Polar bear brought to Hamburg by a whaler, and subsequently acquired other wild animals. Carl was given the whole collection in 1865, and extended the business so that in 1873 he had to erect large buildings. In 1875 he began to exhibit animals representative of many countries throughout all the large cities of Europe. The educational value of these exhibitions was recognized by the French government, which in 1891 awarded him the diploma of the Academy He died at Hamburg on April 14, 1913. Hagenbeck's Zoo at Stellingen, near Hamburg, is renowned for its planning which, like that of Yellowstone National Park (*q.v.*), enables spectators to observe the animals apparently in their natural surroundings and at liberty.

HAGERSTOWN, a city of Maryland, U.S.A., 72m. W N.W. of Baltimore, near Antietam creek; the county seat of Washington county. It is on Federal highways 11 and 40, and is served by the Baltimore and Ohio, the Norfolk and Western, the Pennsylvania, and the Western Maryland railways, and by inter-urban trolleys and motor-coach lines. The population was 28,064 in 1920 (93% native white) and was estimated locally at 36,500 in 1928 It is an active business centre for the rich agricultural environs, and has substantial manufacturing industries, with an output in 1925 valued at $17,542,327. Among the leading manufactures are pipe organs, paper, flour, sash, doors, spokes, furniture, silk and knitted goods, shoes, chemicals and automobiles Hagerstown was laid out in 1761 by Capt Jonathan Hager who had received a patent to 200ac. from Lord Baltimore in 1739; it was incorporated in 1791. It was an important station on the old National (or Cumberland) road.

HAGERUP, GEORG FRANCIS (1853–1921), Norwegian statesman and jurist, was born at Horten on Jan. 22, 1853. Educated at Oslo, Munich, Leipzig and Paris, he began to lecture on law at Oslo in 1879. Hagerup, who belonged to the party of the Right, was minister of justice (1893–95) in Stang's cabinet, and headed the coalition ministry of 1895–98 At this time the question of separate consular representation for Norway was acute, but a joint Swedish-Norwegian committee reached no result. Hagerup was again premier in 1903–05, and himself went to Stockholm to seek a settlement of outstanding questions He failed and resigned office in March Subsequently Hagerup was minister at Copenhagen. He wrote some important works on Scandinavian law, and *Ret og Kultur i det nittende Aarhunderte* (1919). In 1903 he became a member of The Hague court of arbitration He died on Feb. 8, 1921.

HAG-FISH, BORER or **GLUTINOUS HAG** (*Myxine*), one of the *Cyclostomata* (*q.v.*). It is elongated in shape and feeds on fish, eating its way into them and devouring everything but the skin, skeleton, and nervous system. It is found in the temperate seas, and is especially abundant on the east coast of Scotland and the coast of California, where it causes considerable damage to the fisheries. It secretes a glutinous substance in large quantities. (*See* FISH.)

HAGGĀDAH ("narrative"), or 'AGĀDA, and HALĀKHAH ("conduct") are two varieties of Midrash (*q.v.*). The former constitutes the poetical element and the latter the legal, though the two often are closely connected. The theory of H. P. CHAJES (*Markus-Studien,* 1899, p. 11) that Mark i. 22 ("He taught in parables and not as the Scribes," reading פְּסִילָא for מְשִׁיחָא) implies that Jesus reintroduced Haggādah, hitherto almost unknown, as an antithesis to the Halākhah of the Scribes, is controverted by I. Abrahams (*Studies in Pharisaism,* i. p. 94). Haggādah may be traced back to the Old Testament parables and has always been popular. The Talmud abounds in Haggādah and the Haggādic passages were extracted repeatedly, finally by Jacob b Solomon ibn Habib, whose *'Eyn Ya'aqobh* has had many editions. The present Halākhah is mostly of Pharisaic authority. To regard it as nothing but hair-splitting casuistry is incorrect: many enactments are ordinary juridical requirements, common to most systems of Law. Others, especially those generally cited as quibbles, are mere exercises of logic, of purely academic interest. That there are as well far-fetched decisions in this as in every other code is true, but these are not disproportionately numerous Very often the Pharisees who followed the spirit had to find scriptural authority for legislation opposed by the conservative Sadducees, who kept to the letter of the Scriptures: often a primitive custom so modified needed biblical support. The change of the *lex talionis* into covenanted compensation is an instance It is not the legislation that is far-fetched but the scriptural peg from which the legislation hung. After the completion of the Talmud the Halākhah was soon codified; just as the Haggādah was extracted, so in a parallel manner, was the Halākhah Examples are Simon Kayyara's *Halakhoth Gedoloth* (9th century), the code of Isaac al-Fasi (1013–1103), the *Strong Hand* of Moses Maimonides (published in 1180), the *'Arba' Turim* of Jacob ben Asher (1283–1340), the *Semag* of Moses v Jakob of Coucy (*c.* 1235) and the *Shulhan 'Arūkh* of Joseph Caro (1488–1545).

See relevant articles in *Jew. Enc.,* and I. Abrahams, *Short Hist. Jew. Lit.* (1906).

HAGGAI, the tenth in order of the "minor prophets," whose writings are preserved in the Old Testament. The book contains four short prophecies delivered between September and December of the second year of Darius, that is, Darius Hystaspis (521–485 B.C.). The language of the prophet in ii. 3 has suggested that he was so old as to have seen the Temple of Solomon which had been destroyed in 586 B.C This would agree with the shortness of the period covered by his book, and with the fact that his contemporary Zechariah, who began to prophesy in the same autumn, afterwards appears as the leading prophet in Jerusalem (Zech. vii 1–4).

In his first prophecy (i. 1–11) Haggai addresses Zerubbabel and Joshua, rebuking the people for leaving the temple unbuilt. The prevalent famine and distress are due to Yahweh's indignation: let them build the house and Yahweh will take pleasure in it and acknowledge the honour paid to Him The people thereupon began to work at the temple, strengthened by the prophet's assurance that the Lord was with them (i 12–15). In a second prophecy (ii. 1–9) delivered in the following month, Haggai forbids the people to be disheartened by the apparent meanness of the new temple. The silver and gold are the Lord's. He will soon shake all nations and their choicest gifts will be brought to adorn His house. Its glory shall be greater than that of the former temple, and in this place He will give peace A third prophecy (ii 10–19) contains a promise, enforced by a figure drawn from the priestly ritual, that God will remove famine and bless the land from the day of the foundation of the temple onwards. Finally, in ii. 20–23, Zerubbabel is assured of God's special love and protection in the impending catastrophe of kingdoms and nations to which the prophet had formerly pointed as preceding the glorification of God's house on Zion.

The characteristic features of the book are three (1) The importance assigned to the personality of Zerubbabel, who, though a living contemporary, is marked out as the Messiah The hopes fixed on Zerubbabel, the chosen of the Lord, dear to Him as His signet ring (*cf.* Jer. xxii. 24), indicate the importance of the house of David But in the book of Zechariah Zerubbabel is falling into the background, and the kingship is yielding to the priesthood After the foundation of the temple Zerubbabel disappears from history and lives only in legend, which continued to busy itself with his story, as we see from the apocryphal book of Esdras. (2) An almost sacramental significance is attached to the temple. Haggai argues that material prosperity was conditioned by zeal in worship: the prevalent suffering was an indication of divine anger. While the temple lay waste, the people and all their works and offerings were unclean (ii. 14). In this Haggai stands in contrast to those prophets who warn their hearers

against attaching intrinsic importance to the temple (*e.g.*, Isa. lxvi. 1), and he betrays his affinity with Ezekiel, who taught that it was by the possession of the sanctuary and priesthood that Israel was sanctified (Ezek. xxxvii 28). Finally (3) what is the cause of the indifference of the Jews to the desolate condition of their sanctuary? Neither Haggai nor his contemporary Zechariah mentions or implies any return of exiles from Babylon, and the view is accordingly held that the return under Cyrus described in Ezra i–iv. is unhistorical, and that the community addressed by Haggai consisted, in the main, of the Judaeans that had been left in Jerusalem and its neighbourhood after the majority had gone into exile or fled to Egypt (Jer. xliii.) (*See* JEWS.)

From the prophecies of Haggai and Zechariah it would never be supposed that some 50,000 Jews had returned when Cyrus became king of Babylon and showed high favour to the exiles (Ezra i.) Even if their enthusiasm had melted away under the stress of bad seasons, the enmity of jealous neighbours, and other troubles, the contrast which Zechariah draws between Yahweh's past wrath and his imminent intervention on behalf of his people, points to the approach of new conditions. And in fact the Jews everywhere were not likely to have been unmoved by the revolts which broke out in the Persian empire at the accession of Darius. Haggai accordingly sees a shaking of the nations which seemed destined to spread; and with the characteristic tendency of Hebrew prophecy to estimate history only in its bearing upon the destiny of Yahweh's people, he looks for an age when Yahweh's enemies would be overthrown, there would be peace, Yahweh's temple would be enriched by willing nations, and Zerubbabel would occupy the highest place of honour. (*See* JEWS.)

BIBLIOGRAPHY.- Haggai is usually treated along with Zechariah or with the rest of the minor prophets *see* the bibliographies to these.

(W. R. S.; S. A. C.)

HAGGARD, SIR HENRY RIDER (1856–1925), English novelist, was born at Bradenham Hall, Norfolk. At the time of the first annexation of the Transvaal (1877), he was on the staff of the special commissioner, Sir Theophilus Shepstone, and then became a master of the High Court there. After the cession of the Transvaal to the Dutch he returned to England and read for the bar. He gained a great popular success with the novels *Dawn* (1884); *The Witch's Head* (1885), which contains an account of the British defeat at Isandhlwana; *King Solomon's Mines* (1886), suggested by the Zimbabwe ruins; and *She* (1887), another fantastic African story. The scene of *Jess* (1887) and of *Allan Quatermain* (1888) was also laid in Africa. A long list of other stories followed. Haggard showed great interest in rural and agricultural questions, being a practical gardener and farmer on his estate in Norfolk. He dealt with land questions in *Rural England* (2 vols., 1902); the report of an inquiry into colonial land settlement, in *The Poor and the Land* (1905), with suggestions for a scheme of national land settlement in Great Britain itself; and in *Rural Denmark and its Lessons* (1911). Haggard was knighted in 1912. He died in London on May 14, 1925.

HAGGIS. A dish consisting of a calf's, sheep's or other animal's heart, liver and lungs, and also sometimes of the smaller intestines, boiled in the stomach of the animal with seasoning of pepper, salt, onions, etc., chopped fine with suet and oatmeal. It is considered peculiarly a Scottish dish, but was common in England till the 18th century. The derivation of the word is obscure.

HAGIOLOGY, that branch of the historical sciences which is concerned with the lives of the saints (Gr. ἅγιος, saint, λόγος, discourse). If hagiology be considered merely in the sense in which the term has come to be understood in the later stages of its development, *i.e.*, the critical study of hagiographic remains, there would be no such science before the 17th century. But the bases of hagiology may fairly be said to have been laid at the time when hagiographic documents, hitherto dispersed, were first brought together into collections. The oldest collection of this kind, the συναγωγὴ τῶν ἀρχαίων μαρτυρίων of Eusebius, to which the author refers in several passages in his writings (*Hist. Eccl.*, v. proem 2; v. 20, 5), and which has left more than one trace in Christian literature, is unfortunately lost in its entirety. The *Martyrs of Palestine*, as also the writings of Theodoret, Palladius and others, on the origins of the monastic life, and, similarly, the *Dialogues* of St. Gregory (Pope Gregory I.), belong to the category of sources rather than to that of hagiologic collections. The *In gloria martyrum* and *In gloria confessorum* of Gregory of Tours are valuable for the sources used in their compilation. The most important collections are those which comprise the Acts of the Martyrs and the lives of saints, arranged in the order of the calendar. In the Greek Church these are called menologies (from Gr. μήν, month, λόγος, discourse), and their existence can be traced back with certainty to the 9th century (Theodore of Studium, *Epist.* i. 2). One of them, the menology of Metaphrastes, compiled in the second half of the 10th century, enjoyed a universal vogue (*see* SYMEON METAPHRASTES). The corresponding works in the Western Church are the *passionaries* or *legendaries*, varieties of which are dispersed in libraries and have not been studied collectively. They generally draw from a common source, the Roman legendary, and the lives of the local saints, *i.e.*, those specially honoured in a church, a province or a country.

Development in 16th Century.—Hagiology entered on a new development with the publication of the *Sanctorum priscorum patrum vitae* (Venice and Rome, 1551–1560) of Aloysius Lipomanus (Lippomano), bishop of Verona. As a result of the co-operation of humanist scholars a great number of Greek hagiographic texts became for the first time accessible to the West in a Latin translation. The Carthusian, Laurentius Surius, carried on the work of Lippomano, completed it, and arranged the materials strictly in the order of the calendar (*De probatis sanctorum historus*, Cologne, 1570–1575). What prevents the work of Surius from being regarded as an improvement upon Lippomano's is that Surius thought it necessary to retouch the style of those documents which appeared to him badly written, without troubling himself about the consequent loss of their documentary value.

The actual founder of hagiologic criticism was the Flemish Jesuit, Heribert Rosweyde (d. 1629), who, besides his important works on the martyrologies (*see* MARTYROLOGY), published the celebrated collection of the *Vitae patrum* (Antwerp, 1615), a veritable masterpiece for the time at which it appeared. It was he, too, who conceived the plan of a great collection of lives of saints, compiled from the manuscripts and augmented with notes, from which resulted the collection of the *Acta sanctorum* (*see* BOLLANDISTS). This last enterprise gave rise to others of a similar character but less extensive in scope.

Present Status.—To realize the present state of hagiology, the *Bibliotheca hagiographica*, both Latin and Greek, published by the Bollandists, and the *Bulletin hagiographique*, which appears in each number of the *Analecta Bollandiana* (*see* BOLLANDISTS), must be consulted. Thanks to the combined efforts of a great number of scholars, the classification of the hagiographic texts has in recent years made notable progress. The criticism of the sources, the study of literary styles, and the knowledge of local history now render it easier to discriminate in this literature between what is really historical and what is merely the invention of the genius of the people or of the imagination of pious writers (*see* H. Delehaye, *Les Légendes hagiographiques*, 2nd ed., pp. 121–141, Brussels, 1906 and art. "Hagiography" in the *Catholic Encyclopaedia*). "Though the lives of saints," says a recent historian, "are filled with miracles and incredible stories, they form a rich mine of information concerning the life and customs of the people. Some of them are 'memorials of the best men of the time written by the best scholars of the time.'" (C. Gross, *The Sources of Literature of English History*, p. 34, 1900.)

HAGIOSCOPE, in architecture, any opening, usually oblique, through the side or front walls of a church chancel to enable the congregation in transepts, chapels or other portions of the church, from which the altar would not otherwise be visible, to witness the elevation of the host during mass. Similar openings are sometimes furnished to allow an attendant to ring the sanctus bell at the proper time, or to permit someone in a vestry vision of the service so that he can notify the bell ringer. Hagioscopes or squints (*q.v.*) are more common in England than on the continent of Europe.

HAGONOY, a municipality (with 15 *barrios* or districts) of the province of Bulacan, Luzon, Philippine Islands, near Manila bay on the west branch of the delta of Pampanga river, about 25 m. N.W. of Manila. It was founded in 1581. Pop. (1918) 22,490. It is in the midst of a rich agricultural region, producing corn, sugar and a little coffee. Alcohol is made in considerable quantities from the fermented juice of the *nipa* palm, which grows in the neighbouring swamps; the leaves are used to make nipa thatch. Fishing is one of the chief industries. The women are famous for their skill in weaving native fabrics. Hat making, tanning and furniture making are among the other industries. In 1918, it had 5 manufacturing establishments and 100 household industry establishments with outputs valued at 803,900 and 41,600 pesos respectively. Of the 16 schools, 10 were public. The language spoken is Tagalog.

HAGUE, THE (in Dutch, *'s Gravenhage,* or, abbreviated, *den Haag;* in Fr. *La Haye;* and in Late Lat. *Haga Comitis*), the chief town of the province of South Holland, about 2½ m. from the sea. It lies on the main railway line from Rotterdam to Leiden and has tramways connecting it with Scheveningen and the Hook of Holland. It is situated on a branch of the main canal from Rotterdam to Amsterdam. Pop. (1926), 408,634.

The history of The Hague is in some respects singular. In the 13th century it was no more than a hunting-lodge of the counts of Holland, but Count Floris V. made it his residence and it thus became the seat of the supreme court of justice of Holland and the centre of the administration, and from the time of William of Orange onward the meeting-place of the states-general. It did not receive the status of a town, however, until early in the 19th century.

The Hague is the chief town of the province, the usual residence of the court and diplomatic bodies and the seat of the Government, the states-general, the high council of the Netherlands, the council of State and the chamber of accounts. It has grown very largely in modern times, especially on the west, where it stands higher, on more sandy soil, the south-eastern half of the town comprising the poorer and the business quarters.

The mediaeval-looking group of Government buildings situated in the Binnenhof (or "inner court") represent both historically and topographically the centre of The Hague. Close by lies the entrance to the Haagsche Bosch, or the wood, on one side of which is situated the deer-park, and a little beyond on the other the zoological gardens (1862). In the Noordeinde is situated the royal palace, which was purchased by the States in 1595, rebuilt by the stadtholder William III., and extended by King William I. in the beginning of the 19th century. In front of the building is a statue of William I. of Orange. The Binnenhof was once surrounded by a moat, and is still entered through ancient gateways. The oldest portion was founded in 1249 by William II., count of Holland, whose son, Floris V., enlarged it and made it his residence. The old hall of the knights, now containing the archives of the home office, is the historic chamber in which the States of the Netherlands abjured their allegiance to Philip II of Spain, and in front of which Johan van Oldenbarneveldt was executed in 1619. Close by on the one side are the courts of justice, and on the other the first and second chambers of the states-general. In the adjoining Buitenhof, or "outer court," is the old Gevangen Poort, or prison gate (restored 1875), consisting of a tower and gateway. Here Cornelis and Jan de Witt were killed by the mob in 1672.

The Mauritshuis was built in 1633–44 by Count John Maurice of Nassau, governor of Brazil, and contains the famous picture gallery of The Hague. Other artistic collections in The Hague are the municipal museum (*Gemsente* museum), the museum Meermanno-Westreenianum, containing some interesting mss. and specimens of early typography, and the Mesdag museum. The royal library (1798) contains some early illuminated mss., a valuable collection of coins, medals and antique gems. The Groote Kerk of St. James (15th and 16th centuries) has some old stained glass, a carved wooden pulpit (1550) and some escutcheons of the Knights of the Golden Fleece, placed here after the chapter of 1456. The Nieuwe Kerk, or new church (first half 17th century), contains the tombs of the brothers De Witt and of the philosopher Spinoza. Spinoza is further commemorated by a monument in front of the house in which he died in 1677. The town hall (built in 1565 and restored and enlarged in 1882) contains an historical picture gallery. The other principal buildings are the provincial Government offices and the ethnographical institute of the Netherlands Indies with a fine library. The chief industries of the town are iron casting, copper and lead smelting, cannon founding, the manufacture of furniture and carriages, liqueur distilling, lithographing and printing.

The Hague wood is composed chiefly of oaks and alders and beech-trees. Together with the Haarlem wood it is thought to be a remnant of the forest which once extended along the coast. In the wood is the royal villa called the Huis ten Bosch, or "house in the wood." This villa was built in the middle of the 17th century, and wings were added to it by Prince William IV. in 1748. The chief room is the richly decorated Orange Saloon, in which the International Peace Conference had its sittings in the summer of 1899. The collections in the Chinese and Japanese rooms, and the grisailles in the dining-room painted by Jacobus de Wit (1695–1754), are also noteworthy.

In the latter part of the 17th and the first half of the 18th century The Hague was the centre of European diplomacy. Among the many treaties and conventions signed here may be mentioned the treaty of the Triple Alliance (Jan. 23, 1688) between England, Sweden and the Netherlands; the concert of The Hague (March 31, 1710) between the emperor, England and Holland, for the maintenance of the neutrality of the Swedish provinces in Germany during the war of the northern Powers against Sweden; the Triple Alliance (Jan. 4, 1717) between France, England and Holland for the guarantee of the Treaty of Utrecht; the treaty of peace (Feb. 17, 1717) between Spain, Savoy and Austria, by which the first-named acceded to the principles of the Triple Alliance; the treaty of peace between Holland and France (May 16, 1795); the first "Hague Convention," the outcome of the "peace conference" assembled on the initiative of the emperor Nicholas II. of Russia (July 27, 1899), and the series of conventions, the results of the second peace conference (June 15–Oct. 18, 1907).

In 1899 the International Court of Arbitration or Hague Tribunal was established and in 1913 its seat, the Palace of Peace, was dedicated. In 1910 the arbitration tribunal of the North Atlantic fisheries sat here. A committee of the Council of the League of Nations met at The Hague in 1920 to frame a scheme for a permanent court of international justice. This court was created by an international agreement concluded at Geneva late in the same year and it has its seat at The Hague

HAGUE CONFERENCES, the two international conferences held at The Hague in 1899 and 1907, and known as Peace Conferences. Both were organized at the instance of the emperor Nicholas II. of Russia. The chief object of the first conference, as set out in the note of Count Mouraviev, the Russian minister of foreign affairs (Jan. 11, 1899), was to arrive at an "understanding not to increase for a fixed period the present effectives of the armed military and naval forces, and at the same time not to increase the budgets pertaining thereto; and a preliminary examination of the means by which even a reduction might be effected in future in the forces and budgets above mentioned." The conference, which was attended by representatives of 26 states, sat from the 18th of May to the 29th of July, 1899.

When the subject of excessive armaments came up for discussion, the objections of the German military delegate led to its abandonment. Three momentous conventions were adopted, I. for the pacific settlement of international disputes; II. in relation to the laws and customs of war by land; III. for the adaptation to maritime warfare of the principles of the Geneva Convention (*q.v.*) of the 22nd of August, 1864.

Three declarations on the following matters were also adopted: *a.* Prohibition of the launching of projectiles and explosives from balloons or by other similar new methods. *b.* Prohibition of the use of projectiles the only object of which is the diffusion of asphyxiating or deleterious gases *c.* Prohibition of the use of

bullets which expand or flatten easily in the human body, such as bullets with a hard envelope, of which the envelope does not entirely cover the core, or is pierced with incisions.

Great Britain signed and became a party to the three Conventions. Other resolutions having for their object the promotion of international peace and the humane conduct of war were also passed.

The Conference of 1907, which was attended by representatives of 44 States, sat from June 15 to Oct. 18. In spite of the resolution and *voeu* on armaments handed down from the Conference of 1899 this subject was waived, but still more important conventions than in 1899 were adopted on other matters. These were in reference to the following questions: I. the pacific settlement of international disputes; II. the limitation of the employment of force for the recovery of contract debts; III. the commencement of hostilities; IV. the laws and customs of war on land; V. the rights and duties of neutral powers and persons in war on land; VI. the status of enemy merchant-ships at the outbreak of hostilities; VII. the conversion of merchant-ships into war-ships; VIII. the laying of automatic submarine contact mines; IX. bombardment by naval forces in time of war; X the adaptation of the principles of the Geneva Convention to maritime war; XI. restrictions on the exercise of the right of capture in maritime war; XII the establishment of an international prize court; XIII the rights and duties of neutral powers in maritime war; XIV. declaration prohibiting discharge of projectiles, etc., from balloons.

A draft Convention relative to the creation of a judicial arbitration court was also drawn up in connection with the first of the four following *voeux:*—

1. The Conference calls the attention of the signatory powers to the advisability of adopting the annexed draft convention for the creation of a judicial arbitration court, and of bringing it into force as soon as an agreement has been reached respecting the selection of the judges and the constitution of the court.

2. The Conference expresses the opinion that, in case of war, the responsible authorities, civil as well as military, should make it their special duty to ensure and safeguard the maintenance of pacific relations, more especially of the commercial and industrial relations between the inhabitants of the belligerent states and neutral countries.

3. The Conference expresses the opinion that the powers should regulate, by special treaties, the position, as regards military charges, of foreigners residing within their territories.

4. The Conference expresses the opinion that the preparation of regulations relative to the laws and customs of naval war should figure in the programme of the next conference; and that in any case the powers may apply, as far as possible, to war by sea the principles of the Convention relative to the laws and customs of war on land (*See* LONDON, CONFERENCES OF; BLOCKADE; CONTRABAND; INTERNATIONAL LAW.)

HAGUENAU, a town of France, and capital of an arrondissement in the department of Bas-Rhin, in the middle of the Haguenau Forest, on the Moder, and on the railway from Strassburg to Weissenburg, 10 m. N N.E. of the former city. Pop. (1926) 13,503. Haguenau owes its origin to the erection of a hunting lodge by the dukes of Swabia (12th cent.). The emperor Frederick I. surrounded it with walls and gave it town rights in 1154 On the site of the hunting lodge he founded an imperial palace, in which were preserved the jewelled imperial crown, sceptre, imperial globe, and sword of Charlemagne. Subsequently it became the seat of the *Landvogt* of Haguenau, the imperial *advocatus* in Lower Alsace. Richard of Cornwall, king of the Romans, made it an imperial city in 1257. In 1648 it came into the possession of France, and in 1673 Louis XIV. razed the fortifications. In 1675 it was captured by imperial troops, but in 1677 it was retaken by the French and nearly all destroyed by fire. From 1871–1918 it belonged to Germany and in 1918 it became French once more. It has two ancient churches, that of St. George built by Emperor Conrad in 1137, and one built in the 13th century. The principal industries are wool and cotton spinning, and the manufacture of porcelain, earthenware, boots, soap, casks, sparkling wines and beer. There is also considerable trade in hops, vegetables and cattle. Haguenau is the seat of a subprefect.

HAHN, AUGUST (1792–1863), German divine, was born on March 27, 1792, near Eisleben, and studied at Leipzig. In 1819 he was nominated *professor extraordinarius* of theology and pastor of Altstadt in Königsberg, and in 1820 received a superintendency in that city. In 1822 he became *professor ordinarius* and in 1826 removed as professor of theology to Leipzig. There he published two treatises: *De rationalismi qui dicitur vera indole et qua cum naturalismo contineatur ratione* (1827), and also of an *Offene Erklärung an die Evangelische Kirche zunächst in Sachsen u. Preussen* (1827), in which he sought to convince the rationalists that it was their duty voluntarily and at once to withdraw from the national church. In 1833 Friedrich Wilhelm III. summoned him to Breslau as theological professor and consistorial councillor, and in 1843 he became "general superintendent" of the province of Silesia, where he reintroduced the Augsburg Confession. He died at Breslau on May 13, 1863 His *Lehrbuch des christlichen Glaubens* (1828, 2nd. [amended] ed. 1857) explains his position. Among his other works the most important is *Bibliothek der Symbole und Glaubens regeln* (1842; 3rd ed 1897).

HAHNEMANN, SAMUEL CHRISTIAN FRIEDRICH (1755–1843), German physician and founder of "homoeopathy," was born at Meissen, Saxony, on April 10, 1755. He studied medicine at Leipzig and Vienna and settled in Leipzig in 1789. In the following year, while translating W. Cullen's *Materia medica* into German, he was struck by the fact that the symptoms produced by quinine on the healthy body were similar to those of the disordered states it was used to cure. This observation led him to assert the truth of the "law of similars," *similia similibus curantur* or *curentur—i.e.*, diseases are cured (or should be treated) by those drugs which produce symptoms similar to them in the healthy. He promulgated his new principle in a paper published in 1796 in C. W. Hufeland's *Journal,* and four years later, convinced that drugs in much smaller doses than were generally employed effectually exerted their curative powers, he advanced his doctrine of their potentization or dynamization. His chief work, *Organon der rationellen Heilkunde* (1810), contains an exposition of his system, which he called homoeopathy (*q.v.*). His *Reine Arzneimittellehre* (six vols., 1811) detailed the symptoms produced by "proving" a large number of drugs; *i.e.*, by systematically administering them to healthy subjects. In 1821 the hostility of established interests, and especially of the apothecaries, forced him to leave Leipzig, and at the invitation of the grand duke of Anhalt-Cöthen he went to live at Cöthen. Fourteen years later he removed to Paris, where he practised until his death on July 2, 1843. Statues were erected to his memory at Leipzig in 1851 and at Cöthen in 1855. His other works are: *Fragmenta de viribus medicamentorum positivis* (1805) and *Die chronischen Krankheiten* (1828–30).

See the article HOMOEOPATHY; also Albrecht, *Hahnemann's Leben und Werken* (Leipzig, 1875); Bradford, *Hahnemann's Life and Letters* (Philadelphia, 1895).

HAHN-HAHN, IDA, COUNTESS VON (1805–1880), German author, was born at Tressow, Mecklenburg-Schwerin, on June 22, 1805, daughter of count Karl Friedrich von Hahn (1782–1857). She married in 1826 her wealthy cousin count Adolf von Hahn-Hahn. The marriage was unhappy, and in 1829 she procured a divorce. The countess travelled, produced some volumes of poetry indicating true lyrical feeling, and in 1838 appeared as a novelist with *Aus der Gesellschaft,* a title given to a whole series of her novels, the book originally so entitled being renamed *Ida Schönholm.* The countess's patrician affectations at length drew upon her the merciless ridicule of Fanny Lewald in a parody of her style entitled *Diogena, Roman von Iduna H . . . H . . .* (2nd ed., 1847), and after the revolution of 1848 she retired to a convent. *Ulrich* and *Gräfin Faustine* (1841) are her best works. She died at Mainz on Jan. 12, 1880.

See her *Gesammelte Werke* (Regensburg, 45 vols., 1903–04) with an introduction by O. von Schaching. *See* also A. Jacoby, *Ida Gräfin Hahn-Hahn* (Mainz, 1894).

HAI (939–1038), Jewish Talmudical scholar, was born in 939. He was educated by his father Sherira, gaon of Pombeditha (Pumbedita), whom he succeeded in this office in 998. He died on March 28, 1038. Hai is famous chiefly for his answers to problems of ritual and civil law, in which he stresses custom and tradition, provided no infringement of the law were involved, and was essentially conservative in theology. He also composed treatises on Talmudic law, commentaries on the Mishnah, a dictionary of difficult terms in the Bible, Targum and Talmud and possibly a few of the poems which have since been attributed to him. He was well versed in Plato and Aristotle and in Arabic literature.

See Steinschneider, *Hebr. Übersetz.* and article in *Jewish Encyclopedia.*

HAIBAK, a town and khanate in Afghan Turkistan famed in Persian legend. The valley of Haibak, which is 3,100 ft. above sea level, is fertile and richly cultivated The inhabitants call themselves Jagatais, a Turki race, though now generally mixed with Tajiks and speaking Persian. In the neighbourhood of Haibak are some very typical Buddhist ruins. Haibak derives its importance from its position on the main line of communication between Kabul and Afghan Turkestan.

HAIDA, the natives of Queen Charlotte islands, B.C. The Kaigani are an 18th century offshoot on Prince of Wales island With the Tlingit and Tsimshian, the Haida constitute the Indians that have carried the peculiar native culture of the North Pacific coast (*q.v.*) to its highest pitch. Their speech, usually considered distinct, has been linked with Tlingit (*q v.*) and Athabascan (*q.v.*) into a proposed larger Na-Dene family. In 1841, after decline had begun, the population was estimated at 8,300; in 1880, 2,000–2,800; in 1905, 900, and in 1925, 600–700.

HAIDER, KARL (1846–1912), German landscape painter, was born in 1846. He studied at Munich under Anschutz and was a contemporary and friend of Leibe, who painted his portrait in a picture called "The Art Critics" in 1868. Although he lived and worked in the midst of genre painters, Haider turned to landscape and became a great linear stylist. He settled beside the Schliersee, at the foot of the Alps, and the lake inspired much of his best work. His remarkable smoothness of line lent austerity to his pictures, which usually convey an impression of intense stillness

HAIDINGER, WILHELM KARL, RITTER VON (1795–1871), Austrian mineralogist, geologist and physicist, was born at Vienna on Feb. 5, 1795. His father, Karl Haidinger, contributed largely to the development of mineralogical science in the latter half of the 18th century. He studied under Mohs at Graz and Freiberg, spent some years in Edinburgh, and made a tour of northern Europe. He then became scientific director of his brothers' porcelain works, and then succeeded Mohs at Vienna as counsellor of mines. His lectures on mineralogy were printed as *Handbuch der bestimmenden Mineralogie* (1845; tables, 1846) He was director of the imperial geological institute for 17 years, and held many other appointments. In physics he was the discoverer of the interesting optical appearances which have been called after him "Haidinger's brushes." He died at Dornbach near Vienna on March 19, 1871.

Haidinger wrote many other works on mineralogy. Some of his papers will be found in the *Transactions* of the Royal Society of Edinburgh (vol. x) and of the Wernerian Society (1822–23), *Edinburgh Phil. Journal, Brewster's Journal of Science,* and *Poggendorff's Annalen.*

HAIDRA, the ancient Ammadaera, a village on the frontier between Tunisia and Algeria, 20m. S.W. of Kalaa Djerda, the terminus of the railway from Tunis, and the loading point for the phosphates from the quarries of that name. The ruins of Ammadaera, where a colony of veterans was established at the end of the 1st century, are here. There is a fine triumphal arch, constructed in honour of Septimius Severus, another smaller arch and a mausoleum. There is an imposing citadel of the Byzantine period and two or three churches.

HAIDUK, a term probably derived from the Turkish *haidūd,* "marauder." The Haiduks of Serbia and Bulgaria were political outlaws and guerrilla champions of liberty; and the national movement in these countries was first led by bands of Haiduks. In Hungary the name was applied to a class of mercenary foot-soldiers of Magyar stock. In 1605 these Haiduks were rewarded for their fidelity to the Protestant Party (*see* HUNGARY. *History*) with titles of nobility and territorial rights over a district situated on the left bank of the river Theiss, known thenceforward as the Haiduk region. This was enlarged in 1876 and converted into the county of Hajdú. In Austria-Hungary, Germany, Poland, Sweden and some other countries, *Hauduk* came to mean an attendant in court of law, or a male servant, dressed in Hungarian semi-military costume. It is also occasionally used as a synonym for "footman" or "lackey."

HAIFA, a city of Palestine at the foot of Mt. Carmel and south of the Bay of Acre, anc Sycaminum. Haifa's place in history is but small. It was completely overshadowed by Acre. The modern town lies east of the old. With a roadstead free from reefs and a good anchorage for ships, it promises to become the chief seaport of Palestine. The building of a harbour with depth for the greatest vessels is mooted. It is the principal harbour of export for Hauran wheat and the products of Trans-Jordania, and has railway connection with both Damascus and Egypt. Even now (1928) it has a greater import trade than Jaffa. The population (mainly Arabic speaking) is about 35,000 and includes a flourishing German colony. Haifa has a large flour mill and cement and soap factories. Archaeologically it has little of interest to offer. (E. Ro.)

HAIG, DOUGLAS HAIG, 1ST EARL (1861–1928), British soldier, was born in Edinburgh, June 19, 1861, son of John Haig, of Cameronbridge, Fife. He was educated at Clifton and Brasenose college, Oxford, and in 1885 joined the 7th Hussars. He was promoted captain in 1891, afterwards passed through the staff college and was employed with the Egyptian army in 1898 during the Nile campaign, for which he was given a brevet majority. On the outbreak of hostilities in South Africa in 1899, he went out to Natal on the staff, and was present during the opening engagements near Ladysmith. He was afterwards chief staff officer of the cavalry division during Lord Roberts' victorious advance from Cape Colony through the Orange Free State into the Transvaal, and was promoted brevet lieutenant-colonel for his services.

In the later phases of the struggle he was in command of a column and later was controlling groups of columns; at the close of the war he was appointed A.D.C. to the King, promoted brevet-colonel, and given the C.B. Col Haig subsequently commanded the 17th Lancers for a year, after which he went out to India as inspector-general of cavalry; this appointment he held until 1906, having been promoted major-general in 1905, in which year he married the Hon. Dorothy Vivian, daughter of the 3rd Lord Vivian. From 1906–09 he was a director in the War Office, and during this time he was intimately concerned in the development of the general staff and the improvements effected in the organization of the army, which were set on foot while Lord Haldane was secretary of State. In 1907 he published a volume of *Cavalry Studies.* His next appointment was that of chief of the general staff in India, which he held for three years, being promoted lieutenant-general in 1910. In 1912 he was brought home to take the command in Aldershot, and in 1913 he was made a K.C.B.

On the mobilization of the Expeditionary Force in 1914, Sir Douglas Haig took the field as commander of the I. Army Corps, which he led during the Mons, Marne and Aisne operations, and the first battle of Ypres; he was promoted full general in November for his services. On the division of the British Expeditionary Force into two armies at the beginning of 1915, he was placed at the head of the first. On the front of his army during 1915 there took place the battles of Neuve Chapelle, Festubert and Loos, and at the end of the year he succeeded Sir John French in the chief command. He had been made a G.C.B. in the autumn.

At this time the armies were passing through a period of transition. The regular army, with the exception of its cavalry, had almost ceased to exist and the first need was to weld its remnants, the new armies created by Lord Kitchener and the Territorial Army, into a whole capable of combined action both in attack and in defence. This involved the organization of an elaborate system of training for which it was necessary that a certain

number of divisions should be placed sufficiently far behind the line to allow them the ground and the opportunities for gaining experience.

This policy often brought Sir Douglas Haig into discussion both with the French generals and with the French statesmen, who were continually pressing him to take over a large extent of front. Sir Douglas Haig pointed out that it was not possible to compare a national army created during the course of the war with one which had been long established in time of peace, and that the Germans throughout the war maintained a greater density of men opposite the British lines than they did elsewhere. In the event, his policy was justified by the fact that in the latter half of 1918 the British army was, as a whole, at least as efficient as any which was then fighting in the war.

The campaigns and battles of the British army in France and Belgium are dealt with elsewhere and it is here only necessary to refer to the principles which guided Sir Douglas Haig in certain of the crises of the war The first of these during his command arose out of the German attack on Verdun during the first half of 1916. On that occasion he assisted the French by relieving their troops in the front and by preparing for the battle of the Somme While that battle disclosed defects both of preparation and of execution, its results convinced Sir Douglas Haig that it had caused such exhaustion of the German armies as should be exploited at the earliest possible moment He therefore agreed with Joffre to renew the battle early in 1917.

But the battle of the Somme had caused grievous losses and the gains of ground as shown on the maps appeared trifling Therefore, neither French nor British statesmen were prepared to agree to a policy which to their minds seemed likely to exhaust their resources before it caused the enemy to yield The consequence of this was the replacement of Joffre by Nivelle and the assembly of an Allied Conference at Calais at the end of Feb 1917, at which it was decided to give Nivelle the general direction of the British army, while he was at the same time to be in active command of the French army. This arrangement, militarily unsound, early produced friction For Nivelle, who was ill-informed of events on the British front, issued to Haig instructions which were inappropriate both as to form and substance. These differences were adjusted at a further conference in London, but they created the impression that Haig was opposed to any form of unity of command, which was not true.

The direct result of the failure of Nivelle's campaign was a wave of depression which spread through the French armies and resulted in serious mutinies. Pétain, who had succeeded Nivelle, appealed to Haig to keep the Germans occupied while he was restoring the morale of the French troops. To this appeal Haig responded by opening in the summer of 1917 a campaign in Flanders, which began with Plumer's victory at Messine and was followed by the battle of Passchendaele. It was only with difficulty that Haig won the consent of the British Government to this campaign. By the middle of October of that year Pétain was able to tell Haig that the French army was sufficiently restored to be able to look after itself; and it might have been wiser to have stopped the battle of Passchendaele then, as no adequate return was gained for the exhaustion caused by the prolongation of the attack in execrable weather.

The crisis brought about by the success of the German-Austrian attack on the Italians at Caporetto following on the collapse of Russia, resulted in the creation in Nov. 1917 of the Supreme War Council, the first meeting of which was held at the end of the following January. This meeting had been preceded by a renewal of French demands for an extension of the British front, which Haig eventually met by agreeing to take over a portion of the line at and south of Peronne with his V. Army. At this meeting a difference of policy between Haig and his Government was disclosed The commander-in-chief anticipated an early attack by the Germans and asked for reinforcements; the Prime Minister wished for an offensive campaign in Palestine, and won his way; and at this same conference, it was decided to create an Allied general reserve on the Western front under the control of the military representatives of the Supreme War Council with Foch as chairman. During Feb. 1918 Haig became more than ever convinced that a great German attack on his front was imminent, in which he differed from the military representatives, who did not expect it before May. When the military representatives applied to him for divisions for the general reserve, he answered that in view of the lack of reinforcements, the extension of his front and the massing of German troops, he would be unable to furnish these divisions, and the formation of the general reserve broke down.

With what calm determination Haig met the great German offensive of the spring of 1918 is described elsewhere. In the most critical days of that offensive it was Haig's direct intervention with the British Government which brought Lord Milner to France, a visit which resulted eventually in giving Foch direct control of the Allied armies. With Foch Haig's relations were as harmonious as they had been with Joffre, and in the late summer of 1918 the British commander-in-chief reaped at last the reward of his patient policy. When in Aug. 1918 Rawlinson's IV. Army won the victory of Amiens, Foch desired that Rawlinson should follow up his success. Haig, convinced that this would result in another deadlock, and confident now in the superior morale and efficiency of his army, persuaded Foch to agree to an extension of the battle northwards, and so came about the breaking of the Hindenburg line which made it clear that victory could be won in 1918.

For his great services Sir Douglas Haig was raised to the peerage as Earl Haig and Baron Haig of Bemersyde and was given a grant of £100,000. The Order of Merit was also conferred upon him, and the ancestral home of the Haigs at Bemersyde was purchased by national subscription and presented to him. On returning home he was for a short time commander-in-chief in Great Britain, but when that position was abolished he refused other offers of employment and devoted himself wholly to the welfare of ex-service men. Before leaving France he had learned that many disabled and discharged soldiers were in distress, and he refused to accept any reward for himself until the Government had made better provision for the men who had served under him Being satisfied that official provision must be supplemented by private benevolence he succeeded in uniting the various organizations of ex-service men into the British Legion (*q.v.*) of which he became president By organizing the sale of poppies on November 11th, which became known as "Poppy Day," he created a large fund for the benefit of ex-service men. He also created and became president of the British Empire Services League, a union of the ex-service men's organizations of Great Britain and the dominions; he was also appointed chairman of the United Services fund, which, together with the British Legion fund, forms one of the largest benevolent organizations in Great Britain. He died on Jan. 29, 1928, and was buried at Dryburgh Abbey, Scotland, after national tributes to his memory had been paid at Westminster Abbey and St. Giles's cathedral, Edinburgh.

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HAIK, a piece of cloth, usually of coarse hand-woven wool, worn by Arabs, Moors and other Mohammedan peoples (Arabic *hak*, to weave). It is generally 6 to 6½ yd. long, and about 2 yd. broad. It is either striped or plain, and is worn equally by both sexes, usually as an outer covering, but it is often the only garment of the poorer classes. Women arrange the "haik" to cover the head and, in the presence of men, hold it so as to conceal the face. A thin "haik" of silk, like a veil, is used by brides at their marriage.

HAIL is frozen raindrops, though hailstones are frequently much larger than any single raindrop which could be formed by any means Rising convection currents, consequent on some local

instability of the atmosphere, result first in a heavy cloud—usually cumulo-nimbus in type—and then in raindrops which are carried upwards and freeze in the cooling air; during descent the hailstone receives another coating of water which may be frozen during a subsequent ascent in another part of the storm. This results in a concentric structure, but two or more stones may be cemented together until they assume large properties and may reach 3 or 4 in. in diameter and a pound or more in weight; such masses of ice are capable of inflicting considerable damage. "Soft hail," Ger. *graupel*, Fr *grésil*, consists of pellets of closely agglomerated ice crystals, and is a form of snow (*q.v.*). Soft hail breaks with a splash on impact with a hard substance, and therein differs from true hail; it also occurs with winter or spring storms as compared with the more usual summer thunderstorm with which hail is associated.

HAILES, DAVID DALRYMPLE, LORD (1726–1792), Scottish lawyer and historian, was born at Edinburgh, the son of Sir James Dalrymple, auditor-general of the exchequer of Scotland. He was educated at Eton, and studied law at Utrecht, being intended for the Scottish bar, to which he was admitted shortly after his return to Scotland in 1748. In 1766 he was elevated to the bench, when he assumed the title of Lord Hailes. Ten years later he was appointed a lord of justiciary. Lord Hailes's most important contribution to literature was the *Annals of Scotland* (2 vols. 1776–79).

HAILSHAM, DOUGLAS McGAREL HOGG, 1ST BARON cr. 1928 (1872–), British lawyer and politician, was born on Feb. 28, 1872, the son of Quintin Hogg, founder of the Polytechnic, London. On leaving Eton Hogg spent eight years with his father's firm of West India merchants. After serving in the South African War (1899–1902), he was called to the bar (1902), and forthwith took a leading position as a junior. He became K.C. in 1917. His deadly power of cross-examination, easy mastery of facts and figures and persuasive speech made him formidable in every kind of case. In 1922, on entering parliament as Conservative member for Marylebone, he became attorney general in Bonar Law's government, receiving the usual knighthood given to a law officer. In opposition, or in office he showed himself a powerful debater; his vigorous speech on the Campbell prosecution (*see* ENGLISH HISTORY) had not a little to do with the defeat of MacDonald's Government. When the Conservatives returned to power in 1924, Hogg was re-appointed attorney general, with a seat in the cabinet, and in March 1928 he succeeded Lord Cave as lord chancellor.

HAILSHAM, a market-town of Sussex, England, 54 m. S.S.E. from London by the Southern Railway. Pop. (1921) 4,907. The church of St. Mary is Perpendicular. The Augustinian priory of Michelham, 2 m. W. by the Cuckmere river, is altered into a dwelling house, but retains a gate-house, crypt and other portions of Early English date. There was also a Premonstratensian house at Otham, 3 m. south. Hailsham has a considerable agricultural trade, and manufactures of bricks and pottery are carried on.

HAINAN (or Kiung-chow-fu), a large Chinese island separated from the Luichow peninsula of Kwangtung province by the shallow straits of Hainan, about 15 miles broad. It is the most southerly part of China (20° 8′ to 17° 52′ N. and 108° 32′ to 111° 15′ E.) and faces Tong-King (French Indo-China) across the gulf of that name. Its geology and build show it to belong physically to the mainland. The length of the island along its main N.E.–S.W. axis is 160 miles, its average width about 90 miles and its total area about 1,300 square miles. It is essentially rugged and mountainous with a central range (Wu-Chi-Shan) rising to a height of from 5–6,000 feet. On the north-west, north and eastern sides occur narrow coastal plains of which that facing the Strait of Hainan is the most important. Situated well to the south of the Tropic of Cancer and receiving a high rainfall, Hainan has a luxuriant tropical vegetation and the mountains are densely forested. The central mountain chain acts to some extent as a climatic divide, the coast plain to the north experiencing a relatively cool winter monsoon, while the southern districts are uniformly warm.

Hainan first came under Chinese control during the Early Han Dynasty, Lu-Po-Teh, one of Wu-Ti's generals, occupying the island in 111 B.C. Its connection with the Empire was, however, rather nominal until the Yuan Dynasty (A.D. 1275–1368) when it was incorporated with the immediate mainland in a new satrapy Hai-peh Hai-nan Tao (Circuit north and south of the sea). Hence the popular designation of the island, meaning the district south of the sea. Since the administrative re-organisation of China under the Ming Dynasty (1368–1644) Hainan has been attached to the province of Kwangtung. Although there were a considerable number of Chinese immigrants, the island remained relatively undeveloped until comparatively recent times. It was used as a penal settlement and was a favourite place of escape for refugees. In 1858 by the Treaty of Tientsin, Kiung-chow the chief port was opened to foreign trade, but it was only about 1876 that full use was made of the permission. Since then piracy has been brought under control and a fairly active trade developed.

The population of Hainan is estimated at about 3,000,000. It is composite in character, reflecting the relationship of the island to China and Indo-China. (*a*) The aborigines, known as the Sheng-li (barbarians) seem to be closely related to the Laos and kindred peoples of Siam and Indo-China. They are mostly fishers and hunters, living in the interior valleys. (*b*) The Shu-li (civilized savages) are of mixed descent, but are largely descendants of refugees from the mainland, especially Hakka and Miaotze peoples. (*c*) The Chinese are the most recent immigrants but are now the most numerous element (about 2,000,000). They are found principally in the northern and north-western plains. Alike in the composition of its population and in the distribution of its constituent elements Hainan shows a rather striking correspondence to Formosa.

The economic resources of Hainan are considerable and are still in a relatively early stage of development.

The strictly agricultural areas are mainly confined to the marginal plains, particularly the northern. Here rice is the staple product and is exported to South China via Hongkong. Upon rice most of the island credit is based. A new and important development is the introduction of the plantation system for both rubber and sugar production. Hainan is one of the few districts in China where strictly equatorial products of the type cultivated in Malaya find suitable climatic conditions. The first rubber trees for the new plantations were introduced from Singapore in 1915 and the product is now marketed in that port, with which Hainan has an increasing trade. In marked contrast to the mainland of South China, cattle and horses are very numerous in Hainan, the breed of cattle being apparently a cross between the small yellow cow of China and the "zebu" of Indo-China. Animals and animal products, such as bullocks, pigs and hides are among the most important exports.

Apart from agriculture and animal rearing, Hainan has great potential resources in the dense forests of the highlands. It is known to be particularly rich in valuable tropical woods such as mahogany, rosewood, red and white cedar and hard woods suitable for sleepers. Various species of Indo-Malayan type are found in Hainan alone in all China. The coco-nut palm is cultivated with success and the highly prized nuts of the *areca catechu* (pinlang) are reputed to be the best on the market. But the greater part of the forest wealth is at present quite inaccessible and will so remain until transport facilities are greatly increased.

The bulk of the trade of Hainan passes through Kiung-chow, the capital, situated in the Ta-Kiang basin in the centre of the Northern Plain and linked by a macadam road with its outport, an open roadstead, Hoi-hou. This lies on the important steamer route linking up Hongkong and the South China ports with those of the Gulf of Tong-King. Linkao and Tanchow further west are important centres for the sugar plantations. There are few towns of any size in the south, Yaichow in the centre of the chief district for cattle and hides being the most important.

HAINAUT, a province of Belgium, based on the ancient county of Hainaut. There are about 110,000 men and women employed in the coal and iron mines, and about 10,000 in iron and steel works. The chief towns are Mons, the capital, Charleroi, Tournai, Soignies and Thuin. The rivers are the Scheldt

and Sambre, and canals include one from Mons to Condé (joining the French Scheldt), one through Pommeroeul and one through Ath to Flanders, one (enlarged) from Charleroi to Brussels There are 34 cantons and 344 communes. Area 930,405 acres or 1,453 sq mls. Pop. (1925), 1,258,358 or 866 per square mile.

Under the successors of Clovis, Hainaut formed part, first of the kingdom of Metz, and then of that of Lotharingia. It afterwards became part of the duchy of Lorraine. The first to bear the title of count of Hainaut was Reginar "Long-Neck" (*c.* 875), who made himself master of the duchy of Lorraine and died in 916. His eldest son inherited Lower Lorraine, the younger, Reginar II., the countship of Hainaut, which remained in the male line of his descendants, all named Reginar, until the death of Reginar V. in 1036 His heiress, Richildis, married *en secondes noces* Baldwin VI of Flanders, and, by him, became the ancestress of the Baldwin (VI of Hainaut) who in 1204 was raised by the Crusaders to the empire of Constantinople. The emperor Baldwin's elder daughter Jeanne brought the countship of Hainaut to her husbands Ferdinand of Portugal (d 1233) and Thomas of Savoy (d. 1259). On her death in 1244, however, it passed to her sister Margaret, on whose death in 1279 it was inherited by her grandson, John of Avesnes, count of Holland (d. 1304) The countship of Hainaut remained united with that of Holland during the 14th and 15th centuries. It was under the counts William I. "the Good" (1304–37), whose daughter Philippa married Edward III. of England, and William II. (1337–45) that the communes of Hainaut attained great political importance. Margaret, who succeeded her brother William II in 1345, by her marriage with the emperor Louis IV brought Hainaut with the rest of her dominions to the house of Wittelsbach Finally, early in the 15th century, the countess Jacqueline was dispossessed by Philip the Good of Burgundy, and Hainaut henceforward shared the fate of the rest of the Netherlands

HAINBURG, a small town in Lower Austria, on the right bank of the Danube, a short distance above its confluence with the Morava. This is a significant site, commanding the passage of the Danube through the Porta Hungarica, between the Little Carpathians and the Leitha mountains, with a record of continuous settlement since pre-Roman time Numerous Roman remains exist in and near the town and a Roman aqueduct still conveys its water supply, while history supplies ample evidence of the strategic value of the site in a record of struggle between the west and invaders from the east, Magyars and Turks, both of whom held the town at different times Much of its old importance has been lost to Bratislava and to-day Hainburg is chiefly important for its large manufacture of tobacco and the attraction of its antiquities. Pop. (1923) 7,500

HAINICHEN, a town of Germany, in the republic of Saxony, on the Kleine Striegis, 15 m. N E of Chemnitz, on the railway to Rosswein. Pop. (1925) 7,809 Its chief manufacture is flannels, baize, and similar fabrics The special whiteness and excellence of the flannel made in Hainichen are due to the peculiar nature of the water used in the manufacture. There are also large dye-works and bleaching establishments.

HAINISCH, MICHAEL (1858–), Austrian statesman, was born on Aug. 15, 1858, at Aue, near Gloggnitz, Lower Austria, the son of a manufacturer, and of Marianne Hainisch, a pioneer of women's rights. After a short career in the Austrian public service, he devoted himself to the study of social and agricultural questions. As a practising farmer, he was a recognized authority on agriculture; while the interest which he took in the problems of the industrial labourer was shown by his joining with Engelbert Pernerstorfer to found the *Gesellschaft der Fabier* on the model of the British Fabian Society. Hainisch, who was particularly active in the cause of popular education, founded and endowed many hundreds of popular libraries. His works include: *Die Zukunft der deutschen Oesterreicher* (1892); *Voraussetzungen und Berechtigung des Sozialismus* (1919); *Die Landflucht* (Jena, 1923). Hainisch was elected first president of the Austrian republic in Dec. 1920 and re-elected unanimously for a further period of four years in Dec. 1924, leaving office in 1928.

HAI-PHONG, a seaport of Tongking, French Indo-China, on the Cua-Cam, a branch of the Song-koi (Red river) delta. Pop. 74,000. It is situated about 20 m. from the Gulf of Tongking and 58 m E by S. of Hanoi, with which it communicates by river and canal and by railway. It is the second commercial port of French Indo-China, is a naval station, and has government and private ship-building yards. The harbour is equipped with modern appliances and docks; there is a typhoon observatory at Phutien; it is accessible at all times to vessels drawing 19 to 20 ft., but is obstructed by a bar. It is the headquarters of the river steamboat service (*Messageries fluviales*) of Tongking, which plies as far as Lao-kay on the Song-koi, to the other chief towns of Tongking and northern Annam, and also to Hong-kong. There are cotton-spinning, soap, oil and cement factories.

HAIR, a word common to Teutonic languages; the general term for the characteristic outgrowth of the epidermis forming the coat of mammals. The word is also applied by analogy to the filamentous outgrowths from the body of insects, etc., plants, and metaphorically to anything of like appearance.

For anatomy, etc., of animal hair *see* SKIN and EXOSKELETON; FIBRES and allied articles; FUR; LEATHER.

Anthropology.—The human hair has an important place among the physical criteria of race. While its general structure and quantity vary comparatively little, its length in individuals and relatively in the two sexes, its form, its colour, its general consistency, and the appearance under the microscope of its transverse section show persistent differences, which give it its ethnological importance. The hair grows uniformly over the head in all races. The structure of the hair is threefold.—

(1) Short and crisp, generally termed "woolly"; elliptical or kidney-shaped in section, with no distinguishable medulla or pith. Its colour is almost always jet black, and it is characteristic of all the black races except the Australians and aborigines of India. This type of hair has two varieties. When the hairs are relatively long and the spiral of the curls large, the head has the appearance of being completely covered, as with some of the Melanesian races and most of the negroes. This type is called *ulotrichous* or "woolly." Among the Hottentots and Bushmen the hair grows in very short curls with narrow spirals and forms little tufts separated by spaces which appear bare. The head looks as if it were dotted over with pepper-seed, and thus this hair has gained the name of "peppercorn-growth" Most negroes have this type of hair in childhood and, even when fully grown, signs of it around the temples The space between each tuft is not bald, as was at one time generally assumed.

(2) Straight, lank, long and coarse, round or nearly so in section, with the medulla or pith easily distinguishable, and almost without exception black. This is the hair of the yellow races, the Chinese, Mongols and Indians of the Americas This is designated *leiotrichous* or *lissotrichous.*

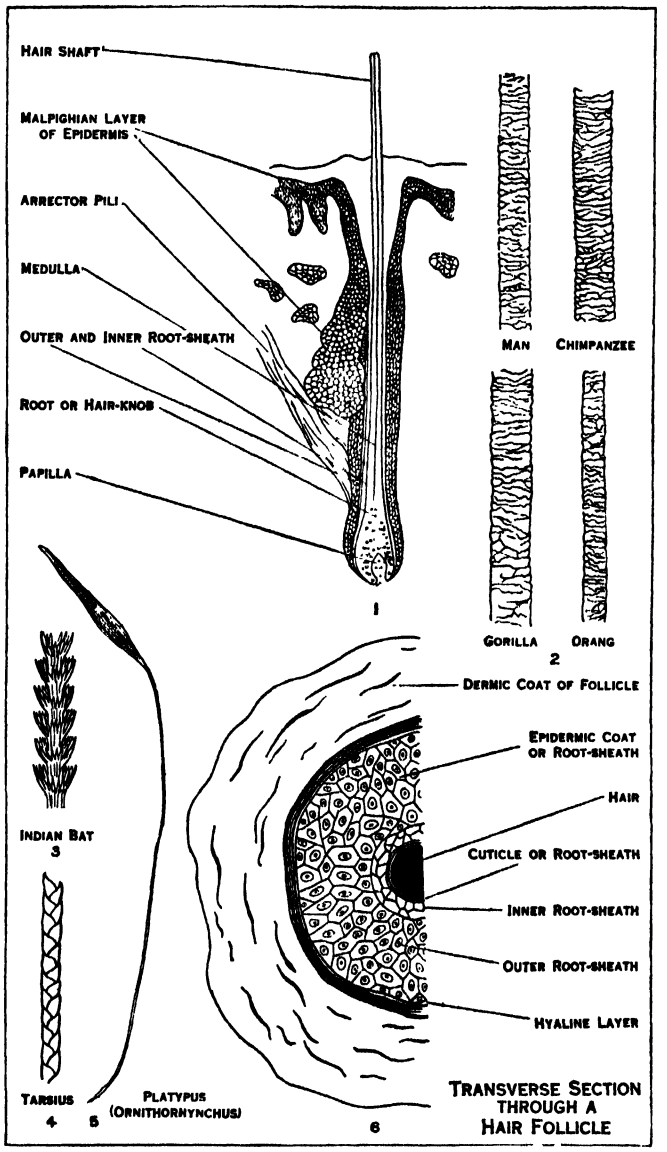
(3) Wavy and curly, or smooth and silky, oval in section, with medullary tube but no pith. This is the hair of Europeans, and is mainly fair, with black, brown, red, or towy varieties. This is termed *cymotrichous.*

There is a fourth type of hair describable as "frizzy." It is easily distinguishable from the Asiatic and European types, but not from the negroid wool. It is always thick and black, and is characteristic of the Australians, Nubians, and certain of the Mulattos. Generally hair curls in proportion to its flatness. The rounder it is the stiffer and lanker. These extremes are respectively represented by the Papuans and the Japanese. The woolly type is found to be the most persistent.

Wavy types of hair vary most in colour: almost the deepest hue of black being found side by side with the most flaxen and towy. Colour varies less in the lank type and scarcely at all in the woolly. The only important exception to the uniform blackness of the negroid wool is to be found among the African pygmies, whose hair is described as "of a dark, rusty brown hue." Fair hair in all its shades is frequent among the population of northern Europe, but much rarer in the south.

The percentage of brown hair is 75% among Spaniards, 39 among French, and 16 only in Scandinavia. Among the straight-

haired races fair hair is far rarer; it is, however, found among the western Finns. Among those races with frizzy hair red is almost as common as among those with wavy hair. Red hair,



1. AFTER BIESIADECKI IN QUAIN'S ANATOMY BY SCHAFER, (ENGELMANN); 3 FROM CARPENTER, "THE MICROSCOPE AND ITS REVELATIONS," (J. & A CHURCHILL), 5. GRIFFITH AND HENFREY, "MICROGRAPHIC DICTIONARY," (GURNEY & JACKSON)

1. HAIR-FOLLICLE IN LONGITUDINAL SECTION (DIAGRAMMATIC). 2–5. MAMMALIAN HAIRS (DIAGRAMMATIC) SHOWING VARIATION OF THE CUTICULAR SCALES. 6. TRANSVERSE SECTION THROUGH HAIR FOLLICLE (DIAGRAMMATIC)

however, is an individual anomaly associated ordinarily with freckles. There are no red-haired races.

A certain correlation appears to exist between the nature of hair and its absolute or relative length in the two sexes. Thus straight hair is the longest (Chinese, Red Indians), while woolly is shortest. Wavy hair holds an intermediate position. In the two extremes the difference of length in man and woman is scarcely noticeable. In some lank-haired races, men's tresses are as long as women's, as in the Chinese pigtail, and the hair of Redskins which grows to the length sometimes upwards of 9 ft. In the frizzy-haired peoples, men and women have equally short growths. It is only in the wavy, and now and again in the frizzy types, that the difference in the sexes is marked. The growth of hair on the body corresponds in general with that on the head. The hairiest races are the Australians and Tasmanians. The least hairy peoples are the yellow races, the men often scarcely having rudimentary beards, *e.g.* Indians of America and the Mongols. Negroid peoples may be said to be intermediate but usually incline to hairlessness. The wavy-haired populations hold also an intermediate position, but somewhat inclined to hairiness. Among negroes especially no rule can be formulated. Bare types such as the Bushmen and western negroes are found contiguous to hairy types such as the inhabitants of Ashanti. Neither is there any rule as to baldness. The *lanugo* or downy hairs, with which the human foetus is covered for some time before birth and which is mostly shed in the womb, and the minute hairs which cover nearly every part of the adult human body, may be regarded as rudimentary remains of a complete hairy covering in the ancestors of mankind. Perhaps the primary divisions of mankind were distinguished by hair the same in texture and colour as that which characterizes to-day the great ethnical groups. The wavy type bridges the gulf between the lank and woolly types. No test has proved, on repeated examination, to be a safer one of racial purity than the hair, and Pruner-Bey goes so far as to suggest that "a single hair presenting the average form characteristic of the race might serve to define it." At any rate a hair of an individual bears the stamp of his origin.

See Dr. Pruner-Bey in *Mémoires de la société d'anthropologie*, ii.; P. A. Brown, *Classification of Mankind by the Hair;* P. Topinard, *L'Homme dans la nature*, chap. vi. (1891); A. C. Haddon, *Races of Man* (1924). (X.)

IN MAMMALS

Characteristically, Mammalian hairs are developed in relatively deep pits in the skin, the hair-follicles, which extend downwards into the thickness of the corium, or even into the subcutaneous tissue. In man the hair-rudiments begin to appear about the third or fourth month of foetal life as small solid downgrowths from the Malpighian layer of the epidermis, their growth being completed about the fifth or sixth month, when they constitute the very delicate hairy covering, the *lanugo*, which is entirely shed before birth. The hairs constituting this are fine, slender, faintly or not pigmented, with large cortical scales and no medulla, and possess some of the characteristics of wool. At birth the hairs of the eyelashes, eyebrows and scalp, though still soft and more or less retaining the characteristics of lanugo, already show a much more vigorous growth and may be pigmented. During the first few months of infancy this growth is shed, being replaced by the typical coarser hair of the eyebrows and head, while over the rest of the body grows the fine, short, generally unpigmented down-hair or *vellus*. Finally, at and following puberty, coarse, longer and more heavily pigmented hair (terminal hair) is developed in armpits (axilla), pubes, certain areas of the trunk and limbs, and in males on the upper lip and chin.

The amount of terminal hair varies according to race, sex and even individual, though generally more abundant in males, the greater part of the body in adult females still being covered by vellus. While there are little or no sexual differences distinguishing the auxiliary hairs, slight differences are observed in the pubic hairs, which appear rather longer and more abundant in men, and relatively coarser in women. One characteristic human trait is that most of the body hairs never develop beyond more or less rudimentary vellus, whereas in other mammals the coarser forms predominate, and, in addition, tactile hairs (sensory vibrissae) are present. The total area of really hairless skin in man is relatively small, being confined to the palms of the hands, soles of the feet, under-surface of the fingers and toes, the margin of the lips, areolae of the nipples, umbilicus and immediate vicinity of the urogenital and anal openings.

The Hair-follicle.—This structure, which is essentially a recess of the skin, is composed of two tissue elements, one, of epithelial origin, closely invests the hair-root, while the second is connective tissue. A cross-section of a hair-follicle shows that the epithelial layer consists of an outer layer of polyhedral cells forming the outer root-sheath, and an inner, horny stratum, the inner root-sheath, composed of three layers, known respectively as Henle's layer (the outermost) of horny, fibrous, oblong cells; Huxley's layer, consisting of polyhedral, nucleated cells containing pigment granules; and the cuticle of the root-sheath, composed of a layer of downwardly imbricated scales that fit over the upwardly imbricate scales of the hair proper. The connective tissue

element consists internally of a vascular layer separated from the root-sheath by a basement-membrane, the hyaline layer of the follicle, and externally has a more open texture corresponding to the deeper part of the cutis containing the larger branches of the arteries and veins A small muscle, the *arrector pili*, is attached to each hair-follicle It passes from the superficial part of the corium, on the side to which the hair slopes, obliquely downwards, to be attached near the bottom of the follicle to a projection formed by localized hypertrophy of the outer root-sheath. If this muscle is contracted, the hair becomes more erect, and the follicle is dragged upwards to cause a prominence on the general surface of the skin, producing that temporarily roughened condition popularly called "goose-skin"

Process of Growth.—The hair grows upwards from the bottom of the follicle by multiplication of the soft cells which cover the papilla and these become elongated and pigmented to form the fibrous substance of the hair-shaft, and are otherwise modified to produce the central medulla and cuticle of the hair The hair-shaft is chiefly composed of a pigmented, horny, fibrous material, which consists, really, of long, tapering, fibrillated cells that have coalesced Externally this fibrous substance is covered by a delicate layer of imbricated scales forming the cuticle In many hairs, the centre of the shaft is occupied by an axial substance, the medulla, formed of angular cells containing granules of eleidin, and frequently in addition, minute air-bubbles which give the cells a dark appearance The medullary cells tend to be grouped along the central axis of the hair as a core; continuous or interrupted in single, double or multiple columns The variations in the medulla may be summarized as: (*a*) the continuous type, which may be homogeneous, as in the chimpanzee, or nodose as in the gelada baboon; (*b*) discontinuous medullas, which in simple forms may be ovate, elongated, or flattened (in *Hylobates* it is discontinuous and elongated); (*c*) a fragmental type, as in *Semnopithecus*

Cuticular Scales.—The delicate cuticular scales are most varied in shape and size, and constitute the most important microscopical structure of the mammalian hair, for they possess definite and constant specific characters. The dominant form is an imbricate scale, like a tile of irregular shape, having its edges rounded, minutely notched or flattened. There are many varieties of the imbricate scale, each typical of its species; thus in man, chimpanzee, gorilla and orang-utan, the hairs have imbricate scales which are, however, quite distinctive in size, shape and structure of the edge (slightly oval in chimpanzee, slightly ovate and crenulate in man and gorilla, with strongly marked [crenulate] edges in orang). The second type of cuticular scale is the coronal in which each individual cuticular cell completely encircles the hair-shaft, and may have a simple, serrated or dentated edge. While the imbricate scale is typical of the higher Primates, the coronal scale in its simpler form is present in the Lemuridae and *Tarsius;* becoming in the Insectivora more specialized, with serrate or dentate edges

In some Indian bats the cuticular scales are developed as leaflet-like processes arranged in whorls at regular intervals along the hair-shaft In many deer (*Cervus*), the cortical substance is nearly indistinguishable, almost the entire hair appearing to be composed of thin-walled polygonal cells In the peccary the cortical envelope sends inwards radial prolongations, the interspaces of which are occupied by medullary substance; and this, on a larger scale, is the structure of the porcupine's "quills" One of the most remarkable mammalian hairs is that of the Australian *Ornithorhynchus*, in which the lower portion of the shaft is slender and wool-like, while the tree-end terminates as a flattened, spear-shaped, pigmented hair with broad imbricated scales. In the three-toed sloth (*Bradypus tridactylus*), a microscopic alga grows between the cuticular scales of the hairs, and would appear to be symbiotic, inasmuch that its presence, giving a curious greenish-gray hue to the coat of the sloth, helps to disguise the animal among the trees, giving it when viewed from the ground almost the appearance of a mass of moss.

Tactile Hairs.—These occur in all mammals except man, and are large stiff hairs of pre-eminently sensory character, having high specialized follicles, the root being embedded in a mass of true erectile tissue (*corpus cavernosum, corpus spongiosum pili*), and having a rich sensory nerve supply, presumably controlled by the sympathetic nervous system. These specialized hairs are few in number, their distribution being chiefly confined to the lips, cheeks and supra-orbital regions, occasionally occurring elsewhere

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CARE OF THE HAIR

The beauty of the hair is dependent largely upon its health A clean scalp, nourished by a strong circulation of pure rich blood, is essential. Any disease or subnormal physical condition which pollutes the blood stream or depletes its nutrient properties is reflected in the condition of the hair People suffering from poor circulation, or anaemia, for instance, generally have weak or lusterless hair. Obviously, hygienic living, outdoor exercise, correct diet, mental happiness, everything that contributes to physical well-being will contribute to the health and natural beauty of the hair

Massaging the Scalp.—At least once a day, devote several minutes to the massage of the scalp Plant the thumbs back of the ears and spread the fingers over the fore part of the head Then rotate the scalp under the finger tips, being sure that it is the scalp that moves and not the fingers Move the hands about and repeat the rotary movements until every area of the scalp has been stimulated Then press the palms of the hands firmly against the scalp, and lift and massage the scalp with deep pressure. A loose elastic scalp ensures freedom of circulation through the scalp tissues and about the hair roots A tight scalp breeds thin weak hair Pinching the scalp and pulling the hair (not in jerks, but with steady lifting pulls) are other means of loosening the scalp, increasing its suppleness and stimulating the flow of blood in its tissues.

Tonics, lotions, ointments or pomades are applied to the scalp by means of these massage movements. These preparations are formulated to correct or ameliorate various scalp conditions, excessive oiliness and excessive dryness being the commonest Normally, the oil glands, which are attached to the roots of the hairs, secrete a natural lubricant in sufficient quantity to keep the surface of the scalp soft and to keep the hair supple and lustrous Ill health, or local infection, may disturb the functioning of these oil glands, and excessive oiliness, or a lack of natural oil, may result For excessive oiliness, astringent lotions and tonics are used, and these should be applied directly to the scalp (with a medicine dropper, or a swab of absorbent cotton) and massaged into the scalp. For dry hair, ointments and pomades are used, which serve to supply the lack of natural lubrication in the scalp.

The hair should be brushed conscientiously for several minutes morning and night, the brush having firm and resilient bristles long enough to penetrate to the scalp. Always brush under the hair and upward, lifting the hair and the scalp to exercise it. Brush the full length of the hair to clean it and to distribute the natural oil down the length of the hair. This helps to keep the hair supple and lustrous Wipe the brush on a clean towel several times during the brushing, to remove dust and lint Brushing stimulates circulation in the scalp, and this daily brushing should leave the scalp glowing and pink, but not sore or irritated. Wash combs and brushes frequently.

Shampooing.—The hair should be shampooed as frequently as is necessary to keep the scalp clean and the hair clean and glossy. In smoky or dusty cities, of course, this is oftener than in the country Oily hair needs washing oftener than dry hair. In any case, however, the hair should be washed at least every fortnight. Absolute cleanliness is the best means of protecting and preserving the health of the hair, of preventing dandruff or other infection, and of correcting any unhealthy scalp conditions.

Arrangement of Hair.—The modern freedom of taste and

interest in the development of individual personality have given rise to an endless variety of coiffures for women. The present-day woman is encouraged by everyone to wear her hair as it becomes her, or as it expresses her individuality. The hair may be worn short or long, waved or straight, flat or fluffed. More and more, women are learning the importance of line and proportion, and the coiffure is studied as a part of the ensemble effect, its relation to the shape of the head and as a frame for the face

Hair Cutting.—Hair cutting involves no little skill, and the work of an amateur is apparent at once. Hair cutting is taught by the method of observation and practice in barbers' schools and in schools of beauty culture. The expert learns to lift the hair from the head and graduate the cutting of each lock, so as to avoid stubby ends and procure a smooth rounded appearance that follows the contour of the head Too heavy hair is thinned at the roots to make it lie flat to the head. The hairdresser who has contributed most to artistic hair cutting for women, Antoine of Paris, was formerly a sculptor, and he has given the modern woman's head that sculptured look which makes her classically beautiful. (D Co)

HAIR-TAIL (*Trichiurus*), a marine fish with a long band-like body terminating in a thread-like tail, and with strong prominent teeth in both jaws. Several species are known

HAITI (HAÏTI, HAYTI, SAN DOMINGO, SANTO DOMINGO or HISPANIOLA), an island of the Greater Antilles (*See* WEST INDIES.) It is separated from Cuba by the Windward passage, the Mona passage separates it from Porto Rico; to the north is the Atlantic ocean, south, the Caribbean sea. Haiti is wholly in the tropics 17° 39′ and 20° N. and 68° 20′ and 74° 30′ W., area 28,242 square miles. High mountains descend abruptly to the sea along much of the shore. About two-thirds of Haiti is rugged mountain, with small alluvial plains, extensive plateaux and great valleys on the remainder. The western third is the Republic of Haiti, with a negro population of 2,000,000 speaking a French *patois* The rest is the Dominican Republic (*q.v.*). The boundary, which is disputed, runs north–south at right angles to the major surface features

Geology and Physiography.—Haiti has its major geographic features in arcs. These extend north-west south-east and determine the major mountain ranges. The great mountain ranges are anticlinal arches; between them lie deep synclinal troughs, forming river valleys and interior plateaux and sometimes outlining the coastal alluvial plains Normal faulting made the broad Trois Rivières structural valley and many minor land forms

A complex group of schists, serpentines, extrusive and intrusive igneous rocks, tuffs and altered limestones, shales and conglomerates form the basal complex and are exposed along the axis of the Cordillera Central and the Haitien Massif du Nord These are primarily Cretaceous. Most of the Samana peninsula and separated areas in the south-western peninsula also have Cretaceous surface rock. Probable Palaeozoic rock is in the schistose limestones of Tortuga island, the south slopes of the Samana peninsula, certain highly metamorphosed rocks of the Cordillera Central and the float of the Leogane and North plains. The most widespread surface rocks are Eocene limestones, principally in the western third of Haiti. Late Tertiary and Quaternary sediments are common. Sedimentary rocks, largely limestones, ranging from probable Palaeozoic to recent, are about two-thirds of the surface rock Solution in the more massive limestones made characteristic land and drainage features. There are many recent complex coastal delta plains.

The tectonic event most affecting present surface features was folding and faulting at the end of Miocene and in Pliocene times, when the Cul de Sac–Enriquillo, Artibonite, San Juan and Cibao valleys and the Central plain depression and chief mountain ranges were formed or modified. Folding and mountain-making processes are evidenced by recent earthquakes, chiefly in the densely populated unconsolidated alluvial plains of the north-west peninsula.

The Cordillera Septentrional (Monti Cristi) runs parallel to the north coast of the Dominican Republic from near Monti Cristi to the Yuna The western part is low, dry and sparsely populated. North of Santiago, are elevations of probably over 4,000 feet. Here there is rainfall and production. The low mountains of the Samana peninsula are separated from the Cordillera Septentrional by a low, narrow, swampy plain. Much coffee grows on the south slopes of the peninsula, with large forests on crests and north slopes. South and parallel to these mountains is the Cibao valley, which is continuous with the North plain. In the eastern half of the valley, drained by the Yuna and tributaries, cacao, bananas and tobacco are grown and verdant savannas support many cattle Here are Santiago and other large towns and the Santiago–Samana railroad. The western part is arid, covered with cactus and mesquite. The Rio Yaqui del Norte traverses it and affords almost the only water for domestic use. The population is sparse, except on the Yaqui delta, where sugar-cane is grown by irrigation The North plain borders the Atlantic Near the frontier it is dry and largely covered with long grass savanna Westward, near Cap Haitien, there is abundant rain and much sugar-cane is grown. To the south, the Cordillera Central and Massif du Nord form the backbone of the island. This is composed of many ranges and isolated mountains. Metamorphic, igneous and sedimentary rocks are exposed. The north and east slopes are humid, with verdant forests. Some mahogany and other commercial woods are exploited. Coffee, cacao and native gardens claim much land Crests of limestone or porous basalt support short-leaf yellow pines and tall grass. The lower lee slopes are dry and unproductive. Throughout the Montagnes du Nord coffee grows virtually wild West of the Trois Rivières the Montagnes du Nordouest form a genetic continuation and reach nearly to the Mole St Nicolas Loma Tina, 10,300 ft. (South central Cordillera Central), is the highest elevation in the West Indies

Near the Ennery–Gonaives road the Mornes des Cahos swing south-eastward to the Dominican frontier near Las Cahabas. This range is less high and complex than that to the north; limestone is the chief surface rock There is much coffee west of the Artibonite river. To the east the range narrows and the low crest is rolling upland Between the Mornes des Cahos and the Massif du Nord is the 1,000 ft. inter-montaine Central plain plateau. The north-western two-thirds is a tall grass savanna It was once an important cattle area but political conditions have ruined that industry. South-east of Hinche, the chief town, the plateau is intricately dissected and the well-watered river valleys support dense agricultural populations.

The Central plain merges into the fertile and well-watered San Juan valley at the frontier South of the Morne des Cahos is the Artibonite valley. At its west or sea end is the Gulf of Gonaive and a great delta plain This, although but partly developed, contains about 100,000 ac (pop 200,000) and offers most attractive irrigation possibilities Rainfall, which is but 20 6 in at Gonaives, increases eastward to 90 in about Mirebalais. The Artibonite fluctuates greatly with very large floods. It is navigated by rafts and canoes to Mirebalais and large quantities of logwood reach the sea by it. South of the Artibonite, the Chaîne des Mateaux (Sierra de Neiba, east of the frontier) swings south-eastward from near St. Marc to Ocoa bay. St Marc coffee comes from the western section, while in the central part is much short-leaf yellow pine. Next southward is the Cul de Sac–Hoya Enriquillo This remarkable trough is filled with alluvium and contains the two great lakes, known as Étang Saumâtre (*c.* 69·5 sq m.) and Lago Enriquillo. Neither has outlets and their waters are salter than sea water. The Lago Enriquillo is drying up; its surface is 145 ft. below sea-level. The Cul de Sac is the most densely populated and productive part of the Republic of Haiti

Much sugar is produced on irrigated land The capital, Port-au-Prince, is on this plain and owes much of its importance to it. The Dominican portion is not so densely populated or productive, owing largely to aridity South of the Cordillera Central are two plains, Azua and Seibo, separated by a branch of the Cordillera Central The western or Azua plain is dry and sparsely populated, but the Seibo has water and a large sugar industry. The mountain range which forms the south-western peninsula continues as the Sierra de Bahoruco, the western part is the Massif de la Hotte (Mont la Hotte, 6,560 ft). Here coffee is an important crop and, south of Jeremie, cacao. Inland are virgin forests of mahogany

and other commercial trees. The fertile and well-watered plain Aux Cayes is south of the mountains. The central portion of the range is the Massif de la Selle (Mont la Selle, 9,186 ft.). Coffee is important and there is much pine and *lignum vitae*.

Clifed coast-lines are the usual types. Where intermittent emergence has taken place there are stair-like sea terraces; at least 20 are on the south shore of the north-west peninsula. Elsewhere the sea has cut cliffs into the mountains, or the cliffs are broken by crescent-shaped sand beaches or deep indentures. The best harbours are on this latter type of coast; but *hinterlands* are generally poor. The most important ports are near the population and production centres on the alluvial plains. Here shallows continue some distance from shore and there are many reefs and mangrove barriers.

Climate.—There is a wide climatic range due to diversity of rainfall and the north-east trades. Mole St. Nicholas is in the lee of mountains and has an average annual rainfall of but 19·25 in., while Mirebalais, at the juncture of mountain valleys, has 90·7 inches. No point has much over 100 in. and large areas are sterile without irrigation. Temperatures vary chiefly with elevation There are everywhere well-defined spring and autumn rainy seasons, and planting conforms to these. Otherwise, rain varies much with place and year. Port-au-Prince (alt. 121 ft.) and Furcy (5,050 ft.) have mean annual temperatures, respectively, of 80·96° and 66 0° F. There is a fall in temperature of 1° F to every 275 ft elevation. Thus, even at the highest elevations, temperatures are too high for frost, snow or ice Daily temperature range averages about 18° F everywhere, while the monthly range is about 9° F. The heat is not uncomfortable except on sheltered lowlands. Hurricanes are sometimes destructive but are less frequent than in the south-eastern islands.

Fauna and Flora.—There is great wealth of species and numbers among insects, while larger animal groups are lacking in both respects. The most prevalent and harmful insects are mosquitoes Cockroaches and ants are destructive. Sand flies and chigres abound in some areas Ticks and blow-flies are a detriment to stock-raising. Scorpions, centipedes and some large spiders are poisonous, but their bites are not usually fatal. Butterflies are surprisingly numerous in late summer. There are few snakes, and none of them poisonous. A number of water-fowl, such as wild ducks, geese and pelicans, occur. Among the shore birds are snipe, flamingos and egrets. Doves and pigeons, a kind of partridge and feral guinea fowl are the chief game birds, and there are white owls, large hawks, woodpeckers and kingfishers. Many fishes, oysters, lobsters and crabs are eaten

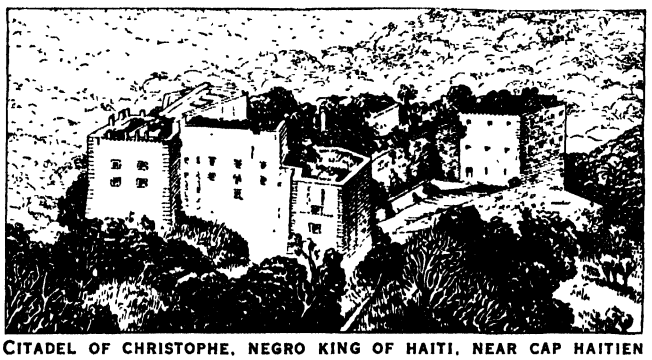
Mesophytic vegetation is largely confined to rainy slopes and stream banks. It includes royal palms, silk cotton trees, Haitian oaks, logwood or campeche, flamboyant, West Indian cedars, short leaf yellow pines, calabash, mahogany, gri-gri, *lignum vitae*, satinwood, rosewood, Brazil wood, fustic and sassafras. There are also avocados, sour and sweet sops, custard and star apples and *zapote*. Oranges, limes, grapefruit, guava, mulberry, mango and breadfruit, although exotic, grow wild, as do coffee, cacao and coco-nut trees. Guinea grass grows in cleared forests. Bamboo, tree ferns and begonias are usually found in moist slope forests. Xerophytic types are on lower leeward slopes and dry plains. Tall and short grass savannas occupy wide areas. Cactus is widespread; several very high species grow on dry plains. Smaller varieties are *Opuntias picardae*, caribea and tuna. *Lotia candelabra*, *Cerus heystrek* and various agaves and palmettos occur. The *bayahonde* (*Prosophis juliflora*), cacti and acacia (*Acacia lutea*) form thorn forests on drier plains. Among halophytic types the black, red and grey mangroves are frequent on the shores. Cacti and dwarfed thorn trees are on high alkaline coastal soils. The forests were largely depleted in colonial times and after; commercial stands are mostly limited. Logwood and *lignum vitae* are for export.

Cotton, maize, tobacco, cocoa, manioc, malanga, banana, plantain, pineapple and yams are indigenous. Sugar-cane, coffee, rice, guinea grass, citrus fruits, fig, breadfruit and others are acclimated.

The Republic.—This occupies the western third (10,200 sq m. including Gonaïve, Tortuga and the Cayemites; pop 2,000,000). The density of population in parts of the well watered plains is over 500 to the square mile; large sections elsewhere are virtually unoccupied. At least 90% of the population is pure negro and the remainder mulatto. Port-au-Prince is the capital (pop. 125,000). Cap Haitien, on the north coast, was the capital of the French colony and is now the second city (pop. 25,000). Others are Les Cayes (15,000), Gonaives (12,000), St. Marc (10,000), Jacmel (10,000), Jeremie (8,000), and Port de Paix (5,000). Although small and backward, Haiti was the earliest State governed constitutionally by negroes.

History.—Haiti was discovered by Columbus, who landed at Mole St. Nicolas on Dec. 6, 1492. The inhabitants—Indians (1,000,000 to 3,000,000)—were an agricultural and fishing people who were then suffering from Carib raids. Columbus called the island La Española (soon corrupted into Hispaniola) and settlers stayed at La Navidad (Petite Anse), near Cap Haitien. Almost all the Indians were shortly slaughtered or worked to death in quest of gold By 1512 negro slaves were imported. Sugar-cane was introduced in 1506. The Spanish soon went to the mainland, leaving Haiti deserted. About 1630 French and English buccaneers settled on Tortuga They soon came to the mainland and (Treaty of Ryswick, 1697) the part they occupied was ceded to France. The French colony of Saint Dominique, based upon slavery and irrigation, was one of the most prosperous of all tropical enterprises. Sugar, cotton, coffee and indigo were staples. Many free *mulattos* became property owners Political rights were granted them in 1789 The whites protested and fierce struggles ensued. Then England, solicited by the French planters, intervened, as did the Spanish. Toussaint L'Overture, the most notable Haitian soldier and statesman, sided with France and drove out both alien groups, becoming governor for France; but Napoleon I. soon substituted Gen Leclerc. A long struggle ensued in which the negroes, aided by fever and heat, successfully competed with the French Finally, Toussaint was captured by ruse and died in prison in France Jean Jacques Dessalines became leader and defeated Richambeau, Leclerc's successor, in Nov. 1803.

On Jan 1, 1804, independence was declared and the Indian name Haiti taken for the State. Dessalines, made governor for life, began by massacring all whites. He soon crowned himself emperor, but in 1806 was assassinated because of his tyranny. Henri Christophe then ruled in the north as King Henry I, and built the famous citadel La Ferrière which stands south of Cap Haitien. Alexandre Sabes Pétion, a most able mulatto, ruled the south. War raged until Gen. Jean Pierre Boyer got control of the south (1818) and until the death of Christophe (1820). In 1821,



CITADEL OF CHRISTOPHE, NEGRO KING OF HAITI, NEAR CAP HAITIEN
The citadel is a huge mass of masonry perched on top of the highest and most inaccessible peak in the district. Christophe reigned from 1811 to 1820

the Spanish portion of the island proclaimed its independence. Boyer invaded it and in 1822 ruled the whole island. A revolution drove him out in 1843; the Dominican Republic (*q.v.*) was founded and there have since been two nations on Haiti.

There was almost constant revolution until American intervention (1915). Irrigation projects fell into decay; production and foreign trade dwindled. Political mismanagement increased the public debt. The courts were corrupt. Education, except that carried on by French priests, practically ceased. There was little protection of property and no industrial encouragement.

Poverty and disease added to the general distress. The interior swarmed with bandits. In Dec. 1913, Oreste Zamor and Davilmar Theodore overthrew Michel Creste; Zamor became president on Feb. 8, 1914 and was displaced by Theodore on Nov. 7, 1914

Intervention by the United States.—Vilbrun Guillaume Sam assumed government on March 4, 1915, holding it against violent opposition until forced to seek refuge at the French legation on July 26, 1915. About 200 political prisoners were bayoneted in the gaol at Port-au-Prince and Sam was dragged from the legation and massacred by the mob. Two hours later U S. marines landed at Port-au-Prince, assumed occupation, disarmed the natives and restored order. U S. naval officers took over most administrative functions but the Haitian Government remained On Aug. 12, 1915, Sudre Dartiguenave was chosen president by the Haitian Congress. On Feb. 28, 1916, the U S Senate unanimously gave its advice and consent to a treaty (Nov. 11, 1916) with Haiti. It was made for ten years and provided that "the Government of the United States will, by its good offices, aid the Haitian Government in the proper and efficient development of its agricultural, mineral and commercial resources and in the establishment of the finances of Haiti on a firm and solid basis," and stated how A serious outbreak against American authority took place in July 1918, under the leadership of Charlemagne Perlate, an ex-bandit The *gendarmerie* being inadequate, the marines were compelled to act. In May 1920 peace was restored Reconstruction has since gone forward unobstructed except by certain Haitian leaders and some American public sentiment Louis Borno became president on May 15, 1922, and was re-elected on April 12, 1926 The original treaty was extended in 1925 for ten years

The chief American official, Brig.-gen John H Russell, is the high commissioner, and has the rank of ambassador. Under him are five departments financial adviser-general receiver of customs, public works, sanitary service, agricultural service and *gendarmerie*. These reduced the public debt (about $31,000,000 on Sept 1, 1915) to less than $20,000,000 in 1927. Tax and customs laws were revised and favourably affected foreign trade. The monetary unit (*gourds*), was stabilized on May 2, 1919, at U S. $0.20 Bridges, trails, harbours, public buildings, irrigation and the telephone, telegraph and lighthouse services and sanitation have been improved Agricultural information has been spread and such crops as sisal introduced

The chiefs of departments are Americans, advised by American experts, and each co-operates with the corresponding number of the Haitian cabinet.

The treaty did not provide for education, and but two schools are maintained besides the Government ones, which are very poor The church schools specialize in religious education Some of the small upper class are educated in France, but strong social stratification prohibits dissemination The Haitian courts are corrupt and the uniform enforcement of laws is impossible The per caput wealth amounts to but $60 and law and politics keep out foreign capital. Slavery under the French was of the worst type. After the revolution there was nominal democracy, but really absolute, though unstable, despotism Poverty and ignorance continue, and labour is confused with slavery. Irrigation is being revived, but the area suitable is very limited. The forests have been largely depleted and minerals are rare.

Production and Trade.—Most production is through small farmers and is consumed locally. Exports, excepting sugar, are wild or semi-wild products gathered by peasants in off seasons Coffee is the most important export (almost 75% of the total), and thus Haiti has the disadvantages of a one-crop country; national and coffee trade prosperity are almost one. The average values of the chief exports for 1916–17 to 1926–27 were: coffee, $10,801,933; cotton, $1,477,245; logwood, $813,564; sugar, $450,002; cacao, $391,192. All exports amounted to $14,916,413 Hides and skins, cotton-seeds, honey and bees-wax, *lignum vitae* and turtle shells are exported and follow cacao in the order named. France, in this period, used 48·99% of the exports, largely coffee, and the United States 29·4%, including logwood, sugar and cotton Imports (average for above period, $15,573,150) somewhat exceed exports This is partly offset by money brought by labourers from Cuba and by American marines. Food-stuffs, especially wheat flour, are 37% of the imports; textiles, largely cotton cloth, 28%. Others are building materials, mineral oils, soap and liquors Tobacco importation has recently been replaced by local production. The United States sends 82% of imports, Great Britain 6%, and France 5%. Port-au-Prince handles 21% of exports and 54% of imports. Cap Haitien, Jacmel, Les Cayes, Petit Goave, Gonaives and St. Marc each handle 5%–10% of the foreign trade. The total national revenue, 1926–27, was $7,772,306 (72% from customs). The coffee export tax ranks first, but its importance has recently declined due to a better balanced schedule Transportation is inadequate for bringing products to port. However, nearly 1,000 m of road, open for motors at least part of the year, have been opened. These are bound by an intricate network of trails to the remotest districts. There are only 65 m of national railroad This unit connects Port-au-Prince and St Marc. The Gonaives-Ennery division equipment is being partly transferred to the St Marc–Petite Rivière, now under construction The Haitian-American Sugar Company also uses some 55 m. of track (Cul de Sac and Leogane plains). Its gauge is not that of the national line. The National Bank of Haiti, a subsidiary of the National City Bank of New York, and the Royal Bank of Canada, conduct banking

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ḤĀJJĪ (Arabic, "pilgrim"), one who makes the *ḥajj* or greater pilgrimage to Mecca, from the 8th to the 10th of the twelfth month of the Muhammadan year The lesser pilgrimage, called *'umrah*, may be made to the mosque at Mecca at any time other than that of the *ḥajj* proper, and is also a meritorious act The word *ḥajj* is sometimes loosely used of any Muhammadan pilgrimage to a sacred place or shrine, and is also applied to the pilgrimages of Christians of the East to the Holy Sepulchre at Jerusalem (*see* MECCA; ISLAM).

ḤĀJJĪ KHALĪFA (Muṣṭafā ibn 'Abdallāh Kātib Chelebī Ḥājjī Khalīfa) (*c.* 1599–1658), Arabic and Turkish author, was born at Constantinople He became secretary to the commissariat department of the Turkish army in Anatolia, was with the army in Baghdad in 1625 and was present at the siege of Erzerum In 1633 he made the pilgrimage to Mecca (hence his title Ḥājjī) While serving in the commissariat department at Constantinople, he wrote in Arabic his largest work, the *Bibliographical Encyclopaedia* After five chapters dealing with the sciences generally, the titles of Arabian, Persian and Turkish books written up to his own time are arranged alphabetically Sometimes short notes on the author, his date and the introductory words of his work are given It was edited by G Flugel with Latin translation (7 vols Leipzig, 1835–58), and also at Constantinople (1893)

For his life *see* the preface to Flugel's edition; list of his works in C. Brockelmann's *Gesch. d. arabischen Literatur* (1902), vol ii

HAKE, EDWARD (*fl.* 1579), English satirist, was protected by the earl of Leicester, whose policy it was to support the Puritan party, and who no doubt found a valuable ally in so vigorous a satirist of error in clerical places as was Hake *Newes out of Paules Churchyarde, A Trappe for Syr Monye*, first appeared in 1567 and was re-issued in 1579 The book takes the form of a dialogue between Bertulph and Paul, who meet in the aisles of the cathedral, and is divided into eight "satyrs," dealing with the corruption of the higher clergy and of judges, the greed of attorneys, the tricks of physicians and apothecaries, the sumptuary laws, extravagant living, Sunday sports, the abuse of St Paul's cathedral as a meeting-place for business and conversation, usury, etc It is written in rhymed 14-syllable metre.

A bibliography of Hake's works was compiled by C. Edmonds for his edition of the *Newes* (Isham Reprints, No. 2, 1872).

HAKE, THOMAS GORDON (1809–1895), English poet, was born at Leeds. He studied medicine at St. George's hospital and at Edinburgh and Glasgow. In 1839 he published a prose epic *Vates*, republished in Ainsworth's magazine as *Valdarno*, which attracted the attention of D. G. Rossetti. In after years he became an intimate member of the Rossetti circle. In 1871 he published *Madeline*; 1872, *Parables and Tales*; 1883, *The Serpent Play*; 1890, *New Day Sonnets*; and in 1892 his *Memoirs of Eighty Years*.

HAKE (*Merluccius merluccius*), a fish of the Mediterranean and the Atlantic coast of Europe, most abundant south of the British Isles. It differs from other fishes of the cod family in skeletal characters, and is, perhaps, best placed in a separate family. It is a slender fish, with long, acute snout, large terminal mouth, and sharp teeth, and reaches a length of 4 ft.; it is a voracious fish, living in rather deep water; the flesh is soft. Other species are known from both coasts of North America, and from Chile and Patagonia, South Africa and New Zealand.

HAKING, RICHARD CYRIL BYRNE, K.C.B. (1916), K.C.M.G. (1918) (1862–), British general, who was born on Jan. 24, 1862. He entered the army in 1881, and served in Burmah (1885–7), in Ireland (1898–9) and in South Africa (1899–1901). From 1901 to 1906 he held a post in the staff college. When the World War broke out he had won the rank of brigadier-general, and in 1914 was promoted major-general in command of the 5th brigade. In 1915 he was promoted lieutenant-general and given command of the 1st division, and from 1915 to 1918 commanded the XI. corps. After the war he was appointed chief of the British section of the armistice commission at Spa, until 1919, when he went to Russia and the Baltic provinces in command of British military missions. After commanding the Allied troops in East Prussia and Danzig (1920), he was appointed (1921) high commissioner for the League of Nations in Danzig, a post which he held until 1923. He then held the command of the British troops in Egypt until his retirement in 1927. He was promoted general in 1925.

HAKKAS ("Guests," or "Strangers"), a people of S.W. China, chiefly found in Kwang-Tung, Fu-Kien and Formosa. Their origin is doubtful. They may be related to the Burmese and Siamese. According to their tradition, they were in Shantung and northern China as early as the 3rd century B.C. In disposition, appearance and customs they differ from the true Chinese. They speak a distinct dialect. Their women do not compress their feet, and move freely about in public.

HAKLUYT, RICHARD (*c.* 1553–1616), British geographer, was born in or near London about 1553. The Hakluyts were of Welsh extraction, not Dutch as has been supposed. They appear to have settled in Herefordshire as early as the 13th century. The family seat was Eaton, 2 m. S.E. of Leominster. Hugo Hakelute was returned M.P. for that borough in 1304–05. Richard went to school at Westminster, where he was a queen's scholar; while there his future bent was determined by a visit to his cousin and namesake, Richard Hakluyt of the Middle Temple. His cousin's discourse, illustrated by "certain bookes of cosmographie, an universall mappe, and the Bible," made young Hakluyt resolve to "prosecute that knowledge and kind of literature." He entered Christ Church, Oxford, in 1570, and shortly after taking his M.A. (1577), he began at Oxford the first public lectures in geography that "showed both the old imperfectly composed and the new lately reformed mappes, globes, spheares, and other instruments of this art."

Hakluyt's *Divers Voyages touching the Discoverie of America* (1582) brought him to the notice of Lord Howard of Effingham, and so to that of Sir Edward Stafford, Lord Howard's brother-in-law; accordingly at the age of thirty, being acquainted with "the chiefest captaines at sea, the greatest merchants, and the best mariners of our nation," he was selected as chaplain to Stafford, English ambassador at Paris (1583). In accordance with the instructions of Secretary Walsingham, he occupied himself chiefly in collecting information of the Spanish and French movements, and "making diligent inquirie of such things as might yield any light unto our westerne discoverie in America." The results are embodied in his *A particuler discourse concerning Westerne discoveries written in the yere 1584, by Richarde Hackluyt of Oxforde, at the requeste and direction of the righte worshipfull Mr. Walter Raghly before the comynge home of his twoo barkes.* This long-lost ms. was at last printed in 1877. Its object was to recommend the enterprise of planting the English race in the unsettled parts of North America. Hakluyt's other works consist mainly of translations and compilations. He revisited England in 1584, laid before Queen Elizabeth a copy of the *Discourse* "along with one in Latin upon Aristotle's *Politicks*," and obtained, two days before his return to Paris, the grant of the next vacant prebend at Bristol, to which he was admitted in 1586 and held with his other preferments till his death.

While in Paris Hakluyt translated the ms. journal of Laudonnière, the *Histoire notable de la Florida, as A notable historie containing foure voyages made by certayne French captaynes into Florida* (London, 1587, 4to.). *De orbe novo Petri Martyris Anglerii decades octo illustratae labore et industria Richardi Hackluyti* (Paris, 1588) contains the exceedingly rare copper-plate map dedicated to Hakluyt and signed F. G. (supposed to be Francis Gualle); it is the first on which the name of "Virginia" appears.

In 1588 Hakluyt finally returned to England, after a residence in France of nearly five years. In 1589 he published the first edition of his chief work, *The Principall Navigations, Voiages and Discoveries of the English Nation* (fol., London, 1 vol.). In the preface to this we have the announcement of the intended publication of the first terrestrial globe made in England by Molyneux. In 1598–1600 appeared the final, reconstructed and greatly enlarged edition of *The Principal Navigations, Voyages, Traffiques and Discoveries of the English Nation* (fol., 3 vols.). Some few copies contain an exceedingly rare map, the first on the Mercator projection made in England according to the true principles laid down by Edward Wright. Hakluyt's invaluable collection has been truly called the "prose epic of the modern English nation." In 1601 Hakluyt edited a translation from the Portuguese of Antonio Galvano, *The Discoveries of the World* (4to., London). In the same year his name occurs as an adviser to the East India Company, supplying them with maps, and informing them as to markets. Hakluyt received many preferments: a Suffolk rectory, the archdeaconry of Westminster, a chaplaincy at the Savoy, the prospective living of Jamestown, Virginia, and the rectory of Gedney, Lince. He was one of the chief promoters of the petition to the king for patents to colonize Virginia. He was also a leading adventurer in the London or South Virginia Company. His last publication was a translation of Fernando de Soto's discoveries in Florida, entitled *Virginia richly valued by the description of Florida her next neighbour* (1609). This work was intended to encourage the young colony of Virginia; to Hakluyt, it has been said, "England is more indebted for its American possession than to any man of that age." At the suggestion of Hakluyt, Robert Parke translated Mendoza's *History of China* (London, 1588–1589) and John Pory made his version of *Leo Africanus* (*A Geographical History of Africa*, London, 1600). Hakluyt died in 1616 (November 23) and was buried in Westminster Abbey (November 26); by an error in the abbey register his burial is recorded under the year 1626.

A number of his mss., sufficient to form a fourth volume of his collections of 1598–1600, fell into the hands of Samuel Purchas, who inserted them in an abridged form in his *Pilgrimes* (1625–26, fol.). Others are preserved at Oxford (Bib. Bod. ms. Seld. B. 8), which consist chiefly of notes gathered from contemporary authors.

Besides the mss. or editions noticed in the text (*Divers Voyages* (1582); *Particuler Discourse* (1584); Laudonnière's *Florida* (1587); Peter Martyr, *Decades* (1587); *Principal Navigations* (1589 and 1598–1600) reprinted in 8 vols. (1927); Galvano's *Discoveries* (1601); De Soto's Florida record, the *Virginia richly valued* (1609, etc.), we may notice the Hakluyt Society's London edition of the *Divers Voyages* in 1850, the edition of the *Particuler Discourse*, by Charles Deane in the *Collections of the Maine Historical Society* (Cambridge, Mass., 1870, with an introduction by Leonard Woods); also, among modern issues of the *Principal Navigations*, those of 1809 (5 vols., with much additional matter), and of 1903–05 (Glasgow, 12 vols.). The new title-

page issued for the first volume of the final edition of the *Principal Navigations*, in 1599, merely cancelled the former 1598 title with its reference to the Cadiz expedition of 1596, but from this has arisen the mistaken supposition that a new *edition* was then (1599) published. Hakluyt's *Galvano* was edited for the Hakluyt Society by Admiral C. R. D. Bethune in 1862. This Society, which was founded in 1846 for printing rare and unpublished voyages and travels, includes the Glasgow edition of the *Principal Navigations* in its *extra series*, as well as C. R. Beazley's edition of *Carpini, Rubruquis*, and other mediaeval texts from Hakluyt (Cambridge, 1903, 1 vol.). Reckoning in these and an issue of Purchas's *Pilgrimes* by the Glasgow publisher of the Hakluyt of 1903–05, the society has now published or "fathered" 150 vols. *See* also *Voyages of the Elizabethan Seamen to America, being Select Narratives from the Principal Navigations*, by E. J. Payne (Oxford, 1880; 1893; new edition by C. R. Beazley, 1907).

For Hakluyt's life the dedications of the 1589 and 1598 editions of the *Principal Navigations* should be especially consulted; also Winter Jones's introduction to the Hakluyt Society edition of the *Divers Voyages;* Fuller's *Worthies of England*, "Herefordshire", *Oxford Univ. Reg.* (Oxford Hist. Soc.), ii., iii. 39; *Historical MSS Commission, 4th report, appendix*, p. 614, the last giving us the Towneley mss. referring to payments (prizes?) awarded to Hakluyt when at Oxford, May 12th and June 4th, 1575.

HAKODATE, a town on the south of the island of Yezo, Japan, for many years regarded as the capital of the island until Sapporo was officially raised to that rank. Pop. (1925) 163,972. The town is built along the north-western base of a rocky promontory (1,157 ft. in height) which forms the eastern boundary of a spacious bay, and is united to the mainland by a narrow sandy isthmus. The summit of the rock, called the Peak, is crowned by a fort. Hakodate is one of the ports originally opened to foreign trade. The Bay of Hakodate, an inlet of Tsugaru Strait, is completely land-locked, easy of access and spacious, with deep water almost up to the shore. The Russians formerly used Hakodate as a winter port. The staple exports are beans, pulse and peas, marine products, sulphur, furs and timber; the staple imports, comestibles (especially salted fish), kerosene and oil-cake. Frequent steamers connect Hakodate and Yokohama and other ports, and there is daily communication with Aomori, 56 m. distant, whence there is rail connection with Tokyo. Hakodate was opened to American commerce in 1854.

HAKO-NIWA (box-garden or box-yard) is a kind of *bon-tei* or *bon-kei* (*qq.v.*) generally acknowledged to be a development of *hako-niwa*. It is therefore sometimes difficult to distinguish them. *Hako-niwa* is a small landscape garden in a wooden box, which nowadays is often replaced by a more durable concrete with one or two holes in the bottom for drainage, though the vessel is usually larger and deeper than that used for *bon-kei*. Planted with dwarf trees, bushes and grass, and embellished with natural stones and miniature figures, houses, towers, bridges, etc., of baked clay or bronze, it generally has a small pond for tiny goldfishes. The box-garden is usually placed outside the window or at a corner of the veranda. Unlike *bon-kei*, which is quickly made and remade according to fancy, the *hako-niwa* is meant to last longer and some require years for their completion as in the case of the real landscape garden. Though *hako-niwa*, in its varying forms, has existed in Japan for centuries, it has come to be associated more or less with the people, and has not attained the dignity enjoyed by *bon-seki, bon-sai* or *ike-bana* (*qq.v.*) and is often no more than a childish amusement. Especially since the popularity of *bon-kei*, the *hako-niwa* has declined, though it is still to be seen in shop windows, at the entrance to workshops, in factory dormitories, or in humble homes.

HAL, a town of Brabant, Belgium, about 10 m. S.W. of Brussels, situated on the river Senne and the Charleroi canal. Pop. (1925) 16,054. The church of Notre Dame, formerly dedicated to St. Martin is a good example of pure Gothic, begun in 1341 and finished in 1409. Its alabaster altar, by J. Mone, was completed in 1533. The bronze font dates from 1446. In the treasury of the church are costly gifts from illustrious persons. The church is chiefly celebrated, however, for its miraculous image of the Virgin. Legend says that during a siege the bullets fired into the town were caught in the folds of the dress. The hôtel de ville dates from 1616 and has been restored.

HALA, a town of British India in Hyderabad district, Sind. Pop. (1921) 5,757. It has long been famous for its glazed pottery and tiles, made from a fine clay obtained from the Indus, mixed with powdered flints.

HALAESA, an ancient town on the north coast of Sicily, about 14 m. E. of Cephaloedium (Cefalu), to the east of the modern Castel di Tusa, founded in 403 B.C. by Archonides, tyrant of Herbita, whose name it sometimes bore. It was the first town to surrender to the Romans in the First Punic War and was granted freedom and immunity from tithe. It became a Roman port of some importance. (T. A.)

HALAKHA: *see* HAGGĀDAH.

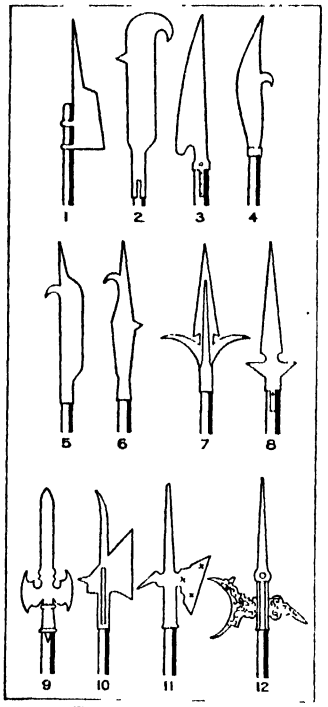
HALBERSTADT, a town in the Prussian province of Saxony, 56 m. by rail N.W. of Halle, and 29 S.W. of Magdeburg. It lies in a fertile country north of the Harz mountains, on the Holzemme, at the junction of railways to Halle, Goslar and Thale. Pop. (1925) 48,125. The history of Halberstadt begins with the transfer to it, in 820, of the see founded by Charlemagne at Seligenstadt. At the end of the 10th century it received a charter and the bishops were granted by the emperors the right to exercise temporal jurisdiction over their see, which became one of the chief ecclesiastical principalities of the Empire. In 1648 it was converted by the treaty of Westphalia into a secular principality for the elector of Brandenburg. By the treaty of Tilsit in 1807 it was annexed to the kingdom of Westphalia, but came again to Prussia on the downfall of Napoleon. The town has many old houses decorated with wood-carving still surviving. The Gothic cathedral (now Protestant), dating from the 13th and 14th centuries, is remarkable for the great height of the interior, with its slender columns and lofty, narrow aisles. The treasure, preserved in the former chapter-house, is rich in reliquaries, vestments and other objects of mediaeval church art. Among the other churches the only one of special interest is the Liebfrauenkirche (Church of Our Lady), a basilica, with four towers, in the later Romanesque style, dating from the 12th and 13th centuries and restored in 1848, containing old mural frescoes and carved figures. The other old buildings are the town hall, of the 14th century and restored in the 17th century, with a crypt, and the Petershof, formerly the episcopal palace, but now utilized as law courts and a prison. The principal manufactures of the town are sugar, cigars, paper, gloves, boots, leather and machinery. About a mile and a half distant is the Klusberge, with prehistoric cave dwellings in the sandstone rocks.

HALBERT, HALBERD or **HALBARD,** a weapon consisting of an axe-blade balanced by a pick and having an elongated pike-head at the end of the staff, which was usually about 5 or 6ft. in length. The utility of such a weapon in the wars of the later middle ages was that it gave the foot soldier the means of dealing with an armoured man on horseback. The pike could do no more than keep the horseman at a distance. This ensured security for the foot soldier but did not enable him to strike a mortal blow, for which firstly a long-handled and secondly a powerful weapon, capable of striking a heavy cleaving blow, was required. Several different forms of weapon responding to these requirements are described and illustrated below; it will be noticed that the thrusting pike is almost always combined with the cutting-bill hook or axe-head, so that the individual billman or halberdier should not be at a disadvantage if caught alone by a mounted opponent, or if his first descending blow missed its object. It will be noticed further that, concurrently with the disuse of complete armour and the development of firearms, the pike or thrusting element gradually displaces the axe or cleaving element in these weapons, till at last we arrive at the court halberts and partizans of the late 16th and early 17th centuries and the so-called "halbert" of the infantry officer and sergeant in the 18th, which can scarcely be classed even as partizans.

Figs. 1–6 represent types of these long cutting, cut and thrust weapons of the middle ages, details being omitted for the sake of clearness. The most primitive is the *voulge* (fig. 1), which is simply a heavy cleaver on a pole, with a point added. The next form, the *gisarme* or *guisarme* (fig. 2), appears in infinite variety but is always distinguished from voulges, etc., by the hook, which was used to pull down mounted men, and generally resembles the agricultural bill-hook of to-day. The *glaive* (fig. 3 is Late Ger-

man) is a broad, heavy, slightly curved sword-blade on a stave; it is often combined with the hooked gisarme as a *glaive-gisarme* (fig. 4, Burgundian, about 1480). A *gisarme-voulge* is shown in fig. 5 (Swiss, 14th century).

The weapon best known to Englishmen is the *bill,* which was originally a sort of scythe-blade, sharp on the concave side (whereas the glaive has the cutting edge on the convex side), but in its best-known form it should be called a bill-gisarme (fig. 6) The *partizans, ranseurs* and *halberts* proper developed naturally from the earlier types. The feature common to all, as has been said, is the combination of spear and axe. In the halberts the axe predominates, as the examples (fig. 10, Swiss, early 15th century; fig. 11, Swiss, middle 16th century; and fig. 12, German court halbert of the same period as fig. 11) show. In the *partizan* the pike is the more important, the axe-heads being reduced to little more than an ornamental feature. A south German specimen (fig. 9, 1615) shows how this was compensated by the broadening of the spear-head, the edges of which in such weapons were sharpened. Fig. 8, a service weapon of simple form, merely has projections on either side, and from this developed the *ranseur* (fig. 7), a partizan with a very long and narrow point, like the blade of a rapier, and with fork-like projections intended to act as "sword-breakers," instead of the atrophied axe-heads of the partizan proper.



TYPES OF HALBERT

1. Voulge; 2, gisarme or guisarme; 3, glaive; 4, glaive-gisarme; 5, gisarme-voulge; 6, bill-gisarme; 7, ranseur; 8, Service halbert; 9, German partizan, 1615; 10, Swiss, early 15th century; 11, Swiss, middle 16th century; 12, German court halbert, middle 16th century

The halbert played almost as conspicuous a part in the military history of Middle Europe during the 15th and early 16th centuries as the pike. But, even in a form distinguishable from the voulge and the glaive, it dates from the early part of the 13th century, and for many generations thereafter it was the special weapon of the Swiss. It was also in the 15th and 16th centuries that the halberts became larger, and the blades were formed in many varieties of shape, often engraved, inlaid or pierced in open work, and exquisitely finished as works of art. This weapon was in use in England from the reign of Henry VII. to the reign of George III, when it was still carried (though in shape it had certainly lost its original characteristics, and had become half partizan and half pike) by sergeants in the guards and other infantry regiments. It is still retained as the symbol of authority borne before the magistrates on public occasions in some of the burghs of Scotland. The Lochaber axe may be called a species of halbert furnished with a hook on the end of the staff at the back of the blade. The godendag (Fr. *godendart*) is the Flemish name of the halbert in its original form

HALDANE, ELIZABETH SANDERSON (1862–), English author, daughter of Robert Haldane of Cloanden, was born in 1862 and educated at home. She took up the nursing profession, and became vice-chairman of the Territorial nursing service She was also manager of Edinburgh royal infirmary for some years. She took an active part in public life, and served on the royal commission on the civil service, and on several advisory committees. She was the first woman to be made a justice of the peace in Scotland. In addition to her public work, she studied philosophy, obtained the degree of LL.D. at St. Andrews university, and wrote several books on the philosophers, as well as many articles in various periodicals Her publications include: *The Wisdom and Religion of a German Philosopher* (1897); *Life of James Ferrier* (1899); *Life of Descartes* (1905); *Descartes' Philosophical Works* (with Prof. Ross, 1912); *British Nurse in Peace and War* (1923); *George Eliot and her Times* (1927); and a translation, with Miss F. Simson, of Hegel's *History of Philosophy* (3 vols., 1892).

HALDANE, JOHN SCOTT (1860–), English scientist, was born in Edinburgh in 1860, and educated at Edinburgh academy and at the universities of Edinburgh and Jena From 1885 he was engaged on scientific investigation and teaching, and is honorary professor and director of the mining research laboratory of Birmingham university, president of the Institution of Mining Engineers, and Gifford lecturer at the University of Glasgow. He has been in charge of several Government enquiries on public health questions, and has served on several Royal commissions. His numerous publications include: *Essays in Philosophical Criticism* (1883, joint-author); *Mechanism, Life and Personality* (1913); *Organism and Environment* (1917); *The New Physiology* (1919); *Respiration* (1922); Blue-books on the causes of death in colliery explosions (1895), and on other subjects connected with mining, etc.

HALDANE, RICHARD BURDON, 1ST VISCOUNT, (1856–1928), British statesman and philosopher, born July 30, 1856, third son of Robert Haldane of Cloanden, Perthshire, a writer to the signet He was educated at Edinburgh academy and the universities of Edinburgh and Göttingen, where he studied philosophy under Lotze He took first-class honours in philosophy at Edinburgh, and was Gray scholar and Ferguson scholar in philosophy of the four Scottish universities (1876). He was called to the bar in 1879, and took silk in 1890. In 1885 he entered parliament as liberal member for Haddingtonshire, for which he was re-elected continuously up to and including 1910. He was included in 1905 in Sir H. Campbell-Bannerman's cabinet as secretary for war, and carried out the great reorganization of the British army, the value of which was only fully recognized when war came in 1914. The work was done in the face of fierce opposition from those interested in the maintenance of the existing order. By the creation of the Officers' Training Corps in 1909, the universities and schools were able to contribute in the time of need exactly the type of officer required The Militia had been replaced by a Special Reserve of real value as events showed. The Territorial Army had been created and saved the situation more than once The general staff was brought into existence by the issue of a special army order, establishing it on the footing it held during the War and after. To Lord Haldane, again, is due the decision of the Dominion Conference in 1907, accepting the principle of an imperial general staff, by which concerted action and intelligent co-operation between armies drawn from all parts of the Empire was made possible. Haldane recognized the place of science in war; to him was due the establishment of the National Physical Laboratory at Teddington, with a special committee charged with experimentation in aircraft and aerial navigation, and he also reconstructed the balloon factory at Farnborough. He economized by cutting out weak units in the army, and made it an effective fighting force. When the storm of controversy was past, he was recognized as the greatest war minister since Cardwell.

In 1910 he was appointed chairman of the royal commission on university education in London. The report (Cd. 6717) dated Dec. 1911 dealt faithfully and vigorously with the problems placed before it, though effect has not yet been given to its recommendations In March 1911 he was raised to the peerage and appointed a member of the judicial committee of the privy council and aided in raising the committee to a commanding position in the empire. His judgments, based on a philosophical reading of law, placed him personally in the great line of British jurists.

Haldane was responsible, under the cabinet, for the conversation with France which laid down the lines of British and French co-operation in case of need. Simultaneously he acted as the agent of the cabinet in seeking an understanding with Germany which would prevent the outbreak of war. In 1906 he attended the German military manoeuvres, and at that time he visited the German War Office, and studied German staff methods. On Feb. 8–12,

1912, he went on a definitely diplomatic mission to Berlin, with instructions to discuss all outstanding questions, including Morocco, the Baghdad railway and naval armaments. On his return he reported to the cabinet information he gathered there as to the attitudes and conditions of those then guiding the policy of Germany. Something resulted from the mission, but the war party in Germany prevailed. Haldane accepted the thwarting of the full result he had looked for with characteristic courage and dignified silence. In 1912 he succeeded Loreburn as lord chancellor.

Practical reasons and popular prejudice (his visits to Germany and his known preoccupation with German philosophy were used by the ignorant as a basis for a charge of pro-Germanism) account for his absence from the first Coalition Ministry in 1915, when he received the Order of Merit. He was not given the opportunity of developing in war-time the army of which he had laid the firm foundation in peace-time He was free—as free as any patriot of his nature and temperament could be in such stressful days—to return to the philosophical studies which had been interrupted by his long term of office. In 1903 he had published his *Pathway to Reality*, the Gifford lectures delivered by him at St. Andrews They were a restatement of the Hegelian doctrine in the light of modern scientific work He published in 1921 *The Reign of Relativity*, a masterly presentment of profound, scientific and metaphysical thought, and in 1922, *The Philosophy of Humanism*, an abiding memorial of the dictum *Das Geistige allein ist das Wirkliche*. Always eager to promote national education, Haldane now devoted much time and energy to the Workers' Educational Association, which owed much to his support and counsel.

Haldane was lord chancellor in the Labour Ministry of Ramsay Macdonald (1924), and working chairman of the committee of imperial defence, where his experience, tact and indefatigable industry were invaluable, and, on the fall of the Labour Ministry, Baldwin invited him to continue his long association with it. The report of the Machinery of Government committee (Cd. 9230, 1918), of which Haldane was chairman, pointed out that "Further provision is needed in the sphere of civil government for the continuous organization of knowledge and the prosecution of research in order to furnish a proper basis of policy" Accepting this declaration of principle, Baldwin established in 1925 the committee of civil research, on which Haldane served as a member. Thus, through every department of State, in education, in university life, in the army, in the law and in industry are found the effects of his master mind, of his clear vision, of his resolute adherence to first principles and of his practical philosophy. Elected first chancellor of Bristol university, he was also lord rector of Edinburgh, and received many honorary degrees His book, *Before the War*, gives an account of his political activities at that time. Haldane never married. He died at Cloan on Aug. 19, 1928.

His *Selected Addresses and Essays* appeared in 1928.

HALDANE, ROBERT (1764–1842), Scottish divine, was born in London on Feb. 28, 1764. In Dec. 1797 he joined his brother J. A. Haldane and others in the formation of the "Society for the Propagation of the Gospel at Home," in building chapels or "tabernacles" for congregations, in supporting missionaries, and in maintaining institutions for the education of young men to carry on the work of evangelization. He also initiated a plan for evangelizing Africa by bringing over native children to be trained as Christian teachers to their own countrymen. He died on Dec 12, 1842.

His treatise *On the Inspiration of Scripture* (1828), passed through many editions, and a later *Exposition of the Epistle to the Romans* (1835), was frequently reprinted, and translated into French and German. *See* Alex. Haldane, *Memoirs of R. and J. A. Haldane* (1852).

HALDEN, a town in the county of Östfold in the south of Norway. It is situated at the mouth of the river Tista near the border of Sweden. Pop. (1927), 11,160. In early times there existed a settlement called Halden on the same site. This settlement gained its charter under King Fredrik II., who called the town Fredrikshald, but in 1928 the name was changed again to Halden. During the frequent wars with Sweden it was especially exposed to Swedish attacks, and a fort, Fredriksten, was built in 1644 for the defence of the town The most important industries of Halden are in connection with the great timber production of the neighbourhood. There are many sawmills along the river, also mills for wood-pulp and paper Other industries are the manufacture of boots and shoes and textiles. In the neighbouring district there are many quarries and granite is exported. The town is connected by rail with Oslo and other towns of the county, and has both coasting and foreign trade

HALDIMAND, SIR FREDERICK (1718–1791), British general and administrator, was born at Yverdun, Neuchâtel, Switzerland, on Aug. 11, 1718, of Huguenot descent He entered the British service in 1754 and later was naturalized as a British citizen. In 1778 he succeeded Sir Guy Carleton (afterwards Lord Dorchester) as governor-general of Canada His measures against French sympathizers with the Americans have incurred extravagant strictures from French-Canadian historians, but he really showed moderation as well as energy In 1785 he returned to London. He died at his birthplace on June 5, 1791.

See a life by Jean McIlwraith in the "Makers of Canada" series (Toronto, 1904). His correspondence and Diary are preserved in the Canadian Archives.

HALE, EDWARD EVERETT (1822–1909), American author, was born in Boston April 3, 1822. He was of a distinguished family, his father being proprietor and editor of the Boston *Daily Advertiser;* his uncle, Edward Everett, the orator and statesman; and his great-uncle, Nathan Hale, the martyr spy. He graduated from Harvard in 1839; studied theology privately while teaching at the Boston Latin School; began to preach in 1842; and became pastor of the church of the Unity, Worcester (Mass.) (1846–56), and of the South Congregational (Unitarian) church, Boston, in 1856 While he was pastor emeritus of the latter church he was named in 1903 chaplain of the United States Senate. He died at Roxbury (Boston, Mass.), June 10, 1909 His forceful personality, organizing genius, and liberal practical theology, together with his deep interest in the anti-slavery movement, popular education and the working-man's home, were active for half a century in raising the tone of American life He was a voluminous contributor to newspapers and magazines, an editor of several periodicals, and the author or editor of more than sixty books—fiction, travel, sermons, biography, and history He first came into notice as a writer in 1850, when he contributed the short story "My Double and How He Undid Me" to the *Atlantic Monthly*. He afterwards published in the same periodical other tales, the best known of which was "The Man Without a Country" (1863), which did much to strengthen the Union cause, and in which, as in some of his other non-romantic tales, he employed a minute realism which has led his readers to suppose the narrative a record of fact. The story *Ten Times One Is Ten* (1870) led to the formation among young people of "Lend-a-Hand Societies" and "Harry Wadsworth Clubs" Out of the romantic story of the Waldenses, *In His Name* (1873), there similarly grew several other organizations for religious work, such as the "King's Daughters"

Among Hale's other books are *Kanzas and Nebraska* (1854), prepared as a contribution to the Kansas Crusade; *If, Yes, and Perhaps* (1868), stories and essays; *The Ingham Papers* (1869); *His Level Best and Other Stories* (1870); *Sybaris and Other Homes* (1869); *Philip Nolan's Friends* (1876), a sequel to *The Man Without a Country; Christmas in Narragansett* (1884), *East and West* (1892; also published as *The New Ohio*); *For Fifty Years* (1893), poems; *Ralph Waldo Emerson* (1899); and *We, the People* (1903) The most charming books of his later years were *A New England Boyhood* (1893), *James Russell Lowell and His Friends* (1899) and *Memories of a Hundred Years* (1902). His *Works*, in ten volumes, appeared in 1898–1901.

See E. E. Hale, Jr., *The Life and Letters of Edward Everett Hale* (1917).

HALE, GEORGE ELLERY (1868–), American astronomer, was born at Chicago (Ill.), on June 29, 1868. He graduated at the Massachusetts Institute of Technology in 1890, and also carried on research work at the Harvard College observatory (1889–90) and the University of Berlin (winter, 1893–94). In 1888–91 he organized the Kenwood observatory in Chi-

cago, where he invented and developed the spectroheliograph, an instrument for photographing the sun in monochromatic light. (*See* SPECTROHELIOGRAPH.) In 1892, when he became associate professor of astrophysics (later professor) in the University of Chicago, he began the organization of the Yerkes observatory, of which he was director until 1904. In 1895 he established the *Astrophysical Journal*, an international review of spectroscopy and astronomical physics. In 1904 he organized the Mt. Wilson observatory of the Carnegie Institution of Washington, and was its director until 1923, when he became honorary director. In 1916 he was chairman of the committee of the National Academy of Sciences that organized the National Research council. He was chairman of this council throughout the World War, becoming honorary chairman in 1918. As foreign secretary of the National Academy of Sciences for many years he took an active part in international affairs, especially in the organization and work of the International Union for Co-operation in Solar Research, the International Astronomical Union, the International Research council, and the International Committee on Intellectual Co-operation of the League of Nations. His researches in solar physics and stellar evolution, and his discoveries of solar vortices, the magnetic fields in sun-spots, and the general magnetic field of the sun, have been recognized by the award of many medals and prizes and honorary degrees, and by his election as a foreign member of the Institute of France, the Royal Society of London, and most of the leading European academies of science.

He assisted in the organization of the California Institute of Technology and the Huntington Library and Art Gallery, of which he is a trustee, and in the improvement of the City of Pasadena as a member of the City Planning commission. He was engaged in 1927 at his solar laboratory in Pasadena in the development of the spectro-helioscope, a new instrument which renders possible the visual observation of the solar atmosphere.

He wrote a large number of scientific papers, *The Study of Stellar Evolution* (1908), *Ten Years' Work of a Mountain Observatory* (1915), *The New Heavens* (1923), *The Depths of the Universe* (1924), and *Beyond the Milky Way* (1926).

HALE, HORATIO EMMONS (1817–1896), American ethnologist, was born in Newport, N.H., on May 3, 1817. He was the son of David Hale, a lawyer, and of Sarah Josepha Hale (1790–1879), a popular poet, who is supposed to have been the first to suggest the national observance of Thanksgiving Day. The son graduated in 1837 at Harvard, and during 1838–42 was philologist to the U.S. exploring expedition, which under Capt. Charles Wilkes sailed around the world. Of the reports of that expedition Hale prepared the sixth volume, *Ethnography and Philology* (1846), which is said to have "laid the foundations of the ethnography of Polynesia." He was admitted to the Chicago bar in 1855, and in the following year removed to Clinton, Ont., Canada, where he practised his profession, and where he died on Dec. 28, 1896. His works include *Indian Migrations as Evidenced by Language* (1882); *The Origin of Language and the Antiquity of Speaking Man* (1886); *The Development of Language* (1888); and *Language as a Test of Mental Capacity: Being an Attempt to Demonstrate the True Basis of Anthropology* (1891). He also edited for Brinton's "Library of Aboriginal Literature" the *Iroquois Book of Rites* (1883).

See "Horatio Hale" by D. G. Brinton in *The American Anthropologist*, vol. 10 (1897).

HALE, JOHN PARKER (1806–1873), American statesman, was born at Rochester, N.H., on March 31, 1806. He graduated at Bowdoin college in 1827 and was admitted to the New Hampshire bar in 1830. In 1843–45 he was a Democratic member of the national House of Representatives. In Jan. 1845, he refused in a public statement to obey a resolution of the State legislature directing him and his New Hampshire associates in Congress to support the cause of the annexation of Texas, a Democratic measure which Hale regarded as being distinctively in the interest of slavery. The Democratic State convention was at once reassembled, Hale was denounced, and his renomination was withdrawn. Hale then set out in the face of apparently hopeless odds to win over his State to the anti-slavery cause. The remarkable canvass which he conducted is known in the history of New Hampshire as the "Hale Storm of 1845." The election resulted in the choice of a legislature controlled by the Whigs and the independent Democrats, Hale himself being chosen as a member of the State house of representatives, of which in 1846 he was speaker. He is remembered, however, chiefly for his long service in the United States Senate, of which he was a member from 1847 to 1853 and again from 1855 to 1865. At first he was the only out-and-out anti-slavery senator, but in 1849 Salmon P. Chase and William H. Seward, and in 1851 Charles Sumner joined him, and the anti-slavery cause became for the first time a force to be reckoned with in that body. He was one of the organizers of the Republican Party, and during the Civil War was an eloquent supporter of the Union and chairman of the Senate naval committee. From 1865 to 1869 he was United States minister to Spain. He died at Dover, N.H., on Dec. 19, 1873. In 1892 a statue of Hale was erected in front of the capitol in Concord, New Hampshire.

HALE, SIR MATTHEW (1609–1676), lord chief justice of England, was born on Nov. 1, 1609, at Alderley, Gloucestershire. Left an orphan when five years old, he was placed by his guardian under the care of the Puritan vicar of Wotton-under-Edge, with whom he remained till his 16th year, when he entered Magdalen Hall, Oxford. At Oxford, Hale studied for several terms with a view to holy orders, but, attracted by a company of strolling players, he threw aside his studies, and plunged carelessly into gay society. He resolved to trail a pike as a soldier under the prince of Orange in the Low Countries. But, before leaving England, he had to go to London to defend his patrimony. His leading counsel was the celebrated Serjeant Glanville (1586–1661), who detected his great ability and pursuaded him to enter Lincoln's Inn (1629). Hale devoted himself to his legal studies with intense application. The rules which he laid down for himself prescribed 16 hours work a day. He read over and over again all the year-books, reports and law treatises in print, and carefully studied the extant records from the foundation of the English monarchy down to his own time. Hale dedicated part of his time to the study of pure mathematics, to investigations in physics and chemistry, and even to anatomy and architecture; and this varied learning enhanced considerably the value of many of his judicial decisions.

He was called to the bar in 1637, and almost at once found himself in full practice. In a very few years he was at the head of his profession. He entered public life at perhaps the most critical period of English history. But amidst the confusion Hale steered a middle course. Taking Pomponius Atticus as his political model, he was persuaded that a man, a lawyer and a judge could best serve his country by holding aloof from partisanship and its violent prejudices. It has been said, but without certainty, that Hale was engaged as counsel for the earl of Strafford, he certainly acted for Archbishop Laud, Lord Maguire, Christopher Love, the duke of Hamilton and others. It is also said that he was ready to plead on the side of Charles I. had that monarch submitted to the court. The parliament having gained the ascendancy, Hale signed the Solemn League and Covenant, and was a member of the famous assembly of divines at Westminster in 1644; but although he would undoubtedly have preferred a Presbyterian form of church government, he had no serious objection to the system of modified Episcopacy proposed by Usher. Hale took the engagement to the Commonwealth as he had done to the king, and in 1653, already serjeant, he became a judge in the court of common pleas. Two years afterwards he sat in Cromwell's parliament as one of the members for Gloucestershire. After the death of the protector, however, he declined to act as a judge under Richard Cromwell, although he represented Oxford in Richard's parliament. At the Restoration in 1660 Hale was graciously received by Charles II., and in the same year was appointed chief baron of the exchequer, and accepted, with extreme reluctance, the honour of knighthood. After holding the office of chief baron for 11 years he was appointed lord chief justice. He retired in 1676 to his native Alderley, where he died on Dec. 25 of the same year.

As a judge Sir Matthew Hale discharged his duties with resolute independence and careful diligence. His sincere piety made him the intimate friend of Isaac Barrow, Archbishop Tillotson, Bishop Wilkins and Bishop Stillingfleet, as well as of the Nonconformist leader, Richard Baxter. He is chargeable, however, with the condemnation and execution of two poor women tried before him for witchcraft in 1664, a kind of judicial murder then falling under disuse. He is also reproached with having hastened the execution of a soldier for whom he had reason to believe a pardon was preparing

Of Hale's legal works the only two of importance are his *Historia placitorum coronae, or History of the Pleas of the Crown* (1736); and the *History of the Common Law of England, with an Analysis of the Law*, etc. (1713). Among his numerous religious writings the *Contemplations, Moral and Divine*, occupy the first place. One of his most popular works is the collection of *Letters of Advice to his Children and Grandchildren*. He left his valuable collection of mss. and records to the library of Lincoln's Inn. His life has been written by G. Burnet (1682); by J. B. Williams (1835), by H. Roscoe, in his *Lives of Eminent Lawyers*, in 1838; by Lord Campbell, in his *Lives of the Chief Justices*, in 1849; and by E. Foss in his *Lives of the Judges* (1848–70).

HALE, NATHAN (1756–1776), hero of the American Revolution, was born at Coventry, Conn., educated at Yale, and became a school teacher. He joined a Connecticut regiment after the breaking out of the war, and served in the siege of Boston, being commissioned a captain at the opening of 1776. When Heath's brigade departed for New York he went with them, and the tradition is that he was one of a small and daring band who captured a provision sloop from under the very guns of a man-of-war. But on Sept. 21, having volunteered to enter the British lines to obtain information concerning the enemy, he was captured in his disguise of a Dutch school teacher and was hanged the next day. The penalty was in accordance with military law, but young Hale's act was a brave one, and he has always been glorified as a martyr. Tradition attributes to him the saying that he only regretted that he had but one life to lose for his country; and it is said that his request for a Bible and the services of a minister was refused by his captors. There is a fine statue of Hale by Macmonnies in New York.

See H. P. Johnston, *Nathan Hale* (1901); William Ordway Partridge, *Nathan Hale, The Ideal Patriot* (1902); H. P. Johnston, *Nathan Hale, 1776* (New Haven, 1914) and J. C. Root, *Nathan Hale* (1915).

HALE, PHILIP (1854–), American music and dramatic critic, was born at Norwich, Vt., March 5, 1854. He graduated at Yale in 1876, was admitted to the bar at Albany, N.Y., in 1879 and studied music in Germany and France from 1882 to 1887. While he was a church organist (1888–1905) he wrote musical criticism for the Boston *Post* and the *Journal*, and edited first the *Musical Record* and afterwards the *Musical World*. In 1903 he joined the editorial staff of the Boston *Herald*.

HALE, WILLIAM GARDNER (1849–), American classical scholar, was born on Feb. 9, 1849, in Savannah, Georgia. He graduated from Harvard university in 1870 and did graduate work there and at Leipzig and Goettingen; after a tutorship at Harvard he was professor of Latin at Cornell university from 1880 to 1892, when he became professor of Latin and head of the Latin department of the University of Chicago. In 1919 he retired as professor emeritus. From 1894 to 1899 he was chairman, and in 1895–96 first director, of the American School of Classical Studies at Rome. He is best known as an original teacher on questions of syntax. *The Cum-Constructions: Their History and Functions*, which appeared in *Cornell University Studies in Classical Philology* (1887–89), involved him in a controversy with Hoffmann, best summarized in Wetzel's *Der Streit zwischen Hoffmann und Hale* (1892). Hale also published *The Sequence of Tenses in Latin* (1887–88); *The Anticipatory Subjunctive in Greek and Latin* (in *Chicago University Studies in Classical Philology*, 1895); a *Latin Grammar* with C. D. Buck (1903); *The Manuscripts of Catullus* (1908); and various pamphlets on methods. He was associate editor of the *Classical Review* (1895–1907) and of the *Classical Quarterly* after 1907, and president of the American Philological Association (1892–93).

HALEBID, a village in Mysore state, southern India. It is the site of Dorasamudra, the capital of the Hoysala dynasty founded early in the 11th century. In 1310 and in 1326 it was plundered by the first Mohammedan invader of south India. Two temples, still standing, though never completed and partly ruined, are the finest examples of elaborately carved Chalukyan architecture.

HALES or **HAYLES, JOHN** (d. 1571), English writer and politician, was a son of Thomas Hales of Hales Place, Halden, Kent. He wrote his *Highway to Nobility* about 1543, and was the founder of a free school at Coventry for which he wrote *Introductiones ad grammaticam*. Hales, who was M.P. for Preston, was the most active of the commissioners appointed in 1548 to redress the evil of the enclosures of land; but he failed to carry his remedial proposals through parliament. When the protector, the duke of Somerset, was deprived of his authority in 1550, Hales left England and lived for some time in Strasbourg and Frankfort, returning to his own country on the accession of Elizabeth. He was imprisoned for a pamphlet, *A Declaration of the Succession of the Crowne Imperiall of Inglande*, but was quickly released, and died on Dec. 28, 1571. The *Discourse of the Common Weal* (ed. E. Lamond, 1893), described as "one of the most informing documents of the age," and written about 1549, has been attributed to Hales.

Hales is often confused with another John Hales, who was clerk of the hanaper under Henry VIII. and his three immediate successors.

HALES, JOHN (1584–1656), English scholar, frequently referred to as "the ever memorable," was born at Bath on April 19, 1584, educated at Corpus Christi college, Oxford, elected a fellow of Merton in 1605, and in 1612 appointed public lecturer on Greek. In 1618 he went to Holland, as chaplain to the English ambassador, Sir Dudley Carleton. In 1619 he returned to Eton, where he held a fellowship. Andrew Marvell called him "one of the clearest heads and best-prepared breasts in Christendom." His eirenical tract entitled *Schism and Schismaticks* (1636) fell into the hands of Archbishop Laud, and in 1639 Hales was made one of Laud's chaplains and also a canon of Windsor. In 1642 he was deprived of his canonry by the parliamentary committee, and two years later was obliged to hide in Eton with the college documents and keys. In 1649 he refused to take the "Engagement" and was ejected from his fellowship. He lived in poverty till his death on May 19, 1656.

See his collected works, ed. Lord Hailes (3 vols., 1765).

HALES, STEPHEN (1677–1761), English physiologist, chemist and inventor, was born at Bekesbourne, Kent, in Sept. 1677. He took holy orders at Cambridge, and in 1708 was presented to the perpetual curacy of Teddington, Middlesex, where he remained all his life, though he subsequently held the rectories of Porlock, Somerset and of Faringdon, Hampshire. In 1717 he was elected fellow of the Royal Society, which awarded him the Copley medal in 1739, and on the death of Sir Hans Sloane in 1753, Hales was chosen foreign associate of the French Academy of Sciences. He died at Teddington on Jan. 4, 1761.

Hales is best known for his *Statical Essays*. The first volume, *Vegetable Staticks* (1727), describes experiments in plant-physiology: transpiration, the rate of growth of shoots and leaves, variations in root-force at different times of the day and the nourishment taken in by plants from the air. In his experiments he was able to collect gases over water in vessels separate from those in which they were generated, and thus used what was to all intents a "pneumatic trough." The second volume (1733) on *Haemostaticks*, contains important experiments on the mechanical relations of blood-pressure, the velocity of the current and the capacity of the different vessels. With Robert Whytt, Hales showed the necessity of the spinal cord for reflex movements. He also devised a "ventilator" (a modified organ-bellows) by which fresh air could be conveyed into gaols, hospitals and ships'-holds, and invented a "sea-gauge" for sounding, and processes for distilling fresh from sea water, for preserving corn from weevils by fumigation with brimstone, for salting animals whole by passing brine into their arteries and for bottling chalybeate waters. His *Admonition to the Drinkers of Gin, Brandy, etc.*, was published anonymously in 1734.

HALESOWEN, market town, Stourbridge parliamentary division, Worcestershire, England, on the G W. and L.M S. railways 6½ m S W. of Birmingham. Pop. (1921) 4,126. There are extensive iron and steel manufactures. The church of SS. Mary and John the Baptist has rude Norman portions. There are a grammar school (1652) and Bourne college (1883). Close to the town are slight ruins of an Early English Premonstratensian abbey. Within the parish and 2 m. N W. of Halesowen is Cradley, with iron and steel works, fire-clay works and a large nail and chain industry

HALEVI, JUDAH BEN SAMUEL (*c.* 1085–*c.* 1140), the greatest Hebrew poet of the middle ages, was born in Toledo *c* 1085, and died in Palestine after 1140 He wrote a philosophical dialogue in five books, called the *Cuzari*, which has been translated into English by Hirschfeld. This book is based on the historical fact that the Crimean Kingdom of the Khazars adopted Judaism, and the Hebrew poet-philosopher describes what he conceives to be the steps by which the Khazar king satisfied himself as to the claims of Judaism. Like many other mediaeval Jewish authors, Judah Halevi was a physician. His real fame depends on his liturgical hymns, which are the finest written in Hebrew since the Psalter, and are extensively used in the Sephardic rite. He wrote some memorable Odes to Zion, which have been commemorated by Heine. He started for Jerusalem, was in Damascus in 1140, and soon afterwards died

Excellent English renderings of some of Judah Halevi's poems may be read in Mrs. H. Lucas's *The Jewish Year*, and Mrs R. N. Solomon's *Songs of Exile*.

HALÉVY, ÉLIE (1870–), French historian, son of Ludovic Halévy (*q v*), was born at Etretat on Sept. 6, 1870 He became in 1898 professor at the Ecole Libre des Sciences Politiques, Paris He is the author of a brilliant study of English history in the 19th century, dealing more especially with the social and economic side and based on an exhaustive study of the original sources This *Histoire du peuple anglais au XIXe siècle* (3 vols., 1913–23) was translated into English (3 vols., 1924–27). The first volume of an *Epilogue* (1895–1914) to this work appeared in 1926.

Halévy's other works include *La Théorie platonicienne des sciences* (1896) and *La Formation du radicalisme philosophique* (3 vols., 1900–03).

HALÉVY, JACQUES FRANÇOIS FROMENTAL ÉLIE (1799–1862), French composer, was born on May 27, 1799, in Paris, of a Jewish family of the name of Lévy He studied at the Paris Conservatoire under Berton and Cherubini, and in 1819 gained the grand prix de Rome with his cantata *Herminie* At Rome he devoted himself to the study of Italian music, and wrote an opera and various minor works. In 1827 his opera *L'Artisan* was performed at the Théâtre Feydeau in Paris, apparently without much success. Other works of minor importance, and now forgotten, followed, amongst which *Manon Lescaut*, a ballet, produced in 1830, deserves mention. In 1834 the Opéra-Comique produced *Ludovic*, the score of which had been begun by Hérold and had been completed by Halévy. In 1835 Halévy composed the tragic opera *La Juive* and the comic opera *L'Éclair*, and on these works his fame is mainly founded *L'Éclair* is something of a curiosity, being written for two tenors and two soprani, without a chorus. After these two works he wrote numerous operas of various *genres*. He died at Nice, on March 17, 1862.

See Léon Halévy, *François Halévy, sa vie, ses oeuvres* (1862); and other works by Ch. de Lorbas, Beulé, E. Monnais and A. Pongin

HALÉVY, LUDOVIC (1834–1908), French author, was born in Paris. His father, Léon Halévy (1802–83), was a clever and versatile writer, who tried almost every branch of literature —prose and verse, vaudeville, drama, history—without, however, achieving decisive success in any. His uncle, J F. Fromental E. Halévy (*q.v*), was for many years associated with the opera; hence the double and early connection of Ludovic Halévy with the Parisian stage. At 18 he entered the civil service, and held various posts, the last being that of secrétaire-rédacteur to the Corps Législatif. In 1865 he retired. Ten years earlier he had become acquainted with the musician Offenbach, who was about to start a small theatre of his own in the Champs Elysées, and he wrote a sort of prologue, *Entrez, messieurs, mesdames,* for the opening night. Other little productions, produced under the pseudonym of Jules Servières, followed. The name of Ludovic Halévy appeared for the first time on the bills on Jan. 1, 1856. Soon afterwards the unprecedented run of *Orphée aux enfers*, a musical parody, written in collaboration with Hector Crémieux, made his name famous. In the spring of 1860 he was commissioned to write a play for the manager of the Variétés in conjunction with another vaudevillist, Lambert Thiboust. The latter having abruptly retired from the collaboration, Halévy met on the steps of the theatre Henri Meilhac (1831–97), then comparatively a stranger to him. There and then began a connection which was to last over 20 years. Their joint works may be divided into three classes: the *opérettes*, the farces, the comedies. Amongst the most celebrated works of the joint authors were *La Belle Hélène* (1864), *Barbe Bleue* (1866), *La Grande Duchesse de Gerolstein* (1867), and *La Périchole* (1868) After 1870 the vogue of parody rapidly declined. The decadence became still more apparent when Offenbach was no longer at hand to assist the two authors with his quaint musical irony. They then wrote farces of the old type, consisting of complicated intrigues, with which they cleverly interwove the representation of contemporary whims and social oddities. A serious effort was *Frou-frou* (1869), which, owing perhaps to the admirable talent of Aimée Desclée, remains their unique *succès de larmes*.

Meilhac and Halévy will be found at their best in light sketches of Parisian life, *Les Sonnettes, Le Roi Candaule, Madame attend Monsieur, Toto chez Tata* Both men had wit, humour, observation of character. Meilhac had a ready imagination, a rich and whimsical fancy; Halévy had taste, refinement and pathos of a certain kind. Not less clever than his brilliant comrade, he was more human. Of this he gave evidence in two delightful books, *Monsieur et Madame Cardinal* (1873) and *Les Petites Cardinal*, in which the lowest orders of the Parisian middle class are faithfully described. Halévy's peculiar qualities are even more visible in the simple and striking scenes of the *Invasion*, published soon after the conclusion of the Franco-German War, in *Criquette* (1883) and *L'Abbé Constantin* (1882), two novels, the latter of which went through innumerable editions Zola had presented to the public an almost exclusive combination of bad men and women; in *L'Abbé Constantin* all are kind and good, and the change was eagerly welcomed by the public. Some enthusiasts rank the *Abbé* with the *Vicar of Wakefield*.

Halévy remained an assiduous frequenter of the Academy, to which he was elected in 1884, the Conservatoire, the Comédie Française, and the Society of Dramatic Authors, but, when he died in Paris on May 8, 1908, he had produced practically nothing for many years

The *Théâtre* of Meilhac and Halévy was published in 8 vols. (1900–02).

HALF-BEAK, a group of fishes consisting of several species belonging to the family Hemiramphidae, distinguished from the needlefish, which they closely resemble by the shortness of the upper jaw, whence they take their name. The half-beak is a small attractively coloured fish native to the coasts of tropical countries.

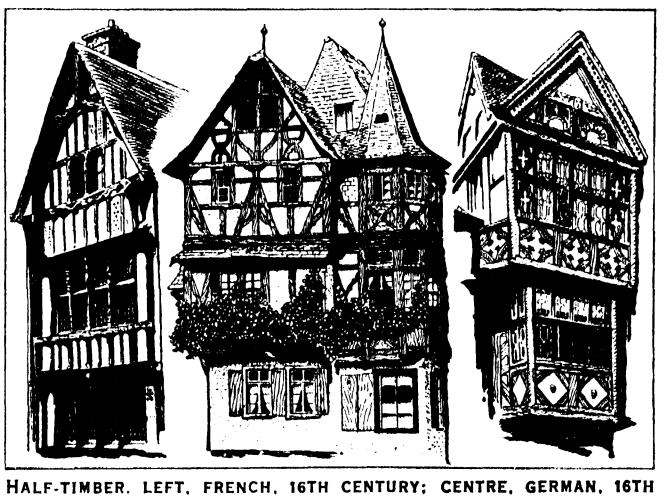
HALF-MOON. An early form of counter-guard work in fortification, sometimes known as a demi-lune, built in front of the bastion to protect it from breaching fire. The work usually consisted of two ramparts meeting at an angle with a half moon shaped gorge from which it derived its name. (*See* further FORTIFICATION AND SIEGECRAFT.)

HALFPENNY, WILLIAM (*fl.* 1752), English 18th century architectural designer, was also known as Michael Hoare. He published about 20 books dealing almost entirely with domestic architecture and especially with country houses in the Gothic and Chinese fashions of his period. His most influential works were *New Designs for Chinese Temples* (1750–52); *Rural Architecture in the Gothic Taste* (1752); *Chinese and Gothic Architecture Properly Ornamented* (1752); and *Rural Architecture in the Chinese Taste* (1750–52). The first of these books disproves the statement that Thomas Chippendale and Sir Thomas Chambers

introduced the Chinese taste into England. John Halfpenny, said to have been his son, was associated with William in the production of the above-mentioned works.

HALF STOCK, in the United States a name often applied to shares of stock which have a par value of $50, because most shares of stock have a par value of $100, which is considered the unit of value. The name does not in any way imply that one is speaking of a half-share of stock, but always of full or entire shares which have the $50 par value.

HALF-TIMBER WORK, in architecture, a type of construction in which the spaces between structural timber members, such as posts, girts, beams, braces, etc., are filled in with lath and plaster, wattle and daub, or brick work, leaving the structural members exposed to view, either outside or in. Half-timber work is a natural building technique wherever braced frame construction in timber is common. It is thus widely used in farm houses and rural buildings in China and was at one time almost universal throughout northern Europe. It is probably an ancient form. Reliefs on the column of Trajan (A.D. 113) at Rome show that the Romans employed for camp buildings, bridges, etc., wood-framed structures that resemble half-timber. Viollet-le-Duc studied, in 1834, a Romanesque house at Dreux, dating from the middle of the 12th century, whose front was of heavy half-timber work between end walls of stone. In this example, although the great size of the timbers, the round arch forms in solid wood, and the shallow incised decoration, all reveal a crude and tentative technique, the projecting of the upper stories and the use of brackets and braces show, already, typical half-timber forms that were to remain in use for 600 years. By the middle of the 13th century tremendous advances had been made and a house at Chateaudun, of this date, shows delicate members, straightforward design and a much greater area of filling. In the 14th century the development continued towards an ever greater freedom in the arrangement of the timber members, which are placed with more and more regard for decorative effect, yet with none of the fantastic elaborations that were to come. Typical of this work are many lovely examples in Strasbourg and also a chapel at Cronceus, near Troyes, illustrated by Viollet-le-Duc (*Dictionnaire raisonné,* 1861–75, article "Pan de Bois"), in which great charm is achieved by delicate cusped arched windows set between the upright posts, and the simple trusses and wooden ceiling.



HALF-TIMBER. LEFT, FRENCH, 16TH CENTURY; CENTRE, GERMAN, 16TH CENTURY; RIGHT, ENGLISH, 17TH CENTURY

During the 15th and 16th centuries, half-timber work was made lavishly decorative; not only was rich carving applied to brackets and beams, but also buttress forms were carved on the posts, and curved and diagonal braces became common. In northern France and Germany there is much similarity in the half-timber work of this period and many examples exist at Hildesheim, Goslar, Nuremburg and many of the Rhine towns in Germany, and in France at Rouen, Caen, Lisieux, Bayeux and Beauvais. In all of these the vertical posts dominate the design and frequently project markedly from the wall face to carry the decoration already referred to. Braces are frequently criss-crossed under the windows, and the dimensions of the timber kept delicate.

In England, where most of the extant examples are of the 16th and 17th centuries, the development was along different lines. The area of timber work exposed is proportionately greater than in the examples on the Continent, and in earlier instances, the design was less formalized and made a greater use of large curved braces and ties. The posts are often further apart. Later, and in the more lavish buildings, the use of criss-crossed and cusped elements became common, the contrast between timber and filling developed as a purely decorative idea and many wooden members added for which there was no structural necessity. Of the simpler type, Staple Inn, at Holborn, London, and Newgate house, York (*c.* 1450) deserve mention; of the more decorative, Speke hall, near Liverpool (17th century), Moreton old hall, Cheshire (1550–59), St. Peter's hospital, Bristol (1607) and Leicester hospital at Warwick (before 1571) are particularly noteworthy.

Half-timbering is used as a decorative motive in many modern houses in England and America. Owing to the difficulty in making true half-timber construction wind and water tight, and the high cost of large timbers, the greater part of this is purely imitation, the apparent timbers being thin boards applied to the face of construction of a different kind. The taste of this is questionable.

(T. F. H.)

HALF-TONE: *see* PHOTO-ENGRAVING.

HALHED, NATHANIEL BRASSEY (1751–1830), English Orientalist and philologist, was born at Westminster on May 25, 1751. He was educated at Harrow, where he began his intimacy with R. B. Sheridan, continued after he entered Christ Church, Oxford, where, also, he made the acquaintance of Sir William Jones, the famous Orientalist, who induced him to study Arabic. Halhed went out to India as a writer under the East India Company, and here, at the suggestion of Warren Hastings, by whose orders it had been compiled, translated the Gentoo code from a Persian version of the original Sanskrit. This translation was published in 1776 under the title *A Code of Gentoo Laws.* In 1778 he published a Bengali grammar, to print which he set up, at Hugli, the first press in India. It is claimed for him that he was the first writer to call attention to the philological connection of Sanskrit with Persian, Arabic, Greek and Latin. In 1785 he returned to England, and from 1790–1795 was M.P. for Lymington, Hants. A speech in parliament in defence of Richard Brothers (*q.v.*), made it necessary for him to leave the House. He died in London Feb. 18, 1830. His collection of Oriental manuscripts was purchased by the British Museum, and there is an unfinished translation by him of the *Mahābhārata* in the library of the Asiatic Society of Bengal.

HALIBURTON, THOMAS CHANDLER (1796–1865), British writer, long a judge of Nova Scotia, was born in Windsor, Nova Scotia. He was called to the bar in 1820, became a member of the house of assembly, and in 1828 was promoted to the bench as a chief-justice of the common pleas. In 1829 he published *An Historical and Statistical Account of Nova Scotia.* He is remembered as the creator of Sam Slick in the series of sketches entitled *The Clockmaker, or Sayings and Doings of Samuel Slick of Slickville* (1837). A second series followed in 1838, and a third in 1840. *The Attaché, or Sam Slick in England* (1843–44), was the result of a visit there in 1841. In 1840 he was promoted to be a judge of the supreme court; but within two years he resigned and removed to England. He was M.P. for Launceston from 1859 to 1865.

A memoir of Haliburton, by F. Blake Crofton, appeared in 1889.

HALIBUT (*Hippoglossius vulgaris*), the largest of the flat fishes, reaching a length of 10 feet. It is found in the north Atlantic and north Pacific, and extends into the Arctic ocean, but is not certainly circumpolar. The eyes are on the right side, and the mouth is large; the body is longer and less compressed than in other flat fishes. The halibut feeds on other fishes. It is a valued food fish, with very firm white flesh.

HALICARNASSUS (mod. *Budrum*), an ancient Greek city on the south-west coast of Caria, Asia Minor, on the Ceramic Gulf or Gulf of Cos. It originally occupied only the small island

of Zephyria close to the shore (which now has the great castle of St. Peter, built by the Knights of Rhodes in 1404), but in course of time this island was united to the mainland and the city extended so as to incorporate Salmacis, an older town of the Leleges and Carians

About the foundation of Halicarnassus various traditions were current; but they agree as to its being a Dorian colony, and the figures on its coins, such as the head of Medusa, Athena and Poseidon, or the trident, support the statement that the mother cities were Troezen and Argos. The inhabitants appear to have accepted Anthes as their legendary founder, and were proud of the title of Antheadae. At an early period Halicarnassus was a member of the Doric Hexapolis, which included Cos, Cnidus, Lindus, Camirus and Ialysus; but owing to the lapses of Agasicles, one of its citizens, the city was cut off from the league. In the early 5th century Halicarnassus was under the sway of Artemisia, who made herself famous at the battle of Salamis. Halicarnassus and other Dorian cities of Asia were afterwards to some extent absorbed by the Delian League, but the peace of Antalcidas in 387 made them subservient to Persia; and it was under Mausolus, a Persian satrap who assumed independent authority, that Halicarnassus attained its highest prosperity. Mausolus increased the population of Halicarnassus by the inhabitants of six towns of the Leleges He was succeeded by Artemisia, whose magnificence has been perpetuated by the "Mausoleum," the monument she erected to her husband's memory. (*See* MAUSOLUS.) One of her successors, Pixodarus, tried to ally himself with the rising power of Macedon.

Alexander, as soon as he had reduced Ionia, summoned Halicarnassus, where Memnon, the paramount satrap of Asia Minor, had taken refuge with the Persian fleet, to surrender; and on its refusal took the city and devastated it, but not being able to reduce the citadel, was forced to leave it blockaded He handed the government back to the family of Mausolus. Later the citizens received the present of a gymnasium from Ptolemy, and built in his honour a stoa or portico; but the city never recovered entirely from the siege, and Cicero describes it as almost deserted The site is now occupied in part by the town of Budrum; but the ancient walls can still be traced round nearly all their circuit, and the position of several of the temples, the theatre, and other public buildings can be fixed with certainty.

Excavations of the Mausoleum show that the building consisted of five parts—a basement or podium, a pteron or enclosure of columns, a pyramid, a pedestal and a chariot group. The basement was built of greenstone and cased with marble. The pteron consisted (according to Pliny) of thirty-six columns of the Ionic order, enclosing a square *cella* Between the columns probably stood single statues. From the portions that have been recovered, it appears that the principal frieze of the pteron represented combats of Greeks and Amazons. Above the pteron rose the pyramid, mounting by 24 steps to an apex or pedestal On this apex stood the chariot with the figure of Mausolus himself and an attendant. The height of the statue of Mausolus in the British Museum is 9 ft 9½ in. without the plinth. All sorts of restorations of this famous monument have been proposed.

See C. T. Newton and R. P. Pullan, *History of Discoveries at Halicarnassus* (1862-63), J Fergusson, *The Mausoleum at Halicarnassus restored* (1862); E. Oldfield "The Mausoleum," in *Archaeologia* (1895); F Adler, *Mausoleum zu Halikarnass* (1900); J. P. Six in *Journ. Hell. Studies* (1905); W. B. Dinsmoor, in *Amer. Journ. of Arch.* (1908); J. J Stevenson, *A Restoration of the Mausoleum of Halicarnassus* (1909); J B. K. Preedy, "The Chariot Group of the Mausoleum," in *Journ. Hell. Stud.*, 1910.

HALICZ, a small town of Galicia, Poland, 70 m. by rail S S.E. of Lwow (Lemberg). It is situated at the confluence of a small stream with the Dniester. In the neighbourhood are the ruins of the old castle, the seat of the ruler of the former kingdom from which Galicia derived its name. Halicz, which is mentioned as early as 1113, was from 1141 to 1255 the residence of the Russian princes of that name. The town as is shown by excavations was then much larger. It probably suffered during the Mongol invasion of 1240. It has changed hands between Poland, Austria and Russia during its history.

HALIDON HILL, BATTLE OF. When the Scottish War was renewed after a four years' uneasy truce, this battle of July 19, 1333, proved the sequel to the unauthorized expedition and battle of Dupplin (*q.v.*) and confirmed the changed balance of fortune. Bruce was dead and the Scots neglected to fulfil his "testament" of guerrilla warfare. Compared with Bannockburn (*q.v.*) the strategical situation was also reversed, for in 1333 Edward III. was besieging Berwick and a great Scottish host marching to relieve it. With him were Baliol and Beaumont, the victors of Dupplin, and there is little doubt that his tactics were inspired by their advice and experience. His force was drawn up in three "battles," composed of dismounted knights and men-at-arms, with archers on the wings. He took up a position like Bruce at Bannockburn—on a hillside with a wood behind and a marshy bottom in front. As the Scottish masses pushed through the marsh and began to climb the slope, they were assailed, and then brought to a standstill, by an unceasing shower of arrows. And when the impetus failed and disorganization spread, Edward ordered his knights to mount and charge, sustaining the pursuit until the Scottish host was a dissolved rabble. The English could well feel that:—

> "Scottes out of Berwick and out of Aberdeen,
> At the Burn of Bannock ye were far too keen
> King Edward has avenged it now, and fully too, I ween."

See Oman, *History of the Art of War in the Middle Ages* (1924).

HALIFAX, CHARLES MONTAGUE, EARL OF (1661-1715), English statesman and poet, fourth son of the Hon. George Montague, was born at Horton, Northamptonshire, on April 16, 1661. He was educated at Westminster school, where he was king's scholar in 1677 and at Trinity college, Cambridge, where he was one of the small band of students who assisted Newton in forming the Philosophical Society of Cambridge. His clever panegyric on the death of Charles II attracted the notice of the earl of Dorset, who introduced him to the principal wits of the time, and in 1687 his joint authorship with Prior of the *Hind and Panther transversed to the Story of the Country Mouse and the City Mouse*, a parody of Dryden's political poem, helped him to political influence.

In 1689, through Dorset's patronage, he entered parliament as member for Maldon. About this time he married the countess-dowager of Manchester, and after the coronation of William and Mary he purchased a clerkship to the council. His poetical *Epistle occasioned by his Majesty's Victory in Ireland* brought him a pension of £500 per annum. In 1692 he was made one of the commissioners of the treasury. His success as a politician was mainly due to his skill in finance. Although perhaps it was inevitable that England should sooner or later adopt the continental custom of lightening the annual taxation in times of war by contracting a national debt, the actual introduction of the expedient was due to Montague, who on Dec. 15, 1692 proposed to raise a million of money on annuities for 99 years. The Scotsman William Paterson (*q.v.*) had already submitted to the Government his plan of a national bank, and when in the spring of 1694 the prolonged contest with France had rendered another large loan absolutely necessary, Montague introduced the bill for the incorporation of the Bank of England. Immediately after the prorogation of parliament Montague was rewarded by the Chancellorship of the Exchequer.

In 1695 he was returned for Westminster to the new parliament, and pushed through the House his famous Recoinage Bill. To provide for the expense of recoinage, Montague introduced the window tax; the temporary absence of a metallic currency was avoided by the issue for the first time of exchequer bills. He carried (1696) his scheme for the establishment of the Consolidated Fund to meet the interest on government loans, and the rapid restoration of public credit secured him a commanding influence; but although Godolphin resigned office in Oct. 1696, the king hesitated for some time between Montague and Sir Stephen Fox as his successor, and it was not till 1697 that Montague was appointed first lord. In 1697 he was accused by Charles Duncombe (*q.v.*), and in 1698 by a Col. Granville, of fraud, but both charges broke down, and Duncombe was himself incrimi-

nated. In 1698 and 1699 Montague acted as one of the council of regency during the king's absence from England. Unfortunately his vanity and arrogance counterbalanced his administrative ability and his eloquence; and his power was already waning when he conferred the lucrative sinecure office of auditor of the Exchequer on his brother in trust for himself should he be compelled to retire from power. After the return of the king in 1699 he was compelled to resign his offices. He succeeded his brother in the auditorship.

On the accession of the Tories to power he was raised to the peerage (1700) as Lord Halifax. In 1701 he was impeached for malpractices along with Lord Somers and the earls of Portland and Oxford, but all the charges were dismissed by the Lords; and in 1703 a second attempt to impeach him also failed In 1706 he was one of the commissioners to negotiate the union with Scotland; and after the passing of the Act of Settlement he was sent to the elector's court to convey the insignia of order of the garter to George I He was a member of the council of regency in 1714 pending the arrival of George I, and was first lord of the treasury in the new ministry He was also created earl of Halifax and Viscount Sunbury. He died on May 19, 1715 and left no issue He was buried in the vault of the Albemarle family in Westminster Abbey His nephew George (d 1739) succeeded to the barony, and was created Viscount Sunbury and earl of Halifax in 1715

Montague was a friend to many men of letters. He procured from Godolphin a commissionership for Addison, and enjoyed a life-long intimacy with Newton, for whom he obtained the mastership of the Mint In administrative talent he surpassed all his contemporaries, and his only rival in parliamentary eloquence was Somers; but the effect of his brilliant financial successes on his reputation was gradually almost nullified by the arrogance of his manner and by his sensitive vanity Marlborough declared that "he had no other principle but his ambition, so that he would put all in distraction rather than not gain his point"

His *Miscellaneous Works* were published at London in 1704; his *Life and Miscellaneous Works* in 1715; and his *Poetical Works*, to which also his "Life" is attached, in 1716 His poems were reprinted in Johnson's *English Poets*, vol ix

HALIFAX, GEORGE MONTAGU DUNK, 2ND EARL OF (1716–1771), son of George Montagu, 1st earl of Halifax (of the second creation), was born on Oct. 5 or 6, becoming earl of Halifax on his father's death in 1739. Educated at Eton and at Trinity college, Cambridge, he became in 1748 president of the Board of Trade While filling this position he helped to found Halifax, the capital of Nova Scotia, which was named after him, and in several ways he rendered good service to trade, especially with North America In March 1761 Halifax was appointed lord-lieutenant of Ireland, and he was also for a time first lord of the admiralty. He was from 1762 to 1765 secretary of state for the northern department under Bute and under George Grenville. He signed the general warrant under which Wilkes was arrested in 1763, for which action he was mulcted in damages by the courts of law in 1769, and he was mainly responsible for the exclusion of the name of the king's mother, Augusta, princess of Wales, from the Regency bill of 1765. He returned to office in 1770 under his nephew, Lord North, but died on June 8, 1771.

HALIFAX, GEORGE SAVILE, FIRST MARQUESS OF (1633–1695), English statesman and writer, was the eldest son of Sir William Savile, third baronet, and of Anne, eldest daughter of Lord Keeper Coventry. He sat in the Convention parliament for Pontefract in 1660, and in 1667 he was created Baron Savile of Halifax A zealous supporter of the Triple Alliance (1668), Halifax was kept in ignorance of the secret terms of the Treaty of Dover (1670), and when he was sent to Holland in 1673 with the mission which visited first The Hague and then Louis XIV 's headquarters he was unaware of the real state of affairs, and the issue was decided by Arlington. From that time he steadily opposed Charles's policy of subservience to France and the relaxation of the laws against the Roman Catholics. He was dismissed from the council in Jan. 1676, but was reinstated in 1679 and received an earldom.

Halifax pursued a policy apparently devious, which won for him the name of the "Trimmer," but in reality logical He tried to steer a middle course between the extreme Protestants on the one hand who would go to all lengths, even to the substitution of the duke of Monmouth as heir to the throne, to exclude James, duke of York, and on the other hand the high Tories and the Romanizing policy of James. Thus he opposed the Exclusion bill (1679), speaking 16 times during the debate and materially affecting its issue, but alienated James by approving the Regency bill, and put up a strong opposition to the return of James from Scotland in 1681. In that year he held for a time the chief power, and consistently urged upon Charles a policy of moderation and conciliation. James returned from Scotland in May 1682, and though Halifax was advanced to a marquessate and the office of lord privy seal, his influence at court was gone for the time being. It revived in 1684, when Charles began to tire of James and Rochester Halifax, who had been in touch with the prince of Orange, tried to establish good relations between him and Charles.

After the accession of James he repeatedly opposed the king's policy and finally, on his firm refusal to support the repeal of the Test and Habeas Corpus Acts, he was dismissed, and his name was struck out of the list of the privy council (Oct 1685) He corresponded with the prince of Orange, but held aloof from plans which aimed at the prince's personal interference in English affairs In 1687 he published the famous *Letter to a Dissenter*, in which he warns the Nonconformists against being beguiled by the "indulgence" into joining the court party. The tract, of which 20,000 copies were circulated, actually and immediately altered the course of history Halifax took the popular side at the trial of the bishops in June 1688; but the same month he refrained from signing the invitation to William, and publicly repudiated any share in the prince's plans He refused any credence to the report that the prince born to James was suppositious After the landing of William he was present at the council called by James on Nov. 22, and urged the king to grant large concessions but in friendly terms With Nottingham and Godolphin he treated with William at Hungerford, but James had from the first resolved on flight. Halifax presided over the council of Lords which concerted measures to maintain public order during the interregnum On the return of James to London on Nov 16 Halifax attached himself to William's cause On Nov 17, he carried with Lords Delamere and Shrewsbury a message from William to the king advising his departure from London, and, after the king's second flight, directed the executive. On Jan. 22, 1689, he was formally elected speaker of the House of Lords. He voted against the motion for a regency (Jan. 20), which was only defeated by two votes The moderate and comprehensive character of the settlement at the revolution plainly shows his guiding hand, and he persuaded the Lords to agree to the compromise whereby William and Mary were declared joint sovereigns On Feb 13 in the banqueting house at Whitehall, he tendered the crown to them in the name of the nation.

At the opening of the new reign he was made lord privy seal His views on religious toleration were as wide as those of the new king He championed the claims of the Nonconformists as against the high or rigid Church party, and he was bitterly disappointed at the miscarriage of the Comprehension bill He thoroughly approved also at first of William's foreign policy; but, having excited the hostility of both Whig and Tory parties, he was now fiercely attacked, and determined to retire He still nominally retained his seat in the privy council, but in parliament he became a bitter critic of the administration He disapproved of William's total absorption in European politics, and his open partiality for his countrymen In Jan 1691 Halifax had an interview with Henry Bulkeley, the Jacobite agent, and is said to have promised "to do everything that lay in his power to serve the king" He entered bail for Lord Marlborough, accused wrongfully of complicity in a Jacobite plot in May 1692, and in June, during the absence of the king from England, his name was struck off the privy council Early in 1695 he delivered a strong attack on the administration in the House of Lords; he died on April 5, at the age of 61. He was buried in Henry VII 's chapel in West-

minster Abbey.

Halifax's attitude of mind was curiously modern. Reading, writing, and arithmetic, he thinks, should be taught to all and at the expense of the state. His opinions again on the constitutional relations of the colonies to the mother-country were completely opposed to those of his own period. For that view of his character which, while allowing him the merit of a brilliant political theorist denies him the qualities of a man of action and of a practical politician, there is no solid basis. At various times of crisis he proved himself a great leader. He returned to public life to defeat the Exclusion bill. At the revolution it was Halifax who seized the reins of government, flung away by James, and maintained public security. His subsequent failure in collaborating with William was due to his failure to realise the development of party government.

Halifax was by no means the "voluptuary" described by Macaulay He was on the contrary free from self-indulgence; his manner of life was decent and frugal, and his dress was proverbially simple. Few were insensible to his personal charm and gaiety. He excelled especially in quick repartee. When quite a young man he is described by Evelyn as "a witty gentleman if not a little too prompt and daring" He was incapable of controlling his spirit of raillery, from jests on Siamese missionaries to sarcasms at the expense of the heir to the throne and ridicule of hereditary monarchy, and his brilliant paradoxes, his pungent and often profane epigrams were received by graver persons as his real opinions and as evidences of atheism. This latter charge he repudiated, assuring Burnet that he was "a Christian in submission," but that he could not digest iron like an ostrich nor swallow all that the divines sought to impose upon the world.

The speeches of Halifax have not been preserved, and his political writings on this account have the greater value In *The Character of a Trimmer* (1684 or 1685), his authorship of which is now established, he discusses the political problems of the time and their solution on broad principles When he treats such themes as liberty, or discusses the balance to be maintained between freedom and government in the constitution, he rises to the political idealism of Bolingbroke and Burke. His other political writings are. *The Character of King Charles II.* (printed 1750); *Letter to a Dissenter* (1687); *The Lady's New Year's Gift, or Advice to a Daughter* (1688); *The Anatomy of an Equivalent* (1688); *Maxims of State* (*c.* 1692); *The Rough Draft of a New Model at Sea* (*c.* 1694); *Some Cautions to the electors of the parliament* (1694), and *Political, Moral and Miscellaneous Thoughts and Reflections* (n.d) (For other writings attributed to Halifax, *see* Foxcroft, *Life of Sir G Savile*, ii. 529, *sqq*)

Halifax was twice married, in 1656 to Lady Dorothy Spencer —daughter of the first earl of Sunderland and of Dorothy Sidney, "Sacharissa"—who died in 1670, leaving a family; and secondly in 1672 to Gertrude Pierrepont, who survived him, and by whom he had one daughter, Elizabeth, Lady Chesterfield. On the death of his son William, second marquess of Halifax, in Aug. 1700 without male issue, the peerage became extinct and the baronetcy passed to the Saviles of Lupset, the whole male line of the Savile family ending in the person of Sir George Savile, eighth baronet, in 1784. Henry Savile, British envoy at Versailles, who died unmarried in 1687, was a younger brother of the first marquess Halifax has been generally supposed to have been the father of the illegitimate Henry Carey, the poet, but this is doubtful

See H. S. Foxcroft, *Life and Letters of Sir George Savile, 1st Marquis of Halifax* (2 vols., 1898).

HALIFAX, a city and port of entry, capital of the province of Nova Scotia, Canada. It is situated in 44° 59′ N. and 63° 35′ W., on the south-east coast of the province, on a fortified hill, 225 ft. in height, which slopes down to the waters of Chebucto bay, now known as Halifax harbour. The harbour, which is open all the year, is about 6 m. long by 1 m. in width, and has excellent anchorage in all parts; to the north a narrow passage connects it with Bedford basin, 6 m. in length by 4 m., and deep enough for the largest men-of-war. At the harbour mouth lies McNab's island, thus forming two entrances; the eastern passage is only employed by small vessels. The population in 1921 was 58,372.

Inferior in natural strength to Quebec alone, the city and its approaches have been fortified till it has become the strongest position in Canada, and one of the strongest in the British empire. Till 1906 it was garrisoned by British troops, but in that year, with Esquimalt, on the Pacific coast, it was taken over by the Canadian government, an operation necessitating a large increase in the Canadian permanent military force. At the same time, the royal dockyard, containing a dry-dock 610 ft. in length, and the residences in connection, were also taken over for the use of the department of marine and fisheries. Till 1905 Halifax was the summer station of the British North American squadron. In that year, in consequence of a redistribution of the fleet, the permanent North American squadron was withdrawn; but Halifax is still visited periodically by powerful squadrons of cruisers.

Though, owing to the growth of Sydney and other outports, it no longer monopolizes the foreign trade of the province, Halifax is still a thriving town, and has the largest export trade of the Dominion in fish and fish products. Lumber (chiefly spruce deals) and agricultural products (especially apples) are also exported in large quantities. The chief imports are manufactures from Great Britain and the United States, and sugar, molasses, rum and fruit from the West Indies. Its industrial establishments include foundries, sugar refineries, manufactures of furniture and other articles of wood, a skate factory and rope and cordage works, the produce of which are all exported It is the Atlantic terminus of the Canadian National and Dominion Atlantic railways, and the chief winter port of Canada, numerous steamship lines connecting it with Great Britain, Europe, the West Indies and the United States. The educational institutions include a ladies' college, several convents, a Presbyterian theological college and Dalhousie university, with faculties of arts, law, medicine and science. Other prominent buildings are Government house, the provincial parliament and library, and the Roman Catholic cathedral. St. Paul's church (Anglican) dates from 1750, and though not striking architecturally, is interesting from the memorial tablets and the graves of celebrated Nova Scotians which it contains The city is the seat of the Anglican bishop of Nova Scotia and Prince Edward island, and of the Roman Catholic bishop of Halifax. About one tenth of the city area was devastated in 1917 by the explosion of a French steamer carrying 3,000 tons of T N T., on colliding with a Norwegian steamer on its way with a relief cargo to Belgium. Reconstruction has been carried out on modern lines of town planning

Founded in 1749 by the Hon. Edward Cornwallis as a rival to the French town of Louisburg in Cape Breton, it was named after the 2nd earl of Halifax, president of the board of trade and plantations. Its privateers played a prominent part in the war of 1812–15 with the United States, and during the American Civil War it was a favourite base of operations for Confederate blockade-runners.

HALIFAX, a municipal county and parliamentary borough in the West Riding of Yorkshire, England, 194 m. N.N.W. from London and 7 m. S.W. from Bradford, on the L.N.E. and L.M.S. railways. Pop. (1921), 99,127. It lies in a bare hilly district on the Hebble, near its confluence with the Calder. The left bank of the Hebble is steep, allowing only small urban development, and the main part of the town is situated on the slopes of an eastward facing spur, on the right bank of the stream. Bridges carrying both road and rail span the valley, the most important being the North bridge, a fine iron structure.

The general appearance of the town is modern—a development of the industrial period—though a few old houses remain. Two early churches are traceable, the first may be pre-Norman, the second of the Early English period, with some very fine woodwork, the greater portion of which dates from 1621. The parish church of St. John the Baptist is Perpendicular, with a lofty western tower. All Souls' church was built in 1859, from the designs of Sir Gilbert Scott. The Square chapel, erected by the Congregationalists in 1857, is a striking building. Among public buildings are the Palladian town hall, with a tower completed in 1863, after the designs of Sir Charles Barry, the central library and museum, and the Akroyd museum and art gallery. The Heath Grammar school was founded in 1585 under royal charter for instruction in

classical languages. It possesses close scholarships at Oxford and Cambridge universities. The Piece Hall was erected in 1799 for the lodgment and sale of piece goods; it is now used as a market. There are six parks.

Halifax ranks with Bradford and Huddersfield as a seat of the woollen and worsted industries. The manufacture of carpets is important, one establishment employing some 5,000 hands. Cotton is also manufactured, and iron and steel industries, resulting in the manufacture of machinery, are very extensive. Coal and freestone are found in the neighbourhood.

History.—At the time of the Conquest, Halifax formed part of the extensive royal manor of Wakefield, but in the 13th century it was in the hands of John, Earl Warrenne (*c.* 1245–1305). The cloth trade began in the 15th century, when there are said to have been only 13 houses. Before the end of the 16th century this number had increased to 520. Camden, about the end of the 17th century, wrote that "the people are very industrious, so that though the soil about it be barren and unprofitable, not fit to live on, they have so flourished . . . by the clothing trade that they are very rich and have gained a reputation for it above their neighbours." The trade is said to have been increased by the arrival of certain merchants driven from the Netherlands by the persecution of the duke of Alva. Among the curious customs of Halifax was the Gibbet law, which was probably established by a prescriptive right to protect the wool trade. It gave the inhabitants the power of executing anyone taken within their liberty, who, when tried by a jury of 16 of the frith-burgesses, was found guilty of the theft of any goods of the value of more than 13 pence. The executions took place on market days, on a hill outside the town, the last execution taking place in 1650.

In 1607, David Waterhouse, lord of the manor of Halifax, obtained a grant of two markets there every week, on Friday and Saturday, and two fairs every year, each lasting three days, one beginning on June 24, the other on Nov. 11 Later, an extra market was added, on Thursday The market rights were sold to the Markets company in 1810, and purchased from them by the corporation in 1853. In 1635 the king granted the inhabitants of Halifax a licence to found a workhouse, and incorporated them under the name of the master and governors. A large house was given them for the purpose by Nathaniel Waterhouse, who was appointed the first master, his successors being elected every year by the 12 governors from among themselves. During the Civil War, Halifax was garrisoned by the parliament, and a field near it is still called the Bloody Field, on account of an engagement which took place there.

Halifax was a borough by prescription, its privileges increasing with increased prosperity brought by the cloth trade, but it was not incorporated until 1848 After the Reform Act of 1832 the burgesses have returned two members to parliament; the borough now returns one. The county borough was created in 1888.

HALISAH (Heb. "act of untying *sc.* the shoe"), act of testimony to the refusal of a man to marry the widow of his brother who has left no son (or child according to Sadducean views, *cf.* Mark xii. 19 and possibly Josephus *Ant.* iv. 8, 23). The word is better written *Ḥaliçah*. The biblical sources for this marriage (levirate, *q.v.*) are Deut. xxv. 5–10 and Gen. xxxviii. 8. This primitive custom was designed to safeguard the widow and the estate. In the days of polygamy, refusal was looked upon as selfishness (*cf.* Ruth iii. 13; iv. 1–12) and the biblical procedure was intended to shame one guilty of unbrotherly conduct. With the passing of polygamy—and no instance occurs in the Talmud of a Rabbi with more than one wife—the levirate marriage became impossible. Consequently, in course of time both the marriage and the repudiation were regarded as disastrous and every legal effort was made to avoid their necessity: a valid reason for remitting *Ḥaliçah* was always accepted and ingenuity was displayed in finding reasons. Marriage between uncle and niece was deprecated in case the husband died and the widow's father should have to undergo the renunciation ceremony. To prevent extortion on the part of brothers-in-law, brothers were often required to sign a document at their sister's marriage, pledging themselves not to refuse *Ḥaliçah* if the need arose and not to exact payment for compliance. Full details with illustrations will be found in the *Jewish Encyclopedia*, *s.v.* Halizah Levirate.

HALKETT, HUGH, Freiherr von (1783–1863), British soldier and general of infantry in the Hanoverian service, was the second son of Major-General F. G. Halkett, and served in India from 1798 to 1801, in Cathcart's expeditions to Hanover, Rugen and Copenhagen, in the Peninsula in 1808–1809, at Walcheren, and then again in Spain He was subsequently employed in the organization of the new Hanoverian army. In the Waterloo campaign he commanded two brigades of Hanoverian militia which were sent to the front with the regulars. After the fall of Napoleon he elected to stay in the Hanoverian service, and rose to be general and inspector-general of infantry. In his old age he led the X Federal Army Corps in the Danish War of 1848, and defeated the Danes at Oversee.

See Knesebeck, *Leben des Freiherrn Hugh von Halkett* (Stuttgart, 1865).

His brother, Sir Colin Halkett (1774–1856), British soldier, began his military career in the Dutch Guards but entered the British service, served through the Peninsular War, and commanded in 1815 the 5th British Brigade of Alten's division. At Waterloo he received four wounds. Unlike his brother, he remained in the British service, in which he rose to general. At the time of his death he was governor of Chelsea hospital.

For information about both the Halketts, *see* Beamish, *History of the King's German Legion* (1832).

HALL, ASAPH (1829–1907), American astronomer, was born on Oct 15, 1829, at Goshen, Conn., and left school when 13 years of age to support the family after the death of his father. At 16 he became a carpenter and his desire to be an architect led him to study mathematics. Nine years later he was able to spend a year and a half at Central college, McGrawville, N.Y., and later a summer term at the University of Michigan, where, under Brunnow, he made his first acquaintance with astronomical instruments. Determined to become an astronomer, he went to Cambridge, Mass., in 1857, as an assistant to Prof. Bond at $3 a week In 1862 he had made such progress that he was appointed an aid, and one year later professor in mathematics at the U S Naval Observatory, Washington, D C. This position he held until his retirement in 1891. From 1895 to 1901 he was professor of astronomy at Harvard. At the Naval observatory Hall had the 26 in. equatorial telescope under his charge from 1875 to 1891. His work with it was chiefly in three fields; planetary observations and the orbits of their satellites; observations of double-star orbits; determinations of the stellar parallax. In each of these fields Hall's extensive observations were of great value. His most spectacular achievement was the discovery in 1877 of the two satellites of Mars, whose orbits he calculated. He died at Annapolis, Md., on Nov. 22, 1907.

See G. W. Hill, *Biographical Memoir of Asaph Hall* (1908) which contains a full bibliography of Hall's scientific writings, and A. Hall, *An Astronomer's Wife* (1908), a biography of Mrs. Hall.

HALL, BASIL (1788–1844), British naval officer and traveller, was born at Edinburgh on Dec. 31, 1788, the son of Sir James Hall of Dunglass, the geologist. Basil entered the navy in 1802, and in 1817 became post-captain His cruise in the sloop "Lyra" in 1816 with Lord Amherst's embassy, to China is described in *An Account of a Voyage of Discovery to the West Coast of Corea and the Great Loochoo Island in the Japan Sea* (1818). In 1824 he published *Extracts from a Journal written on the Coasts of Chili, Peru and Mexico, in the Years 1820–21–22*, and in 1829 *Travels in North America in the Years 1827 and 1828*. His *Fragments of Voyages and Travels* (9 vols.) appeared in three detachments between 1831 and 1840. He died in Haslar hospital, Portsmouth, on Sept. 11, 1844.

HALL, CARL CHRISTIAN (1812–1888), Danish statesman, was born at Christianshavn on Feb. 25, 1812, and was educated for the law. Returned to the *Rigsforsamling* of 1848 as member for the first district of Copenhagen, which he continued to represent in the *Folketing* till 1881, he displayed rare ability as a debater, while his extraordinary tact and temper disarmed opposition. Hall was not altogether satisfied with the fundamental

law of June; but he accepted the existing constitution and sought to unite the best conservative elements of the nation in its defence. Failing to rally the landed aristocracy to the good cause, he determined to organize the middle class into a political party. Hence the "June Union," whose programme was progress and reform in the spirit of the constitution, and at the same time opposition to the *Bondevenner* or peasant party. The "Union" exercised an essential influence on the elections of 1852, and was, in fact, the beginning of the national Liberal party, which found its natural leader in Hall. During the years 1852–54 the burning question of the day was the connection between the various parts of the monarchy Hall was "eiderdansk" by conviction He saw in the closest possible union between the kingdom and a Slesvig freed from all risk of German interference the essential condition for Denmark's independence; but he did not think that Denmark was strong enough to carry such a policy through unsupported, and he was therefore inclined to promote it by diplomatic means and international combinations.

Hall first took office in the Bang administration (Dec. 12, 1854) as minister of public worship. In May 1857 he became president of the council after Andrae, Bang's successor, had retired, and in July 1858 he exchanged the ministry of public worship for the ministry of foreign affairs, while still retaining the premiership. Hall's programme, "den Konstitutionelle Helstat," *i.e.*, a single State with a common constitution, was difficult enough in a monarchy which included two nationalities, one of which, to a great extent, belonged to a foreign and hostile jurisdiction But as this situation had been guaranteed by the Conventions of 1851–52, Hall sought to establish this "Helstat" by the Constitution of Nov 13, 1863 For the failure of the attempt *see* DENMARK: *History*. Hall himself soon became aware of the impossibility of the "Helstat," and his whole policy aimed at making its absurdity patent to Europe, and substituting for it a constitutional Denmark to the Eider which would be in a position to come to terms with an independent Holstein That this was the best thing possible for Denmark is indisputable, and "the diplomatic Seven Years' War," which Hall in the meantime conducted with all the powers interested in the question, is the most striking proof of his superior statesmanship

After 1864 Hall's unconquerable faith in the future of his country made him, during those difficult years, a power in the public life of Denmark In 1870 he joined the Holstein-Holsteinborg ministry as minister of public worship; he passed many useful educational reforms, but on the fall of the administration, in 1873, he retired from public life. He died on Aug. 14, 1888.

See V C S Topsoe, *Polit Portraetstudier* (Copenhagen, 1878); S. P. V. Birkedal, *Personlige Oplevelser* (Copenhagen, 1890–91)

HALL, CHARLES FRANCIS (1821–1871), American arctic explorer, was born at Rochester, N H. His enthusiasm for arctic exploration led him in 1859 to volunteer to the American Geographical Society to "go in search for the bones of Franklin" With the proceeds of a public subscription he was equipped for his expedition and sailed in May 1860 on board a whaling vessel. The whaler being ice-bound, Hall took up his abode in the regions to the north of Hudson bay, where he found relics of Frobisher's 16th century voyages He published an account of his experiences under the title of *Arctic Researches and Life among the Esquimaux* (1864) Determined to learn more about the fate of the Franklin expedition he returned to the same regions in 1864, and passing five years among the Eskimo was successful in obtaining a number of Franklin relics, as well as information pointing to the exact fate of 76 of the crew, whilst also performing some geographical work of interest. In 1871 he was given command of the North Polar expedition fitted out by the U S. Government in the "Polaris" Making a remarkably rapid passage up Smith sound at the head of Baffin bay, which was found to be ice-free, the "Polaris" reached on Aug. 30, the lat of 82° 11′, at that time and until the English expedition of 1876 the highest north attained by vessel. He died suddenly on Nov. 8, 1871.

HALL, CHARLES MARTIN (1863–1914), American inventor, was born at Thompson, O., on Dec 6, 1863, and graduated at Oberlin college in 1885. While still at college he became interested in the problem of devising a cheap process for the reduction of aluminium. Working with such apparatus as the Oberlin laboratory afforded, he invented, eight months after his graduation, the electrolytic process, which forms the basis for the present commercial production of the metal. The next three years were spent perfecting his process and interesting capitalists. In 1889 the Pittsburgh Reduction Company (later the Aluminum Company of America) began to manufacture aluminium and in 1890 Hall was made its vice-president. The invention made aluminium a common article of commerce, for which constantly increasing uses are being found. Hall's death occurred in Daytona, Fla., on Dec. 27, 1914 The fortune resulting from his invention was bequeathed chiefly to educational institutions, Oberlin receiving gifts totalling more than $3,000,000.

HALL, CHRISTOPHER NEWMAN (1816–1902), English Nonconformist divine, was born at Maidstone on May 22, 1816. He was educated at University college, London, and at Highbury college, and was then appointed pastor of the Albion Congregational Church, Hull. At Hull Newman Hall first began his active work in temperance reform, and in defence of his position wrote *The Scriptural Claims of Teetotalism*. In 1854 he became pastor of Surrey chapel, London, which was superseded by Christchurch, Westminster Bridge Road, for the building of which Newman Hall raised the money. He held his charge for nearly 40 years, resigning in 1892 to devote himself to general evangelical work. Newman Hall visited the United States during the Civil War, and did much to promote a friendly understanding between England and America. A Liberal in politics, and a keen admirer of John Bright, few preachers of any denomination have exercised so far-reaching an influence as the "Dissenters' Bishop," as he came to be termed He died on Feb. 18, 1902.

See his *Autobiography* (1898)

HALL, EDWARD (*c.* 1498–1547), English chronicler and lawyer, was a son of John Hall of Northall, Shropshire. Educated at Eton and King's college, Cambridge, he became common serjeant of the city of London and judge of the sheriff's court He was also M.P. for Bridgnorth. Hall's great work, *The Union of the Noble and Illustre Famelies of Lancastre and York*, commonly called *Hall's Chronicle*, was first published in 1542, and continued by Richard Grafton (*q.v.*). The value of the *Chronicle* in its early stages is not great, but is very considerable for the reign of Henry VIII. To the student of literature it has the exceptional interest of being one of the prime sources of Shakespeare's historical plays

See J Gairdner, *Early Chroniclers of Europe; England* (1879), and the editions of the *Chronicle* by Sir H. Ellis (1809) and C. Whitley (1904).

HALL, FITZEDWARD (1825–1901), American orientalist, was born in Troy, N Y., on March 21, 1825. He graduated at the Rensselaer Polytechnic institute at Troy in 1842, and entered Harvard in the class of 1846; just before his class graduated he went to India in search of a runaway brother. In Jan 1850 he was appointed tutor, and in 1853 professor of Sanskrit and English, in the Government college at Benares; in 1855 he was made inspector of public instruction in Ajmere-Merwara and in 1856 in the Central Provinces. He settled in England in 1862 and received the appointment to the chair of Sanskrit, Hindustani and Indian jurisprudence in King's college, London, and to the librarianship of the India Office. He died at Marlesford, Suffolk, on Feb. 1, 1901.

Hall ed. and trans. in the *Bibliotheca Indica*, many oriental works, including *Ātma-bodha* (1852), *Sánkhya-pravachana-bháshya* (1856), *Vásavadattá* (1855–59) and the *Daśa-rúpa* (1865). He also was the author of *A Contribution towards an Index to the Bibliography of the Indian Philosophical Systems* (1859), text-books, and several works on English philology His valuable collection of oriental mss. he gave to Harvard university.

HALL, GRANVILLE STANLEY (1844–1924), American psychologist and educationalist, was born at Ashfield, Mass., on Feb 1, 1844, of Puritan ancestry. He graduated from Williams college in 1867, studied in Germany two years, and graduated from Union Theological seminary in 1871. After holding the chair of psychology at Antioch college, 1872–76, he studied under

William James at Harvard and took the degree of Ph.D. in 1878. He then pursued for two years further studies at Berlin, Bonn, Heidelberg and Leipzig, working with Wundt, Helmholtz and other noted investigators. From 1881 to 1888 Hall was professor of psychology at Johns Hopkins university, where his laboratory was the first of its kind in the country, and attracted many able students, among them John Dewey, Joseph Jastrow and J. McKern Cattell. In 1889 Hall was installed first president and made professor of psychology of the newly formed Clark university, Worcester, Mass., which, under his personal leadership, was devoted, during its first two decades, chiefly to educational research. Because of his varied and interesting investigations, he attained prominence in the educational field, and for thirty years was an important contributor to educational literature. He became widely known as an exponent of the culture-epoch theory, a doctrine set forth in his most influential work, *Adolescence* (1904). Although his methods at times lacked in scientific precision, his contributions to the progress of psychology and education in his time were substantial and stimulating. In 1887 he founded the *American Journal of Psychology*, which he edited until 1921. For long periods he edited also several other scientific and educational journals. He resigned the presidency of Clark university in 1920, but continued active literary work until his death, April 24, 1924.

Hall's numerous published works include: *The Contents of Children's Minds on Entering School* (1894), *Youth—Its Education, Regimen and Hygiene* (1907), *Educational Problems* (1911), *Founders of Modern Psychology* (1912), *Jesus the Christ, in the Light of Psychology* (1917), *Morale: The Supreme Standard of Life and Conduct* (1920), *Recreations of a Psychologist* (1920), *Senescence* (1922), and *Life and Confessions of a Psychologist* (1923).

See G. E. Partridge, *Genetic Philosophy of Education: An Epitome of the Published Writings of G. Stanley Hall* (1912); Louis N. Wilson, *G. Stanley Hall: A Sketch* (1914); and Lorine Pruett, *G. Stanley Hall; a Biography of Mind* (1926).

HALL, ISAAC HOLLISTER (1837–1896), American Orientalist, was born in Norwalk, Connecticut, on December 12, 1837. He graduated at Hamilton College in 1859, was a tutor there in 1859–1863, graduated at the Columbia Law School in 1865, practised law in New York City until 1875 and in 1875–1877 taught in the Syrian Protestant College at Beirut where he discovered a valuable Syriac manuscript of the Philoxenian version of a large part of the New Testament which he published in part in facsimile in 1884. He worked with General di Cesnola in classifying the famous Cypriote collection in the Metropolitan Museum of New York City and was a curator of that museum from 1885 until his death in Mount Vernon, New York, on July 2, 1896.

HALL, SIR JAMES (1761–1832), Scottish geologist and physicist, was born at Dunglass on Jan. 17, 1761. He made a series of experiments to demonstrate the views of James Hutton with regard to intrusive rocks, and was thus the founder of experimental geology. The results of his experiments were brought before the Royal Society of Edinburgh. He was M.P. for Michael, Cornwall, from 1807–12. He died on June 23, 1832, at Edinburgh. He left three sons, of whom the second, Basil (*q.v.*), was a well known writer of travel books.

HALL, JAMES (1793–1868), American judge and man of letters, was born Aug. 19, 1793. Perhaps the most zealous worker for adequate treatment of the early West in literature, Hall was nevertheless not a native of this section. He was born in Philadelphia, studied law in the East and took a gallant part in the War of 1812 before migrating to the Mississippi Valley "in search of adventure." After being admitted to the bar in Pittsburgh he commenced practice at Shawneetown (Ill.), where he also edited the *Illinois Gazette*. Successively public prosecutor of the circuit, circuit judge, and state treasurer (1827–31), he nevertheless continued his practice and did much editorial work. He died near Cincinnati, July 4, 1868.

Hall is at his best in the short stories contained in *The Soldier's Bride* (1833), *Tales of the Border* (1835), *Legends of the West* (1832), and *The Wilderness and the War-Path* (1846). In parts these are marred by melodrama, but his tales of the tiny French villages show a delicate humour, an imaginative charm and an ease and grace of style that reveal Hall as a follower of Irving and a significant figure in the development of the American short story.

See W. H. Venable, "Judge James Hall" in *Beginnings of Literary Culture in the Ohio Valley* (1891), and F. L. Pattee, *The Development of the American Short Story* (1923).

HALL, JAMES (1811–1898), American geologist and palaeontologist, was born at Hingham, Mass., on Sept. 12, 1811. Extreme poverty was the lot of his family, and he acquired through his own efforts his early education, which was, however, sufficiently complete to prepare him for admission to the Rensselaer Polytechnic Institute of Troy, New York. Even as a boy he was passionately interested in natural history, and at the time of Silliman's Lowell lectures he walked to Boston and back from Hingham in order to attend them. As a student he collected and determined more than 900 species of plants. He spent his summers and all of his limited finances doing field work. After his graduation from the Rensselaer institute in 1832 he became librarian at the institute, and later in the same year an assistant professor; subsequently he became professor of chemistry, natural science and geology. Stephen Van Rensselaer became interested in Hall and sent him to make geological explorations in the St. Lawrence valley.

In 1836 he was appointed one of four geologists on the geological survey of the State of New York which had been established just before that time. Although the youngest of the group, his is the only one of the four final reports which deals broadly with the problems of the science and has endured with authority as a classic of geological literature.

Eventually Hall became State geologist and director of the Museum of Natural History of Albany. Through various periods when State support was withdrawn from geological work, he carried it on at his own expense. At one time he sold 2,000ac. of Ohio land in order to gain funds to pay obligations incurred through his work, receiving $15,000 for the land, which was valued at $200,000 ten years later. It was only through this sacrifice that the continued publication of the volume of the *Palaeontology of New York* (1847–94) was made possible. These volumes, the results of his chief work, contained descriptions of the invertebrate fossils of New York, in which he dealt with the graptolites, brachiopods, mollusca, trilobites, echini and crinoids of the palaeozoic formations. He was also at one time State geologist of Iowa and afterwards of Wisconsin.

His publications, dating from 1836, include more than 260 scientific papers and 35 books, dealing with numerous phases of geology and palaeontology of the different regions of the United States and Canada, including reports on the geology of Oregon and California (1845), of Utah (1852), Iowa (1859) and Wisconsin (1862). He received the Wollaston medal from the Geological Society of London in 1858.

Hall was regarded as a great teacher as well as collector. In his 86th year he journeyed to St. Petersburg (Leningrad) to take part in the International Geological Congress, and then joined the excursion to the Ural mountains. He died at Echo Hill, Bethlehem, New Hampshire, on Aug. 7, 1898, and was buried at Albany.

His most important publications were: *Palaeontology of New York*, vols. 1–8 (1847–88; vol. 8, in collaboration with J. M. Clarke, of especial importance); *Geology of New York*, part IV. (comprising the survey of the fourth geological district, 1843); with J. M. Clarke, *An Introduction to the Study of the Brachiopoda*, part I. (11th annual report of New York State Geologist, 1892); and part II. (13th annual report, 1894). A complete bibliography of his work is given in the *Bulletin of the Geological Society of America*, vol. X. (1898), pp. 436–451. *See* also "Life and Works of James Hall," by H. C. Hovey, *American Geol.* XXIII. (1899), p. 137 (portraits); "Memoir of James Hall," by John J. Stevenson, *Bull. of Geol. Soc. of America*, vol. X. (1898), pp. 425–435.

HALL, JOSEPH (1574–1656), English bishop and satirist, was born at Bristow park, near Ashby de la Zouch, Leicestershire, on July 1, 1574. He was sent (1589) to Emmanuel college, Cambridge, where he wrote his *Virgidemiarum* (1597), satires written after Latin models. The claim he put forward in the prologue to be the earliest English satirist:—

I first adventure, follow me who list
And be the second English satirist—

gave bitter offence to John Marston, who attacks him in the satires published in 1598 He was presented (1601) by Sir Robert Drury to the living of Halsted, Essex. His devotional writings had attracted the notice of Henry, prince of Wales, who made him one of his chaplains (1608); other preferments followed. In 1616 the king nominated him dean of Worcester, and in 1617 he accompanied James to Scotland, where he defended the five points of ceremonial which the king desired to impose upon the Scots In the next year he was one of the English deputies at the synod of Dort. In 1624 he refused the see of Gloucester, but in 1627 became bishop of Exeter

He took an active part in the Arminian and Calvinist controversy in the English Church. He did his best in his *Via media, The Way of Peace*, to secure a compromise. In spite of his Calvinistic opinions he maintained that to acknowledge the errors which had arisen in the Catholic Church did not necessarily imply disbelief in her catholicity, and that the Church of England having repudiated these errors should not deny the claims of the Roman Catholic Church on that account. This view commended itself to Charles I. and his episcopal advisers, but Laud sent spies into Hall's diocese to report on the Calvinistic tendencies of the bishop and his lenience to the Puritan and low-church clergy. His defence of the English Church, entitled *Episcopacy by Divine Right* (1640), was twice revised at Laud's dictation. This was followed by *An Humble Remonstrance to the High Court of Parliament* (1640 and 1641), an eloquent and forceful defence of his order, which produced a retort from the syndicate of Puritan divines, who wrote under the name of "Smectymnuus," and was followed by a long controversy to which Milton contributed five pamphlets, virulently attacking Hall and his early satires

In 1641 Hall was translated to the see of Norwich, and in the same year sat on the Lords' Committee on religion On Dec. 30 he was, with other bishops, brought before the bar of the House of Lords to answer a charge of high treason of which the Commons had voted them guilty. They were finally convicted of an offence against the Statute of Praemunire, and condemned to forfeit their estates, receiving a small maintenance from the parliament. They were immured in the Tower from New Year to Whitsuntide. On his release Hall went to his new diocese at Norwich, the revenues of which he seems for a time to have received, but in 1643, when the property of the "malignants" was sequestrated, Hall had difficulty in securing the maintenance (£400) assigned to the bishop by the parliament and was compelled to retire to Higham, near Norwich, where he spent the time preaching and writing until "he was first forbidden by man, and at last disabled by God." He died on Sept. 8, 1656 Thomas Fuller says: "He was commonly called our English Seneca, for the purenesse, plainnesse and fulnesse of his style. Not unhappy at *Controversies*, more happy at *Comments*, very good in his *Characters*, better in his *Sermons*, best of all in his *Meditations*"

It is by his early work as the censor of morals and the unsparing critic of contemporary literary extravagance and affectations that Hall is best known *Virgidemiarum. Sixe Bookes. First three Bookes. Of Toothlesse Satyrs* (1) *Poeticall*, (2) *Academicall*, (3) *Morall* (1597) was followed by an amended edition in 1598, and in the same year by *Virgidemiarum. The three last bookes. Of byting Satyres* (reprinted 1599). If he was not the earliest English satirist, Hall was certainly one of the best. He writes in the heroic couplet, which he manoeuvres with great ease and smoothness In the first book of his satires (*Poeticall*) he attacks the writers whose verses were devoted to licentious subjects, the bombast of *Tamburlaine* and other tragedies, the laments of the ghosts of the *Mirror for Magistrates*, the metrical eccentricities of Gabriel Harvey and Richard Stanyhurst, the extravagances of the sonneteers, and the sacred poets. In Book II. Satire 6 occurs the well-known description of the trencher-chaplain, who is tutor and hanger-on in a country manor. Book VI. consists of one long satire on the various vices and follies dealt with in the earlier books. If his prose is sometimes antithetical and obscure, his verse is remarkably free from the quips and conceits which mar so much contemporary poetry.

He also wrote *The King's Prophecie; or Weeping Joy* (1603), a gratulatory poem on the accession of James I.; *Epistles*, both the first and second volumes of which appeared in 1608 and a third in 1611; *Characters of Virtues and Vices* (1608), versified by Nahum Tate (1691); *Solomons Divine Arts . . .* (1609); and, probably, *Mundus alter et idem sive Terra Australis antehac semper incognita . . . lustrata* (1605? and 1607), by "Mercurius Britannicus." *Mundus alter* is an excuse for a satirical description of London, and is said to have furnished Swift with hints for *Gulliver's Travels*. For the arguments in favour of the authorship by Alberico Gentili, *see* E. A. Petherick, *Mundus alter et idem*, reprinted from the *Gentleman's Magazine* (July 1896). His controversial writings include:—*A Common Apology . . . against the Brownists* (1610); *Episcopacie by Divine Right* (1640); *A Short Answer to the Vindication of Smectymnuus* (1641); *A Modest Confutation of . . . (Milton's) Animadversions* (1642).

His devotional works include: *Heaven upon Earth, or of True Peace and Tranquilitie of Mind* (1606), reprinted in John Wesley's *Christian Library* (1819); *The Devout Soul* (1644), often since reprinted; *Christ Mysticall* (1647), of which General Gordon was a student, and others.

BIBLIOGRAPHY —The chief authority for Hall's biography is to be found in his autobiographical tracts: *Observations of some Specialties of Divine Providence in the Life of Joseph Hall, Bishop of Norwich, Written with his own hand*; and his *Hard Measure*, reprinted in Christopher Wordsworth's *Ecclesiastical Biography*. The best criticism of his satires is to be found in Thomas Warton's *History of English Poetry*, vol. iv. pp. 363–409 (ed. Hazlitt, 1871). Editions of Hall's works appeared in 1625, 1627, 1628, 1634, 1662. The first complete *Works* appeared in 1808, ed. by the Rev Josiah Pratt. *See* also A B. Grosart, *The Complete Poems of Joseph Hall . . . with introductions, etc.* (1879); *Satires, etc.* (*Early English Poets*, ed. S. W. Singer, 1824).

HALL, MARSHALL (1790–1857), English physiologist, was born on Feb. 18, 1790, at Basford, near Nottingham, the son of a cotton manufacturer. He studied medicine at Edinburgh, and became resident house physician to the Royal Infirmary. This appointment he resigned after two years to visit the medical schools of Paris, Berlin and Göttingen. He then settled at Nottingham, where he became physician to the General Hospital, and in 1826 removed to London. Hall's principal works are. *Diagnosis* (1817); *Mimoses* (1818), on the affections designated as bilious, nervous, etc ; *Observations on Blood-letting* (1830), and *Experimental Essay on the Circulation of the Blood in the Capillary Vessels* (1831) in which he showed that the blood-channels intermediate between arteries and veins serve the office of bringing the fluid blood into contact with the material tissues of the system. In 1832 he read before the Royal Society a paper "On the inverse ratio which subsists between respiration and irritability in the animal kingdom." His most important work in physiology was concerned with the theory of reflex action, embodied in a paper "On the reflex function of the Medulla Oblongata and the Medulla Spinalis" (1832), supplemented in 1837 by another "On the true Spinal Marrow, and the Excito–motor System of Nerves." Hall thus became the authority on the multiform deranged states of health referable to an abnormal condition of the nervous system. His "ready method" for resuscitation in drowning and other forms of suspended respiration has saved innumerable lives. He died on Aug. 11, 1857.

A list of his works and details of his "ready method," etc., are given in his *Memoirs* by his widow (1861).

HALL, ROBERT (1764–1831), English Baptist divine, was born on May 2, 1764, at Arnesby near Leicester, where his father, Robert Hall (1728–1791), was pastor of a Baptist congregation. Ending his studies at Aberdeen university he became classical tutor at the Bristol academy, where he spent four years. In 1790 he became pastor of a church at Cambridge, where he remained for 15 years and made a great reputation as a preacher He died on Feb. 21, 1831.

See *Works of Robert Hall, A.M., with a Brief Memoir of his Life, by Olinthus Gregory, LL.D., and Observations on his Character as Preacher by John Foster* (6 vols. 1832).

HALL, SAMUEL CARTER (1800–1889), English journalist, was born at Waterford, the son of an army officer. In 1839 he founded and edited *The Art Journal* in which he exposed the trade in bogus "Old Masters." His wife, Anna Maria Fielding (1800–81), became well known as Mrs. S. C. Hall, for her numerous novels, sketches of Irish life, and plays.

HALL, WILLIAM EDWARD (1835–94), English writer on international law, was born on Aug. 22, 1835, at Leatherhead, Surrey. His father was physician to the king of Hanover, and subsequently to the British legation at Naples, and the boy spent much of his early life abroad. After a distinguished career at Oxford university, he was called to the bar at Lincoln's Inn in 1861. He spent much of his time in travel. He was an early and enthusiastic member of the Alpine club, making several first ascents, notably that of the Lyskamm. His travels took him to Lapland, Egypt, South America and India. In 1874 he published a thin 8vo upon the *Rights and Duties of Neutrals*, and followed it up in 1880 by his *magnum opus*, the *Treatise on International Law*. In 1894 Hall published a useful monograph upon a little-explored topic, "The Foreign Jurisdictions of the British Crown." He died on Nov. 30, 1894.

See T. E. Holland in *Law Quarterly Review*, vol. xi ; and in *Studies in International Law*, p. 302.

HALL or **BAD-HALL** is a small spa, of about 1,400 inhabitants, on a tributary of the river Krems, Upper Austria. Local saline springs rich in bromides and iodides, though long known, have grown in popularity since 1855 when they became the property of the Government and a large new one was opened in 1925. The town is visited yearly by numbers of sufferers for treatment of scrofulous and other malignant skin diseases.

HALL (generally known as SCHWÄBISCH-HALL, to distinguish it from the small town of Hall in Tirol and Bad-Hall, a health resort in Upper Austria), a town of Germany, in the republic of Württemberg, situated on the Kocher, and on the railway from Heilbronn to Krailsheim, 35 m. N E of Stuttgart. Pop. (1925) 8,978. Hall was early of importance on account of its salt-mines, which were held as a fief of the Empire by the Salzgrafen who had their seat in the castle of Hall. The word Hall or Hal, in some form, with or without a suffix, comes into the name of many ancient towns connected with salt. Later the town belonged to the Knights Templars. It was made a free imperial city in 1276 by Rudolph of Habsburg. In 1802 it came into the possession of Württemberg. The Michaeliskirche dates from the 15th century and has fine mediaeval carving A short distance south from the town is the castle of Komburg, formerly a Benedictine abbey, with a church dating from the 12th century. The town is chiefly known for its production of salt, which is converted into brine and piped from Wilhelmsglück mine, 5 m. distant. The industries of the town also include cotton-spinning, tanning and the manufacture of soap, starch, brushes, machines and flat irons

HALL, a large, undivided room; also an entrance room or passageway affording communication to other parts of a building. Originally the word was limited to the chief room of a feudal house or castle, and was applied even to the entire building, probably because in early north Europe the lord's house consisted of merely one such big room with detached out-buildings. Thus certain early houses on the border between England and Scotland, of which one remains almost intact, in the deanery at Carlisle, consisted merely of a fortified tower with one room to each floor. During the 13th and 14th centuries, as the complexity of life increased, and houses became larger and more complex, the hall still remained as the most important feature. Here was the daïs where the lord and his family dined, while the retainers ate in the remaining space. Here guests were received, and here, in the earlier periods, was the house fire, built on stones in the centre of the floor, as in the existing hall of Penshurst place, Kent. The hall retained its importance into the 16th century. Then, as more and more separate small rooms, easier to heat and more private, were gradually added for sleeping, eating and resting, the importance of the hall declined. It became first a ceremonial chamber, and finally merely an entrance way; it is from this that the modern usage as a passage way derives.

The typical Tudor hall was a rectangular room, usually running the entire height of the building with exposed timber trusses. At Mayfield in Sussex (*c.* 1350), great stone arches take the place of the trusses. At one end a narrow passageway was screened off, serving as a vestibule; the house entrance led into the passage and from there by doors through the screens into the hall. On the opposite side of the passage were the doors into the kitchen, buttery, larder and other service rooms, and above the passage the musician's gallery. At the end of the hall, opposite the screen, was the raised dais (*q.v.*). The hall was lighted by windows high in the wall, except at the dais end, where there was a bay window, and sometimes two. One or more great fireplaces furnished heat. The hall was usually roofed with timber trusses, although that of Bolsover castle in Derbyshire (late 16th century) is vaulted. Many of the trusses are of great richness and are of the type known as hammerbeam (*q.v.*), as in the great hall of Hampton Court palace (1534–35) and that of the Middle Temple, London (1562–72).

Halls similar to those of baronial houses were also incorporated as integral parts of other buildings such as colleges and the buildings of the great guilds, which, like many of the houses, took their names from this feature (*e.g.*, Clothworkers' hall, Goldsmiths' hall, the Guildhall, etc.). Of these the finest examples are those of New college (1386) and Christ Church (*c.* 1525), both at Oxford, and Trinity college, Cambridge (1604). Among the most beautiful domestic examples are Great Chalfield manor (*c.* 1450), Ightham Mote (*c.* 1350), Compton Wynyates (*c.* 1520), Montacute (between 1580 and 1601), Burton Agnes (1602–10) and Hatfield house (1611).

See J. Nash, *The Mansions of England in the Olden Time* (1839); J. A Gotch, *Early Renaissance Architecture in England* (1901, new ed. 1914), and *Growth of the English House* (1909), T Garner and A. Stratton, *Domestic Architecture of England During the Tudor Period* (1911). (T. F. H.)

HALLAM, HENRY (1777–1859), English historian, was the only son of John Hallam, canon of Windsor and dean of Bristol, and was born on July 9, 1777. He was educated at Eton and Christ Church, Oxford, where he graduated in 1799. Called to the bar, he practised for some years on the Oxford circuit; but his tastes were literary, and when, on the death of his father in 1812, he inherited a small estate in Lincolnshire, he gave himself up wholly to the studies of his life. His Whig connections won for him a well-paid and easy post of commissioner of stamps He supported the abolition of the slave trade; and he was throughout his life a sincere upholder of Whig principles General sympathy was felt for him when he lost his two brilliant sons, Arthur Henry Hallam (d 1833), the A.H.H. of Tennyson's *In Memoriam*, and Henry Fitzmaurice Hallam (d. 1850). Hallam was a fellow of the Royal Society and a trustee of the British Museum. He died on Jan. 21, 1859. His great reputation rests on three standard works: *The View of the State of Europe during the Middle Ages* (1818; supplementary note, 1848); *Constitutional History of England* (1827); and *Introduction to the Literature of Europe in the 15th, 16th and 17th Centuries* (1838–39).

The *Middle Ages* is made up of nine long chapters, each of which is a complete treatise. The history of France, of Italy, of Spain, of Germany and of the Greek and Saracenic empires, sketched in rapid and general terms, is the subject of five separate chapters. Others deal with the great institutional features of mediaeval society—the development of the feudal system, of the ecclesiastical system and of the free political system of England. The last chapter sketches the general state of society, the growth of commerce, manners and literature in the middle ages.

The *Constitutional History of England* takes up the subject at the point at which it had been dropped in the *View of the Middle Ages*, viz., the accession of Henry VII., and carries it down to the accession of George III. An unwillingness to excite the prejudices of modern politics, which withheld him from touching perhaps the most interesting period in the history of the Constitution, did not save him from a violent attack by Southey in the *Quarterly Review*, 1828; he was accused "of heaping obloquy on all who supported the established institutions of the country." His chief unfairness was in tacitly assuming the 19th century theory of the

Constitution to be the right theory in previous centuries, and that those who departed from it on one side or the other were in the wrong. But though his work is thus coloured by his opinions, this was not the outcome of a conscious purpose, and he was scrupulously conscientious in collecting and weighing his materials. In this he was helped by his legal training, and the *Constitutional History* remains a standard authority.

Like the *Constitutional History*, the *Introduction to the Literature of Europe* continues one of the branches of inquiry opened in the *View of the Middle Ages*. The great qualities displayed in this work have been universally acknowledged—conscientiousness, accuracy, judgment and enormous reading. In science and theology, mathematics and poetry, metaphysics and law, Hallam is a competent and always a fair if not a profound critic. The bent of his own mind is manifest in his treatment of pure literature and of political speculation—which seems to be inspired with stronger personal interest and a higher sense of power than other parts of his work display.

Hallam is generally described as a "philosophical historian." The description is worthy in that he fixed his attention on results rather than on persons. His conception of history embraced the whole movement of society But sweeping theories of the government of society, and broad characterizations of particular periods of history had no attraction for him The view of mankind on which such generalizations are usually based, taking little account of individual character, was highly distasteful to him.

HALLAM, ROBERT (d. 1417), bishop of Salisbury and English representative at the council of Constance, was educated at Oxford, and was chancellor of the university from 1403 to 1405. In the latter year the pope nominated him to be archbishop of York, but the king objected However, in 1407 he was consecrated by Gregory XII at Siena as bishop of Salisbury. At the council of Pisa in 1409 he was one of the English representatives On June 6, 1411, Pope John XXIII. made Hallam a cardinal, but there was some irregularity, and his title was not recognized. At the council of Constance (*q.v.*), which met in Nov. 1414, Hallam was the chief English envoy. In the discussions which led up to the deposition of John XXIII. on May 29, 1415, he had a leading share With the trials of John Hus and Jerome of Prague he had less concern. Under Henry V.'s direction, he gave the emperor Sigismund vigorous support in the endeavour to secure a reform of the Church, before the council proceeded to the election of a new pope. Hallam died suddenly, on Sept. 4, 1417.

HALLÉ, SIR CHARLES (originally KARL HALLE) (1819–1895), English pianist and conductor, German by nationality, was born at Hagen, Westphalia, on April 11, 1819. He studied under Rink at Darmstadt in 1835, and in 1836 went to Paris, where for twelve years he mixed with Cherubini, Chopin, Liszt, Alfred de Musset, George Sand and other celebrities. He had started a set of chamber concerts with Alard and Franchomme, when the revolution of 1848 drove him from Paris, and he settled, with his wife and two children, in London. His pianoforte recitals, given at first from 1850 in his own house, and from 1861 in St. James's Hall, were for many years an important feature of London musical life. At the Musical Union founded by John Ella, and at the Popular Concerts from their beginning, Hallé was a frequent performer, and from 1853 he was director of the Gentlemen's Concerts in Manchester, where, in 1857, he started the famous Hallé Concerts which have remained in existence since that time. In 1888 he married Madame Norman Neruda, the violinist. In the same year he was knighted; and in 1890 and 1891 he toured with his wife in Australia and elsewhere. He died at Manchester on Oct. 25, 1895. Throughout his career Hallé was an influence of the first importance in English musical life and a consistent upholder of the highest musical ideals.

Lady Hallé, in turn, was one of the finest violinists of her time, being the first woman player to hold her own with the greatest male executants, and for many years she shared the leadership of the famous Monday and Saturday Popular Concerts with Joachim. She was born at Brünn on March 21, 1839, and died in Berlin on April 15, 1911. Queen Alexandra gave her the title of "Violinist to the Queen."

HALLE (known as HALLE-AN-DER-SAALE, to distinguish it from the small town of Halle in Westphalia), a town in the Prussian province of Saxony, situated in a sandy plain on the right bank of the Saale, which here divides into several arms, 21 m. N.W. from Leipzig by the railway to Magdeburg. Pop. (1925) 193,722.

Halle is first mentioned as a fortress erected on the Saale in 806. In 968 Halle, with the valuable salt works, was given by the emperor Otto I. to the newly founded archdiocese of Magdeburg, and in 981 Otto II. gave it a charter as a town. From the first there were separate jurisdictions for the Halloren and the German settlers in the town. The conflict of interests and jurisdictions led to the usual internecine strife during the middle ages, and both resisted the pretensions of the archbishops. In the 13th and 14th centuries it was a member of the Hanseatic League. Its liberty perished, however, as a result of the internal feud between the democratic gilds and the patrician panners. In 1478 a demagogue member of the town council, with his confederates opened the gates to the soldiers of the archbishop. The townsmen were subdued, and to hold them in check the archbishop built the castle of Moritzburg Notwithstanding the efforts of the archbishops of Mainz and Magdeburg, the Reformation found an entrance into the city in 1522. After the peace of Westphalia in 1648 the city came into the possession of the house of Brandenburg.

Its situation at the junction of railway lines from Berlin, Breslau, Leipzig, Frankfort-on-Main, the Harz country and Hanover, has developed the commercial and industrial importance of Halle. It consists of the old, inner town and two small towns, Glaucha in the south and Neumarkt in the north The centre of the town is occupied by the market square, on which stand the mediaeval town hall (restored in 1883) and the Gothic Marienkirche, dating mainly from the 16th century, with two towers connected by a bridge. In the square is a bronze statue of Handel, the composer, a native of Halle Among the churches, the St. Moritzkirche, dating from the 12th century, with fine wood carvings and sculptures, and the cathedral (belonging since 1689 to the Reformed or Calvinistic church), built in the 16th century are worthy of note. The castle of Moritzburg, formerly the residence of the archbishops of Magdeburg was destroyed by fire in the Thirty Years' War, with the exception of the left wing The university was founded by the elector Frederick III. of Brandenburg (afterwards king of Prussia), in 1694, was closed by Napoleon in 1806 and again in 1813, but in 1815 was re-established and united with the university of Wittenberg. From the first it has been recognized as one of the principal seats of Protestant theology, originally of the pietistic and latterly of the rationalistic and critical school. It is a famous centre of agricultural research. The salt-springs of Halle which have been known from a very early period, rise within the town and on an island in the Saale. The workmen employed at the salt works are known as the *Halloren*.

Among the industries of Halle are sugar refining, machine building, the manufacture of spirits, malt, chocolate, cocoa, rubber, confectionery, cement, paper, chicory, lubricating and illuminating oil, wagon grease, carriages and playing cards, printing, dyeing and coal mining (soft brown coal). The trade is considerable, the principal exports being machinery, raw sugar and petroleum. Halle is the seat of several important publishing firms. The Bibelanstalt (Bible institution) of von Castein is the central authority for the revision of Luther's Bible, of which it sells annually thousands of copies.

HALLECK, FITZ-GREENE (1790–1867), American poet, was born at Guilford (Conn.), July 8, 1790, and died there Nov. 19, 1867. In collaboration with Joseph Rodman Drake, he contributed the "Croaker Papers" to the New York *Evening Post* in 1819, and on the death of his friend he wrote the beautiful tribute beginning "Green be the turf above thee." This poem, the title poem of *Alnwick Castle* (1827), "Burns," and the schoolboy favourite "Marco Bozzaris" mark him as a poet of slight but genuine gift.

His *Life and Letters* by J. G. Wilson appeared in 1869. His *Poetical Writings* were edited by Wilson in the same year.

HALLECK, HENRY WAGER (1815–1872), American general and jurist, was born at Westernville, Oneida county, N.Y., in 1815. Upon graduating from West Point military academy in 1839 he was appointed to the engineers, and in 1845 he was sent by the Government to visit the principal military establishments of Europe. After his return, Halleck delivered a course of lectures on the science of war, published in 1846 under the title *Elements of Military Art and Science*, a later edition of which was widely used as a text-book by volunteer officers during the Civil War. On the outbreak of the Mexican War in 1846, he served with the expedition to California and the Pacific coast, acting for several years in California as a staff officer, and as secretary of State under the military government, and in 1849 he helped to frame the State Constitution of California. In 1854 Capt. Halleck resigned his commission and took up the practice of law with great success. On the outbreak of the Civil War he returned to the army as a major-general, and in Nov. 1861 he was charged with the supreme command in the western theatre of war.

There can be no doubt that his administrative skill was mainly instrumental in bringing order out of chaos in the hurried formation of large volunteer armies in 1861, but the strategical and tactical successes of the following spring were due rather to the skill and activity of his subordinate generals, Grant, Buell and Pope, than to the plans of the supreme commander. In July, however, he was called to Washington as general-in-chief of the armies. At headquarters his administrative powers were conspicuous, but he proved to be utterly wanting in any large grasp of the military problem; the successive reverses of McClellan, Pope, Burnside and Hooker in Virginia were not infrequently traceable to the defects of the general-in-chief. In March 1864 Grant was appointed to replace him, Halleck becoming chief of staff at Washington This post he occupied with credit until the end of the war. Halleck's position as a soldier is easily defined by his uniform success as an administrative official, his equally uniform want of success as an officer at the head of large armies in the field, and the popularity of his theoretical writings on war. While his interference with the dispositions of the commanders in the field was often disastrous, his services in organizing and instructing Union forces were of high value. He died at Louisville, Ky., Jan. 9, 1872.

Besides *Military Art and Science*, Halleck wrote *Bitumen, its Varieties, Properties and Uses* (1841); *The Mining Laws of Spain and Mexico* (1859); *International Law* (1861; new ed., 1908); and *Treatise on International Law and the Laws of War, prepared for the use of Schools and Colleges*, abridged from the larger work. He translated Jomini's *Vie politique et militaire de Napoléon* (1864) and de Fooz *On the Law of Mines* (1860). The works on international law mentioned above entitle Gen. Halleck to high rank among the jurists of the 19th century.

See R. N. R. Phelps, *Stanton and Halleck in the Civil War* (1905); J. G. Wilson, "Types and Traditions of the Old Army," in *Journal of Military Service Institute*, vol. xxxvii., pp. 333–356 (1905).

HÄLLEFLINTA (a Swedish word meaning rock-flint), a white, grey, yellow, greenish or pink, fine-grained rock consisting of an intimate mixture of quartz and felspar. Many examples are banded or striated; others contain porphyritic crystals of quartz which resemble those of the felsites and porphyries. Mica, iron oxides, apatite, zircon, epidote and hornblende may also be present in small amount. The more micaceous varieties form transitions to granulite and gneiss. Hälleflinta under the microscope is very finely crystalline, or even cryptocrystalline, resembling the felsitic matrix of many acid rocks It is essentially metamorphic and occurs with gneisses, schists and granulites, especially in the Scandinavian peninsula, where it is regarded as being very characteristic of certain horizons. Of its original nature there is some doubt, but its chemical composition and the occasional presence of porphyritic crystals indicate that it has affinities to the fine-grained acid intrusive rocks In this group there may also have been placed metamorphosed acid tuffs and a certain number of adinoles (shales, contact-altered by intrusions of dolerite). The assemblage is not a perfectly homogeneous one but includes both igneous and sedimentary rocks, but the former preponderate. Rocks very similar to the typical Swedish hälleflintas occur in Tirol, in Galicia and eastern Bohemia.

HALLEL, a Jewish liturgical term, including "the great Hallel" or Ps. cxxxvi. and "the Egyptian Hallel," Ps. cxiii.–cxviii., possibly so-called because of Ps. cxiv. (Hebrew "praise," *cf.* Hallelujah "Praise ye Jah," cognate to Arabic root *hállala*, to sing praises at the new moon or *Hilál*). According to the Talmud (Arachin 10) Hallel was recited on certain festivals On the new moon, a minor festival, and on the last six days of passover, on account of the drowning of the Egyptians, the Hallel is curtailed The blessing preceding the Hallel varies, in certain rites, when this curtailing occurs Some of the Hallel is recited antiphonally. At the conclusion of the Hallel a doxology is pronounced. At the domestic passover service, Hallel is recited, as it was in the Temple days (Pesahim x., 4). Jesus followed this custom (Mark xiv. 26). On tabernacles the *Lulab* (palm branch) is waved during *Hallel*. Originally the Hallel consisted of Ps. cxiii. (school of Shammai) or cxiv. (school of Hillel). The other psalms were probably added about A.D. 100.

Bibliography.—On the Hallel generally *see* S. Singer's *Authorized Daily Prayerbook* (1928, pp. 219 *sqq*.) and I. Abraham's notes in the annotated edition; I. Elbogen, *Der Jud. Gottesdienst* (Frankfurt a. M., 1924, *s.v.* in index); *Jewish Encycl.*, where also music and references to other settings are given.

HALLER, ALBRECHT VON (1708–1777), Swiss anatomist and physiologist, was born at Berne on Oct. 16, 1708. Prevented by ill-health from joining in sports, he developed an amazing precocity. He studied medicine at Tubingen under Camerarius, and then at Leyden under Boerhaave and Albinus, graduating in 1727 with a thesis that proved the so-called salivary duct, claimed as a recent discovery by Coschwitz, to be merely a blood vessel. After visiting London, Oxford and Paris, in 1728 he went to Basle where the awakening of his interests in botany led him to begin a collection of plants which was afterwards the basis of his great work on Swiss flora. About the same time he wrote his poem *Die Alpen*, describing the charm of the simple and idyllic life of the Alpine inhabitants It was included in the first edition of his *Gedichte* (1732).

In 1730 von Haller began to practise as a physician in Berne, but the fame of his botanical and anatomical researches led George II., in 1736, to offer him the chair of medicine, anatomy, surgery and botany in the newly-founded university of Gottingen, a chair which he held for 17 years, conducting at the same time a monthly journal (the *Göttingische gelehrte Anzeiger*), to which he is said to have contributed some 12,000 articles on almost every branch of knowledge. In 1753 von Haller resigned his chair and returned to Berne, where, during the remaining 21 years of his life, which were largely occupied with various municipal and State duties, he prepared his *Bibliotheca medica*, the botanical, surgical and anatomical parts of which he lived to complete, wrote three philosophical romances—*Usong* (1771), *Alfred* (1773) and *Fabius and Cato* (1774), expounding his views on various types of government, and produced, among other medical works, the justly-famed *Elementa physiologiae corporis humani* (1757–66). Von Haller died on Dec. 17, 1777.

Among von Haller's most important contributions to medicine may be named his recognition of the mechanism of respiration and the automatism of the heart, his admission of the use of bile in the digestion of fat, his descriptions of the development of the embryo, his work on the anatomy of the organs of generation, of the brain, of the heart and of many imperfectly-known arteries, and above all his classification of the bodily parts as sensible and insensible, irritable and non-irritable, together with his noteworthy demonstration that sensibility and irritability are independent, the former being a property of tissues endowed with nerves, the latter a peculiarity of all muscular tissue, independent of the nerves proceeding to it and surviving in severed parts

Bibliography.—Apart from the works mentioned above von Haller's chief writings are *Enumeratio methodica stirpium Helveticarum* (1742); *Icones anatomicae* (1743–54); *Disp. anatomicae Selectiores* (1746–52); *De respiratione experimenta anatomica* (1747); *Opuscula botanica* (1749); *Opuscula pathologica* (1754); an edition of Boerhaave's *Artis medicae principia* (1760) and *Disp. chirurg. collectio* (1777). *See* J. G. Zimmermann, *Das Leben des Herrn von Haller* (Zürich, 1755), and the detailed biography in L. Hirzel's edition of the *Gedichte* (Frauenfeld, 1882).

HALLER, BERTHOLD (1492–1536), Swiss reformer, was born at Aldingen, Württemberg, and after studying at Pforzheim, where he met Melanchthon, and at Cologne, taught in the gymnasium at Berne. Even before his acquaintance with Zwingli in 1521 he had begun to preach the Reformation, his sympathetic character and his eloquence making him a great force. In 1526 he was at the abortive conference of Baden, and in January 1528 drafted and defended the ten theses for the conference of Berne which established the new religion in that city. He left no writings except a few letters which are preserved in Zwingli's works. He died on Feb. 25, 1536

See C. Pestalozzi, *Berthold Haller* (Elberfeld, 1861).

HALLEY, EDMUND (1656–1742), English astronomer, was born in London, on Oct. 29, 1656. He was educated at St. Paul's school, London, and at Queen's college, Oxford. He studied astronomy in his schooldays, and in 1676 published a paper on the planetary orbits. Wishing to observe in the southern hemisphere, he embarked for St. Helena in Nov 1676. Here he catalogued 341 stars, observed a transit of Mercury, and made numerous pendulum observations. Upon his return to England he began a friendship with Newton, which resulted in the publication of the *Principia*, the expense of this work being borne by Halley. He observed the comet of 1682, calculated its orbit, and predicted its return in 1757, this being the first prediction of a comet's return ever made. (*See* COMET) In 1703 he was appointed Savilian professor of geometry at Oxford and in 1720 he succeeded Flamsteed as astronomer-royal Although in his 64th year, he undertook to observe the moon through an entire revolution of her nodes (18 years), and actually carried out his purpose. Halley also detected the proper motions of the stars (1718), the acceleration of the moon's mean motion, and the long inequality of Jupiter and Saturn; and indicated first in 1679, and again in 1716, *Phil. Trans* , No. 348, a method extensively used in the 18th and 19th centuries for determining the solar parallax by means of the transits of Venus He died on Jan. 14, 1742.

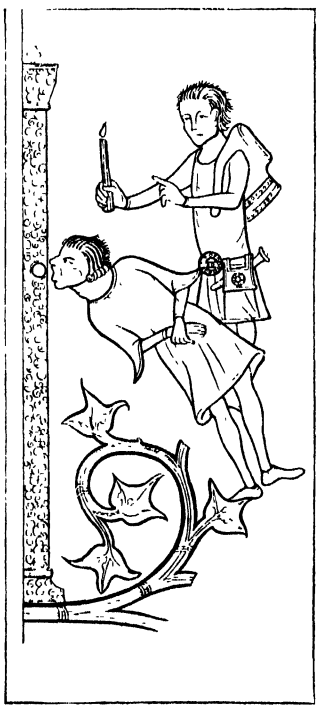
His principal works are *Catalogus stellarum australium* (London, 1679), the substance of which was embodied in vol. iii. of Flamsteed's *Historia coelestis* (1725); *Synopsis astronomiae cometicae* (Oxford, 1705); *Astronomical Tables* (London, 1752); also 81 miscellaneous papers of considerable interest, scattered through the *Philosophical Transactions*. To these should be added his version from the Arabic (which language he acquired for the purpose) of the treatise of Apollonius *De sectione rationis*, with a restoration of his two lost books *De sectione spatii*, both published at Oxford in 1706; also his fine edition of the *Conics* of Apollonius, with the treatise by Serenus *De sectione cylindri et coni* (Oxford, 1710, folio). His edition of the *Spherics* of Menelaus was published by his friend Costard in 1758

See also *Biographia Britannica*, vol. iv (1757); J. Aubrey, *Lives*, ii.; F. Baily, *Account of Flamsteed;* R Grant, *History of Astronomy;* A. J. Rudolph, *Bulletin of Bibliography*, No. 14 (Boston, 1904); E. F McPike, "Bibliography of Halley's Comet," *Smithsonian Misc. Collections* (1905); *Notes and Queries*, 9th series, vols. x, xi xii., 10th series, vol. ii (E. F McPike). A collection of manuscripts regarding Halley is preserved among the Rigaud papers in the Bodleian library.

HALLGRÍMSSON, JÓNAS (1807–1844), the chief lyrical poet of Iceland, was born in 1807 at Steinsstaðir in Eyjafjarðarsýsla in the north of that island, and educated at the famous school of Bessastaðr and at the University of Copenhagen. He went to Iceland on a geological mission (1837–42) from the Danish Government; and made many interesting scientific observations But his fame rests on his Icelandic poems and short stories. The study of the German masters and the old classical writers of Iceland opened his eyes to the corrupt state of Icelandic poetry. The misuse of the Eddic metaphors made the lyrical and epical poetry of the day hardly intelligible, and the language of the poets was mixed up with words of German and Danish origin. The great Danish philologist and friend of Iceland, Rasmus Rask, and the poet Bjarni Thórarensen had done much to purify the language, but Jonas Hallgrimsson completed their work by his poems and tales, in a purer language than ever had been written in Iceland since the days of Snorri Sturlason. The excesses of Icelandic poetry were specially seen in the so-called *rímur*, ballads of heroes, etc., which were fiercely attacked by Jónas Hallgrímsson, who at last succeeded in converting the educated to his view. Most of the principal poems, tales and essays of Jónas Hallgrímsson appeared in the periodical *Fjölnir*, which he began publishing at Copenhagen in 1835, together with Konráð Gíslason, and the patriotic Thómas Saemundsson. When *Fjölnir* at last ceased, its programme and spirit still lived in *Ný Félagsrit* and other patriotic periodicals which took its place. Jónas Hallgrímsson, who died in 1844, is the father of a separate school in Icelandic lyric poetry. He introduced foreign thoughts and metres, but at the same time revived the metres of the Icelandic classical poets. Although his poetical works are all comprised in one small volume, he strikes every string of the old harp of Iceland.

HALLIDAY, ANDREW (ANDREW HALLIDAY DUFF) (1830–1877), British journalist and dramatist, was born at Marnoch, Banffshire. He was the author, alone and with others, of a great number of farces, burlesques and melodramas, and a peculiarly successful adapter of popular novels for the stage. Of these *Little Em'ly* (1869), his adaptation of *David Copperfield*, had a long run at Drury Lane. Halliday died in London on April 10, 1877

HALLIWELL-PHILLIPS, JAMES ORCHARD (1820–1889), English Shakespearian scholar, son of Thomas Halliwell, was born in London June 21, 1820 and educated privately and at Jesus college, Cambridge In 1839 he edited Sir John Mandeville's *Travels;* in 1842 published an *Account of the European MSS. in the Chetham Library*, besides a newly discovered metrical romance of the 15th century (*Torrent of Portugal*). He became best known, however, as a Shakespearian editor and collector. In 1848 he brought out his *Life of Shakespeare*, which passed through several editions; in 1853–65 a sumptuous edition, limited to 150 copies, of Shakespeare in folio, with full critical notes; in 1863 a *Calendar of the Records at Stratford-on-Avon;* in 1864 a *History of New Place* After 1870 he devoted his attention to elucidating Shakespeare's life. He exhausted the available records in his *Outlines of the Life of Shakespeare* (privately printed 1881, other eds. 1882, etc). He was a prime mover in the purchase of New Place for the corporation of Stratford-on-Avon, and in the formation there of the Shakespeare museum. His house, Hollingbury Copse, near Brighton, was full of rare and curious works, many of which he gave to the Chetham library, Manchester, to the town library of Penzance, to the Smithsonian Institution, Washington, and to the library of Edinburgh university He died on Jan. 3, 1889.



"BOBBING FOR APPLES," (FROM THE LOUTERELL PSALTER)
"It is customary," says Brand, "on this night for young people to dive for apples, or catch at them when stuck upon one end of a kind of hanging beam, at the other extremity of which is fixed a lighted candle, and that with their mouths only, their hands being tied behind their backs"

Halliwell-Phillips' works are very numerous. He edited many early English and Elizabethan works for the Percy, Camden and Shakespeare Societies, and prepared the valuable *Dictionary of Old English Plays* (1860).

HALLOWE'EN or **ALL HALLOWS EVE,** the name given to Oct. 31, as the vigil of Hallowmas or All Saints' Day, now chiefly known as the eve of the Christian festival. It long antedates Christianity. The two chief characteristics of ancient Hallowe'en were the lighting of bonfires and the belief that this is the one night in the year during which ghosts and witches are most likely to wander abroad. History shows that the main celebrations of Hallowe'en were purely Druidical, and this is further

proved by the fact that in parts of Ireland Oct. 31 is still known as *Oidhche Shamhna*, "Vigil of Saman." This is directly connected with the Druidic belief in the calling together of certain wicked souls on Hallowe'en by Saman, lord of death. On the Druidic ceremonies were grafted some of the characteristics of the Roman festival in honour of Pomona held about Nov. 1, in which nuts and apples, representing the winter store of fruits, played an important part The custom of lighting Hallowe'en fires survived until recently in the highlands of Scotland and Wales.

For details of the Hallowe'en games and bonfires *see* Brand's *Antiquities of Great Britain;* Chambers's *Book of Days;* Grimm's *Deutsche Mythologie*, ch. xx. (*Elemente*), ch. xxxiv. (*Aberglaube*); and J. G. Frazer's *Golden Bough*, vol. iii. (*See* BELTANE and BONFIRE.)

HALLSTATT. The first iron age of Central and Western Europe and the Balkans is known as the Hallstatt period after the place of that name in Upper Austria. It is not the cradle of the earliest iron age culture, but the site where objects characteristic of it were first identified Here, between 1846–99, upwards of 2,000 graves were found. The majority fall into two groups, an earlier (*c.* 900–700 B.C.) and a later (*c.* 700–400 B.C.). Hallstatt became an important settlement in the first iron age. Both cremation and inhumation were practised, the latter slightly preponderating The cremation graves are on the whole the richer and, viewed in the mass, contain older objects than the inhumation burials, but this should not be pressed too strictly, for the two rites overlapped chronologically. Most of the types of grave-furniture are found elsewhere in phase C and D burials (*see* below), but objects of a peculiar character occur as well. The pottery unearthed by the earlier excavators was practically all destroyed. Near by lies the prehistoric salt mine where salt was extensively obtained A number of shafts were sunk, often to a considerable depth, sometimes at a steep angle Thanks to the preservative nature of the salt, their implements, parts of their clothing and even (at Hallein as well as at Hallstatt) the bodies of the miners themselves have come to light.

Typology and Art.—Reinecke divides the Hallstatt period into four phases, A–D (*see* EARLY IRON AGE) He equates the first of these with the period of the Urn-field culture Schumacher regards the latter as comprising the last phase of the bronze and the first of the iron ages Others hold that Hallstatt A and B are in reality the latest bronze age, and that the iron age did not begin until Hallstatt C. Others regard it as the last period of the bronze age. The fourfold division is adhered to in the following account

Phase A—Iron, though known, is very rare, but Villanovan influences are already apparent. The rite is cremation, in cemeteries of flat graves (or under very low mounds). The pottery in south-west Germany is thin-walled, of various forms, some types betraying strong metallic influence. The large urns often contain a number of smaller vessels (fig 1). Further east (Stillfried, Mariarast, etc.) the Silesian influence (Lusatian B) is noticeable in much of the pottery Among the metal objects are:—Antennae, Ronzano (fig 2) and other bronze swords; razors (fig 3) and knives, compound fibulae, and, in the east harp and simple bow brooches, torcs, pins, the so-called "Old Italian" bronze vessels: cups, vessels with "sun-boat and swans" (fig 5), etc.

Phase B, if it can be said to have a general chronological significance, is marked by the reassertion of the old bronze age population of South-west Germany over the comparatively newly-come Urnfield peoples It is confined to the more western regions The tumulus again becomes common; cremation is the usual rite. The pottery (sometimes polychrome) is extremely well-made and of various forms. The urns are often globular in body and with funnel-shaped necks (fig 6) and influenced by Hallstatt A and older bronze age forms. The chief metal objects which have been found are the slender bronze Hallstatt sword with winged or slightly scrolled chapes (fig. 7) and the vase-headed pin (fig. 8).

Phase C—Iron is first in general use. The rite is mixed; the tumulus prevails. The pottery is both polychrome and unpainted (often with polished graphite slip). In the west, the urns are more onion-shaped than in phase B (fig 14); the bronze age chip-carving (Kerbschnitt) reappears. In the east—Moravia, eastern Austria, etc.—where the culture of D is not represented, this phase probably lasted longer. The urns (graphite or polychrome) have often high conical necks (fig. 12); the so-called "Moon-idols," their horns often ending in beasts' heads, are very characteristic (fig. 13). Among the many metal types are—long, heavy iron and bronze swords with beautifully scrolled chapes; the winged Hallstatt axe (fig 11); long bronze girdle-mounts with répoussé ornamentation (fig. 13); various types of pins (figs 9 and 10); fibulae, rare in the west (spiral spectacle and half-moon brooches), in the East, these and other types; bronze vessels (broadly ribbed bucket and other types, chariot-and-horse-harness—among the latter, the pointed tutulus (fig 17) a type which occurs in the warrior's tomb at Corneto, and gives a synchronism with Italy (*see* ITALY, IRON AGE.)

Phase D.—Not represented in Eastern Austria, etc, but lasts until the appearance of the La Tène period (*s.v.*) in other areas. The tumulus prevails; the rite is mostly inhumation The pottery, which is not common, degenerates; the urns are derived from C forms but are less crisp in profile (fig 19). Among the metal objects are—the dagger-sword (sometimes one-edged) with "horse-shoe" or antennae hilt, pins are rare, brooches common (the drum, cup (fig. 18), and the later variants of the bow and serpentine fibulae) A variety of ring ornaments: ear- (fig 16), neck-, arm- and foot-rings; girdle mounts, shorter than in C, sometimes in pierced work (fig. 15). Bronze vessels, among which, the narrowly-ribbed bucket, and in upper Italy and the Veneto-Illyrian zone, situlae with figured motifs in friezes, stylized scenes from every day life Early archaic Greek vessels appear in the west, Pertuis (fig 20) Grachwyl, etc. Amber occurs in C and D, gold mostly in D; ivory, lignite, jet and coral are not unknown, the last in D.

Hallstatt art, with the exception of the Veneto-Illyrian "situla style," is severely geometric in feeling, the advances made were on technical rather than aesthetic lines It reveals indirect connections with the Greek Dipylon art, but developments of older bronze age elements are more prominent. There is a general tendency towards the extravagant, the baroque. The Greek orientalizing influence is hardly felt. Even the figural motifs are geometric in feeling as is shown by urns from Oedenburg, and many of the girdle-mounts; these are mainly confined to the Austrian area. The typical bird motif, probably derived from Italy, may perhaps be traced back to late Helladic times in Greece Plant patterns are very rare and strongly stylized (Urmitz). Among the other motifs are lozenges, triangles, concentric circles, arcs, chevrons, "garlands," herring-bone groups of parallel lines (sometimes grooved), and occasionally the swastika, triskele and meander, etc Contrasts in colour and the breaking up of smooth surfaces were in favour The arrangement of figures in pairs is very characteristic In H_a pottery we find designs grouped in a circular field around a star or cross, or arranged in bands Generally speaking, the arrangement consists in mechanical repetitions and a rigid regard for symmetry, rather than in the treatment of the design as an organic whole. Compared with the art of the northern bronze age, or of the La Tène period, the Hallstatt style is lifeless and sterile.

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HALLUCINATION, a psychological term which has been the subject of much controversy, and to which, although there is now fair agreement as to its denotation, it is still impossible to give a precise and entirely satisfactory definition (from Lat. *alucinari* or *allucinari*, to wander in mind, Gr. ἀλύσσειν or ἀλύειν, from ἄλη, wandering). Hallucinations constitute one of the two great classes of all false sense-perceptions, the other class consisting of the "illusions," and the difficulty of definition is clearly to mark the boundary between the two classes. *Illusion* may be defined as the misinterpretation of sense-impression, while *hallucination*, in its typical instances, is the experiencing of a sensory presentation, *i.e.*, a presentation having the sensory vividness that distinguishes perceptions from representative imagery, at a time when no stimulus is acting on the corresponding sense-organ. There is, however, good reason to think that in many cases, possibly in all cases, some stimulation of the sense-organ, coming either from without or from within the body, plays a part in the genesis of the hallucination. This being so, we must be content to leave the boundary between illusions and hallucinations ill-defined, and to regard as illusions *those false perceptions in which impressions made on the sense-organ play a leading part in determining the character of the percept*, and as hallucinations *those in which any such impression is lacking, or plays but a subsidiary part and bears no obvious relation to the character of the false percept.*

As in the case of illusion, hallucination may or may not involve delusion, or belief in the reality of the object falsely perceived. Among the sane the hallucinatory object is frequently recognized at once as unreal or at least as but quasi-real; and it is only the insane, or persons in abnormal states, such as hypnosis, who, when an hallucination persists or recurs, fail to recognize that it corresponds to no physical impression from, or object in, the outer world. Hallucinations of all the senses occur, but the most commonly reported are the auditory and the visual, while those of the other senses seem to be comparatively rare. This apparent difference of frequency is no doubt largely due to the more striking character of visual and auditory hallucinations, and to the relative difficulty of ascertaining, in the case of perceptions of the lower senses, *e.g.*, of taste and smell, that no impression adequate to the genesis of the percept has been made upon the sense-organ; but, in so far as it is real, it is probably due in part to the more constant use of the higher senses and the greater strain consequently thrown upon them, in part also to their more intimate connection with the life of ideas.

The hallucinatory perception may involve two or more senses, *e.g.*, the subject may seem to see a human being, to hear his voice and to feel the touch of his hand. This is rarely the case in spontaneous hallucination, but in hypnotic hallucination the subject is apt to develop the object suggested to him, as present to one of his senses, and to perceive it also through other senses.

Among visual hallucinations the human figure, and among auditory hallucinations human voices, are the objects most commonly perceived. The figure seen always appears localized more or less definitely in the outer world. In many cases it appears related to the objects truly seen in just the same way as a real object; *e.g.*, it is no longer seen if the eyes are closed or turned away, it does not move with the movements of the eyes, and it may hide objects lying behind it, or be hidden by objects coming between the place that it appears to occupy and the eye of the percipient. Visual hallucinations are most often experienced when the eyes are open and the surrounding space is well or even brightly illuminated. Less frequently the visual hallucination takes the form of a self-luminous figure in a dark place or appears in a luminous globe or mist which shuts out from view the real objects of the part of the field of view in which it appears.

Auditory hallucinations, especially voices, seem to fall into two distinct classes: (1) those which are heard as coming from without, and are more or less definitely localized in outer space, (2) those which seem to be within the head or, in some cases, within the chest, and to have less definite auditory quality. It seems probable that the latter are hallucinations involving principally kinaesthetic sensations, sensations of movement of the organs of speech.

Hallucinations occur under a great variety of bodily and mental conditions, which may conveniently be classified as follows:

I. CONDITIONS WHICH IMPLY NORMAL WAKING CONSCIOUSNESS AND NO DISTINCT DEPARTURE FROM BODILY AND MENTAL SANITY

a. It would seem that a considerable number of perfectly healthy persons occasionally experience, while in a fully waking state, hallucinations for which no cause can be assigned. The census of hallucinations conducted by the Society of Psychical Research showed that about 10% of all sane persons can remember having experienced at least one hallucination while they believed themselves to be fully awake and in normal health. These sporadic hallucinations of waking healthy persons are far more frequently visual than auditory, and they usually take the form of some familiar person in ordinary attire. The figure in many cases is seen, on turning the gaze in some new direction, fully developed and lifelike, and its hallucinatory character may be revealed only by its noiseless movements, or by its fading away *in situ*. A special interest attaches to hallucinations of this type, owing to the occasional coincidence of the death of the person with his hallucinatory appearance. The question raised by these coincidences will be discussed in a separate paragraph below.

b. A few persons, otherwise normal in mind and body, seem to experience repeatedly some particular kind of hallucination. The voice (*δαιμόνιον*) so frequently heard by Socrates, warning or advising him, is the most celebrated example of this type.

II. CONDITIONS MORE OR LESS UNUSUAL OR ABNORMAL BUT NOT IMPLYING DISTINCT DEPARTURE FROM HEALTH

a. A kind of hallucination to which perhaps every normal person is liable is that known technically as "recurrent sensation." This kind is experienced only when some sense-organ has been continuously or repeatedly subjected to some one kind of impression or stimulation for a considerable period; *e.g.*, the microscopist, after examining for some hours one particular kind of object or structure, may suddenly perceive the object faithfully reproduced in form and colour, and lying, as it were, upon any surface to which his gaze is directed. Perhaps the commonest experience of this type is the recurrence of the sensations of movement at intervals in the period following a sea voyage or long railway journey.

b. A considerable proportion of healthy sane persons can induce hallucinations of vision by gazing fixedly at a polished surface or into some dark translucent mass; or of hearing, by applying a large shell or similar object to the ear. These methods of inducing hallucinations, especially the former, have long been practised in many countries as modes of divination, various objects being used, *e.g.*, a drop of ink in the palm of the hand, or a polished finger-nail. The object now most commonly used is a polished sphere of clear glass or crystal (*see* CRYSTAL-GAZING). Hence such hallucinations go by the name of *crystal visions*. The crystal vision often appears as a picture of some distant or unknown scene lying, as it were, in the crystal; and in the picture figures may come and go, and move to and fro, in a perfectly natural manner. In other cases, written or printed words or sentences appear. The percipient, seer or scryer, commonly seems to be in a fully waking state as he observes the objects thus presented. He is usually able to describe and discuss the appearances, successively discriminating details by attentive observation, just as when observing an objective scene; and he usually has no power of controlling them, and no sense of having produced them by his own activity. In some cases these visions have brought back to the mind of the scryer facts or incidents which he could not voluntarily recollect. In other cases they are asserted by credible witnesses to have given to the scryer information, about events distant in time or place, that had not come to his knowledge by normal means. These cases have been claimed as evidence of telepathic communication or even of clairvoyance. But at present the number of well-attested cases of this sort is too small to justify acceptance of this conclusion by those who have only second-

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II. CONDITIONS MORE OR LESS UNUSUAL OR ABNORMAL BUT NOT IMPLYING DISTINCT DEPARTURE FROM HEALTH

a A kind of hallucination to which perhaps every normal person is liable is that known technically as "recurrent sensation" This kind is experienced only when some sense-organ has been continuously or repeatedly subjected to some one kind of impression or stimulation for a considerable period; *e g*, the microscopist, after examining for some hours one particular kind of object or structure, may suddenly perceive the object faithfully reproduced in form and colour, and lying, as it were, upon any surface to which his gaze is directed. Perhaps the commonest experience of this type is the recurrence of the sensations of movement at intervals in the period following a sea voyage or long railway journey.

b. A considerable proportion of healthy sane persons can induce hallucinations of vision by gazing fixedly at a polished surface or into some dark translucent mass; or of hearing, by applying a large shell or similar object to the ear. These methods of inducing hallucinations, especially the former, have long been practised in many countries as modes of divination, various objects being used, *e g*, a drop of ink in the palm of the hand, or a polished finger-nail. The object now most commonly used is a polished sphere of clear glass or crystal (*see* CRYSTAL-GAZING) Hence such hallucinations go by the name of *crystal visions* The crystal vision often appears as a picture of some distant or unknown scene lying, as it were, in the crystal; and in the picture figures may come and go, and move to and fro, in a perfectly natural manner. In other cases, written or printed words or sentences appear. The percipient, seer or scryer, commonly seems to be in a fully waking state as he observes the objects thus presented. He is usually able to describe and discuss the appearances, successively discriminating details by attentive observation, just as when observing an objective scene; and he usually has no power of controlling them, and no sense of having produced them by his own activity. In some cases these visions have brought back to the mind of the scryer facts or incidents which he could not voluntarily recollect. In other cases they are asserted by credible witnesses to have given to the scryer information, about events distant in time or place, that had not come to his knowledge by normal means. These cases have been claimed as evidence of telepathic communication or even of clairvoyance. But at present the number of well-attested cases of this sort is too small to justify acceptance of this conclusion by those who have only second-

hand knowledge of them.

c Prolonged deprivation of food predisposes to hallucinations, and it would seem that, under this condition, a large proportion of otherwise healthy persons become liable to them, especially to auditory hallucinations.

d. Certain drugs, notably opium, Indian hemp and mescal predispose to hallucinations, each tending to produce a peculiar type. Thus Indian hemp and mescal, especially the latter, produce in many cases visual hallucinations in the form of a brilliant play of colours, sometimes a mere succession of patches of brilliant colour, sometimes in architectural or other definite spatial arrangement.

e. The states of transition from sleep to waking, and from waking to sleep, seem to be peculiarly favourable to the appearance of hallucinations The recurrent sensations mentioned above are especially prone to appear at such times, and a considerable proportion of the sporadic hallucinations of persons in good health are reported to have been experienced under these conditions. The name "hypnagogic" hallucinations, first applied by Alfred Maury, is commonly given to those experienced in these transition states.

f. The presentations, predominantly visual, that constitute the principal content of most dreams, are generally described as hallucinatory, but the propriety of so classing them is very questionable. The present writer is confident that his own dream-presentations lack the sensory vividness which is the essential mark of the percept, whether normal or hallucinatory, and which is the principal, though not the only, character in which it differs from the representation or memory-image It is true that the dream-presentation, like the percept, differs from the representative imagery of waking life in that it is relatively independent of volition; but that seems to be merely because the will is in abeyance or very ineffective during sleep. The wide currency of the doctrine that classes dream-images with hallucinations seems to be due to this independence of volitional control, and to the fact that during sleep the representative imagery appears without that rich setting of undiscriminated or marginal sensation which always accompanies waking imagery, and which by contrast accentuates for introspective reflection the lack of sensory vividness of such imagery.

g. Many of the subjects who pass into the deeper stages of hypnosis (*see* HYPNOTISM) show themselves, while in that condition, extremely liable to hallucination, perceiving whatever object is suggested to them as present, and failing to perceive any object of which it is asserted by the operator that it is no longer present. The reality of these positive and negative hallucinations of the hypnotized subject has been recently questioned, it being maintained that the subject merely gives verbal assent to the suggestions of the operator. But that the hypnotized subject does really experience hallucinations seems to be proved by the cases in which it is possible to make the hallucination, positive or negative, persist for some time after the termination of hypnosis, and by the fact that in some of these cases the subject, who in the post-hypnotic state seems in every other respect normal and wide awake, may find it difficult to distinguish between the hallucinatory and real objects. Further proof is afforded by experiments such as those by which Alfred Binet showed that a visual hallucination may behave for its percipient in many respects like a real object, *e.g.*, that it may appear reflected in a mirror, displaced by a prism and coloured when a coloured glass is placed before the patient's eyes It was by means of experiments of this kind that Binet showed that hypnotic hallucinations may approximate to the type of the illusion, *i.e.*, that some real object affecting the sense-organ (in the case of a visual hallucination some detail of the surface upon which it is projected) may provide a nucleus of peripherally excited sensation around which the false percept is built up. An object playing a part of this sort in the genesis of an hallucination is known as a "*point de repère.*" It has been maintained that all hallucinations involve some such *point de repère* or objective nucleus; but there are good reasons for rejecting this view.

h In states of ecstasy, or intense emotional concentration of attention upon some one ideal object, the object contemplated seems at times to take on sensory vividness, and so to acquire the character of an hallucination In these cases the state of mind of the subject is probably similar in many respects to that of the deeply hypnotized subject and these two classes of hallucination may be regarded as very closely allied.

III. HALLUCINATIONS WHICH OCCUR AS SYMPTOMS OF BOTH BODILY AND MENTAL DISEASES

a. Dr. H. Head has the credit of having shown for the first time, in the year 1901, that many patients, suffering from more or less painful visceral diseases, disorders of heart, lungs, abdominal viscera, etc., are liable to experience hallucinations of a peculiar kind. These "visceral" hallucinations, which are constantly accompanied by headache of the reflected visceral type, are most commonly visual, more rarely auditory. In all Dr. Head's cases the visual hallucination took the form of a shrouded human figure, colourless and vague, often incomplete, generally seen by the patient standing by his bed when he wakes in a dimly lit room. The auditory "visceral" hallucination was in no instance vocal, but took such forms as sounds of tapping, scratching or rumbling, and were heard only in the absence of objective noises In a few cases the "visceral" hallucination was bisensory, *i e* , both auditory and visual.

In all these respects the "visceral" hallucination differs markedly from the commoner types of the sporadic hallucination of healthy persons

b Hallucinations are constant symptoms of certain general disorders in which the nervous system is involved, notably of the *delirium tremens*, which results from chronic alcohol poisoning, and of the delirium of the acute specific fevers. The hallucinations of these states are generally of a distressing or even terrifying character. Especially is this the rule with those of *delirium tremens*, and in the hallucinations of this disease certain kinds of objects, *e.g.*, rats and snakes, occur with curious frequency

c. Hallucinations occasionally occur as symptoms of certain nervous diseases that are not usually classed with the insanities, notably in cases of epilepsy and severe forms of hysteria In the former disorder, the sensory aura that so often precedes the epileptic convulsion may take the form of an hallucinatory object, which in some cases is very constant in character Unilateral hallucinations, an especially interesting class, occur in severe cases of hysteria, and are usually accompanied by hemi-anaesthesia of the body on the side on which the hallucinatory object is perceived.

d. Hallucinations occur in a large, but not accurately definable, proportion of all cases of mental disease proper. Two classes are recognized: (1) those that are intimately connected with the dominant emotional state or with some dominant delusion; (2) those that occur sporadically and have no such obvious relation to the other symptoms of disease. Hallucinations of the former class tend to accentuate, and in turn to be confirmed by, the congruent emotional or delusional state; but whether these are to be regarded as primary symptoms and as the cause of the hallucinations, or *vice versa*, it is generally impossible to say. Patients who suffer delusions of persecution are very apt to develop later in the course of their disease hallucinations of the voices of their persecutors; while in other cases hallucinatory voices, which are at first recognized as such, come to be regarded as real and in these cases seem to be factors of primary importance in the genesis of further delusions. Hallucinations occur in almost every variety of mental disease, but are commonest in the forms characterized by a cloudy dream-like condition of consciousness, and in extreme cases of this sort the patient (as in the delirium of chronic alcohol-poisoning) seems to move waking through a world consisting largely of the images of his own creation, set upon a background of real objects.

In some cases hallucinations are frequently experienced for long periods in the absence of any other symptom of mental disorder, but these no doubt usually imply some morbid condition of the brain.

Physiology of Hallucination.—There has been much discussion as to the nature of the neural process in hallucination. It

is generally and rightly assumed that the hallucinatory perception of any object has for its immediate neural correlate a state of excitement which, as regards its characters and its distribution in the elements of the brain, is entirely similar to the neural correlate of the normal perception of the same object. The hallucination is a perception, though a false perception. In the perception of an object and in the representation of it, introspective analysis discovers a number of presentative elements. In the case of the representation these elements are memory images only (except perhaps in so far as actual kinaesthetic sensations enter into its composition); whereas, in the case of the percept, some of these elements are sensations, sensations which differ from images in having the attribute of sensory vividness; and the sensory vividness of these elements lends to the whole complex the sensory vividness or reality, the possession of which character by the percept constitutes its principal difference from the representation Normally, sensory vividness attaches only to those presentative elements which are excited through stimulations of the sense-organs. The normal percept, then, owes its character of sensory reality to the fact that a certain number of its presentative elements are sensations peripherally excited by impressions made upon a sense-organ. The problem is, then, to account for the fact that the hallucination contains presentative elements that have sensory vividness, that are sensations, although they are not excited by impressions from the external world falling upon a sense-organ. Most of the discussions of this subject suffer from the neglect of this preliminary definition of the problem Many authors, notably W. Wundt and his disciples, have been content to assume that the sensation differs from the memory-image only in having a higher degree of intensity; from which they infer that its neural correlate in the brain cortex also differs from that of the image only in having a higher degree of intensity. For them an hallucination is therefore merely a representation whose neural correlate involves an intensity of excitement of certain brain-elements such as is normally produced only by peripheral stimulation of sensory nerves in the sense-organs. But this view, so attractively simple, ignores an insuperable objection. Sensory vividness is not to be identified with superior intensity; for while the least intense sensation has it, the memory image of the most intense sensation lacks it completely. And, since intensity of sensation is a function of the intensity of the underlying neural excitement, we may not assume that sensory vividness is also the expression in consciousness of that intensity of excitement If Wundt's view were true a progressive diminution of the intensity of a sensory stimulus should bring the sensation to a point in the scale of diminishing intensity at which it ceases to be sensation, ceases to have sensory vividness and becomes an image merely. But this is not the case; with diminishing intensity of stimulation, the sensation declines to a minimal intensity and then disappears from consciousness. This objection applies not only to Wundt's view of hallucinations, but also to H. Taine's explantation of them by the aid of his doctrine of "reductives," for this too identifies sensory vividness with intensity. (H. Taine, *De l'intelligence,* tome i. p. 108.)

Another widely current explanation is based on the view that the representation and the percept have their anatomical bases in different element-groups or "centres" of the brain, the "centre" of the representation being assigned to a higher level of the brain than that of the percept (the latter being sometimes assigned to the basal ganglia of the brain, the former to the cortex). It is then assumed that while the lower perceptual centre is normally excited only through the sense-organ, it may occasionally be excited by impulses playing down upon it from the corresponding centre of representation, when hallucination results.

This view also is far from satisfactory, because the great additions recently made to our knowledge of the brain tend very strongly to show that both sensations and memory-images have their anatomical bases in the same sensory areas of the cerebral cortex; and many considerations converge to show that their anatomical bases must be, in part at least, identical.

The views based on the assumptions of complete identity, and of complete separateness, of the anatomical bases of the percept and of the representation are then alike untenable; and the alternative—that their anatomical bases are in part identical, in part different, which is indicated by this conclusion—renders possible a far more satisfactory doctrine. We have good reason to believe that the neural correlate of sensation is the transmission of the nervous impulse through a sensori-motor arc of the cortex, made up of a chain of neurones; and the view suggests itself that the neural correlate of the corresponding memory-image is the transmission of the impulse through a part only of this chain of cortical elements, either the efferent motor part of this chain or the afferent sensory part of it. Prof. W. James's theory of hallucinations is based on the latter assumption He suggests that the sensory vividness of sensation and of the percept is due to the discharge of the excitement of the chain of elements in the forward or motor direction; and that, in the case of the image and of the representation, the discharge takes place, not in this direction through the efferent channel of the centre, but laterally into other centres of the cortex Hallucination may then be conceived as caused by obstruction, or abnormally increased resistance, of the paths connecting such a cortical centre with others, so that, when it becomes excited in any way, the tension or potential of its charge rises, until discharge takes place in the motor direction through the efferent limbs of the sensori-motor arcs which constitute the centre

It is a serious objection to this view that, as James himself, in common with most modern authors, maintains, every idea has its motor tendency which commonly, perhaps always, finds expression in some change of tension of muscles, and in many cases issues in actual movements Now if we accept James's theory of hallucination, we should expect to find that whenever a representation issues in bodily action it should assume the sensory vividness of an hallucination; and this, of course, is not the case.

The alternative form of the view that assumes partial identity of the anatomical bases of the percept and the representation of an object, would regard the neural correlate of the sensation as the transmission of the nervous impulse throughout the length of the sensori-motor arc of the cortex, from sensory inlet to motor outlet; and that of the image as its transmission through the efferent part of this arc only; that is to say, in the case of the image, it would regard the excitement of the arc as being initiated at some point between its afferent inlet and its motor outlet, and as spreading, in accordance with the law of forward conduction, towards the motor outlet only, so that only the part of the arc distal or efferent to this point becomes excited.

This view of the neural basis of sensory vividness, which correlates the difference between the sensation and the image with the only known difference between their physiological conditions, namely the peripheral initiation of the one and the central initiation of the other, enables us to formulate a satisfactory theory of the physiology of hallucinations.

The anatomical basis of the perception and of the representation of any object is a functional system of nervous elements, comprising a number of sensori-motor arcs, whose excitement by impulses ascending to them by the sensory paths from the sense-organs determines sensations, and whose excitement in their efferent parts only determines the corresponding images. In the case of perception, some of these arcs are excited by impulses ascending from the sense-organs, others only by the spread of the excitement through the system from these peripherally excited arcs; while, in the case of the representation, all alike are excited by impulses that reach the system from other parts of the cortex and spread throughout its efferent parts only to its motor outlets.

If then impulses enter this system by any of the afferent limbs of its sensori-motor arcs, the presentation that accompanies its excitement will have sensory vividness and will be a true perception, an illusion, or an hallucination, according as these impulses have followed the normal course from the sense-organ, or have been diverted, to a lesser or greater degree, from their normal paths. If any such neural system becomes abnormally excitable, or becomes excited in any way with abnormal intensity, it is thereby rendered a path of exceptionally low-resistance capable of diverting to itself, from their normal path, any streams of

impulses ascending from the sense-organ; which ascending impulses, entering the system by its afferent inlets, excite sensations that impart to the presentation the character of sensory vividness; the presentation thus acquires the character of a percept in spite of the absence of the appropriate impression on the sense-organ, and we call it an hallucination.

This view renders intelligible the *modus operandi* of many of the predisposing causes of hallucination; *e.g.*, the pre-occupation with certain representations of the ecstatic, or of the sufferer from delusions of persecution; the intense expectation of a particular sense impression, the generally increased excitability of the cortex in states of delirium; in all these conditions the abnormally intense excitement of the cortical systems may be supposed to give them an undue directive and attractive influence upon the streams of impulses ascending from the sense-organs, so that sensory impulses may be diverted from their normal paths. Again, it renders intelligible the part played by chronic irritation of a sense-organ, as when chronic irritation of the internal ear leads on to hallucinations of hearing; perhaps also the chronic irritation of sensory nerves that must accompany the states of visceral disease, shown by Head to be so frequently accompanied by a liability to hallucinations; for any such chronic irritation supplies a stream of disorderly impulses rising constantly from the sense-organ, for the reception of which the brain has no appropriate system, and which, therefore, readily enters any organized cortical system that at any moment constitutes a path of low-resistance A similar explanation applies to the influence of fixed gazing upon a crystal, or the placing of a shell over the ear, in inducing visual and auditory hallucinations. The "recurrent sensations" experienced after prolonged occupation with some one kind of sensory object may be regarded as due to an abnormal excitability of the cortical system concerned, resulting from its unduly prolonged exercise. The hypothesis renders intelligible also the liability to hallucination of persons in the hysterical and hypnotic states, in whose brains the cortical neural systems are in a state of partial dissociation which renders possible an unduly intense and prolonged excitement of some one system at the expense of all other systems (*cf.* HYPNOTISM).

Coincidental Hallucinations.—It would seem that, in well-nigh all countries and in all ages, apparitions of persons known to be in distant places have been occasionally observed. Such appearances have usually been regarded as due to the presence, before the bodily eye of the seer, of the ghost, wraith, double or soul of the person who thus appears; and, since the soul has been very commonly supposed to leave the body, permanently at death and temporarily during sleep, trance or any period of unconsciousness, however induced, it was natural to regard such an appearance as evidence that the person whose wraith was thus seen was in some such condition. Such apparitions have probably played a part, second only to that of dreams, in generating the almost universal belief in the separability of soul and body.

In many parts of the world traditional belief has connected such apparitions more especially with the death of the person so appearing, the apparition being regarded as an indication that the person so appearing has recently died, is dying or is about to die. Since death is so much less common an event than sleep, trance, or other form of temporary unconsciousness, the wide extension of this belief suggests that such apparitions may coincide in time with death, with disproportionate frequency. The belief in the significance of such apparitions still survives in civilized communities, and stories of apparitions coinciding with the death of the person appearing are occasionally reported in the newspapers, or related as having recently occurred. The Society for Psychical Research has sought to find grounds for an answer to the question "Is there any sufficient justification for the belief in a causal relation between the apparition of a person at a place distant from his body and his death or other exceptional and momentous event in his experience?" The problem was attacked in a thoroughly scientific spirit, an extensive inquiry was made, and the results were presented and fully discussed in two large volumes, *Phantasms of the Living*, published in the year 1886, bearing on the title-page the names of Edmund Gurney, F. W. H. Myers and F. Podmore. Of the three collaborators Gurney took the largest share in the planning of the work, in the collection of evidence, and in the elaboration and discussion of it.

Gurney set out with the presumption that apparitions, whether coincidental or not, are hallucinations in the sense defined above; that *they are false perceptions* and are not excited by any object or process of the external world acting upon the sense-organs of the percipient in normal fashion; that they do not imply the presence, in the place apparently occupied by them, of any wraith or any form of existence emanating from, or specially connected with, the person whose phantasm appears. This initial assumption was abundantly justified by an examination of a large number of cases for it, which showed that, in all important respects, most of these apparitions of persons at a distance, whether coincidental or not, were similar to other forms of hallucination.

The acceptance of this conclusion does not, however, imply a negative answer to the question formulated above. The Society for Psychical Research had accumulated an impressive and, to almost all those who had first-hand acquaintance with it, a convincing mass of experimental evidence of the reality of telepathy (*q.v.*), the influence of mind on mind otherwise than through the recognized channels of sense. The successful experiments had for the most part been made between persons in close proximity, in the same room or in adjoining rooms; but they seemed to show that the state of consciousness of one person may induce directly (*i.e.*, without the mediation of the organs of expression and sense-perception) a similar state of consciousness in another person, especially if the former, usually called the "agent," strongly desired or "willed" that this effect should be produced on the other person, the "percipient."

The question formulated above thus resolved itself for Gurney into the more definite form, "Can we find any good reason for believing that coincidental hallucinations are sometimes veridical, that the state of mind of a person at some great crisis of his experience may telepathically induce in the mind of some distant relative or friend an hallucinatory perception of himself?" It was at once obvious that, if coincidental apparitions can be proved to occur, this question can only be answered by a statistical inquiry; for each such coincidental hallucination, considered alone, may always be regarded as most educated persons of the present time have regarded them, namely, as merely accidental coincidences. That the coincidences are not merely accidental can only be proved by showing that they occur more frequently than the doctrine of chances would justify us in expecting Now, the death of any person is a unique event, and the probability of its occurrence upon any particular day may be very simply calculated from the mortality statistics, if we assume that nothing is known of the individual's vitality. On the other hand, hallucinatory perceptions of persons, occurring to sane and healthy individuals in the fully waking state, are comparatively rare occurrences, whose frequency we may hope to determine by a statistical inquiry. If, then, we can obtain figures expressing the frequency of such hallucinations, we can deduce, by the help of the laws of chance, the proportion of such hallucinations that may be expected to coincide with (or, for the purposes of the inquiry, to fall within twelve hours of) the death of the person whose apparition appears, if no causal relation obtains between the coinciding events. If, then, it appears that the proportion of such coincidental hallucinations is greater than the laws of probability will account for, a certain presumption of a causal relation between the coinciding events is thereby established; and the greater the excess of such coincidences, the stronger does this presumption become. Gurney attempted a census of hallucinations in order to obtain data for this statistical treatment, and the results of it, embodied in *Phantasms of the Living*, were considered by the authors of that work to justify the belief that some coincidental hallucinations are veridical. In the year 1889 the Society for Psychical Research appointed a committee, under the chairmanship of the late Henry Sidgwick, to make a second census of hallucinations on a more extensive and systematic plan than the first, in order that the important conclusion reached by the authors of *Phantasms of the Living* might be put to the severer test rendered

possible by a larger and more carefully collected mass of data. Seventeen thousand adults returned answers to the question, "Have you ever, when believing yourself to be completely awake, had a vivid impression of seeing or being touched by a living being or inanimate object, or of hearing a voice; which impression, so far as you could discover, was not due to any external physical cause?" Rather more than two thousand persons answered affirmatively, and to each of these were addressed careful inquiries concerning their hallucinatory experiences. In this way it was found that of the total number, 381 apparitions of persons living at the moment (or not more than twelve hours dead) had been recognized by the percipients, and that, of these, 80 were alleged to have been experienced within twelve hours of the death of the person whose apparition had appeared. A careful review of all the facts, conditions and probabilities, led the committee to estimate that the former number should be enlarged to 1,300 in order to make ample allowance for forgetfulness and for all other causes that might have tended to prevent the registration of apparitions of this class. On the other hand, a severe criticism of the alleged death-coincidences led them to reduce the number, admitted by them for the purposes of their calculation, to 30. The making of these adjustments gives us about 1 in 43 as the proportion of coincidental death-apparitions to the total number of recognized apparitions among the 17,000 persons reached by the census. Now the death-rate being just over 19 per thousand, the probability that any person taken at random will die on a given day is about 1 in 19,000; or, more strictly speaking, the average probability that any person will die within any given period of twenty-four hours duration is about 1 in 19,000. Hence the probability that any other particular event, having no causal relation to his death, but occurring during his lifetime (or not later than twelve hours after his death) will fall within the same twenty-four hours as his death is 1 in 19,000; *i.e.*, if an apparition of any individual is seen and recognized by any other person, the probability of its being experienced within twelve hours of that individual's death is 1 in 19,000, if no causal relation obtains between the two events. Therefore, of all recognized apparitions of living persons, 1 only in 19,000 may be expected to be a death-coincidence of this sort. But the census shows that of 1,300 recognized apparitions of living persons 30 are death-coincidences and that is equivalent to 440 in 19,000. Hence, of recognized hallucinations, those coinciding with death are 440 times more numerous than we should expect, if no causal relation obtained; therefore, if neither the data nor the reasoning can be destructively criticized, we are compelled to believe that some causal relation obtains; and, since good evidence of telepathic communication has been experimentally obtained, the least improbable explanation of these death-apparitions is that the dying person exerts upon his distant friend some telepathic influence which generates an hallucinatory perception of himself.

These death-coincidences constitute the main feature of the argument in favour of telepathic communication between distant persons, but the census of hallucinations afforded other data from which a variety of arguments, tending to support this conclusion, were drawn by the committee; of these the most important are the cases in which the hallucinatory percept embodied details that were connected with the person perceived and which could not have become known to the percipient by any normal means. The committee could not find in the results of the census any evidence sufficient to justify a belief that hallucinations may be due to telepathic influence exerted by personalities surviving the death of the body.

The critical handling of the cases by the committee seems to be above reproach. Those who do not accept their conclusion based on the death-coincidences must direct their criticism to the question of the reliability of the reports of these cases. It is to be noted that, although only those cases are reckoned in which the percipient had no cause to expect the death of the person whose apparition he experienced, and although, in nearly all the accepted cases, some record or communication of the hallucination was made before hearing of the death, yet in very few cases was any contemporary written record of the event forthcoming for the inspection of the committee. (W. McD.)

HALLUIN, a frontier town of northern France, in the department of Nord, near the Lys, 14 m. N. by E. of Lille by rail. Pop. (1926) 11,012. The family of Halluin, which became extinct in the 14th century, is mentioned in the 13th century. Halluin has a Gothic church. The manufactures comprise linen and cotton goods, chairs and rubber goods, and brewing and tanning are carried on; there is a board of trade arbitration.

HALM, CARL FELIX (1809–1882), German classical scholar and critic, was born at Munich on April 5, 1809, and died there on Oct. 5, 1882. He is known chiefly as the editor of Cicero. He also edited a number of other classical texts for the Teubner series, the most important of which are Tacitus (4th ed., 1883); *Rhetores Latini minores* (1863); Quintilian (1868); Sulpicius Severus (1866); Minucius Felix together with Firmicus Maternus *De errore* (1867); Salvianus (1877) and Victor Vitensis's *Historia persecutionis Africanae provinciae* (1878).

See articles by W. Christ and G. Laubmann in *Allgemeine deutsche Biographie* and by C. Bursian in *Biographisches Jahrbuch;* and J. E. Sandys, *Hist. of Classical Scholarship,* iii. 195 (1908).

HALMA (Greek for "jump"), a table game, a form of which was known to the ancient Greeks, played on a board divided into 256 squares with wooden *men,* resembling chess pawns. In the two-handed game 19 men are employed on each side, coloured respectively black and white; in the four-handed each player has 13, the men being coloured white, black, red and green. At the beginning of the game the men are drawn up in triangular formation in the enclosures, or *yards,* diagonally opposite each other in the corners of the board. The object of each player is to get all his men into his enemy's yard, the player winning who first accomplishes this. The moves are made alternately, the mode of progression being by a *step,* from one square to another immediately adjacent, or by a jump (whence the name), which is the jumping of a man from a square in front of it into an empty square on the other side of it. This corresponds to jumping in draughts, except that, in halma, the hop may be in any direction, over friendly as well as hostile men, and the men jumped over are not taken but remain on the board. In the four-handed game either each player plays for himself, or two adjacent players play against the other two.

See Hoffmann, *Card and Table Games* (London, 1903); R. F. Foster, *Foster's Complete Hoyle* (1928).

HALMAHEIRA ("great land"; also Jilolo or Gilolo), an island of the Dutch East Indies, belonging to the residency of Ternate, lying under the equator and about 128° E. Its shape is extremely irregular, resembling that of the island of Celebes. It consists of four peninsulas so arranged as to enclose three great bays (Kayu, Bicholi, Weda), all opening towards the east, the northern peninsula being connected with the others by an isthmus only 5 m. wide. On the western side of the isthmus lies another bay, that of Dodinga, in the mouth of which are situated the two islands Ternate and Tidore, whose political importance exceeds that of the larger island (*see* these articles). Of the four peninsulas of Halmaheira the northern and the southern are reckoned to the sultanate of Ternate, the north-eastern and south-eastern to that of Tidore; the former having 11, the latter three districts. The distance between the extremities of the northern and southern peninsulas, measured along the curve of the west coast, is about 240 m.; and the total area of the island is 6,500 sq.m. Knowledge of the island is very incomplete. It appears that the four peninsulas are traversed in the direction of their longitudinal axis by mountain chains 3,000 to 4,000 ft. high, covered with forests rich in a great variety of trees, without a central chain at the nucleus of the island whence the peninsulas diverge. The mountain chains, from which spurs extend to the coast, are frequently interrupted by plains, such as those of Weda and Kobi. The northern part of the mountain chain of the northern peninsula is volcanic, its volcanoes continuing the line of those of Makian, Ternate and Tidore. The mountains along the western coast are volcanic, and at least one, Gam Kenora (4,922 ft.), is active. Coral formations on heights in the interior would indicate oscillations of the land in several periods, but a detailed

geology of the island is wanting. There are numerous rivers, of which the chief are the Taliabu and the Kaii, but none are of great importance, and there are several lakes. Near Weda is a beautiful stalactite grotto—the Grotto of Sagea—which has been likened to the famous Blue Grotto of Capri. To the north-east of the northern peninsula is the considerable island of Morotai (635 sq m.), which is more than 50 m. long and from 13 to 26 m. wide, with mountains reaching 3,000 ft. (the Sabotai range), and several rivers, and to the west of the southern peninsula the more important island of Bachian (*q.v.*) among others. Galela is a considerable settlement, situated on a bay of the same name on the north-east coast, in a well-cultivated plain which extends southward and inland. Vegetation is prolific. Rice is grown by the natives, but the sago tree is of far greater importance to them. Damsar is collected and coco-nuts are also grown, and the forests yield wild nutmeg and ironwood (*Nania vera*). The sea yields trepang and pearl shells. A little trade is carried on by the Chinese and Macassars of Ternate, who, crossing the narrow Isthmus of Dodinga, enter the Bay of Kayu on the east coast. The chief town is Patani, with probably not more than 2,000 inhabitants, and ports of call for vessels of the Royal Mail Packet Company are Galela, Tobela, Kayu, Weda and Patani, together with Wajibula in Morotai. The total population with Morotai is 102,340.

The inhabitants are mostly of immigrant Malayan stock. In the northern peninsula, which is the most thickly populated, are found people akin to the Papuan-Malay type, and a tribe around Galela who are Polynesian in physique, possibly remnants, much mixed by subsequent crossings with the Papuan indigenes, of the Caucasian hordes emigrating in prehistoric times across the Pacific. M. Achille Raffray gives a description of them in *Tour du Monde* (1879) where photographs will be found. "They are as unlike the Malays as we are, excelling them in tallness of stature and elegance of shape, and being perfectly distinguished by their oval face, with a fairly high and open brow, their aquiline nose and their horizontally placed eyes. Their beards are sometimes thick; their limbs are muscular; the colour of their skins is cinnamon brown. Spears of iron-wood, abundantly barbed, and small bows and bamboo arrows free from poison are their principal weapons." They are further described as having temples (*sabuas*) in which they suspend images of serpents and other monsters, as well as the trophies procured by war. They believe in a better life hereafter, but have no idea of a hell or a devil, their evil spirits only tormenting them in the present state.

The people in the Tidore part of the island, as the result of keen propaganda of the sultans of Tidore, are all Mohammedans, but in the Ternate division the aborigines are largely pagan. These people have crisp, wavy hair, a skin even lighter than that of the average Malay, and the men are strongly built and well made, though the women are thick-set and ugly. They are true forest people, some nomads, living only in shelters. A loin-cloth, with headdress, is their only covering. The sago and areca palm give them food and drink. They fish, hunt and cultivate the land in a simple style. Head-hunters in the past, they are a gentle and willing race now, but prone to violence from motives of revenge. Many indigenous dialects are spoken and on the coast Ternatan is largely used. Morotai has several Mohammedans and a few Christians among its population. The pagan people collect forest products and natives of Galelo in Halmaheira visit Morotai to seek sago, and to fish.

The Portuguese and Spaniards were better acquainted with Halmaheira than with many other parts of the archipelago; they sometimes called it Batu China, and sometimes Moro. It was circumnavigated by one of their vessels in 1525, and the general outline of the coasts is correctly given in their maps at a time when separate portions of Celebes, such as Macassar and Menado, are represented as distinct islands. The name (Jilolo) was really that of a native State, the sultan of which had the chief rank among the princes of the Moluccas before he was supplanted by the sultan of Ternate about 1380. His capital, Jilolo, lay on the west coast, on the first bay to the north of that of Dodinga. The Dutch obtained a footing in Halmaheira with the aid of their ally, the sultan of Ternate, and when they severed relations with this chief in 1683, the lands in Halmaheira under the suzerainty of Ternate, came under Dutch influence, and by their treaty of 1660 with the sultan of Tidore, they had become overlords of all Tidorese fiefs, which opened up to them that part of Halmaheira under Tidorese influence. In 1876 Danu Hassan, a descendant of the sultans of Jilolo, raised an insurrection in the island for the purpose of throwing off the authority of the sultans of Tidore and Ternate; and his efforts would probably have been successful but for the intervention of the Dutch. In 1878 a Dutch expedition was directed against the pirates in Tobolai, who were virtually extirpated.

HALMSTAD, a seaport of Sweden, chief town of the district (*län*) of Halland, on the east shore of the Cattegat, 76 m. S.S.E. of Gothenburg by the railway to Helsingborg. Pop. (1925) 23,171. Mention of the church of Halmstad occurs as early as 1462, and the fortifications are mentioned first in 1225. The latter were demolished in 1734. There were formerly Dominican and Franciscan monasteries in the town. The oldest town-privileges date from 1307 and it appears to have been frequently chosen as the meeting-place of the rulers and delegates of the three northern kingdoms. Under the union of Kalmar it was appointed to be the place for the election of a new Scandinavian monarch whenever necessary. Until 1660, when it was ceded to Sweden, the *lan* of Halland formed part of the territory of Denmark in Sweden. The town lies at the mouth of the river Nissa, having a harbour (20 ft. depth) and roads giving safe anchorage. In the neighbourhood there are quarries of granite, which is exported chiefly to Germany. Other industries are engineering, shipbuilding and brewing, and there are cloth, jute, hat, wood-pulp and paper factories. The principal exports are granite, timber and matches; and butter through Helsingborg and Gothenburg. The imports are coal, machinery, manures, jute and cloth. Potatoes are largely grown in the district, and the salmon fisheries are valuable. The castle is the residence of the governor of the province. There are both mineral and sea-water baths in the neighbourhood.

HALO, in physical science a luminous circle, with various auxiliary features, surrounding the sun or moon. The word is derived from the Greek ἅλως, a threshing-floor and used to denote the disc of the sun or moon, probably on account of the circular path traced out by the oxen threshing the corn. It was later used for any luminous ring, such as that encircling the sun or moon, or portrayed about the heads of saints.

A halo is caused by the ice-crystals in the atmosphere producing reflection and refraction of the light. The optical phenomena produced by atmospheric water and ice may be classified according to the relative positions of the luminous ring and the source of light. *Halos* and *coronae*, or "glories," encircle the luminary; *rainbows*, *fog-bows*, *mist-halos*, *anthelia* and *mountain-spectres* have their centres at the anti-solar point. Halos are at definite distances (22° and 46°) from the centre of illumination, and when coloured have red on the *inside*, being caused by refraction; coronae surround the sun at variable distances but always nearer than 22° and the red colour appears on the *outside*—the result of diffraction.

Coronae are of frequent occurrence, but the halo, particularly of well-developed form, is rare except in polar regions. Here they attain great brilliance and complexity. (For illustrations of various types of halos *see* Met. Office *Observer's Handbook*.) The phenomenon of a halo, solar or lunar, as seen from the earth, is represented in fig. 1; fig. 2 is a diagrammatic sketch showing the appearance as viewed from the zenith; though only in very exceptional circumstances are all the parts visible. Encircling the luminary (S), are two circles, the "inner halo" (I) and the "outer halo" (O), having radii of about 22° and 46°, and usually exhibiting confused spectrum colours with a decided red tint on the inside. Passing through the luminary and parallel to the horizon, there is a luminous white ring, the *parhelic circle* (P), on which a number of images of the sun or moon appear (four of these are indicated on the figures by means of the letter *p*) but the images at 46° are very rare. The most brilliant are situated at the intersections of the inner halo and the parhelic circle and are known

as *parhelia,* or "mock-suns" (Gr. παρά, beside, and ἥλιος, the sun), or as *paraselenae,* "mock-moons" (Gr. σελήνη, the moon). The parhelia are most brilliant when the sun is low; as it rises they pass slightly outside the halo and exhibit flaming tails. The other images on the parhelic circle are the *paranthelia* (*q*) and the *anthelion* (*a*) (Gr. ἀντί, opposite). Paranthelia are situated at from 90° to 140° of parhelic arc from the sun while the anthelion is at

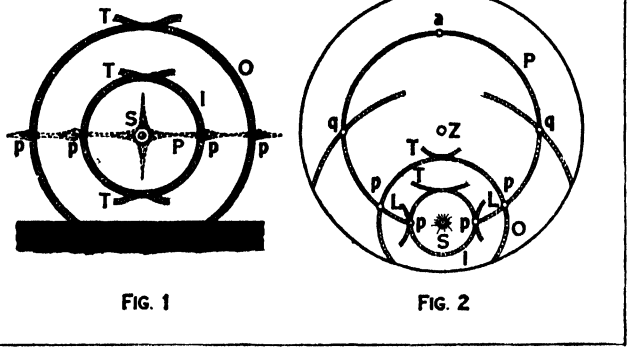

FIG. 1 FIG. 2

FIG 1 —PHENOMENON OF A HALO, SOLAR OR LUNAR, AS SEEN FROM THE EARTH FIG. 2 —SHOWING THE APPEARANCE AS VIEWED FROM THE ZENITH. SEE TEXT FOR REFERENCES

the anti-solar point and is a patch of white light often exceeding in size the apparent diameter of the sun. From the parhelia of the inner halo two arcs (L) curve towards the outer halo These "arcs of Lowitz" were first described in 1794 by Johann Tobias Lowitz (1757–1804). Arcs (T), tangential to the visible upper and lower parts of each halo, also occur, and in the case of the inner halo they may be prolonged and joined to form a luminous closed curve, quasi-elliptical in shape.

The explanation of halos originated with René Descartes, who correctly ascribed their formation to the effects of ice-crystals This theory was adopted by Edmé Mariotte, Henry Cavendish and Thomas Young, who explained the various parts of the halo, though sometimes in a somewhat arbitrary manner. Subsequently J. G Galle and A. Bravais completely demonstrated the general validity of the theory. Bravais' memoir, published in the *Journal de l'École royale polytechnique* (1847), still ranks as the classic on halos.

Ice-crystals exist only in high clouds; the type usually associated with halos is the cirro-nebula. In this the normal form of ice-crystal is an upright hexagonal prism either elongated as a needle or flattened like a thin plate. Three refracting angles become possible: 120° between two adjacent prism faces, 60° between two alternate prism faces, and 90° between a prism face and the base. If innumerable numbers of such crystals fall in any manner between the observer and the sun, there will always be some prisms whose *alternate* faces are traversed by a ray of light, and this would be refracted. Mariotte showed that the inner halo represented by the crowding together of refracted rays is the position of minimum deviation. This approximately equals the minimum deviation (22°) produced by an ice prism whose refractory angle is 60°. As the angle of minimum deviation is smaller for the less refrangible red rays than for the violet, the halo will be coloured red on the inside. Henry Cavendish similarly explained the halo of 46° as being the result of refraction by faces inclined at 90°. The impurity of the colours, chiefly consequent on oblique refraction, results in a well-marked red tint with but mere traces of green and blue, while the external ring of each halo is nearly white; the 46° halo is broader and less luminous.

The two halos admit of explanation without assigning any particular arrangement to the ice-crystals. Nevertheless, certain distributions will predominate, for the crystals will tend to fall so as to offer the least resistance to their motion, a needle-shaped crystal tending to keep its axis vertical, a plate-shaped crystal to keep its axis horizontal. Young explained the parhelic circle as caused by reflection from the vertical faces of the long prisms and the bases of the short ones. If the vertical faces become very numerous, the eye will perceive a white horizontal circle. Reflection from an excess of horizontal faces gives rise to a luminous vertical circle passing through the sun, but this appearance is of infrequent occurrence.

The parhelia, according to Mariotte, are caused by refraction through a pair of alternate faces of a vertical prism When the sun is on horizon the rays fall upon the principal section of the prisms; the minimum deviation for such rays is 22°, and consequently the parhelia are not only on the inner halo, but also on the parhelic circle. As the sun rises, the rays enter the prisms more and more obliquely, and the angle of minimum deviation increases; but, since the emergent ray and the incident ray make the same angle with the refracting edge, the parhelia will remain on the parhelic circle, but gradually recede from the inner halo The different values of the angle of minimum deviation for differently coloured rays will give rise to spectrum colours, the red being nearest the sun, while farther away the overlapping of the spectra produces a long luminous white tail sometimes extending for a space of nearly 20°. The "arcs of Lowitz" have been explained by Galle and Bravais as consequent on small oscillations of the vertical prisms, but the theory has only been imperfectly verified.

The *tangential arcs* were explained by Young as being caused by thin plates with their axes horizontal, refraction taking place through alternate faces. If there are many of these plates then their axes will lie in all possible horizontal directions and consequently give rise to a continuous series of parhelia which touch externally in the inner halo, both above and below, and under certain conditions (such as the requisite altitude of the sun) form two closed elliptical curves; generally, however, only the upper and lower portions are seen. The tangential arcs to the halo of 46° are due to refraction through faces inclined at 90°; these arcs occur more frequently and are of greater brilliance than the 22° arcs.

The *paranthelia* (a) may be caused by two internal or two external reflections. A pair of equilateral triangular prisms having a common face, or a stellate crystal formed by the symmetrical interpenetration of two equilateral triangular prisms, permits of two internal reflections by faces inclined at 120° (producing a total deviation of 240°), and so gives rise to two white images of the sun each at an angular distance of 120° from it. Double internal reflection by an equilateral triangular prism would form a single coloured image on the parhelic circle at about 98° from the sun. The 120° and 98° angular distances result only when the sun is on the horizon; they increase as it rises.

The *anthelion* may be explained as being caused by two internal reflections of the solar rays by a hexagonal lamellar prism of ice having its axis horizontal and one of the diagonals of its base vertical. The emerging rays are parallel to their original direction and form a bright patch of light on the parhelic circle diametrically opposite to the sun. (*See also* MIRAGE)

HALOGENS. This term is applied to fluorine, chlorine, bromine and iodine, on account of the great similarity of their sodium salts to ordinary sea-salt (Gr. ἅλς, salt, and γεννᾶν, to produce). These four elements show a great resemblance to one another in their general chemical behaviour, and in that of their compounds, whilst their physical properties show a gradual transition. Thus, as the atomic weight increases, the state of aggregation under ordinary conditions changes from that of a gas in the case of fluorine and chlorine, to that of a liquid (bromine) and finally to that of the solid (iodine). The halogen of lower atomic weight can displace one of higher atomic weight from its hydrogen compound, or from the salt derived from such hydrogen compound, while, on the other hand, the halogen of higher atomic weight can displace that of lower atomic weight, from the halogen oxy-acids and their salts; thus iodine will liberate chlorine from potassium chlorate, and also from perchloric acid. All four of the halogens unite with hydrogen, but the affinity for hydrogen decreases as the atomic weight increases, hydrogen and fluorine uniting explosively at very low temperatures (even at −253°, where all other chemical action has apparently ceased), and in

the dark, whilst hydrogen and iodine unite only with difficulty and even then the resulting compound is very readily decomposed by heat. The hydrides of the halogens are all colourless, strongly fuming gases, readily soluble in water to give a strongly acid solution, they react readily with basic oxides, forming in most cases well-defined crystalline salts which resemble one another very strongly. On the other hand the stability of the known oxygen compounds increases with the atomic weight; thus iodine pentoxide is, at ordinary temperatures, a well-defined crystalline solid, which is decomposed only when heated strongly, whilst chlorine monoxide, chlorine peroxide, and chlorine heptoxide are unstable, even at ordinary temperatures, decomposing at the slightest shock. Binary compounds of bromine and oxygen have not yet been isolated In some respects there is a very marked difference between fluorine and the other members of the group, for, whilst sodium chloride, bromide and iodide are readily soluble in water, sodium fluoride is much less soluble; again, silver chloride, bromide and iodide are practically insoluble in water, whilst, on the other hand, silver fluoride is appreciably soluble in water. Further, although calcium fluoride is practically insoluble in water, the other halides of calcium are very soluble. Again, fluorine shows a great tendency to form double salts which have no counterpart among the compounds formed by the other members of the family

All four halogens apparently possess seven valency electrons, and by combination they strive to obtain the stable 8-electron grouping, thereby becoming negatively charged.

HALOPHYTES, a general name used in botany to denote plants growing in salt marshes and similar environments with a high salt content. Such plants show adaptations for conservation of water. (*See* PLANTS: *Ecology;* XEROPHYTE)

HALPHEN, LOUIS (1880–), French historian, was born in Paris on Feb. 4, 1880 He was educated at Versailles and in Paris, and since 1910 has been professor at Bordeaux. His chief publications are, *Le Comté d'Anjou au XIe siècle* (1906), *Etudes sur l'administration de Rome au Moyen Age* (1907); *Paris sous les premiers Capétiens 987–1223* (1909); *Le règne de Charles le Chauve* (1909, with F. Lot); *L'histoire en France depuis cent ans* (1914); *Etudes critiques sur l'histoire de Charlemagne* (1921) and an edition with translation of the Life of Charlemagne by Eginhardus (1923). Halphen has also directed several series, the most recent being *Peuples et civilisation, histoire générale depuis l'antiquité jusqu'à nos jours* (1925 *seq.*).

HALS, FRANS (1580?–1666), Dutch painter, was born at Antwerp according to the most recent authorities in 1580 or 1581, and died at Haarlem in 1666. As a portrait painter second only to Rembrandt in Holland, he displayed extraordinary talent and quickness in the exercise of his art coupled with improvidence in the use of the means which that art secured to him. He brought up and supported a family of ten children with success till 1652, when the forced sale of his pictures and furniture, at the suit of a baker to whom he was indebted for bread and money, brought him to absolute penury. The inventory of the property seized on this occasion only mentions three mattresses and bolsters, an armoire, a table and five pictures. This humble list represents all his worldly possessions at the time of his bankruptcy. Subsequently to this he was reduced to still greater straits, and his rent and firing were paid by the municipality, which afterwards gave him (1664) an annuity of 200 florins. We may admire the spirit which enabled him to produce some of his most striking works in his unhappy circumstances. Hals's pictures illustrate the various strata of society into which his misfortunes led him. His banquets or meetings of officers, of sharpshooters, and gildsmen are the most interesting of his works. But they are not more characteristic than his low-life pictures of itinerant players and singers His portraits of gentlefolk are true and noble, but hardly so expressive as those of fishwives and tavern heroes. His first master at Antwerp was probably van Noort, as has been suggested by M. G. S. Davies, but on his removal to Haarlem Frans Hals entered the atelier of van Mander, the painter and historian, of whom he possessed some pictures which went to pay the debt of the baker already alluded to.

In every form of his art we can distinguish his earlier style from that of later years It is curious that we have no record of any work produced by him in the first decade of his independent activity, save an engraving by Jan van de Velde after a lost portrait of "The Minister Johannes Bogardus," who died in 1614. The earliest works by Frans Hals that have come down to us, "Two Boys Playing and Singing" in the gallery of Cassel, and a "Banquet of the officers of the 'St. Joris Doele' " or Arquebusiers of St. George (1616) in the museum of Haarlem, exhibit him as a careful draughtsman capable of great finish, yet spirited withal. His flesh, less clear than it afterwards becomes, is pastose and burnished Later he becomes more effective, displays more freedom of hand, and a greater command of effect At this period we note the beautiful full-length of "Madame van Beresteyn" at the Louvre in Paris, and a splendid full-length portrait of "Willem van Heythuysen" leaning on a sword in the Liechtenstein collection at Vienna. Both these pictures are equalled by the other "Banquet of the officers of the Arquebusiers of St. George" (with different portraits) and the "Banquet of the officers of the 'Cloveniers Doelen' " or Arquebusiers of St. Andrew of 1627 and an "Assembly of the officers of the Arquebusiers of St Andrew" of 1633 in the Haarlem Museum A picture of the same kind in the town hall of Amsterdam, with the date of 1637, suggests some study of the masterpieces of Rembrandt, and a similar influence is apparent in a picture of 1641 at Haarlem, representing the "Regents of the Company of St Elizabeth" and in the portrait of "Maria Voogt" at Amsterdam But Rembrandt's example did not create a lasting impression on Hals. He gradually dropped more and more into grey and silvery harmonies of tone; and two of his canvases, executed in 1664, "The Regents and Regentesses of the Oudemannenhuis" at Haarlem, are masterpieces of colour, though in substance all but monochromes. In fact, ever since 1641 Hals had shown a tendency to restrict the gamut of his palette, and to suggest colour rather than express it. This is particularly noticeable in his flesh tints which from year to year became more grey, until finally the shadows were painted in almost absolute black, as in the "Tymane Oosdorp," of the Berlin Gallery. As this tendency coincides with the period of his poverty, it has been suggested that one of the reasons, if not the only reason, of his predilection for black and white pigment was the cheapness of these colours as compared with the costly lakes and carmines.

As a portrait painter Frans Hals had scarcely the psychological insight of a Rembrandt or Velazquez, though in a few works, like the "Admiral de Ruyter," in Earl Spencer's collection, the "Jacob Olycan" at the Hague Gallery, and the "Albert van der Meer" at Haarlem town hall, he reveals a searching analysis of character which has little in common with the instantaneous expression of his so-called "character" portraits. In these he generally sets upon the canvas the fleeting aspect of the various stages of merriment, from the subtle, half ironic smile that quivers round the lips of the curiously misnamed "Laughing Cavalier" in the Wallace Collection to the imbecile grin of the "Hille Bobbe" in the Berlin Museum.

Though a visit to Haarlem town hall, which contains the five enormous Doelen groups and the two Regenten pictures, is as necessary for the student of Hals's art as a visit to the Prado in Madrid is for the student of Velazquez, good examples of the Dutch master have found their way into most of the leading public and private collections. In the British isles, besides the works already mentioned, portraits from his brush are to be found at the National Gallery, the Edinburgh Gallery, the Glasgow Corporation Gallery, Hampton Court, Buckingham Palace, Devonshire House, the collections of Lord Northbrooke, Lord Ellesmere and Lord Spencer and in the Lord Iveagh bequest at Kenwood House. At Amsterdam is the celebrated "Flute Player," once in the Dupper collection at Dort; at Brussels, the patrician "Heythuysen"; at the Louvre, "Descartes"; at Dresden, the painter "Van der Vinne." Hals's sitters were taken from every class of society—admirals, generals and burgomasters pairing with merchants, lawyers, clerks. To register all that we find in public galleries would involve much space. There are eight portraits at Berlin, six at Cassel, five at St. Petersburg, six at the Louvre, two at Brussels, five at Dresden, two at Gotha. In private collections, chiefly in Paris, Haarlem and

Vienna, we find an equally important number.

For two centuries after his death Frans Hals was held in such poor esteem that some of his paintings, which are now among the proudest possessions of public galleries, were sold at auction.

The earliest record of a sale of a Frans Hals in Great Britain is that of 1769 when "A Music Conversation" was bought from the Schaub Collection for £28 by Lord Byron The portrait of "Johannes Aeronius" now at the Berlin Museum realized five shillings at a sale in 1786. In 1885, £1,000 was still considered a very high price for a work by the master; but in 1913 a picture by him only 11in.x8in., "Portrait of a Lady," fetched £5,985, while in 1908 the fine large family group from the collection of Lord Talbot of Malahide was acquired by the National Gallery for £25,000. The outcry at the time against this high price has since proved unworthy, for in 1919 at the Drummond sale a much smaller picture, "Portrait of Cozmans," made as much as £26,775. Of the master's numerous family none has left a name except FRANS HALS THE YOUNGER, born about 1622, who died in 1669. His pictures represent cottages and poultry; and the "Vanitas" at Berlin, a table laden with gold and silver dishes, cups, glasses and books, is one of his finest works and deserving of a passing glance.

Quite in another form, and with much of the freedom of the elder Hals, DIRK HALS, his brother (born at Haarlem, died 1656), is a painter of festivals and ball-rooms But Dirk had too much of the freedom and too little of the skill in drawing which characterized his brother. He remains second on his own ground to Palamedes. A fair specimen of his art is a "Lady playing a Harpsichord to a Young Girl and her Lover" in the van der Hoop collection at Amsterdam, now in the Ryks Museum More characteristic, but not better, is a large company of gentle-folk rising from dinner, in the Academy at Vienna.

See W Bode, *Frans Hals und seine Schule* (Leipzig, 1871); W. Unger and W. Vosmaer, *Etchings after Frans Hals* (Leyden, 1873); Percy Rendell Head, *Sir Anthony Van Dyck and Frans Hals* (London, 1879); D Knackfuss, *Frans Hals* (Leipzig, 1896); G S Davies, *Frans Hals* (London, 1902) W Bode and M. Binder, *Franz Hals, sein Leben und seine Werke* (Berlin, 1914).

HALSBURY, HARDINGE STANLEY GIFFARD, 1ST EARL OF (1823–1921), English lord chancellor, son of Stanley Lees Giffard, LL D., was born in London on Sept. 3, 1823. He was educated at Merton college, Oxford, and was called to the bar at the Inner Temple in 1850, joining the North Wales and Chester Circuit. Afterwards he had a large practice at the central criminal court and the Middlesex sessions, and he was for several years junior prosecuting counsel to the Treasury. He was engaged in most of the celebrated trials of his time, including the Overend and Gurney and the Tichborne cases. He became queen's counsel in 1865, and a bencher of the Inner Temple. Giffard twice contested Cardiff in the Conservative interest, in 1868 and 1874, but he was still without a seat in the House of Commons when he was appointed solicitor-general by Disraeli in 1875 and received the honour of knighthood In 1877 he succeeded in obtaining a seat, when he was returned for Launceston, which borough he continued to represent until his elevation to the peerage in 1885 He was then created Baron Halsbury and appointed lord chancellor, thus forming an exception to the rule that no criminal lawyer ever reaches the woolsack. Lord Halsbury resumed the position in 1886 and held it until 1892 and again from 1895 to 1905, his tenure of the office, broken only by the brief Liberal ministries of 1886 and 1892–95, being longer than that of any lord chancellor since Lord Eldon. In 1898 he was created earl of Halsbury and Viscount Tiverton. Among Conservative lord chancellors Lord Halsbury must always hold a high place, his grasp of legal principles and mastery in applying them being pre-eminent among the judges of his day. He died in London on Dec. 11, 1921.

HALSEY, SIR LIONEL (1872–), G.C.V.O. (1920), K.C.I.E. (1922), G C M G. (1925), British admiral, was born on Feb. 26, 1872, son of the Rt. Hon. Sir Frederick Halsey of Gaddesden. He was educated at Stubbington House, Fareham. He entered the navy, joining H.M.S. Britannia in 1885, and was one of those who served in the defence of Ladysmith (1899–1900). For his services in the defence he was promoted commander in 1901. He was promoted captain (1905), and after the outbreak of the World War was in command of H M S. "New Zealand" in the actions in the Heligoland fight (1914), and at the Dogger Bank (1915). At the battle of Jutland he served in H M S. "Iron Duke." In 1917 he was promoted rear-admiral, and appointed third sea lord, and from 1918 to 1919 commanded the Royal Australian navy. He acted as chief of staff to the Prince of Wales during his tours in Canada (1919), Australia and New Zealand (1920) and India and Japan (1921–22), being promoted vice-admiral in 1921 He retired in 1922, and was given the rank of admiral in 1926. In 1920 he was appointed comptroller and treasurer to the Prince of Wales.

HALSTEAD, a market-town added to the borough of Harwick in 1917, in the Harwich parliamentary division of Essex, England, on the Colne, 17 m. N.N E from Chelmsford Pop (1921) 5,923 The church of St. Andrew is mainly Perpendicular The grammar school dates from 1594 There are large silk and crape works Two miles north of Halstead is Little Maplestead, where the church is the latest in date of the four churches with round naves extant in England, being of 12th-century foundation, but showing early Decorated work The chancel, which is without aisles, terminates in an apse. Three m N W. from Halstead are the large villages of Sible Hedingham and Castle Hedingham. At the second is the Norman keep of the De Veres, of whom Aubrey de Vere held the lordship from William I The keep dates from the end of the 11th century, and exhibits much Norman work. The church of St. Nicholas, Castle Hedingham, is Norman, Transitional and Early English.

HALT. Lame, crippled; also a verb meaning to limp. "String-halt" or "spring-halt" is a nervous disorder affecting the muscles of the hind legs of horses.

HALUNTIUM, an ancient city of Sicily (Gr. *Ἀλόντιον*, mod. S. Marco d'Alunzio), 6 m. from the north coast and 25 m. E.N.E. of Halaesa It was probably of Sicel origin, though its foundation was ascribed to some of the companions of Aeneas. It suffered considerably at the hands of Verres. The abandoned church of S. Mark, just outside the modern town, is built into the *cella* of an ancient Greek temple, which measures 62 ft by 18.

HALYBURTON, JAMES (1518–1589), Scottish reformer, was one of the lords of the congregation in 1557, and commanded the contingents sent by Forfar and Fife against the queen regent in 1559 He took part in the defence of Edinburgh, and in the battles of Langside (1568) and Restalrig (1571), where he was captured by Mary's troops. He represented Morton at the conference of 1578, and was one of the royal commissioners to the General Assembly in 1582 and again in 1588

HALYBURTON, THOMAS (1674–1712), Scottish divine, was born at Dupplin, near Perth, on Dec 25, 1674 His father, one of the ejected ministers, having died in 1682, he was taken by his mother in 1685 to Rotterdam to escape persecution In 1696 he graduated at the University of St. Andrews and in 1700 he was ordained minister of the parish of Ceres. In 1710 he became professor of theology in St. Leonard's college, St Andrews. He died from the effects of overwork in 1712

The works by which he continues to be known were all of them published after his death Wesley and Whitefield were accustomed to commend them to their followers. They were published as follows: *Natural Religion Insufficient, and Revealed Religion Necessary, to Man's Happiness in his Present State* (1714), an able statement of the orthodox Calvinistic criticism of the deism of Lord Herbert of Cherbury and Charles Blount; *Memoirs of the Life of Mr. Thomas Halyburton* (1715), three parts by his own hand, the fourth from his diary by another hand; *The Great Concern of Salvation* (1721), with a word of commendation by I. Watts; *Ten Sermons Preached Before and After the Lord's Supper* (1722); *The Unpardonable Sin Against the Holy Ghost* (1784).

HAM is the name of Noah's second son. It is true that, contrary to the prevailing tradition, he appears in Gen ix 24 as the youngest of Noah's three sons, but close examination of this story makes it clear that here the name Ham has replaced an original Canaan The table of nations in Gen x. represents Ham as the ancestor of Cush (=Ethiopia), Mizraim (=Egypt), Put, and Canaan, that is, of the original inhabitants of Palestine and the peoples to the south-west. Ham appears also as a place-name

Gen. xiv. 5, and as the designation of a people or place, 1 Chron. iv. 40: both references are obscure. *See* the *Cambridge Ancient History*, vol 1, p. 184 *seq.*

HAM, a small town of northern France, in the department of Somme, 36 m E S E. of Amiens on the Northern railway between that city and Laon. Pop. (1926) 2,786. It stands on the Somme, dominated by a castle which was built in the 10th century, now in ruins. The castle of Ham has frequently been used as a state prison both in ancient and modern times, and the list of prisoners include Joan of Arc, Louis of Bourbon, the ministers of Charles X, Louis Napoleon, and Generals Cavaignac and Lamoricière. During 1870–1871 Ham was several times captured and recaptured by the belligerents From the 9th century onwards it was the seat of a lordship which, after the extinction of its hereditary line, passed in succession to the houses of Coucy, Enghien, Luxembourg, Rohan, Vendôme and Navarre, and was finally united to the French crown on the accession of Henry IV. The church, damaged during the war 1914–1918, includes 12th century effigies of the Lords of Ham in its ancient crypt Ham is at an important position on the Somme and suffered greatly during the campaign on the Western front in 1914–1918, especially during the retreat in the spring of 1917. It was in this vicinity that tanks were first used.

HAM. The thigh and hind leg of a pig is termed the gammon, but when cut from the carcase and separately cured it is termed the ham As in the case of bacon (*q.v.*) there are different methods of curing, but the variety of methods by which hams are cured is much larger. When home curing of bacon and hams in farm houses was common every housewife had her own special recipe for pickling, curing and, generally, smoking hams Now that the operation is done commercially on a large scale there is general uniformity of system. One or two special methods of curing have established a trade in a particular kind and quality of ham Among them are the York ham in England, the Brandenburg ham in Germany, and the peach-fed ham in America.

No statistics are available of the production of hams but the quantity and value imported into Great Britain and Northern Ireland are ascertainable from the trade accounts. Practically the whole of the imports come from Canada and the United States. The following were the imports in 1927, the pre-war average being added for comparison:

Great Britain: Imports of Ham

	1927		1909–13	
	Quantity	Value	Quantity	Value
	Cwts.	£	Cwts.	£
U.S.A.	716,104	3,718,803	841,442	2,637,361
Canada	133,703	715,216	63,623	211,610
Other countries	52,720	275,835	6,102	22,173
	902,536	4,709,854	911,167	2,871,144

It is noteworthy that while the importation of hams into Great Britain is less that in 1909–13 that of bacon has increased by about 4 million cwt. The reduction has been especially marked since 1923 when 1¾ million cwt. of hams were imported. It appears probable that there has been an increase in British home production, but no statistical evidence can be cited in proof of this fact. (R. H. R)

United States.—In the United States the term "ham" is applied to the fresh or cured thigh of the hog. The hams are cut from the rest of the side, trimmed and cured in a pickle made of salt, sugar and a nitrate or nitrite. After pickling and soaking, the ham is smoked with fumes from hard-wood or from sawdust. Hams also are sold and consumed to some extent in the fresh state

Production —The production of ham in the United States runs into millions of pounds annually. An average hog will yield approximately 13% of its live weight in ham. Figuring an estimated average weight of 14 lb. per ham, the production of hams in the United States, both fresh and cured, probably exceeds 1,600,000,000 lb. annually. (This includes farm production.)

Exports of Ham.—Exports of ham and bacon from the United States during the period from 1910 to 1913 ranged from approximately 150,000,000 lb. to 200,000,000 pounds. In 1927, exports of hams and shoulders totalled 122,613,240 lb., valued at approximately $25,319,569. During the World War, exports of hams greatly increased. During one year they reached the total of approximately three quarters of a billion pounds. Most of the hams exported from the United States are sent to the United Kingdom. A few are shipped to the Netherlands, France and Belgium and also to Central and South American countries.

Marketing.—After smoking, the ham is chilled and then wrapped in a grease-proof paper, then in an absorbent paper, and finally in an attractively coloured and printed parchment paper covering for sale in the retail meat shop. Some hams are sold unwrapped but practically all hams are branded on the skin side with a trademark.

As is the case with bacon, both fresh and cured hams are traded in extensively on the Chicago Board of Trade and also are sold by one packer to another. Most trading is done in carload lots. The processing and marketing of hams is handled at many points in much the same way as bacon (*q.v.*).

The practice of skinning hams at the point of production is growing in the United States. Skinning involves removal of the skin and sometimes portions of the fat from the upper part of the ham.

Uses and Food Value of Ham.—Ham is one of the most popular dishes in the American dietary This undoubtedly is due to the fact that it is very palatable and that it may be prepared easily in a variety of ways. The whole or half ham and the butt and shank may be baked or boiled; slices may be broiled or fried. It is also used extensively as a sandwich meat From nutritional and other standpoints, ham offers some rather obvious reasons for being popular. Fresh meats must be consumed within a short space of time; cured meats can be kept in good condition for great lengths of time Again, ham offers a pleasing contrast in flavour to fresh meats.

Besides the points just enumerated, there is the additional virtue that ham is one of the products of a very economical meat-producing animal. The hog is one of the most economical of all food-producing animals when measured in terms of the yield received from a given outlay of feed consumed by the animal. Ham is one of the most nutritious of meat foods. It furnishes large quantities of the highest quality protein Proteins differ in their value as food for human beings according to the kind and amount of the various smaller chemical compounds, known as amino acids, of which they are constituted. As a rule, animal proteins are superior to vegetable proteins in this respect. The flesh of meat-producing animals—and this includes ham—is one of the best sources of this protein

Readily available energy is also supplied by ham The amount depends upon the fatness of the ham and upon the relative amount of this fat eaten. For example, lean ham may furnish about 1,200 calories and fat ham may furnish as much as 2,600 calories per pound of substance eaten. Ham is a good source of many of the mineral elements needed for adequate nutrition. Many of these mineral elements are furnished in adequate amounts in any usual diet. Those most apt to be deficient are, in the relative order of their importance: calcium, iron, iodine and phosphorus. Ham, along with muscle meats in general, is a good source of iron and phosphorus The iodine content will depend upon whether the hog has been fed on crops grown on land that has not had its store of iodine depleted The supply of calcium in ham is rather small.

As a source of the vitamins, ham qualifies for a place on the menu. Its content of vitamin A may be quite low, but it also may be high if the animal from which it came has been fed on feeds rich in this vitamin. According to the work of investigators in the U.S. Department of Agriculture, lean pork is an important source of vitamin B and compares rather favourably with such excellent vitamin foods as liver and kidney. Even when the pork is cured, smoked and cooked its content of this vitamin is high. Ham, therefore, is a good source of vitamin B.

Since ham is not eaten unless it is well cooked, it can not be counted as a source of vitamin C. However, it is rich in both the pellagra-preventing vitamin (G) and the vitamin needed for the normal functioning of the reproductive process in animals (vitamin E). (W. Ha.)

HAMA, an ancient Hittite city, built on both banks of the Orontes, now a centre of commerce for the Bedouin: pop. 51,000 (about 6,000 Christians). The citadel hill, which is partly artificial, rises to a height of about 130 feet. European competition has seriously affected the silk, woollen and cotton manufactures for which the city was formerly noted. It has connection by rail through Aleppo with the Constantinople-Baghdad railway on the north, and through Homs with the Beirut-Damascus railway on the south. Interesting and peculiar to Hama are the vast water wheels (*na'ura*) which raise the water to the higher levels for irrigation. In the 14th century there were over 30 of these wheels; now only nine.

History.—Hama was an early Hittite settlement and is the most southerly place where Hittite inscriptions have been found. Lying athwart the Assyrian road to the west lands it fell a prey to Shalmanassar II. (854 and 849 B.C.) to Tiglath Pileser III. (738 B.C.), and to Sargon (720 B.C.). According to 2 Kings, xvii., 24, a portion of its inhabitants was transported to northern Israel.

In the Hellenistic period Hama received the name Epiphania in honour of Antiochus (iv.) Epiphanes. It surrendered to the Mohammedans (A.D. 638) and its Christian basilica was transformed into a mosque (the Great Mosque). It was captured by the Crusaders (1108), retaken by the Mohammedans (1115), and occupied by Saladin (1187). During the 12th century it suffered severely from earthquakes. The famous Arab geographer, Abu'l-Fida (14th century), was its prince and under him the city enjoyed great prosperity. (E. Ro.)

HAMADAN, a province and town of Persia The province is bounded north by Kazvin and Khamseh, west by Kermanshah, south by Malayer and Iraq and east by Tehran provinces. It has many well watered plains producing much grain. Before the World War there were extensive plantations of trees but much timber was cut down during the Turkish occupation The population is estimated at 350,000, more than one half being Turkistanis of the Karaguzlu (now a quite sedentary people) and Shamlu tribes. The revenue in 1926–27 amounted to 5,560,429 krans.

Hamadan the chief town of the province is situated some 180 m. W S W. of Tehran, on the Kazvin-Kermanshah motor road, at an elevation of over 6,000 ft., near the foot of the Mount Alvand, whose granite peak has an altitude of 11,900 feet. It is one of the principal trade and distributing centres of Persia, being at the meeting point of a number of roads, some of which, including that to Sultanabad, were made passable for motor traffic during and after the World War. The population was estimated in 1919 at 70,000, of whom one-fourth were Turks or of Turkish origin, the remainder being Persians, Jews (some 4,000) with a sprinkling of Armenians. The bazars are extensive and well stocked, but the streets of the town are narrow and tortuous. Hamadan is the seat of the leather, shell-lac and gall-nut trade of Persia, and a centre of the important rug industry. An authority states that one-eighth of the population lives and works in the tanneries, and hides are imported from all over Persia. The climate of Hamadan is described as pleasant; but the winters are long and severe with heavy falls of snow.

Hamadan is the Ecbatana of the classical authors (*q.v.*). According to a tradition Darius rebuilt the city which had long lain in ruins in order to have a safe asylum for his family and treasures during the war with Alexander. Whether the later citadel of Hamadan actually dated back to such early times must remain uncertain; but it is certain that it was destroyed by Agha Muhammad Khan in 1789 and that the remains, now called Al Musalla, are to be seen outside the town. Another monument of ancient times is the Bab al Asad (Lion gate) which was adorned by a colossal figure of a lion In A.D 931 the Bab was destroyed and the lion thrown down, and to this day the inhabitants esteem a figure of a lion lying outside the town as a talisman against hunger and cold. As a centre of a well populated district, Hamadan developed at a very early period, and is said to have been four parasangs (16 m.) in length. Jews are attracted to the town not only by the favourable conditions of trade, but also by the alleged tombs of Mordecai and Esther, in an insignificant domed building in the middle of the town, to which Jews from other countries as well make a pilgrimage. Hamadan also boasts the tomb of the celebrated philosopher Avicenna (Abu Ali ibn Sina) who died there in 1037.

See G. N. Curzon, *Persia and the Persian Question* (1892); Brugsch, *Reise nach Persien* (1862–63); J. De Morgan, *Expedition scientifique* etc., iv; Le Strange, *Lands of the Eastern Caliphate;* A. Y. W. Jackson, *Persia past and present* (1906), M H Donohoe, *With the Persian expedition* (1919); A. Poidebard, *Au carrefour des routes de Perse* (1923).

HAMADHĀNĪ [Abū-l Fadl Aḥmad ibn ul-Ḥusain ul-Hamadhānī] (967–1007), Arabian writer, known as Badi' uz-Zamān (the wonder of the age), was born and educated at Hamadhān. After 990 he travelled in Jorjān, Nishapur, Khorasan and Sijistān, and finally settled in Herāt under the protection of the vizir of Mahmūd, the Ghaznevid sultan. He was renowned for a remarkable memory and for fluency of speech, as well as for the purity of his language He was one of the first to renew the use of rhymed prose both in letters and *maqāmas.* (*See* Arabia: *Literature,* section "Belles Lettres.")

His letters were published at Constantinople (1881), and with commentary at Beirut (1890); his *maqāmas* at Constantinople (1881), and with commentary at Beirut (1889). S. de Sacy has edited six of the *maqamas* with French trans. in *Chrestomathie arabe,* vol. iii. (2nd ed., 1827). *See* also A. von Kremer's *Culturgeschichte des Orients,* ii. (Vienna, 1877).

HAMANDRYAS (*Papio hymandryas*), a name for the sacred baboon of the ancient Egyptians, inhabiting Arabia and Abyssinia. (*See* Baboon, Primates.)

HAMANN, JOHANN GEORG (1730–1788), German writer on philosophy and theology, was born at Königsberg, Prussia on Aug 27, 1730, of poor parents. During his restless life he experienced poverty and profound mental struggles. In 1707 he was made translator in the Königsberg office, and ten years later became a storekeeper in a mercantile house. In 1784 the failure of some commercial speculations reduced his means, and about the same time he was dismissed with a small pension from his situation. The kindness of friends, however, enabled him to spend some time with Jacobi at Pempelfort and with Buchholz at Walbergen where he was seized with illness, and died on June 21, 1788.

Hamann's works resemble his life and character. His hatred of system, incapacity for abstract thinking, and intense personality rendered it impossible for him to do more than utter the disjointed, oracular, obscure dicta which gained for him the name of "Magus of the North." His fundamental thought is the unsatisfactoriness of abstraction. Attacking his friend, Kant, for separating matter and form, and sense and understanding, he contends that reason, apart from tradition, belief and experience, only exhibits the contradictions in life. Belief is the groundwork of knowledge and life should be taken as a whole. Hamann used to refer to Bruno's conception of the identity of contraries as representing his own thought.

Bibliography.—Hamann's works were published by F. Roth (1821–42), by C. H. Gildemeister (6 vols., 1851–73 including a biography), and by M. Petri, *Hamanns Schriften u. Briefe,* 4 vols. (1872–73). *See* also J. Poel, *Hamann, der Magus im Norden* (2 vols., 1874); J. Claassen, *Hamanns Leben und Werke* (1885); H. Weber, *Hamann u. Kant* (1904), and *Neue Hamanniana* (1905); R. Unger, *Hamann u. die Aufklärung* 2 vols. (Halle, 1925). A comprehensive essay on Hamann is found in Hegel's *Vermischte Schriften,* ii. (*Werke,* Bd. xvii.). On Hamann's influence on German literature, *see* J. Minor, *J. G. Hamann in seiner Bedeutung fur die Sturm- und Drang-Periode* (1881).

HAMAR or Storehammer (Great Hamar), a town of Norway in Hedemarken *amt* (county), 78 m. by rail N. of Oslo. Pop. (1927), 6,003. It is pleasantly situated between two bays of Lake Mjösen, and is the junction of the railways to Trondhjem and to Otta in Gudbrandsdal. The existing town was laid out in 1849, and made a bishop's see in 1864. Near the same site there

stood an older town, which, together with a bishop's see, was founded in 1152 by the Englishman Nicholas Breakspeare (afterwards Pope Adrian IV.); but both town and cathedral were destroyed by the Swedes in 1567, though ruins of the latter still exist. The town is a centre for the richest agricultural district in Norway, and has condensed milk factories. It has also steel and iron industries, including the manufacture of railway engines.

HAMĀSA (Ḥamāsah), the name of a famous Arabian anthology compiled by Ḥabīb ibn Aus aṭ-Ṭā'ī, surnamed Abū Tammām. (*See* Abū Tammām.) The collection is so called from the title of its first book, containing poems descriptive of constancy and valour in battle, patient endurance of calamity, steadfastness in seeking vengeance, manfulness under reproach and temptation, all which qualities make up the attribute called by the Arabs *ḥamāsah* (briefly paraphrased by at-Tibrīzī as *ash-shiddah fi-l-amr*). It consists of ten books or parts, containing in all 884 poems or fragments of poems, and named respectively—(1) *al-Ḥamāsa*, 261 pieces, (2) *al-Marāthī*, "Dirges," 169 pieces; (3) *al-Adab*, "Manners," 54 pieces; (4) *an-Nasīb*, "The Beauty and Love of Women," 139 pieces; (5) *al-Hijā*, "Satires," 80 pieces; (6) *al-Aḍyāf wa-l-Madīḥ*, "Hospitality and Panegyric," 143 pieces; (7) *aṣ-Ṣifāt*, "Miscellaneous Descriptions," 3 pieces; (8) *as-Sair wa-n-Nu'ās*, "Journeying and Drowsiness," 9 pieces; (9) *al-Mulah*, "Pleasantries," 38 pieces; and (10) *Madhammat-an-nisā*, "Dispraise of Women," 18 pieces. The poems are for the most part fragments selected from longer compositions. They are taken from the works of Arab poets of all periods down to that of Abū Tammām himself (the latest ascertainable date being A.D. 832), but chiefly of the Ante-Islamic time (*Jāhiliyyūn*), of the early days of Al-Islām (*Mukhaḍrimūn*), and of the reigns of the Omayyad caliphs, A.D. 660–749 (*Islāmiyyūn*). Perhaps the oldest in the collection are those relating to the war of Basūs, which ended with the peace of Dhu-l-Majāz, about A.D. 534.

Most of the poems belong to the class of extempore or occasional utterances, as distinguished from *qaṣīdas*, or elaborately finished odes. While the latter abound with comparisons and long descriptions, the poems of the *Ḥamāsa* are short, direct and for the most part free from comparisons. Abū Tammām in compiling his collection chose hardly anything from the works of the most famous poets of antiquity. Not a single piece from Imra 'al-Qais (Amru-ul-Qais) occurs in the *Ḥamāsa*, nor are there any from 'Alqama, Zuhair or A'shā; Nābigha is represented only by two pieces of four and three verses respectively; 'Antara by two pieces; Ṭarafa by one piece, Labīd by one piece; and 'Amr ibn Kulthūm by one piece.

The book entitled *an-Nasīb*, is, however, an important exception, and contains verses relating to women and love. In the classical age of Arab poetry it was the established rule that all *qaṣīdas* must begin with the mention of women and their charms (*tashbīb*), in order that the hearts of the hearers might be softened. These fragments are therefore generally taken from the opening verses of *qaṣīdas;* where this is not the case, they are chiefly compositions of the early Islamic period.

The compiler was himself a distinguished poet and wandered through the Muslim empire living by his skill in panegyric. About A.H. 220 he betook himself to Khorasan, then ruled by 'Abdallah ibn Ṭāhir, whom he praised and by whom he was rewarded; on his journey home to 'Irāk he passed through Hamadhān, and was there detained as a guest of Abu-l-Wafā, son of Salama. During his residence at Hamadhān, Abū Tammām is said to have compiled or composed five poetical works, of which one was the *Ḥamāsa*. This collection remained as a precious heirloom in the family of Abu-l-Wafā until it fell into the hands of Abu-l-'Awādhil, who carried it to Iṣfahān and made it known to the learned of that city.

The worth of the *Ḥamāsa* as a store-house of ancient legend can hardly be exaggerated. The high level of excellence which is found in its selections caused it to be said that Abū Tammām displayed higher qualities in his choice of extracts than in his own compositions. The class of poetry of which the *Ḥamāsa* is a specimen is remarkable for the evident first-hand experience which the singers possessed of all of which they sang. For historical purposes the value of the collection is not small; but most of all there shines forth from it a complete picture of the strenuous life of passion and battle, which marked the valiant stock who bore Islām abroad over the outworn civilizations of Persia, Egypt and Byzantium.

No fewer than 20 commentaries are enumerated by Ḥājjī Khalīfa. Of these the earliest was by Abū Riyāsh (otherwise ar-Riyāshī), who died in A.H. 257; excerpts from it are frequently given by at-Tibrīzī (Tabrīzī). He was followed by the famous grammarian Abu-l-Fatḥ ibn al-Jinnī (d. A.H. 392), and later by Shihāb ad-Din Ahmad al-Marzūqī of Iṣfahān (d. A.H. 421). Upon al-Marzūqi's commentary is chiefly founded that of Abu Zakarīyā Yahyā at-Tibrīzī (b. A.H. 421, d. 502), which has been published by the late Professor G. W. Freytag of Bonn, together with a Latin translation and notes (1828–1851). This work is a treasure of information regarding the classical age of Arab literature. In 1856 an edition appeared at Calcutta under the names of Maulavī Ghulām Rabbānī and Kabīru-d-dīn Aḥmad, which is a simple reprint of Professor Freytag's text (without at-Tibrīzī's commentary), and follows its original even in the misprints (corrected by Freytag at the end of the second volume). Freytag's text, with at-Tibrīzī's commentary, has been reprinted at Būlāq (1870). In 1882 an edition of the text, with a marginal commentary by Munshi 'Abdul-Qādir ibn Shaikh Luqmān, was published at Bombay.

The *Ḥamāsa* has been rendered into German verse by Friedrich Ruckert (Stuttgart, 1846). A small collection of translations, chiefly in metres imitating those of the original, was published in London by Sir Charles Lyall in 1885.

When the *Ḥamāsa* is spoken of, that of Abū Tammām, as the first and most famous of the name, is meant; but several collections of a similar kind, also called *Ḥamāsa*, exist. The best-known and earliest of these is the *Ḥamāsa* of Buhturi (d. A.H. 284), of which the unique ms. now in the Leyden university library, has been reproduced by photo-lithography (1909); a critical edition has been prepared by Professor Chlikho at Beyreuth. Four other works of the same name, formed on the model of Abū Tammām's compilation, are mentioned by Ḥājjī Khalīfa. Besides these, a work entitled *Ḥamasat ar-Rah* ("the Ḥamāsa of wine") was composed of Abu-l-'Alā al-Ma'arrī (d. A.H. 429). (C. J. L.; X.)

HAMBLEDEN, WILLIAM FREDERICK DANVERS SMITH, 2ND VISCOUNT (1868–1928), was born on Aug. 12, 1868, son of William Henry Smith (*q.v.*). He succeeded to the viscountcy in 1913, on the death of his mother who had been raised to the peerage in 1891. He was educated at Eton and New college, Oxford, and the year after his father's death succeeded him as Conservative M.P. for the Strand division (1891), holding his seat until 1910. He had many years earlier entered the newspaper distributing firm founded by his grandfather, and the removal of the firm's premises to the site occupied by King's College hospital was the occasion for Hambleden's gift to the hospital of the site at Denmark Hill. From 1915–1916 he served in Gallipoli and Egypt as lieutenant-colonel of the Royal 1st Devon Yeomanry. Hambleden is remembered chiefly for his work for the voluntary hospitals, King's College hospital of which he was chairman at the time of his death, being only one of many which benefited from his interest and generosity. He died on June 16, 1928.

HAMBURG, a State of Germany, on the lower Elbe, bounded by the Prussian provinces of Schleswig-Holstein and Hanover. The whole territory has an area of 160 sq.m., and consists of the city of Hamburg with its incorporated suburbs and the surrounding district, including several islands in the Elbe, five small enclaves in Holstein, the communes of Moorburg in the Lüneburg district of the Prussian province of Hanover and Cuxhaven-Ritzebüttel at the mouth of the Elbe, the islands of Neuwerk and Scharhorn off the coast, and the bailiwick (*amt*) of Bergedorf, which down to 1867 was held in common by Lübeck and Hamburg. Cuxhaven-Ritzebüttel and Bergedorf are the only towns besides the capital. The Geestlande comprise the suburban districts encircling the city on the north and west; the Marschlande includes various islands in the Elbe and the fertile tract of land lying between the northern and southern arms of the Elbe, and

with its pastures and market gardens supplying Hamburg with large quantities of country produce. In the Bergedorf district lies the Vierlande, or Four Districts, celebrated for its fruit gardens. Ritzebüttel with Cuxhaven, also a watering-place, have mostly a seafaring population. Two rivers, the Alster and the Bille, flow through the city of Hamburg into the Elbe, the mouth of which, at Cuxhaven, is 75 m. below the city.

As a State of the republic, Hamburg is represented in the Reichsrat. Its present constitution came into force in 1921. According to this Hamburg is a republic, the government (*Staatsgewalt*) residing in two chambers, the senate and the house of burgesses. The senate, which exercises the greater part of the executive power, is composed of 16 members over 30 years of age, elected from the house of burgesses, itself composed of 160 members over 25 years of age who have been residents for at least one year. They are elected on a basis of proportional representation. The law administered is that of the civil and penal codes of the German republic, and the court of appeal for all three towns is the common *Oberlandesgericht*, which has its seat in Hamburg. There is also a special court of arbitration in commercial disputes and another for such as arise under accident insurance.

From the Reformation to the French occupation in the beginning of the 19th century, Hamburg was a purely Lutheran State; according to the "Recess" of 1529, re-enacted in 1603, non-Lutherans were subject to legal punishment and expulsion from the country. Exceptions were gradually made in favour of foreign residents; but it was not till 1785 that regular inhabitants were allowed some religious freedom. In 1860 full religious liberty was guaranteed, and the identification of church and State abolished Since 1887 a church rate has been levied on the Evangelical-Lutheran communities, and since 1904 upon the Roman Catholics also. Civil marriages have been permissible in Hamburg since 1866. In 1925 Protestants formed 85%, Roman Catholics 5%, and Jews nearly 2% of the population.

The jurisdiction of the Free Port was on Jan. 1, 1882, restricted to the city and port by the extension of the Zollverein to the lower Elbe, and in 1888 the whole of the State of Hamburg, with the exception of the so-called "Free Harbour" (which comprises the port proper and some large warehouses, set apart for goods in bond), was taken into the Zollverein.

The population increased from 453,000 in 1880 to 1,134,112 in 1925. The population exclusive of the city of Hamburg was 74,554 in 1925. The crops raised in the country districts are principally vegetables and fruit, potatoes, hay, oats, rye and wheat.

HAMBURG, a seaport of Germany, capital of the free State of Hamburg, on the right bank of the northern arm of the Elbe, 75 m. from its mouth at Cuxhaven and 178 m. N.W. from Berlin by rail, is the largest seaport on the continent of Europe. Pop. (1925) 1,075,024. In 1927 the number of ships entering the port was 14,788 with a tonnage of 17,423,197. The city proper lies on both sides of the little river Alster, which, dammed up a short distance from its mouth, forms a lake, of which the southern portion within the line of the former fortifications bears the name of the Inner Alster (*Binnen Alster*), and the other and larger portion, that of the Outer Alster (*Aussen Alster*). The oldest portion of the city lies to the east of the Alster. To the west lies the new town (Neustadt), incorporated in 1678; beyond this and contiguous to Altona is St. Pauli, incorporated in 1876, and towards the north-east St. Georg, which arose in the 13th century but was not incorporated till 1868.

The old town lies low, and it is traversed by a great number of narrow canals or "fleets" (*Fleeten*) which serve as convenient channels for transport of goods. They are bordered by warehouses, cellars and the lower class of dwelling-houses. As they are subject to the ebb and flow of the Elbe, at certain times they run almost dry. The Binnen and Aussen Alster are separated by the Lombardsbrücke and surrounded by newer buildings. Shallow draught screw steamers provide means of communication between the business centre of the city and the outlying suburbs, and down to Glückstadt, Hamburg and Cuxhaven. The largest of the public squares in Hamburg is the Hopfenmarkt, which contains the church of St. Nicholas (Nikolaikirche) and is the principal market for vegetables and fruit. Others of importance are the Gänsemarkt, the Zeughausmarkt and the Grossneumarkt. The St. Petrikirche, Nikolaikirche, St Katharinenkirche, St. Jakobi kirche and St. Michaeliskirche give their names to the five old city parishes. The old Nikolaikirche was destroyed in the great fire of 1842, and the new building, designed by Sir George Gilbert Scott in 13th century Gothic, was erected 1845–74 The Michaeliskirche, on the highest point in the city, is remarkable for its bold construction, there being no pillars The St. Petrikirche, originally consecrated in the 12th century and rebuilt in the 14th, was the oldest church in Hamburg; it was burnt in 1842 and rebuilt in its old form in 1844–49. It has the granite columns from the old cathedral. The St. Katharinenkirche and the St. Jakobikirche are the only surviving mediaeval churches.

The new Rathaus, a German Renaissance building, constructed of sandstone in 1886–97 contains the city archives. Immediately adjoining it and connected with it is the exchange, erected in 1836–41 on the site of the convent of St. Mary Magdalen. Along the line of the former town wall are the criminal law courts (1879–82, enlarged 1893) and the civil law courts (finished in 1901). Facing the botanical gardens a new central post-office, in the Renaissance style, was built in 1887. The picture gallery contains works by modern masters, while the museum for art and industry, with which is connected a trades school, founded in 1878, is one of the most important institutions of the kind in Germany. It also contains public zoological gardens, Hagenbeck's private zoological gardens in the vicinity, schools of music and navigation, and a school of commerce. In 1900 a high school for shipbuilding was founded, and in 1901 an institute for seamen's and tropical diseases, with a laboratory for their physiological study, was opened. In 1919 a university was founded in the city.

Transport, Trade and Shipping.—The through railway traffic of Hamburg is practically confined to that proceeding northwards to Kiel and Jutland. On Hamburg converge the lines from Cologne and Bremen, Hanover and Frankfort-on-Main, from Berlin, via Nelzen, and from Lübeck Hamburg grew enormously during the last 30 years of the 19th century. Its commerce is almost entirely of the nature of transit trade, for it is not only the chief distributing centre for the middle of Europe of the products of all other parts of the world, but is also the chief outlet for German raw products and manufactures. It was also the port from which the large majority of continental emigrants embarked before 1914 Its principal imports are coffee (of which it is the greatest continental market), tea, sugar, spices, rice, cereals, sago, saltpetre, dried fruits, herrings, ores, tobacco, hemp, jute, cotton, wool, skins, leather, oils, guano, phosphates and coal. It exports machinery, electrical goods, sugar, dairy produce, iron and steel, chemical manures, paper, vegetable oils and fats, maize, cement, chinaware and glassware

Manufacturing industries developed greatly after 1888, when Hamburg joined the German customs union, and the barriers which prevented goods manufactured at Hamburg from entering into other parts of Germany were removed The import trade of various cereals by sea to Hamburg is very large, and a considerable portion of this corn is ground at Hamburg itself. There are also, in this connection, numerous bakeries for biscuit, rice-peeling mills and spice mills. Besides the foregoing there are cocoa, chocolate, confectionery and baking-powder factories, coffee-roasting and ham-curing and smoking establishments, lard refineries, margarine, and fish-curing, preserving and packing factories. There are numerous breweries, spirit distilleries and factories of artificial waters. There are large jute-spinning mills and factories for cotton-wool and cotton driving-belts. Among other important articles of industry are tobacco and cigars, hydraulic machinery, electro-technical machinery, chemical products (including artificial manures), oils, soaps, india-rubber, explosives, ivory and celluloid articles, furniture, wall paper and the manufacture of leather.

Shipbuilding is an important industry, and in Hamburg ocean-going steamers of the largest class are built. Along with this we have the allied industries of iron founding, and the manu-

facture of steel plate, ships' paint, oil fuel, cork, nautical and other instruments. Bicycles, sewing machines, carriages and motor cars are also made, and tin, zinc and copper works are found here. In 1888 a portion of the port was set apart as a free harbour, altogether an area of 750 ac. of water and 1,750 ac. of dry land, with a system of docks, basins and quays, and since 1910 the area of the free port has been much enlarged. During the last 25 years of the 19th century the channel of the Elbe was greatly improved and deepened, and during the last two years of the 19th century some £360,000 was spent by Hamburg alone in regulating and correcting this lower course of the river. The total water area of the port is now 4,095 ac., the area for sea-going ships being 2,184 ac., with a quay length of 20 miles.

University.—The University of Hamburg was formed in 1919 from the material of the Colonial Institute, and consists of the faculties of law, medicine, philosophy and natural science. Special facilities exist for study of phonetics and of the history and culture of the Orient generally, of India, China, Japan, Africa and the South seas. Anthropology, folklore and missionary problems are among the many notable features of the courses.

HISTORY

Hamburg probably had its origin in a fortress erected in 808 by Charlemagne, on an elevation between the Elbe and Alster, as a defence against the Slavs, and called Hammaburg because of the surrounding forest (*Hamme*). In 811 Charlemagne founded a church here, perhaps on the site of a Saxon place of sacrifice, and this became a great centre for the evangelization of the north of Europe, missionaries from Hamburg introducing Christianity into Jutland and the Danish island and even into Sweden and Norway. In 834 Hamburg became an archbishopric, St. Ansgar, a monk of Corbie and known as the apostle of the North, being the first metropolitan. In 845 church, monastery and town were burnt down by the Norsemen, and two years later the see of Hamburg was united with that of Bremen and its seat transferred to the latter city. The town, rebuilt after this disaster, was again more than once devastated by invading Danes and Slavs. In 1110 Hamburg, with Holstein, passed into the hands of Adolph I., count of Schauenburg, and it is with the building of the Neustadt (the present parish of St. Nicholas) by his grandson, Adolph III. of Holstein, that the history of the commercial city actually begins. In return for a contribution to the costs of a crusade, he obtained from the emperor Frederick I. in 1189 a charter granting Hamburg considerable franchises, including exemption from tolls, a separate court and jurisdiction, and the rights of fishery on the Elbe from the city to the sea. The city council (*Rath*), first mentioned in 1190, had jurisdiction over both the episcopal and the new town. Craft gilds were already in existence, but these had no share in the government. The defensive alliance of the city with Lübeck in 1241, extended for other purpose by the treaty of 1255, practically laid the foundations of the Hanseatic League (*q.v.*), of which Hamburg continued to be one of the principal members. The internal organization of the city, too, was rendered more stable by the new constitution of 1270, and the recognition in 1292 of the complete internal autonomy of the city by the count of Schauenburg. The exclusion of the handicraftsmen from the *Rath* led, early in the 15th century, to a rising of the craft gilds against the patrician merchants, and in 1410 they forced the latter to recognize the authority of a committee of 48 burghers, which concluded with the senate the so-called First Recess; there were, however, fresh outbursts in 1458 and 1483, which were settled by further compromises. In 1510 Hamburg was made a free imperial city by the emperor Maximilian I.

In 1529 the Reformation was definitively established in Hamburg by the Great Recess of Feb. 19, which at the same time vested the government of the city in the *Rath*, together with the three colleges of the *Oberalten*, the Forty-eight (increased to 60 in 1685) and the Hundred and Forty-four (increased to 180). The ordinary burgesses consisted of the freeholders and the master-workmen of the gilds.

The 17th and 18th Centuries.—The 17th century saw notable developments. Hamburg had established, so early as the 16th century, a regular postal service with certain cities in the interior of Germany, *e.g.*, Leipzig and Breslau; in 1615 it was included in the postal system of Turn and Taxis. In 1603 Hamburg received a code of laws regulating exchange, and in 1619 the bank was established. In 1615 the Neustadt was included within the city walls. During the Thirty Years' War the city received no direct harm; but the ruin of Germany reacted upon its prosperity, and the misery of the lower orders led to an agitation against the *Rath*, culminating in 1708 in the victory of the democratic factions. The imperial government, however, intervened, and in 1712 the "Great Recess" established durable good relations between the *Rath* and the commonalty.

The trade of Hamburg received its first great impulse in 1783, when the United States, by the Treaty of Paris, became an independent power. From this time dates its first direct maritime communication with America. Its commerce was further extended and developed by the French occupation of Holland in 1795, when the Dutch trade was largely directed to its port. The French Revolution and the later occupation of the city by Napoleon, however, exercised a depressing and retarding effect. Under the long peace which followed the close of the Napoleonic wars, its trade gradually revived, fostered by the introduction of steam navigation and the Declaration of Independence of South and Central America, with both of which it opened close commercial relations. In 1866 Hamburg joined the North German Confederation, and in 1871 became a constituent state of the German empire.

Effects of the World War.—Hamburg's commercial prosperity was seriously affected by the World War. In Nov. 1918, in the troubled times after the Armistice, the Council of Workmen and Soldiers assumed complete political power in the city, and endeavoured to form a state of Great Hamburg; but in the following February, after a conflict with the soldiers of the German *Reich*, the movement was suppressed. (*See* H. Ströbel, *The German Revolution and After;* Eng. trans., 1923). In Oct. 1923, serious Communist riots again broke out. Barricades were erected in the streets and severe fighting took place. The rising was not put down until a cruiser and three torpedo-boats had entered the harbour and marines had been landed to assist the police. The new Constitution of Hamburg, which was adopted in Dec. 1920, reduced the senate to a democratic and parliamentary Government, the senators being no longer appointed for life, but elected on parliamentary lines by the *Burgerschaft* (representative assembly), which consists of 160 members elected on the system of proportional representation. The franchise is extended to all citizens of the *Reich* who are present in Hamburg on the day of election.

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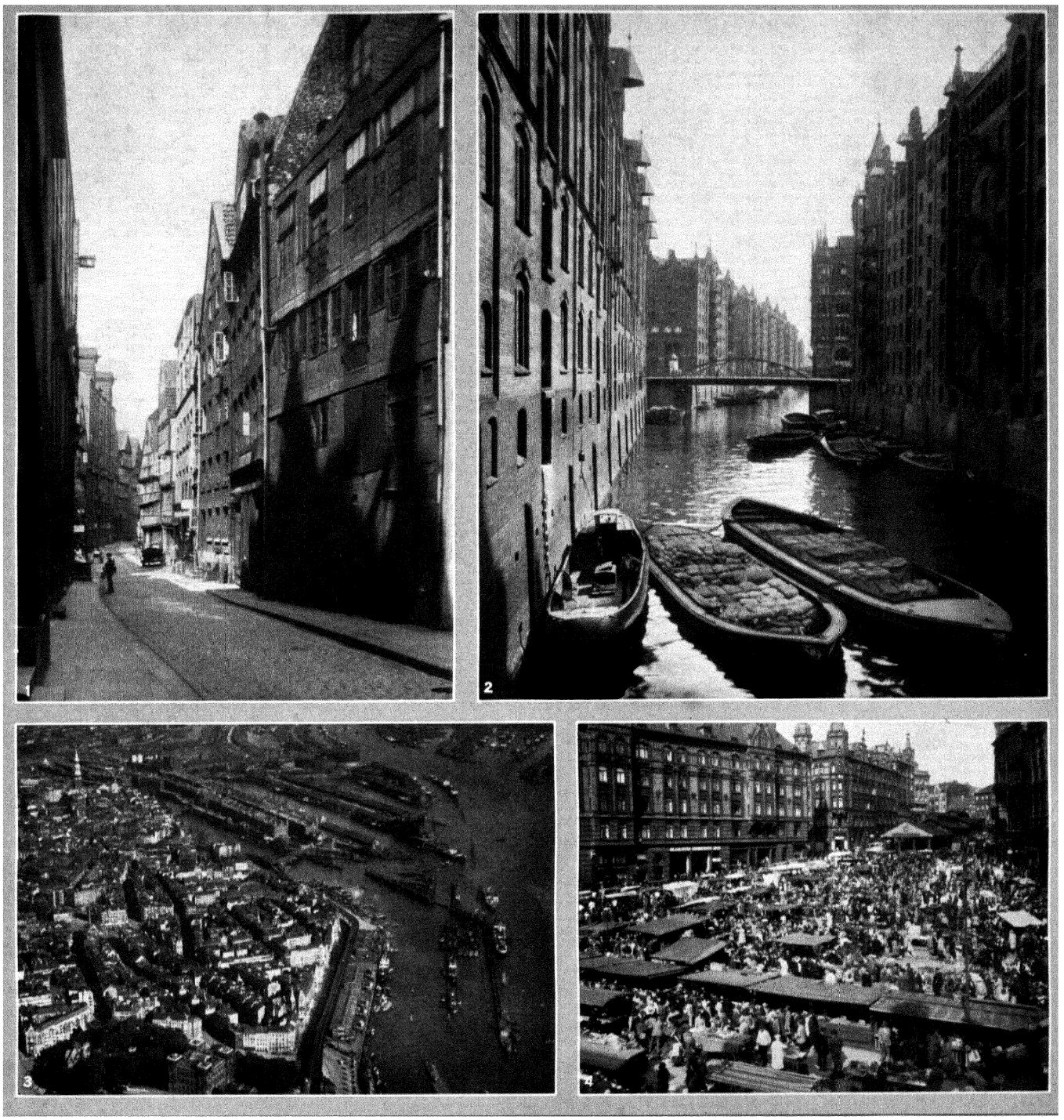
HAMBURG AMERIKA LINE, THE. In 1918 the German mercantile marine was reduced to about 2,000,000 gross tons lying in home ports and about 800,000 gross tons laid up in neutral ports, whereas it had aggregated about 5,200,000 gross tons before the war. At the close of 1923 the Hapag fleet, exclusive of auxiliary vessels, consisted of 75 ocean-going ships aggregating 366,104 gross tons, or just under one-third of its pre-war tonnage. In the early part of 1926, when the Hapag took over the Harriman shipping interests, three large vessels totalling 46,000 gross tons passed over to it. The merger of the Austral-Kosmos Lines with Hapag (1926) and by the simultaneous purchase of the shares of the Hugo Stinnes Lines, resulted in additions of 37 Austral-Kosmos vessels totalling 210,000 gross tons and 23 Hugo Stinnes vessels totalling 140,000 gross tons. At the present time the Hapag owns 167 sea-going vessels (not counting 17 ships now building) and about 250 tugs, lighters, steamers employed in the seaside service, and other auxiliary craft, or more than 1,000,000 gross tons altogether.

The first engagements entered into with foreign concerns were the agreements with the American Kerr Steamship Line in respect of the North Atlantic business and with the British firms



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THE OLD CITY AND HARBOUR OF HAMBURG

1. A street in Old Hamburg (the *Altstadt*), situated in the lower part of the city, to the east of the river Alster. This district has preserved little of its antiquity, the greater part of it having been destroyed by fire in 1842 and rebuilt on modern lines
2. Barges on a canal in the *Altstadt*. The old town, on low-lying ground, is traversed by a great number of narrow canals or "fleets" bordered by warehouses and serving as a convenient channel for the transport of goods
3. View of the harbour of Hamburg, which with its suburbs stretches for 6 miles along the left bank of the Elbe. In the centre foreground is the Niederhafen basin; beyond it, the Grasbrook basin, which is used by French, Swedish and transatlantic vessels; and to the right of this the Sandtor basin, used chiefly by British and Dutch steamers
4. View of the *Fischmarkt* during the early morning market. It is situated in the *Altstadt* just below the University library and is one of the most important squares in the city

HAMERTON, PHILIP GILBERT (1834–1894), English art critic and man of letters, was born at Laneside, Lancashire, on Sept 10, 1834. He married a Frenchwoman, and spent much time in France, where he developed a keen appreciation of French art and literature. His more important works on art are: *Etching and Etchers* (1866), which became a standard work; *Contemporary French Painters* (1867); *Painting in France after the Decline of Classicism* (1868); and *The Graphic Arts* (1882). He died near Paris on Nov. 4, 1894

HAMI, an important oasis in Chinese Turkestan (Sinkiang) in lat 42° 48′ N and long 93° 28′ E. Hami is situated in the north-east of the Tarim basin, on the southern slopes of the eastern spurs of the Thian Shan Mts., and on the western verge of the Gobi desert It lies at an elevation of 3,150 ft. Its position as a fertile tract at the point of convergence of the two main routes north and south of the Thian Shan connecting China with the West has given it importance since the westward expansion of the Chinese Empire under the Han dynasty in the first century A.D. It is first mentioned in Chinese history under the name of I-Wu-lu. Whenever China was strong enough to assert her claims to the control of central Asia, it was Hami which served as the main rendezvous and supply base for Chinese forces sent to overcome the hostile nomadic tribes in the north. Its commercial importance was equally great since the Pei-shan desert would have been a far more formidable obstacle if Hami had not been available as a place where caravans could re-victual and where animals could be rested. One serious drawback, however, in early times was the constant liability to raids from the nomadic tribes of the good grazing lands on the northern slopes of the eastern Thian Shan. When the Chinese lost their hold on eastern Turkestan, Hami fell into the hands of the Uighurs, who made it their chief town and held it for several centuries It continued to be an important Buddhist centre long after Islam was dominant in the west of the Tarim Basin In the early part of the 17th century, however, Hami was ruled by the Mohammedan khan of Kashgar. It was recovered for the Chinese in 1720 during the period of vigorous expansion under the early Manchus, lost for a short time during the great Mohammedan rebellion of 1865 and again recovered in 1873 as part of the successful reconquest of Sinkiang. Hami is now a small town of about 6,000 inhabitants and is still a busy trading centre Its population consists in part of descendants of the Uighurs and in part of Mohammedan immigrants from Kashgar, Bukhara and Samarkand

HAMILCAR BARCA or BARCAS, Carthaginian general and statesman, father of Hannibal, was born *c.* 270 B.C. During the First Punic War in 247, he took over the chief command in Sicily, which at this time was almost entirely in the hands of the Romans, and seizing Mt. Ercte (Monte Pellegrino, near Palermo), carried his raids as far as the coast of south Italy. By the peace of 241 Hamilcar's unbeaten force was allowed to depart from Sicily without any token of submission On returning to Africa his troops broke out into open mutiny when their rewards were withheld by Hamilcar's opponents among the governing aristocracy The serious danger into which Carthage was brought was averted by Hamilcar, whom the government reinstated After crushing the revolt (237), Hamilcar enjoyed a virtual dictatorship On his own responsibility he led an expedition into Spain to gain a new empire to compensate Carthage for the loss of Sicily and Sardinia In eight years by force of arms and diplomacy he secured an extensive territory, but his premature death in battle (228) prevented him from completing the conquest.

This Hamilcar has been confused with another general who succeeded to the command of the Carthaginians in the First Punic War, and after successes at Therma and Drepanum was defeated at Ecnomus (256 B.C.) Apart from subsequent unskilful operations against Regulus, nothing is certainly known of him. For others of the name *see* CARTHAGE, SICILY, Smith's *Classical Dictionary*

See Polybius i.–iii.; Cornelius Nepos, *Vita Hamilcaris;* Appian, *Res Hispanicae,* chs. 4, 5; Diodorus, *Excerpta,* xxiv., xxv.; O. Meltzer, *Geschichte der Karthager* (1877), ii., also PUNIC WARS.

HAMILTON, the name of a famous Scottish family. The first authentic ancestor of the Hamiltons is one Walter FitzGilbert, one of the witnesses (Jan. 10, 1295) to a charter by James, the high steward of Scotland, to the monks of Paisley; in 1296 his name appears in the Homage Roll as Walter FitzGilbert of "Hameldone." He joined the English party, but after Bannockburn went over to Bruce, was knighted and subsequently received the barony of Cadzow. His younger son John was father of Alexander Hamilton who acquired the lands of Innerwick by marriage, and from him descended a certain Thomas Hamilton, who acquired the lands of Priestfield early in the 16th century. Another Thomas, grandson of this last, who had with others of his house followed Queen Mary and with them had been restored to royal favour, became a lord of session as Lord Priestfield. His eldest son, Thomas, was made an ordinary lord of session as early as 1592 and was eventually created earl of Haddington (*q.v.*). The 5th earl of Haddington by his marriage with Lady Margaret Leslie brought for a time the earldom of Rothes to the Hamiltons to be added to their already numerous titles.

Sir "David FitzWalter FitzGilbert," who carried on the main line of the Hamiltons, was taken prisoner at Neville's Cross (1346), in 1371 and 1373 he was one of the barons in the parliament His son David succeeded in the representation of the family, Sir John Hamilton of Fingaltoun was ancestor of the Hamiltons of Preston, and Walter is stated to have been progenitor of the Hamiltons of Cambuskeith and Sanquhar in Ayrshire. David Hamilton, the first apparently to describe himself as lord of Cadzow, died before 1392, leaving four or five sons, from whom descended the Hamiltons of Bathgate and of Bardowie, and perhaps also of Udstown, to which last belong the lords Belhaven. Sir John Hamilton of Cadzow, his eldest son, was twice a prisoner in England. John Hamilton's two younger sons are stated to have been founders of the houses of Dalserf and Raploch. His eldest son, James Hamilton of Cadzow, like his father and great-grandfather, visited England as a prisoner, being one of the hostages for the king's ransom. From him the Hamiltons of Silvertonhill and the lords Hamilton of Dalzell claim descent, among the more distinguished members of the former branch being General Sir Ian Hamilton, K.C.B.

James Hamilton was succeeded by his eldest son Sir James Hamilton of Cadzow, an hereditary lord (1445) of parliament. He married (1474) as his second wife, Mary, sister of James III. and widow of Thomas Boyd, earl of Arran. Their son, James, second lord Hamilton, was created (1503) earl of Arran. Of his many illegitimate children Sir James Hamilton of Finnart, beheaded in 1540, was ancestor of the Hamiltons of Gilkerscleugh; and John, archbishop of St. Andrews, hanged by his Protestant enemies, was ancestor of the Hamiltons of Blair, and is said also to have been ancestor of Hamilton of London, baronet. James, second earl of Arran (*q.v.*) son of the first earl by his second wife Janet Beaton, was chosen governor to the little Queen Mary, being nearest of kin to the throne through his grandmother, though the question of the validity of his mother's marriage was by no means settled. He received (1549) the duchy of Châtellerault in France. He was succeeded in the title in 1579 by his eldest son James, who became insane, his brother John, afterwards first marquess of Hamilton, administering the estates From the third son, Claud, created a lord of parliament as Baron Paisley (1587), descends the duke of Abercorn, heir male of the house of Hamilton

The first marquess of Hamilton had a natural son, Sir John Hamilton of Lettrick, who was legitimated in 1600 and was ancestor of the lords Bargany. His two legitimate sons were James, 3rd marquess and first duke of Hamilton, and William, who succeeded his brother as 2nd duke and was in turn succeeded under the special remainder contained in the patent of dukedom, by his niece Anne, duchess of Hamilton, who was married in 1656 to William Douglas, earl of Selkirk. The history of the descendants of this marriage belongs to the great house of Douglas, the 7th duke of Hamilton becoming the male representative and chief of the house of Douglas, earls of Angus. Claud Hamilton, Baron Paisley, had five sons, of whom three settled in Ireland, Sir Claud being ancestor of the Hamiltons of Beltrim and Sir Frederick, distinguished in early life in the Swedish wars, being ancestor of the viscounts Boyne

James, eldest son of Lord Paisley, was created in 1603 lord of

Abercorn, and in 1606 earl of Abercorn and lord of Paisley, Hamilton, Mountcastell and Kilpatrick. His eldest son James, 2nd earl of Abercorn, eventually heir male of the house of Hamilton and successor to the dukedom of Châtellerault, was created in his father's lifetime lord of Strabane in Ireland, but resigned this title in 1633 in favour of his brother Claud, whose grandson, Claud, 5th Lord Strabane, succeeded eventually as 4th earl of Abercorn. The 8th earl of Abercorn, who was summoned to the Irish house of peers in his father's lifetime as Lord Mountcastle, was created a peer of Great Britain in 1786 as Viscount Hamilton of Hamilton in Leicestershire, and renewed the family's connection with Scotland by repurchasing the barony of Duddingston and later the lordship of Paisley. His nephew and successor was created marquess of Abercorn in 1790, and was father of James, 1st duke of Abercorn.

See the article HAMILTON, MARQUESSES AND DUKES OF, and other articles on the different branches of the family (*e.g.*, ABERCORN, HADDINGTON and BELLHAVEN) in Sir J. B. Paul's edition of Sir R. Douglas's *Peerage of Scotland;* and also G. Marshall, *Guide to Heraldry and Genealogy.*

HAMILTON, MARQUESSES AND DUKES OF. The holders of these titles descended from Sir James Hamilton of Cadzow (*see* HAMILTON).

JOHN, 1st marquess of Hamilton (*c.* 1542–1604), third son of James Hamilton, 2nd earl of Arran (*q.v.*) and duke of Châtellerault, was given the abbey of Arbroath in 1551. In politics he was largely under the influence of his unscrupulous younger brother Claud, afterwards Baron Paisley (*see* HAMILTON). At first hostile to Mary, they later became her devoted partisans Claud met Mary on her escape from Lochleven and escorted her to Hamilton palace. John appears to have been in France in 1568 when the battle of Langside was fought, and it was probably Claud who commanded Mary's vanguard in the battle. With others of the queen's party they were forfeited by the parliament and sought their revenge on the regent Murray. Although the Hamiltons disavowed all connection with Murray's murderer, James Hamilton of Bothwellhaugh, he had been provided with horse and weapons by the abbot of Arbroath, and it was at Hamilton that he sought refuge after the deed Their uncle, Archbishop Hamilton, was hanged at Stirling in 1571 for alleged complicity in the murder of Darnley, and is said to have admitted that he was a party to the murder of Murray. At the pacification of Perth in 1573 the Hamiltons abandoned Mary's cause. On the uncertain evidence extracted from the assassin by torture, the Hamiltons had been credited with a share in the murder of the regent Lennox in 1571. In 1579 proceedings against them for these two crimes were resumed, and when they escaped to England their lands and titles were seized by their enemies, James Stewart becoming earl of Arran. John Hamilton presently dissociated himself from the policy of his brother Claud, who continued to plot for Spanish intervention on behalf of Mary. With other Scottish exiles he crossed the border in 1585 and marched on Stirling; he was admitted on Nov. 4, and formally reconciled with James VI., with whom he was thenceforward on the friendliest terms. He was created marquess of Hamilton and Lord Evan in 1599, and died on April 6, 1604.

His eldest surviving son JAMES, 2nd marquess of Hamilton (*c.* 1589–1625), was created baron of Innerdale and earl of Cambridge in the peerage of England in 1619, and these honours descended to his son James, who in 1643 was created duke of Hamilton (*q.v.*). William, 2nd duke of Hamilton (1616–1651), succeeded to the dukedom on his brother's execution in 1649. He was created earl of Lanark in 1639, and in the next year became secretary of state in Scotland. Arrested at Oxford by the king's orders in 1643 for "concurrence" with Hamilton, he escaped, and was temporarily reconciled with the Presbyterian party Sent by the Scottish committee of estates to treat with Charles I. at Newcastle in 1646, he sought in vain to persuade the king to consent to the establishment of Presbyterianism in England On Sept. 26, 1647 he signed on behalf of the Scots the treaty with Charles known as the "Engagement" at Carisbrooke Castle, and helped to organize the second Civil War. In 1648 he fled to Holland; he returned to Scotland with Prince Charles in 1650, and joined in the Scottish invasion of England. He died on Sept. 12, 1651 from wounds received at Worcester. He left no male heirs, and the title devolved on the 1st duke's eldest surviving daughter Anne, duchess of Hamilton in her own right.

Anne married in 1656 William Douglas, earl of Selkirk (1635–1694), who was created duke of Hamilton in 1660 on his wife's petition, receiving also several of the other Hamilton peerages, but for his life only. He resisted Lauderdale's measures in Scotland, and was dismissed from the privy council in 1676. He presided over the convention of Edinburgh which offered the Scottish crown to William and Mary in March 1689. He died at Holyrood on April 18, 1694. His wife survived until 1716.

JAMES DOUGLAS (1658–1712), 4th duke of Hamilton and duke of Brandon (cr. 1711), eldest son of the preceding and of Duchess Anne, succeeded his mother, who resigned the dukedom to him in 1698 On Nov. 15, 1712 he fought the duel with Charles, Lord Mohun, narrated in Thackeray's *Esmond*, in which both the principals were killed.

The title of Lord Hamilton and that of Viscount Hamilton, in the peerage of Great Britain, conferred on the 8th earl of Abercorn in 1786, are borne by the dukes of Abercorn, whose eldest son is usually styled by courtesy marquess of Hamilton, a title which was added to the other family honours when the 2nd marquess of Abercorn was raised to the dukedom in 1868.

See John Anderson, *The House of Hamilton* (1825); *Hamilton Papers*, ed. J. Bain (2 vols., Edinburgh, 1890–92); Gilbert Burnet, *Lives of James and William, dukes of Hamilton* (1677); *The Hamilton Papers relative to 1638–1650*, ed. S. R. Gardiner for the Camden Society (1880); G. E. C[okayne], *Complete Peerage* (1887–98); an article by the Rev. J. Anderson in Sir J. B. Paul's edition of the *Scots Peerage*, vol. IV. (1907).

HAMILTON, ALEXANDER (1757–1804), American statesman, was born a British subject, on the island of Nevis in the West Indies, on Jan. 11, 1757 He came of good family on both sides. His father was James Hamilton, a Scottish merchant of St. Christopher His mother, Rachael Fawcett (Faucette, of French Huguenot descent), married a Danish proprietor of St. Croix with whom she lived unhappily and whom she soon left, subsequently living with James Hamilton; her husband procured a divorce in 1759 and the court forbade her remarriage. Whatever the fault or the excuse of the parents, the anxiety bestowed upon these facts by the son's biographers seems exaggerated. Business misfortunes having caused his father's bankruptcy, and his mother dying in 1768, young Hamilton was thrown upon the care of maternal relatives in St Croix, where, in his 12th year, he entered the counting-house of Nicholas Cruger. Shortly afterward Cruger, going abroad, left the boy in charge of the business. The extraordinary specimens we possess of his letters, mercantile and friendly, written at this time, attest an astonishing poise and maturity of mind His opportunities for regular schooling must have been very scant; but he early formed the habits of wide reading and industrious study that were to persist through his life. An accomplishment later of great service to Hamilton, common enough in the Antilles but very rare in the English continental colonies, was a familiar command of French In 1772 some friends, impressed by his talents, made it possible for him to complete his education in the colonies of the mainland. He prepared for college at Elizabethtown, N.J., and in 1774 entered King's college (now Columbia university) in New York city. His studies, however, were interrupted by the Revolutionary War A visit to Boston confirmed him in an opinion that he should cast his fortunes with the colonists. Into their cause he threw himself with ardour. In 1774–75 he wrote two influential anonymous pamphlets (entitled "A Full Vindication of the Measures of the Congress from the Calumnies of their Enemies," and "The Farmer Refuted") which were attributed to John Jay; they show remarkable maturity and controversial ability, and rank high among the political arguments of the time. Concerning them George Ticknor Curtis (*Constitutional History of the United States*, vol. i. p. 274) has said, "There are displayed in these papers a power of reasoning and sarcasm, a knowledge of the principles of government and of the English constitution, and a grasp of the merits of the whole controversy, that would have

done honour to any man at any age." He then organized an artillery company, was awarded its captaincy on examination, won the interest of Nathanael Greene and Washington by the proficiency and bravery he displayed in the campaign of 1776 around New York city, joined Washington's staff in March 1777 with the rank of lieutenant-colonel, and during four years served as his private secretary and confidential aide. The duties with which he was entrusted—including constant correspondence with Congress, and some very important military missions—attest a complete confidence in his abilities and character. But Hamilton was ambitious for military glory—it was an ambition he never lost; he became impatient of detention in what he regarded as a position of unpleasant dependence, and seized a slight reprimand administered by Washington as an excuse for abandoning his staff position (Feb 1781; *see* his *Works*, vol ix., p. 232); the incident, however, involved no break in their good relations Later he secured, through Washington, a field command and won laurels at Yorktown, where he led the American column that captured the first redoubt of the British works.

Meanwhile, in 1780, he had married Elizabeth, daughter of Gen. Philip Schuyler, and thus became allied with one of the most distinguished families in New York. Also, he had begun the political efforts upon which his fame principally rests. In letters of 1779–80 he correctly diagnosed the ills of the Confederation, and suggested with admirable prescience the necessity of centralization in its governmental powers After a year's service in Congress in 1782–83, in which he experienced the futility of endeavouring to attain through that decrepit body the ends he sought, he settled down to legal practice in New York. The call for the Annapolis Convention (1786), however, presented an opportunity which he immediately improved. A delegate from New York, he supported Madison in inducing the Convention to exceed its delegated powers and summon the Federal Convention of 1787 at Philadelphia (himself drafting the call); secured a place on the New York delegation thereto; and, after his anti-Federal colleagues withdrew from the Convention, signed the constitution for his State. So long as his colleagues were present his own vote was useless, and he absented himself for some time from the debates after making one remarkable speech (June 18, 1787). In this he held up the British Government as the best model in the world. It is worth while noting that it was the monarchy of George III. that Hamilton defended and admired. Both parties, as Sir Henry Maine pointed out (*Popular Government*, 1886, pp 212–13), had in mind "monarchy" as practised by George III. It is with this in mind that the quarrel of Hamiltonians and Jeffersonians is to be judged Hamilton favoured an elective executive of life tenure, holding an absolute veto on national legislation, and with power to appoint the State governors who should hold a similar veto on State legislation; an upper house chosen for life on a property basis; a lower house (this, doubtless, a sop to democrats!) chosen by manhood suffrage; and control by the Federal Government of all militia. Complete extinction of the States he deemed desirable but impracticable. (See *Works*, vol. i., p. 347; and cp x., pp. 446, 431, 329.)

Hamilton certainly realized that such proposals could serve no purpose except to focus conservative aims. Though fully conscious that monarchy in America was impossible, he wished to obtain the next best solution in an aristocratic, strongly centralized, coercive, but representative union, with devices to give weight to the influence of class and property. Aside from his one elaborate argument, and membership (undoubtedly, with his admirer Madison as chairman, no fruitless membership) of the committee on style that gave final form to the constitution, he played an inconspicuous part in the Convention. "No man's ideas," he wrote when the work was done, "are more remote from the plan than my own are known to be; but is it possible to deliberate between anarchy and convulsion on one side and the chance of good to be expected on the other?" Unable to secure all that he desired he used his talents and utmost endeavours to secure what was attainable.

To this struggle was due the greatest of his writings, and the greatest individual contribution to the adoption of the new Government, *The Federalist*, a series of essays that appeared in the New York journals between Oct. 1787 and April 1788. Its inception and much more than half its contents were Hamilton's; the rest, Madison's and Jay's (see *Amer. Hist. Review*, vol. ii., pp. 443–60, 675–80). It remains a classic commentary, not merely on American constitutional law but on the principles of Government generally. Guizot said of it that "in its application of elementary principles of government to practical administration" it was the greatest work he knew; and Chancellor Kent declared it—quite justly—to be "equally admirable in the depth of its wisdom, the comprehensiveness of its views, the sagacity of its reflections, and the fearlessness, patriotism, candour, simplicity and elegance with which its truths are uttered and recommended." Sheer will and reasoning could hardly be more brilliantly and effectively exhibited than they were by Hamilton in the New York convention of 1788, whose vote he won, against the greatest odds, for ratification.

When the new Government was inaugurated he became secretary of the treasury in Washington's cabinet. Congress immediately referred to him a press of queries and problems, and there came from his pen a succession of papers that have left the strongest imprint on the administrative organization of the national Government—two reports on public credit (1790), upholding an ideal of national honour higher than the prevalent popular principles; a report on manufactures (1791), advocating their encouragement (*e.g.*, by bounties paid from surplus revenues amassed by tariff duties)—a famous report, one of the first notable revolts against the doctrines of Adam Smith, which has served ever since as a storehouse of arguments for American protective policy, and served also as an inspiration for Friedrich List; a report favouring the establishment of a national bank (1790), the argument being based on the doctrine of "implied powers" in the Constitution, and on the application that Congress may do anything that can be made, through the medium of money, to subserve the "general welfare" of the United States—doctrines that, through judicial interpretation, have revolutionized the Constitution; and, finally, a vast mass of detailed work by which order and efficiency were given to the national finances. In 1793 he put to confusion his opponents who had brought about a congressional investigation of his official accounts. The success of his financial measures was immediate and remarkable. They did not, as is often but loosely said, create economic prosperity; but they propped it, in an all-important field, with order and confidence. His ultimate purpose was always the strengthening of the Union; but before particularizing his political theories, and the political import of his financial measures, the remaining events of his life may be traced.

His activity in the cabinet was by no means confined to the finances. He apparently regarded himself as premier, and sometimes overstepped the limits of his office in interfering with other departments. The heterogeneous character of the duties placed upon his department by Congress seemed in fact to reflect the English idea of its primacy. It is often said that Hamilton's counsels were predominant with Washington. In domestic affairs this is, on the whole, true; partly because their views were naturally sympathetic, and partly because Hamilton's advice was naturally accepted in the field of his special competence where Washington really needed guidance—finance. With regard to foreign relations, common sense and better judgment usually supported Jefferson's counsels—but where those qualities were involved Washington needed no counsel. Neutrality and isolation were American policies (to be found in the letters of every public man) before any occasion arose for their official promulgation. There was here no real difference between Hamilton and Jefferson: one sympathized with England, the other with France, but both desired neutrality. On domestic policy their differences were vital and in their conflicts over Hamilton's financial measures they organized, on the basis of varying tenets and ideals which have never ceased to conflict in American politics, the parties of Federalists and Republicans. In Jan. 1795 Hamilton resigned and returned to the practice of law in New York, leaving it for public service only in 1798–1800, when he was the active head, under Washington (who insisted that Hamilton should be second only to him-

self), of the army organized for war against France. But though in private life he remained the continual and chief adviser of Washington, notably in the serious crisis of the Jay Treaty, of which Hamilton approved, Washington's "Farewell Address" can not fairly be said to have been "written" by Hamilton; for Washington had worked upon it for years, and Madison had contributed to it. But though Washington supplied what he called the "body" to Hamilton, the latter apparently largely redressed it; and in particular he added what he described as "such reflections and sentiments as will wear well, progress in approbation with time, and redound to future reputation"—which can hardly be other than the passages which, to-day, give to the address its life.

After Washington's death the Federalist leadership of John Adams, who had the prestige of a varied and great career and greater strength than any other Federalist with the people, was disputed by Hamilton, who controlled practically all the leaders of lesser rank. Hamilton's faults were glaringly displayed in this connection. He sacrificed his influence and his future in political intrigues. Twice, when Adams had been nominated for the presidency he sought to bar him from that office by manipulations of the electoral college; after Adams became president, and so the official head of the party, Hamilton directed the members of the cabinet, and colluded with Federalist senators, in an endeavour to control the president's policy; and finally, on the eve of the crucial election of 1800, he wrote a bitter personal attack on the president (containing much confidential cabinet information) which he only privately circulated, but which was secured and published by the Democrats.

Had he been prosecuted for this under the Sedition Act passed by his Party, as was threatened by a political opponent, it would have been only a just rebuke to him and to his Party. The result of his efforts against Adams was that his agents were dismissed from the Cabinet, that the president turned to southern Federalists, and that he made peace (in 1799) with France; thereby ending such influence as Hamilton enjoyed, and such ambitions as he may have cherished, as head of the army. Similarly, when in Washington's cabinet, he had carried on for five years behind the back of the secretary of State confidential communications with the British minister, which—aside from the ill effects (discernible in the Jay Treaty) of the false ideas that they conveyed of American sentiment—in substance amounted to intrigue. Again, after Aaron Burr outgeneralled Hamilton in the New York campaign of 1799, carrying the State for the Democrats, Hamilton proposed to Gov. John Jay to call together the out-going Federalist legislature in order to choose Federalist presidential electors, a suggestion which Jay simply endorsed. "Proposing a measure for party purposes which it would not become me to adopt" (*Works,* vol. x., p. 371). Indeed, his opposition to Burr for a decade was conducted very largely by indirection, innuendo and whisper, in letters and conversation.

In short, as a political manager Hamilton, though ready in intrigue, was unsuccessful in it. He was a fighter through and through, and his courage was superb; but he was indiscreet in utterance, impolitic in management, opinionated, self-confident and uncompromising in nature and methods. To considerations of what was politic or practical he could not yield, and yet he could not leave politics alone and devote himself to law. With the establishment of democratic power in 1801 he lost all influence upon national affairs. His courage, and his high ideal of public rectitude were displayed in publishing the details of his *amour* with Mrs. Reynolds, that the favours shown to her complacent husband might permit no suspicion of impropriety in his conduct of the Treasury.

To his antipathy against Adams he sacrificed much prestige; to that against Burr, his life. No matter what may be the final judgment on Burr's character and schemes, doubtless Hamilton judged it a patriotic duty to thwart him in his ambitions; defeating his hopes successively of a foreign mission, the presidency, and the governorship of New York. Unfortunately, personal rivalry was also clearly involved, and personal dislike, and his methods of attack certainly, under the customs of that day, gave abundant cause for the duel in which he died. If his unsparing denunciations were known to Burr they were ignored by him until his last defeat. After that he forced a quarrel on a trivial bit of hearsay (that Hamilton had said he had a "despicable" opinion of Burr); and Hamilton, believing as he explained in a letter he left before going to his death that a compliance with the duelling prejudices of the time was inseparable from the ability to be in the future useful in public affairs, accepted a challenge from him. The duel was fought at the same spot where his eldest son, a boy of 20, had fallen in a duel in 1801. He was mortally wounded, and died on the following day, July 12, 1804. The tragic close of his career appeased for the moment the fierce hatreds of politics, and his death was very generally deplored as a national calamity

No emphasis, however strong, upon the mere events of Hamilton's life suffices to show his importance in American history. In his earliest pamphlets he started out with the ordinary pre-Revolutionary Whig doctrines of natural rights and liberty; but the first experience of semi-anarchic States'-rights and individualism released by the Revolution ended his fervour for ideas so essentially alien to his mind, and they have no place in his later writings. The loose and barren rule of the Confederation, its feeble inadequacy of conception, infirmity of power, disintegrating particularism, and vicious finance were realized by many; but none other saw so clearly the concrete nationalistic remedies for these concrete ills, or pursued remedial ends so constantly and so ably. An immigrant, Hamilton had no particularistic ties; he was by instinct a "continentalist" or Federalist. Liberty, he remarked in the New York convention in 1788, was too exclusively considered, but there was another thing equally important: "a principle of strength and stability in the organization . . . and of vigour in its operation." He wanted a strong union and energetic Government that should "rest as much as possible on the shoulders of the people and as little as possible on those of the State legislatures"; that should have the support of wealth and class; that should curb the States to such an "entire subordination" as nowise to be hindered by those bodies; that should overbear all local and sectional prejudices and influences, and control the people. At these ends he aimed with extraordinary skill in all his financial measures—though of course he also regarded them as merely justice to creditors. As early as 1776 he urged the direct collection of Federal taxes by Federal agents. From 1779 onward we trace the idea of supporting Government by the interest of the propertied classes; from 1781 onward the idea that a not-excessive public debt would be a blessing in giving cohesiveness to the union: hence his device by which the Federal Government, assuming the war debts of the States, secured greater resources, based itself on a high ideal of nationalism, strengthened its hold on the individual citizen, and gained the support of property. From 1784 onward he seems to have been clear in his desire for judicial review of all legislation. In his report on manufactures his chief avowed motive was to strengthen the union. To the same end he conceived the constitutional doctrines of liberal construction, "implied powers," and the "general welfare," which were later embodied in the decisions of John Marshall. The idea of nationalism pervaded and quickened all his life and works.

The adoption of the constitution was less the end than the beginning of the struggle between its supporters and its opponents. The issue was not merely one of political abstractions; the literature of the Confederation epoch is full of discussions of class rights and economic interests; *The Federalist,* as Beard says, is "the finest study in the economic interpretation of politics which exists in any language." The constitution's "champions as well as its opponents knew that its real character was to be determined by the measures of law and administration to be established under it. . . . It did not go into effect until the economic measures which its adoption implied were put upon the statute books and carried into execution" (*Economic Interpretation of the Constitution,* pp. 10, 153, 189; *Economic Origins of Jeffersonian Democracy,* pp. 3, 85–86). Here was Hamilton's contribution. He believed with Hume that men are moved only by force and by interest, and in *The Federalist* he remarked: "Every institution will grow and flourish in proportion to the quantity and extent of the means concentrated towards its formation and support." This explains all

his financial measures. Madison and Hamilton reasoned alike, but they parted, as the former stated years later, "upon its plainly becoming his (Hamilton's) purpose to *administration* the government into something totally different from that which he and I perfectly knew the convention when it framed that government intended, and from what the people intended in adopting that framework." With one great exception, the dictum of Guizot is hardly an exaggeration, that "there is not in the Constitution of the United States an element of order, of force, of duration, which he did not powerfully contribute to introduce into it and to cause to predominate."

The exception, as history has shown—though Hamilton, of course, would have held it an element merely of disorder and dissolution—was American democracy. It is a commonplace today that colonial experience shaped the Constitution. It was Hamilton's weakness—and misfortune—that he did not share that experience, and lacked feeling for its lessons. It is a weakness everywhere apparent in his calculations, but especially apparent in his total failure to understand the democracy created by two centuries of frontier life. It explains, also, his total lack of understanding of the West. When scores of thousands of settlers were yearly pouring over the Alleghanies, north and south of the Ohio, he was opposed to the wide distribution of public land; and was so fatuous as to encourage the British minister to believe that his country would share with Great Britain the navigation of the Mississippi. Only a few lesser contemporaries were so lacking in judgment of their own time and place. This misunderstanding of American society, and exaltation of administration over the ends of government, condemned him to increasing isolation and impotence; confidence in the integrity, the self-control, and the good judgment of the people, which was the content of Jefferson's political faith, had almost no place in his theories. "Men," said he, "are reasoning rather than reasonable animals"; "opinion is as much influenced by appearances as by realities"; "I have an indifferent opinion of the honesty of the country." It is easy to understand why he received but twice an office at the hands of the people, and none after 1788. The charge that he laboured to introduce monarchy by intrigue was a gross underestimate of his good sense. The idea, he wrote to Washington, was "one of those visionary things none but madmen could undertake, and that no wise man will believe" (1792). We may accept as just, and applicable to his entire career, the statement made by himself in 1803 of his principles in 1787: "(1) That the political powers of the people of this continent would endure nothing but a representative form of government. (2) That, in the actual situation of the country, it was itself right and proper that the representative system should have a full and fair trial. (3) That to such a trial it was essential that the government should be so constructed as to give it all the energy and the stability reconcilable with the principles of that theory."

Throughout life, however, he held to his preference for such a government as he proposed in the convention of 1787; and though its inconsistency with American tendencies was yearly more apparent, he never ceased to avow on all occasions his aristocratic-monarchical partialities. Since Jefferson's assertions, alike as regards Hamilton's talk and the intent and tendency of his political measures, were, to the extent of the underlying basic fact—but discounting Jefferson's somewhat intemperate interpretations—unquestionably true,[1] it cannot be accounted strange that Hamilton's Democratic opponents mistook his theoretic predilections for positive designs Nor would it be a strained inference from much that he said, to believe that he hoped and expected that in the "crisis" he foresaw—and in which he evidently hoped to play a military rôle—when democracy should have caused the ruin of the country, a new government might be formed that should approximate to his own ideals. No Jeffersonian obsession regarding "monocrats" is more fantastic than this counter obsession of his great opponent.

After the Democratic victory of 1800, his letters are but rarely relieved in their sombre pessimism by flashes of hope and courage. "Every day," he wrote, "proves to me more and more that this American world was not made for me." His last letter on politics, written two days before his death, illustrates the two sides of his thinking already emphasized: in this letter he warns his New England friends against dismemberment of the Union as "a clear sacrifice of great positive advantages, without any counterbalancing good; administering no relief to our real disease, which is democracy, the poison of which, by a subdivision, will only be more concentrated in each part, and consequently the more virulent." To the end he never appreciated the value of his own labours, never lost his fear of the States, nor gained faith in the future of the country. He laboured still, in mingled hope and apprehension, "to prop the frail and worthless fabric," but for its spiritual content of democracy he had no understanding, and even in its nationalism he had little hope. (*See* his *Works*, vol x., pp. 363, 425, 434, 440, 445.) Yet to no other men, except to Washington and Marshall, does American nationalism owe so much.

In the development of the United States the influence of Hamiltonian nationalism and Jeffersonian democracy has been a reactive union; but changed conditions since Hamilton's time, and particularly since the Civil War, have created misconceptions as to Hamilton's position in his own day. Great constructive statesman as he was, he was also in that day essentially a reactionary. He was in sympathy with the dominant forces of public life only while they took, during the war, the predominant impress of an imperfect nationalism. Jeffersonian democracy came into power in 1800 in direct line with colonial development; Hamiltonian Federalism had been a break in that development; and this alone can explain the ouster of the Federalists despite their brilliant success in constructing the Government. Hamilton stigmatized his great opponent as a political fanatic; but actualist as he claimed to be, himself, he could not see, or would not concede, the predominating forces in American life, and would uncompromisingly have minimized the two great political conquests of the colonial period—local self-government and democracy.

Few Americans have received higher tributes from foreign authorities. Talleyrand, personally impressed when in America with Hamilton's brilliant qualities, declared him greater than Fox and Napoleon. Of the judgments rendered by his countrymen, Washington's confidence in his ability and integrity is perhaps the most significant. Chancellor James Kent, and others only less competent, paid remarkable testimony to his legal abilities. Chief-justice Marshall ranked him second to Washington alone. No appraisal is more justly measured than Madison's (1831): "That he possessed intellectual powers of the first order, and the moral qualities of integrity and honour in a captivating degree, has been awarded him by a suffrage now universal. If his theory of government deviated from the republican standard he had the candour to avow it, and the greater merit of co-operating faithfully in maturing and supporting a system which was not his choice."

In person Hamilton was rather short (5 ft. 7 in.) and slender; in carriage, erect, dignified and graceful. Deep-set dark eyes vivified his features, and set off his light hair and very fair and rosy complexion. His head in the famous Trumbull portrait is boldly poised and striking. The charm of his manners and conversation is attested by all who knew him, and in familiar life he was artlessly simple. Friends he won readily, and held in devoted attachment by a frank, ardent, generous, warm-hearted and high-minded character. As Lodge says, "the roll of his followers is enough of itself to establish his position in American history." It is therefore the more notable that reciprocal confidence and respect took the place, between Washington and Hamilton, of personal attachment—at least as regards Hamilton. This may be under-

[1] *Cf.* Gouverneur Morris, *Diary and Letters*, vol. ii., pp. 455, 526, 531 and even Lodge's judgments, *Life*, pp. 90–92, 115–116, 122, 130, 140. When he says (p. 140) that "In Hamilton's successful policy there were certainly germs of an aristocratic republic, there were certainly limitations and possibly dangers to pure democracy," this is practically Jefferson's assertion (1792) that "His system flowed from principles adverse to liberty"; but Jefferson went on to add: "and was calculated to undermine and demolish the republic." Jefferson merely had exaggerated fears of a moneyed political engine, and seeing that Hamilton's measures of funding and assumption did make the national debt politically useful to the Federalists in the beginning he concluded that they would seek to fasten the debt on the country forever.

stood, considering their extremely different temperaments. It is more difficult to understand why Hamilton—although on the score of personal and Federalist indebtedness he left explicit recognition—never really appreciated Washington's great qualities: Jefferson differed equally from him in temperament and vastly more in opinions, yet fully recognized his greatness. A firm will, tireless energy, courage and bold self-confidence were other leading qualities of Hamilton's nature. Amiability and enthusiastic aggressiveness seem to have been equally characteristic. In his mind, clarity and penetration were matched with logical solidity. Its remarkable quality lay in a combination of acute analysis and grasp of detail with great comprehensiveness of thought. So far as his writings show he was almost wholly lacking in humour, and in imagination little less so. In public speaking, however, he often combined a rhetorical effectiveness and emotional intensity that might take the place of imagination, and enabled him, on the coldest theme, to move the feelings of his auditors.

He died insolvent, leaving a widow and seven children, none of whom revealed the brilliance of their father.

BIBLIOGRAPHY.—Hamilton's Works have been edited by H. C. Lodge (New York, 9 vols., 1885–86, and 12 vols., 1904); all references above are to the latter edition. There are various editions of *The Federalist*, notably those of H. B. Dawson (1863), H. C. Lodge (1888), and—the most scholarly—P. L. Ford (1898); cf. *American Historical Review*, vol. ii., pp. 413, 675. Among modern biographies *see* A. M. Hamilton, *The Intimate Life of Alexander Hamilton* (1910), very valuable for its materials but both biased and naive in judgments; H. J. Ford, *Alexander Hamilton* (1920), carefully reasoned; James Schouler, *Alexander Hamilton* (1901), a slender but very judicious study; J. T. Morse, *Life of Alexander Hamilton* (1876), and H. C. Lodge, *Alexander Hamilton* (1882), both partisan; and G. Shea's two books, his *Historical Study* (1877) and *Life and Epoch* (1879). W. G. Sumner's *Alexander Hamilton* (1890) is important for its criticism from the point of view of an American free-trader; *see* also, on Hamilton's finance and economic views, C. F. Dunbar, *Quarterly Journal of Economics*, vol. iii. (1889), p. 32; E. G. Bourne in *ibid.*, vol. x. (1894), p. 328; E. C. Lunt in *Journal of Political Economy*, vol. iii. (1895), p. 289; W. C. Culbertson, *Alexander Hamilton: an Essay* (New Haven, 1911); and the two indispensable books by C. Beard cited in the text. F. S. Oliver's *Alexander Hamilton: An Essay on American Union* (1906), an English study, which uses its subject to illustrate the necessity of British imperial federation, has been criticized as being too partisan. *See* also James Bryce, "Predictions of Hamilton and de Tocqueville," in *Johns Hopkins University Studies*, vol. v. (Baltimore, 1887); and the capital essay of Anson D. Morse in the *Political Science Quarterly*, vol. v. (1890), pp. 1–23. The unfinished *Life of Alexander Hamilton*, by his son, J. C. Hamilton, going only to 1787 (New York, 1834–40), was superseded by the same author's valuable, but partisan and uncritical *History of the Republic . . . as traced in the Writings of Alexander Hamilton* (New York, 1857–64; Boston, 1879). New materials and viewpoints have rendered somewhat antiquated the earlier biographies mentioned. (F. S. P.)

HAMILTON, ALLEN McLANE (1848–1919), American physician, was born in Brooklyn, N.Y., on Oct. 6, 1848. He graduated from the College of Physicians and Surgeons (Columbia university) in 1870, and engaged in practice in New York city as a specialist in diseases of the mind and nervous system. In 1879 for an essay on "Diseases of the Lateral Columns of the Spinal Cord" he won the first prize given by the American Medical Association. Later he took up more specifically the work of an alienist and medico-legal practitioner. He was present in an advisory capacity at over 100 murder trials where insanity was the issue, notably at the trials of the assassins of Presidents Garfield and McKinley and in the Thaw case. He was greatly influential in the reform of court methods in dealing with criminals of this type. He was visiting surgeon to the epileptic and paralytic hospital on Blackwell's island and from 1900 to 1903 professor of mental diseases at Cornell Medical college. He died at Great Barrington, Mass., on Nov. 23, 1919.

Beside many contributions to medical journals he wrote *Clinical Electro-Therapeutics* (1873); *Nervous Diseases* (1878); *Types of Insanity* (1883); *Insanity in its Medico-Legal Bearings* (1894); *An Intimate Life of Alexander Hamilton* (1910); *Recollections of an Alienist* (1916). *See* sketch by H. A. Kelly in Kelly and Burrage, *Dictionary of American Medical Biographies* (1928).

HAMILTON, ANTHONY (?1645–1720), French author, was born about 1645, probably in Tyrone or Tipperary. His grandfather, Earl of Aberdare, settled in Ireland in the Plantation of Ulster. The family moved to France in 1651, and returned at the Restoration to a house near Whitehall. Anthony's sister Elizabeth, *La Belle Hamilton*, married the Comte de Gramont (*q.v.*). Anthony probably went to France in 1667 with his brother George, after the expulsion of the Roman Catholics from the army. In any case, we find him serving in the *régiment d'Hamilton*, getting wounded in the Palatinate in 1674, and at intervals going over to Ireland for recruits. The regiment was not a success after George's death, and Anthony seems to have left France for Ireland in 1678. James II. gave him command of an Irish regiment in 1687. After the siege of Limerick, Anthony joined the court of James at St. Germain, where he shared the general poverty, and died on April 21, 1720.

The *Mémoires du Comte de Gramont* were written, theoretically at Gramont's dictation, at the château of the duchesse du Maine at Sceaux, and published, probably much against the author's will, under the rubric of Cologne, but really in Holland, in 1713. They are after the manner of Bussy Rabutin, half-way between English memoirs and the French *roman prétendu historique*. The prose is typically early 18th century, well-bred and conversational. They are generally accurate in substance, though weak in chronology, and are especially valuable for their pictures of the English court. Of Hamilton's other works, *Le Bélier* is a parody on the followers of Perrault, and the *Contes des Fées, Fleur d'Epine, Zeneyde* and *Les Quatre Facardines* satirize the romantic tales popularized by Galland's *Arabian Nights*. He also wrote some light verse and corresponded with Lady Mary Wortley Montague. His *Oeuvres Diverses* were collected in 1731.

The *Mémoires* were translated into English by Boyer in 1714, and there have been over 30 editions since. *See* Sayou, *Histoire de la littérature française à l'étranger* (1853); Ruth Clark, *The Life of Anthony Hamilton* (1921).

HAMILTON, ELIZABETH (1758–1816), British author, born in Belfast, of Scottish extraction, spent the greater part of her life in Scotland and at Bath. Her most famous works are *Letters on Education* (1801–2); *The Cottagers of Glenburnie* (1808), and the popular song "My ain Fireside." She died at Harrogate on July 23, 1816.

See E. O. Benger, *Memoirs of Mrs Elizabeth Hamilton* (1818).

HAMILTON, EMMA, LADY (*c.* 1765–1815), wife of Sir William Hamilton (*q.v.*), the British envoy at Naples, and famous as the mistress of Nelson, was the daughter of Henry Lyon, a blacksmith of Great Neston, Cheshire, where she was christened on May 12, 1765. When she went to live with Charles Greville in 1781 she called herself Emily Hart. Under the protection of Greville, whose means were narrowed by debt, she was taught to sing, dance and act with professional skill. In 1782 he introduced her to his friend Romney, whose portraits of her may have somewhat idealized her apparently robust and brilliantly coloured beauty, but her vivacity and powers of fascination cannot be doubted. She seems to have been sincerely attached to Greville. In 1784 his uncle, Sir William Hamilton, saw—and admired—her. Two years later she was sent on a visit to him at Naples, as the result of an understanding between Hamilton and Greville—the uncle paying his nephew's debts and the nephew ceding his mistress. Emma at first resented the exchange, but submitted. Her beauty, her artistic capacity, and her high spirits made her a great favourite in Neapolitan society, and Queen Maria Carolina became closely attached to her. She became famous for her "attitudes," a series of *poses plastiques* in which she represented classical and other figures. On Sept. 6, 1791, during a visit to England, Hamilton married her, in order to justify her public reception at the court of Naples, where she was the channel of communication between the queen and the British minister—sometimes in opposition to the policy of the king. It was claimed that she secured valuable information in 1796, and was of essential service to the British fleet in 1798 during the Nile campaign, by enabling it to obtain stores and water in Sicily. When Nelson returned from the Nile in Sept. 1798 Lady Hamilton subjugated him, and drew him into a most unhappy participation in the domestic troubles of Naples, and when Sir W. Hamilton was recalled in 1800 she travelled with him and Nelson across Europe. In England Lady

Hamilton paraded her hold over Nelson. Their child, Horatia Nelson Thompson, was born on Jan. 30, 1801. On her husband's death in 1803 she received by his will a liferent of £800, and the furniture of his house in Piccadilly. She then lived with Nelson at his house at Merton. On his death she received Merton, and an annuity of £500, as well as the control of the interest of the £4,000 he left to his daughter. But gambling and extravagance kept her poor, and in 1813 she was put in prison for debt and remained there for a year. She died at Calais in distress if not in want on Jan 15, 1815.

See *The Memoirs of Lady Hamilton* (anon., 1815); and Walter Sichel, *Emma, Lady Hamilton* (1905); J. Turquan and J. d'Auriac, *Une aventurière de haut vol.: Lady Hamilton et la Révolution de Naples 1763–1815* (1913). *See* also the references *s.v.* NELSON.

HAMILTON, LORD GEORGE (1845–1927), English statesman, was born on Dec. 17, 1845, son of the first duke of Abercorn (*q.v.*). He was educated at Harrow school and entered the House of Commons in 1868 as member for Middlesex After 1885 he sat for the Ealing division until his retirement in 1906. Lord George took a keen interest in education throughout his life. He was vice-president of the committee of council on education from 1878 to 1880, and chairman of the London School Board from 1894 to 1895 He was a well-known economist and statistician, and rendered signal service to social science as chairman of the Poor Law Commission, 1904–1909. But his most famous achievements were in two departments of state, the India Office and the Admiralty. Disraeli made him under-secretary at the India Office in 1874, and he spent four years there. He returned to the office as secretary of state in 1895 and held office until 1903. This important period in Indian affairs covered the viceroyalties of Lord Elgin and Lord Curzon. At the outset he laid down a moderate frontier policy which secured the Indian government from much fruitless border warfare. His other and perhaps greatest work was done as first lord of the Admiralty (1885–1886 and 1886–1892) He carried through the Naval Defence Act of 1889, which formed the framework for the development of the navy up to the beginning of the great war. He secured the transfer of the control of naval ordnance from the War Office to the Admiralty, created the naval intelligence department and "discovered" Lord Fisher. His long service with Unionist governments ended in 1903, when he and Ritchie resigned on the fiscal question His last public service was as chairman of the Mesopotamia commission (1916–1917) He died in London on Sept 22, 1927.

Lord George married in 1871 Lady Maud Lascelles, daughter of the third Earl Harewood He wrote *Parliamentary Reminiscences and Reflections* (1917).

HAMILTON, SIR IAN STANDISH MONTEITH (1853–), British soldier, was born at Corfu on Jan 16, 1853. Educated at Wellington college and in Germany, he joined the army in 1872. He served with the 92nd Highlanders in the Afghan War and the Boer War of 1881, and was severely wounded on Majuba hill, one arm being permanently disabled. He was then for several years intermittently on the staff of Sir F. (Lord) Roberts He served in the Nile Expedition of 1884–85, in Burma in 1886–87, and on the staff of the Chitral Relief Force in 1895 He commanded a brigade on the North-West Frontier in 1897, and afterwards the School of Musketry, Hythe. In the South African War he commanded a mounted infantry division during the advance from Bloemfontein to Pretoria and into the eastern Transvaal He returned home early in 1901 to become military secretary at the War Office, but towards the end of the year went back to South Africa nominally as chief of the staff to Lord Kitchener, although in reality he was employed chiefly as the commander-in-chief's deputy to control particular groups of operations from time to time during the closing stages of the struggle

He was afterwards again military secretary and then quartermaster-general at the War Office, and in 1904 he went out to the Far East to accompany the Japanese armies in the field. His impressions under the title *A Staff Officer's Scrap Book* (2 vol, 1906–07), by reason of the interest of its subject, the charm of the author's style, and the combination of war experience and of imagination which inspired his judgments and criticisms; at once took rank in Europe as a modern military classic. His literary ability, though a token of unusual imagination and clearness of thought, rather prejudiced him throughout his career in the eyes of old-fashioned soldiers. On his return he had charge of the Southern Command until 1909, and was afterwards adjutant-general at the War Office for a year. He took a prominent part on behalf of the voluntary service system during the campaign in favour of compulsory service led by Lord Roberts, and in the course of this controversy he published a book *Compulsory Service* (1910), which he wrote at the request of Lord Haldane. In 1910 he was appointed commander-in-chief in the Mediterranean and inspector-general of the Overseas Forces.

On the outbreak of the World War in 1914 Hamilton served for some months as commander-in-chief of the Home Defence Army in England. Then in March 1915, he was selected to take charge of the Mediterranean Expeditionary Force (*see* DARDANELLES CAMPAIGN). The naval effort to force the Dardanelles having failed, he found himself obliged to undertake operations in the Gallipoli peninsula, and although his army was very ill-equipped for the task, he succeeded in landing it in the face of the enemy, but was brought to a standstill. Having, after considerable delay, received substantial reinforcements, he made a great effort in August to improve his position, but partly through the inertia of some of the local commanders, sent out without consulting him, the operations miscarried, and a situation of stalemate arose The Government consulted him in October as to the expediency and feasibility of withdrawing from the peninsula, and on his pronouncing himself strongly opposed to such a policy he was replaced by Sir C. Monro and returned home. In 1920, after the issue of the *Report* of the Dardanelles Commission, he published his own story of the campaign under the title of *Gallipoli Diary* (2 vol, 1920), and in 1921 *The Soul and Body of an Army*. Hamilton was the recipient of many honours, including the G.C.M.G (1919) and the D.S.O (1891).

(B. H. L. H.)

HAMILTON, JAMES HAMILTON, 1ST DUKE OF (1606–1649), Scottish nobleman, son of James, 2nd marquess of Hamilton, and of the Lady Anne Cunningham, daughter of the earl of Glencairn, was born on June 19, 1606 As the descendant and representative of James Hamilton, 1st earl of Arran, whose mother was a daughter of James II. of Scotland, he was the heir to the throne of Scotland after the descendants of James VI. He married in his fourteenth year May Feilding, aged seven, daughter of Lord Feilding, afterwards 1st earl of Denbigh, and was educated at Exeter College, Oxford, where he matriculated on Dec. 14, 1621 He succeeded to his father's titles on the latter's death in 1625. In 1628 he was made master of the horse, gentleman of the bedchamber and a privy councillor. In 1631 Hamilton took over a force of 6,000 men to assist Gustavus Adolphus in Germany. He guarded the fortresses on the Oder while Gustavus fought Tilly at Breitenfeld, and afterwards occupied Magdeburg, but his army was destroyed by disease and starvation, and after the complete failure of the expedition Hamilton returned to England in September 1634. He now became Charles I's chief adviser in Scottish affairs. In 1638, after the outbreak of the revolt against the English Prayer Book, he was appointed commissioner for Scotland to appease the discontents. He was easily intimidated by the covenanting leaders and accomplished nothing Charles offered an assembly and a parliament, and eventually revoked the prayer book. On Nov. 21, Hamilton presided over the first meeting of the assembly in Glasgow cathedral, but dissolved it on the 28th on its declaring the bishops responsible to its authority. The assembly, however, continued to sit notwithstanding, and Hamilton returned to England leaving the enemy triumphant and in possession. War was now decided upon, and Hamilton was chosen to command an expedition to the Forth to menace the rear of the Scots. He failed, and in July 1639 resigned his commissionership.

Hamilton supported Strafford's proposal to call the Short Parliament, but otherwise opposed him as the chief adversary of the Scots. In Feb. 1641 he persuaded Charles to admit some of the

parliamentary leaders to the council. Hamilton was now confronted by a new antagonist in Montrose, who detested both his character and policy and repudiated his supremacy in Scotland. On Aug. 10, 1641, he accompanied Charles on his last visit to Scotland.

As no reconciliation proved possible between Charles and Argyll, Hamilton sided with Argyll at Edinburgh. In consequence he received a challenge from Lord Ker, of which he gave the king information, and obtained from Ker an apology. Montrose wrote to Charles declaring he could prove Hamilton to be a traitor. Shortly afterwards the plot—known as the "Incident"—to seize Argyll, Hamilton and the latter's brother, the earl of Lanark, was discovered, and on Oct. 12 they fled from Edinburgh.

In July 1642 Hamilton, who, in spite of his intrigues, retained Charles's confidence, went to Scotland on a hopeless mission to prevent the intervention of the Scots in the war, and a breach then took place between him and Argyll When in February 1643 proposals of mediation between Charles and the parliament came from Scotland, Hamilton instigated the "cross petition" which demanded from Charles the surrender of the annuities of tithes in order to embarrass Loudoun, the chief promoter of the project, to whom they had already been granted. This failing, he promoted a scheme for outvoting Argyll in the Scottish parliament by sending to Scotland all the Scottish peers then with the king, while Charles was to guarantee the establishment of Presbyterianism in Scotland only. Montrose was eager to strike and anticipate the plans of the Covenanters. Hamilton, however, gained over the queen for his project, and in September was made a duke, while Montrose was condemned to inaction Hamilton's scheme completely failed On refusing to take the Covenant, he and Lanark were obliged to leave Scotland They arrived at Oxford on Dec. 16 Hamilton's conduct had at last incurred Charles's resentment and he was sent, in Jan 1644, a prisoner to Pendennis Castle, in 1645 being removed to St Michael's Mount, where he was liberated by Fairfax's troops on April 23, 1646.

Hamilton showed great activity in the futile negotiations between the Scots and Charles at Newcastle In 1648 he obtained a temporary influence and authority in the Scottish parliament over Argyll, and led a large force into England in support of the king on July 8. He showed complete incapacity in military command; was kept in check for some time by Lambert; and though outnumbering the enemy by 24,000 to about 9,000 men, allowed his troops to disperse over the country and to be defeated in detail by Cromwell, during the three days Aug. 17–19, at the so-called battle of Preston, being himself taken prisoner on the 25th. He was tried on Feb. 6, 1649, condemned to death on March 6 and executed on the 9th

For his successors *see* HAMILTON, MARQUESSES AND DUKES OF.

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HAMILTON, JAMES (1769–1831), English educationist, and author of the Hamiltonian system of teaching languages, was born in 1769. He went in 1814 to America, intending to become a farmer and manufacturer of potash; but, changing his plan before he reached his "location," he started as a teacher in New York There, and in other cities, he was very successful, using a method of teaching languages which he had learned in Hamburg from a French émigré, General d'Angelis. He returned to England in 1823, and taught in various centres. The two master principles of his method were that the language should be presented to the scholar as a living organism, and that its laws should be learned from observation and not by rules As textbooks for his pupils Hamilton printed interlinear translations of the Gospel of John, of an *Epitome historiae sacrae,* of Aesop's *Fables*, Eutropius, Aurelius Victor, Phaedrus, etc., and many books were issued as Hamiltonian with which he had nothing personally to do. He died on Oct 31, 1831.

See Hamilton's own account, *The History, Principles, Practice and Results of the Hamiltonian System* (Manchester, 1829, new ed, 1831), Alberte, *Über die Hamilton'sche Methode;* C. F Wurm, *Hamilton und Jacotot* (1831).

HAMILTON, JOHN (*c.* 1511–1571), Scottish prelate and politician, natural son of James Hamilton, 1st earl of Arran, became a monk and abbot of Paisley. After studying in Paris he returned to Scotland, where, under his half-brother, the regent Arran, he was made keeper of the privy seal (1543), bishop of Dunkeld (1545), archbishop of St. Andrews (1546) and finally became treasurer of the kingdom. He was imprisoned, owing to Protestant hostility, in 1563. After his release he was an active partisan of Mary queen of Scots, he baptized the infant James, afterwards King James VI., and pronounced the divorce of the queen from Bothwell After the battle of Langside, he took refuge in Dumbarton castle. Here he was seized, and on the charge of complicity in the murders of Lord Darnley and the regent Murray he was tried, and hanged on April 6, 1571. The archbishop had three children by his mistress, Grizzel Sempill.

HAMILTON, PATRICK (1504–1528), Scottish protomartyr of the Reformation, second son of Sir Patrick Hamilton, and of Catherine Stewart, daughter of Alexander, duke of Albany, second son of James II. of Scotland. In 1517 he was appointed titular abbot of Ferne, Ross-shire. He graduated in Paris in 1520, and then went to Louvain, attracted probably by the fame of Erasmus.

On returning to Scotland he became a member of the University of St. Andrews where he conducted as precentor, a musical mass of his own composition in the cathedral. Early in 1527 the attention of James Beaton, archbishop of St. Andrews, was directed to the heretical preaching of the young priest. Hamilton fled to Germany, first visiting Luther at Wittenberg, and afterwards enrolling as a student in the new university of Marburg He returned to Scotland, bold in the conviction of the truth of his Protestant principles. He accepted Beaton's invitation to a conference at St. Andrews, and for nearly a month was permitted to preach and dispute. At length he was summoned before a council of bishops and clergy presided over by the archbishop; there were 13 charges, seven of which were based on the doctrines affirmed in his *Loci communes.* The council convicted him, after a sham disputation with Friar Campbell, and handed him over to the secular power. The sentence of burning at the stake was carried out on the same day (Feb. 29, 1528) lest he should be rescued by his friends. His courageous bearing greatly helped to spread the Reformation in Scotland. The "reek of Patrick Hamilton infected all it blew on" He represented in Scotland the Lutheran stage of the Reformation. The *Loci communes*, known as "Patrick's Places," set forth the doctrine of justification by faith and the contrast between the gospel and the law in a series of clear-cut propositions It was translated into English by John Frith (1528), and is to be found in Fox's *Acts and Monuments.*

See Lorimer, *Patrick Hamilton the first preacher and martyr of the Scottish Reformation* (1857)

HAMILTON, ROBERT (1743–1829), Scottish economist and mathematician, born at Pilrig, Edinburgh, on June 11, 1743, was rector of Perth academy (1769–1779), professor of natural philosophy (1779–1817), and of mathematics (1817–1829), at Aberdeen Hamilton's most important work is the *Essay on the National Debt* (1813), attacking the sinking fund.

HAMILTON, SIR WILLIAM (1730–1803), British diplomatist and archaeologist, son of Lord Archibald Hamilton, governor of Greenwich hospital and of Jamaica, was born in Scotland on Dec. 13, 1730, and served in the 3rd Regiment of Foot Guards from 1747 to 1758 He left the army after his marriage with Miss Barlow, a Welsh heiress from whom he inherited an estate near Swansea upon her death in 1782 From 1764 to 1800 he was British envoy to the court of Naples, held for 36 years—until his recall in 1800 Hamilton made, or caused to be made a series of observations on the action of volcanoes at Vesuvius and Etna, and published several treatises on earthquakes and volcanoes between 1776 and 1783. He was a notable collector and many of his treasures went to enrich the British Museum In

1791 he married Emma Lyon. The outbreak of the French Revolution and the rapid extension of the revolutionary movement in Western Europe soon overwhelmed Naples, a situation which he was incapable of dealing with *See*, for the rest of his career, the articles HAMILTON, EMMA and NELSON, HORATIO. He died on April 6, 1803.

See E. Edwards, *Lives of the Founders of the British Museum* (1870).

HAMILTON, SIR WILLIAM, BART. (1788–1856), Scottish metaphysician, was born in Glasgow on Mar 8, 1788, the son of Dr. William Hamilton, professor of anatomy and botany in Glasgow university He was educated at Glasgow, Edinburgh and Balliol college, Oxford, taking his B.A. in 1811 and becoming a member of the Scottish bar two years later.

Two visits to Germany in 1817 and 1820 led to his study of German and later on to that of contemporary German philosophy, which was then almost entirely neglected in the British universities. In 1821 he was appointed professor of civil history at Edinburgh, after having failed to secure the chair of moral philosophy, which fell vacant on the death of Thomas Brown.

In 1829 appeared his well-known essay on the "Philosophy of the Unconditioned" (a critique of Cousin's *Cours de philosophie*). In 1836, he was elected to the Edinburgh chair of logic and metaphysics, and from this time dates the influence which, during the next twenty years, he exerted over the thought of the younger generation in Scotland through his extensive knowledge embracing anatomy, physiology, literature and theological lore as well as his own particular subjects His edition of Reid's works appeared in 1846 with only seven of the intended dissertations. During the next few years he elaborated his scheme of logic, an account of his controversy with Augustus de Morgan being contained in the appendices to his *Lectures on Logic* In 1852 appeared his *Discussions in Philosophy, Literature and Education*, a reprint, with additions, of his contributions to the *Edinburgh Review*. He died in Edinburgh on May 6, 1856

Hamilton was not a great originator, but he stimulated a spirit of criticism in his pupils, by insisting on the importance of psychology as opposed to the older metaphysical method, and recognized the importance of Aristotle and his commentators and of German philosophy, especially that of Kant, and so brought English philosophy out of insularity.

In logic, Hamilton is now known chiefly as the inventor of the doctrine of the "quantification of the predicate," *i e* that the judgment "All A is B" should really mean "All A is *all* B," whereas the ordinary universal proposition should be stated "All A is *some* B"

BIBLIOGRAPHY.—His posthumous works are his *Lectures on Metaphysics and Logic*, 4 vols., ed. H L. Mansel, Oxford, and John Veitch (*Metaphysics*, 1858; *Logic*, 1860); and *Additional Notes to Reid's Works*, from Sir W Hamilton's MSS., ed. H. L. Mansel (1862). *See* J. Veitch, *A Memoir of Sir W. Hamilton* (1869); J. S Mill, *Examination of Hamilton's Philosophy* (1865); Hutcheson Sterling, *Sir W. Hamilton* (1881); M P. Bolton, *Inquisitio Philosophica* (1868); W. H. Monck, *Sir W Hamilton* (1881); S. V. Rasmussen, *The Philosophy of Sir W. Hamilton* (1925); and J. McCosh, *Scottish Philosophy* (1875)

HAMILTON, WILLIAM (1704–1754), Scottish poet, author of the famous poem "The Braes of Yarrow," wrote a number of odes, epitaphs, songs, etc., the longest of which is "Contemplation, or the Triumph of Love"

See J. Paterson, *The Poems and Songs of William Hamilton* (1850), which contains a life of Hamilton by the editor.

HAMILTON, WILLIAM GERARD (1729–1796), English statesman, popularly known as "Single Speech Hamilton," was born in London on Jan 28, 1729, and educated at Winchester and at Oriel College, Oxford. His maiden speech, in the House of Commons, delivered on Nov. 13, 1755, during the debate on the address, which excited Walpole's admiration, was, in fact, not the only one which he made in the House He was one of the commissioners for trade and plantations (1756), chief secretary to Lord Halifax, the lord-lieutenant of Ireland (1761), chancellor of the exchequer in Ireland (1763) and filled other administrative offices

HAMILTON, SIR WILLIAM ROWAN (1805–1865), Scottish mathematician, was born in Dublin on Aug. 4, 1805. His great mathematical intelligence was awakened by the reading of Newton's *Arithmetica universalis* when he was 12 years old. He went on to the *Principia*, and when he was 17 attacked Laplace's *Mécanique céleste*. In this he detected an error, which was communicated to John Brinkley, then royal astronomer in Ireland, who at once recognized one of the first mathematical minds of the age Hamilton had a brilliant career at Trinity college, Dublin, but before it was completed, he was appointed, at the age of 22 to the Andrews chair of astronomy in succession to Brinkley. The rest of his life was spent at the observatory at Dunsink, near Dublin, in the close study of mathematics. He was knighted in 1835. At the time of his death, Sept. 2, 1865, he was working on his *Elements of Quaternions*, on which the last six years of his life had been spent.

His earliest papers were the "Theory of Systems of Rays" (*Trans. Roy. Irish Acad.*, 1828–32); in the last of these, by the aid of mathematics, he predicted conical refraction. These were followed by papers on "The Principle of Varying Action" and in 1834 and 1835 by two memoirs "On a General Method in Dynamics." The latter papers made a great addition to the methods of inquiry in dynamics; they have been of great value in mathematical physics and particularly in the Quantum theory His *Lectures on Quaternions* were published in 1853 and his great book, *The Elements of Quaternions*, posthumously in 1866. In the preface to the *Lectures* he describes the steps by which he reached his important conclusions, a full description of which is given in the article QUATERNIONS It has been said of his work on this subject that the methods of analysis elaborated by him "are as great an advance over those of analytical geometry, as the latter were over those of Euclidean geometry."

The discoveries, papers and treatises mentioned might well have formed the whole work of a long and laborious life. But he left an enormous collection of ms books, full to overflowing with new and original matter, which were handed over to Trinity college, Dublin. His investigations connected with the solution of algebraic equations of the fifth degree form a great contribution to science. His paper on *Fluctuating Functions* and his extremely ingenious invention of the hodograph must also be mentioned. Of his investigations into the solution (especially by numerical approximation) of certain classes of differential equations only a few items were published at intervals in the *Philosophical Magazine*. Hamilton was a neat, precise and fastidious writer, and it was probably for this reason that he published so little compared with the extent of his investigations.

His works have been collected and published by R. P. Graves, *Life of Sir W. R. Hamilton* (1882–89).

HAMILTON, a town of Dundas and Normanby counties, Victoria, Australia, on the Wannon river, 197 m by rail W. of Melbourne. Pop. (1925) 5,209. It is situated where the western edge of the Great Dividing Range dies down to the plain of western Australia, and is thus an important sheep and agricultural country. Mutton is frozen and exported Hamilton has a number of educational institutions, including the Hamilton and Western District College, and the Hamilton Academy. There is also a racecourse.

HAMILTON, one of the chief cities of Canada, capital of Wentworth county, Ontario. It occupies a highly picturesque situation upon the shore of a spacious land-locked bay at the western end of Lake Ontario. It covers the plain stretching between the water-front and the escarpment (called "The Mountain"), this latter being a continuation of that over which the Falls of Niagara plunge 40 m. to the east. Founded about 1778 by one Robert Land, the growth of Hamilton has been steady and substantial, and, owing to its remarkable industrial development, it has come to be called "the Birmingham of Canada." This development is largely due to the use of electrical energy generated by water-power, in regard to which Hamilton stands first among Canadian cities.

The manufacturing interests of Hamilton are varied, including the largest plough works and implement works in the British em-

pire. In addition Hamilton is the centre of one of the finest fruit-growing districts on the continent, and its open-air market is a remarkable sight. The Canadian National, the Canadian Pacific, and the Toronto, Hamilton and Buffalo railway and two electric radial roads afford Hamilton ample facilities for transport by land, while during the season of navigation a number of steamboat lines supply daily services to Toronto and other lake ports. Entrance into the broad bay is obtained through a short canal intersecting Burlington Beach, which is crossed by two swing bridges, whereof one—that of the Canadian National railway—is among the largest of its kind in the world. Burlington Beach is lined with cottages occupied by the city residents during the hot summer months. Hamilton is rich in public institutions. The educational equipment comprises a normal college, collegiate institute, model school and more than a score of public schools, for the most part housed in handsome stone and brick buildings. There are four hospitals, and the asylum for the insane is the largest in Canada. There is an excellent public library, and in the same building with it a good art school. Since its incorporation in 1833 the history of Hamilton has shown continuous growth. Its population in 1921 was 114,351. It was estimated (1924) at 120,235. The Anglican bishop of Niagara has his seat here, and also a Roman Catholic bishop.

HAMILTON, municipal and police burgh, Lanarkshire, Scotland. Pop. (1921) 39,420. It is situated about 1 m from the junction of the Avon with the Clyde, 10¾ m. S.E of Glasgow by road, and has stations on the L.M S.R and L N E R Among the subjects of antiquarian interest are Queenzie Neuk, where Queen Mary rested on her journey to Langside, the old steeple and pillory built in the reign of Charles I, the Mote hill, the old Runic cross, and the carved gateway in the palace park. In the churchyard there is a monument to four covenanters who suffered at Edinburgh, on Dec. 7, 1600, whose heads were buried here. Among the industries are manufactures of cotton, lace and embroidered muslins, and carriage-building, and there are also large market gardens, the district being famed for its apples, and some dairy-farming; but the prosperity of the town depends chiefly upon the coal and ironstone of the surrounding country. Hamilton originated in the 15th century under the protecting influence of the lords of Hamilton, and became a burgh of barony in 1456 and a royal burgh in 1548. The latter rights were afterwards surrendered and it was made the chief burgh of the regality and dukedom of Hamilton in 1668, the third marquess having been created duke in 1643. Hamilton palace, a magnificent building in classical style (1822–29), has recently been dismantled, owing to subsidence of the ground. The Low parks, part of the estate, including the mausoleum resembling in design that of Hadrian at Rome, have been bought by the town of Hamilton. The palace occupied most of the site of the original burgh of Netherton At Barncluith, 1 m. S.E. of the town, may be seen the Dutch gardens laid down in terraces on the steep banks of the Avon, planned in 1583 by John Hamilton, an ancestor of Lord Belhaven. About 2 m. S E. of Hamilton, within the western High park, on the summit of a precipitous rock 200 ft. in height, the foot of which is washed by the Avon, stand the ruins of Cadzow castle, the subject of a ballad by Sir Walter Scott. The castle had been a royal residence for at least two centuries before Bannockburn (1314), but immediately after the battle Robert Bruce granted it to Sir Walter FitzGilbert Hamilton, the son of the founder of the family, in return for the fealty. Near it is the noble chase with its ancient oaks, the remains of the Caledonian forest.

HAMILTON, a village of Madison county, New York, U.S.A., 29 m. S.W. of Utica; on the New York, Ontario and Western railway. The population in 1925 was 1,668. It is the seat of Colgate university (Baptist), founded in 1819, and renamed in 1890 after the Colgate family, several members of which had made liberal gifts. The region was settled about 1790, and the village was incorporated in 1812.

HAMILTON, a city of south-western Ohio, U.S.A., on the Great Miami river, 25m. N. of Cincinnati; the county seat of Butler county. It is the centre of a network of fine roads, and is served by the Baltimore and Ohio, the Erie and the Pennsylvania railways, and by inter-urban electric lines. The population in 1920 was 39,675 (90% native white) and was estimated locally at more than 51,000 in 1928. The city has a land area of 5·9 sq.m., and an assessed valuation in 1925 of $105,766,830. It is surrounded by a rich farming and stock-raising country. There are beautiful parks and substantial public buildings. The manufacturing industries, with an output in 1925 valued at $54,874,566, are varied and important. They include two factories which make three-fourths of the world's supply of bank vaults and safes, a branch of the Ford motor works, one of the largest plants in the world making heavy machine tools, and one of the largest mills making coated paper. A stockade fort was built here in 1791 by Gen. Arthur St Clair (on the spot now occupied by the Soldiers' and Sailors' monument) and in 1794 a town was laid out and named Fairfield. The fort was abandoned in 1796. About the same time the town was renamed, after Alexander Hamilton. It became the county seat in 1803, was incorporated as a village in 1810, as a city in 1857. Hamilton was the early home of William Dean Howells, where he learned to set type in his father's printing-shop, and his recollections of it are embodied in *A Boy's Town.*

HAMILTON (Grand or Ashuanipi), the chief river of Labrador peninsula, Canada. It rises in the Labrador highlands at an elevation of 1,700 ft., its chief sources being among the many irregularly shaped lakes of central Quebec. The river itself flows into a line of weakness on a very old and worn down ancient shield whose present drainage has not been able to establish itself finally since the Ice Age. After a course of 600 m. the river empties into Melville Lake (90 m. long and 18 wide), an extension of Hamilton inlet, on the Atlantic. About 220 m. from its mouth occur the Grand Falls with a vertical drop of 316 ft. Below the falls are many rapids, and the river sweeps through a deep and narrow canyon. In certain portions of the valley spruce and poplars grow to a moderate size From the head of Lake Attikonak, one of the southern sources of the Hamilton, a steep and rocky portage of less than a mile leads to Burnt Lake, which is drained into the St. Lawrence by the Romaine river.

HAMIRPUR, a town and district of British India, in the Allahabad division of the United Provinces. The town stands on a tongue of land near the confluence of the Betwa and Jumna, 110 m. N W. of Allahabad. Pop. (1921) 6,760. It was founded, according to tradition, in the 11th century by Hamir Deo, a Karchuli Rajput expelled from Alwar by the Mohammedans.

The district has an area of 2,292 sq m., and encloses the small Indian states of Sarila, Jigni and Bihat, besides portions of Charkhari and Garrauli. Hamirpur forms part of the great plain of Bundelkhand, which stretches from the banks of the Jumna to the central Vindhyan plateau and contains the famous artificial lakes of Mahoba. These magnificent reservoirs were constructed by the Chandel rajas before the Mohammedan conquest, for purposes of irrigation and as sheets of ornamental water. Many of them enclose craggy islets or peninsulas, crowned by the ruins of granite temples, exquisitely carved and decorated. From the base of this hill and lake country the general plain of the district spreads northward in an arid and treeless level towards the broken banks of the rivers. Of these the principal are the Betwa and its tributary the Dhasan. The deep black soil of Bundelkhand, known as *mār,* retains the moisture under a dried and rifted surface, and renders the district fertile; but the rainfall is precarious, and droughts are frequent. The staple produce is grain of various sorts, the most important being gram Cotton is also a valuable crop. Agriculture suffers much from the spread of the *kāns* grass, a noxious weed which overruns the fields and is found to be almost ineradicable wherever it has once obtained a footing. In 1921 the population was 440,245. Exports are chiefly agricultural produce and cotton cloth. Rath is the principal commercial centre.

From the 9th to the 10th century this district was the centre of the Chandel kingdom, with its capital at Mahoba. The rajas adorned the town with many splendid edifices, remains of which still exist, besides constructing the noble lakes already described. At the end of the 12th century Mahoba fell into the hands of the Mohammedans. In 1680 the district was conquered by Chhatar Sal, the hero of the Bundelas, who assigned at his death one-third

of his dominions to his ally the peshwa of the Mahrattas. Until Bundelkhand became British territory in 1803 there was constant warfare between the Bundela princes and the Mahratta chieftains.

HAMITIC LANGUAGES. This important family of African languages is now definitely affiliated with the Semitic languages; they constitute a separate division thereof. A brief summary of the facts upon which this conclusion is based is given in *Les Langues du Monde* (Meillet and Cohen, 1924, p 84, *sqq.*).

Distribution.—This group is spoken in Northern Africa and is divided into three sub-groups, Berber, Libyan and Cushite. The Berber group comprises Kabile and Guanche, now obsolete. To the Libyan group belong Siwah, Libyan and Coptic. The Cushite group consists firstly of the languages spoken by mixed tribes in the Sudan, Adamawa, Bisharin, together with Somali and Galla. In the second group fall Kuhama and one or two smaller languages spoken in the same area. Masai and Nama belong to this group. Both have been influenced by other languages, Nama, now spoken in the southern extremity of Africa, largely by Hottentot and Bushman speech while Masai contains elements derived from the former population. The influence of Hamitic speech upon Amharic (*q v*) has been considerable. Although Hamites form an important element in the populations of Uganda and that area generally, in which as elsewhere they form the dominant group, the Bantu language of the people must be regarded as distinct.

Main Characteristics.—In these inflecting languages nouns usually express number, gender and case by suffixes. Verbs use both prefixes and suffixes to form conjugation, voices, moods and tenses The verb has intensive, reflective, attributive and causative forms. Some languages are more copious and developed than others The influence of Arabic is found in tense formation, which normally expresses completion or incompletion of action rather than time. Attention must be drawn to the different kinds of plurals of the nouns. There is a distributive plural in which each of the objects mentioned is regarded as still individual, a collective plural where they form a unity, and generic plurals used of things which appear in mass, such as grass, water, swarms of insects. In some languages, *e.g.*, Masai, gender distinguishes size and strength rather than sex. The relation of plural forms to singular is conditioned by what Meinhof calls the "law of polarity," according to which fields of perception were originally divided into two groups, persons and things, and there are only two classes of genders, one for persons, the other for things. A person therefore, belongs to one or other of the two classes. Persons in the plural are distinguishable from the person regarded as an individual. The person class may be first regarded as male. What, therefore, is not male, belongs to the other or thing class which, therefore, in time adopted the feminine gender. Therefore nouns, which in the singular belong to one gender utilize in the plural the form of plural appropriate to the other gender.

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HAMITIC RACES. The term Hamitic as applied to race is not only extremely vague but has been much abused by anthropological writers. Sergi and Meinhof have both made classifications. Sergi includes the Hamites, racially, as a branch of his Mediterranean Race and distinguishes an eastern branch including the Nubians, Bejas, Abyssinians, Gallas, Somalis, Masais, etc., and a northern branch including the Berbers, Fulani, etc. Meinhof's classification is on broad lines essentially the same but he would include the Hottentots, on very unsatisfactory grounds, mainly linguistic. The southern Abyssinians have certainly absorbed Galla blood but the majority are Semitic or Semito-Negroid. There is still some support for the contention that only Sergi's eastern branch should be called definitely Hamitic and that the northern should take the name Libyan.

The definition of the term Hamitic as an anthropological description is still a type of brown people with frizzy hair, of lean and sinewy physique, with slender but muscular limbs, a thin, straight or even aquiline nose with delicate nostrils, thin lips and utter absence of prognathism. There is still much confusion in the use of the term from linguistic and ethnologic viewpoints. *See* G. Sergi, *Africa Antropologia della stirpe camitica* (1897), and *The Mediterranean Race* (1901); C. Meinhof, *Die Hamitensprachen* (*Hamburg Kolonials-Institute*).



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

MASAI WARRIORS, OF BRITISH EAST AFRICA

Masai men live in military kraals for several years during their youth, and then settle down as cattle-breeders

HAMLET, the hero of Shakespeare's tragedy, a striking figure in Scandinavian romance. Saxo Grammaticus devotes parts of the third and fourth books of his *Historia Danica*, written at the beginning of the 13th century, to the story of Hamlet, Amleth or Amloði, which is supposed to have been contained in the lost Skjöldunga saga. The close parallels between the tale of Hamlet and the English romances of Havelok, Horn and Bevis of Hampton make it conceivable that Hamlet is of British rather than of Scandinavian origin. His name does in fact occur in the Irish *Annals of the Four Masters* (ed. O'Donovan 1851). Late in the 10th century there is evidence of the existence of an Icelandic saga of Amloði or Amleth in a passage from the poet Snaebjorn in the second part of the prose *Edda:* " 'Tis said that far out, off yonder ness, the Nine Maids of the Island Mill stir amain the host—cruel skerry-quern—they who in ages past ground Hamlet's meal." This passage may be compared with one of Hamlet's sayings quoted by Saxo: "As they passed the sand-hills, and bade him look at the meal, meaning the sand, he replied that it had been ground small by the hoary tempests of the ocean." According to Saxo (Books iii. and iv., chaps. 86–106), Hamlet's history is briefly as follows. In the days of Rorik, king of Denmark, Gervendill was governor of Jutland, and was succeeded by his sons Horvendill and Feng. Horvendill married Gerutha, Rorik's daughter, who bore him a son Amleth. But Feng, out of jealousy, murdered Horvendill, and persuaded Gerutha to become his wife, on the plea that he had avenged her of a husband by whom she had been hated. Amleth, afraid of sharing his father's fate, pretended to be imbecile, but the suspicion of Feng put him to various tests. Among other things they sought to entangle him with a young girl, his foster-sister, but his cunning saved him. When, however, Amleth slew the eaves-dropper hidden, like Polonius, in his mother's room, Feng despatched him to England in company with two attendants, who bore a letter enjoining the king of the country to put him to death. Amleth secretly altered the message on their wooden tables to the effect that the king should put the attendants to death and give Amleth his daughter in marriage. After marrying the princess, Amleth returned to Denmark, taking with him certain hollow sticks filled with gold. He arrived in time for a funeral feast, held to celebrate his supposed death. At the feast he plied the courtiers with wine, and during their drunken sleep fastened down over them the woollen hangings of the hall with pegs he had sharpened during his feigned madness, and then set fire to the palace. Having slain Feng with his own sword, he was proclaimed king. Returning to England for his wife he found that his father-in-law and Feng had been pledged each to avenge the other's death. The English king, unwilling personally to carry out his pledge, sent Amleth as proxy wooer for the hand of a terrible Scottish queen Hermuthruda, who had put all former

wooers to death, but fell in love with Amleth. On his return to England his first wife, whose love proved stronger than her resentment, told him of her father's intended revenge. In the battle which followed Amleth won the day by setting up the dead men of the day before with stakes, and thus terrifying the enemy. He then returned with his two wives to Jutland, where he was slain in a battle against Wiglek, Rorik's successor.

The other Scandinavian versions of the tale are: the *Hrolfs-saga Kraka;* the modern Icelandic *Ambales Saga,* a romantic tale the earliest ms. of which dates from the 17th century; and the folk-tale of Brjám which was put in writing in 1707. Saxo Grammaticus was certainly familiar with the Latin historians, and it is most probable that, recognizing the similarity between the northern Hamlet legend and the classical tale of Lucius Junius Brutus, he deliberately added circumstances from the classical story. Dr. O. L. Jiriczek first pointed out the striking similarities existing between the story of Amleth and that of Kei Chosro in the *Shahnameh* (Book of the King) of the Persian poet Firdausi, and R. Zenker (*Boeve Amlethus,* pp. 207–268, Berlin and Leipzig, 1904) even concluded that the northern saga rested on an earlier version of Firdausi's story. Further resemblances exist in the *Ambales Saga* to the tales of Bellerophon, of Heracles and of Servius Tullius. In *The Classical Tradition in Poetry* Prof. Gilbert Murray has drawn an interesting parallel between the story of Hamlet and the story of Orestes. The tale of Hamlet's adventures in Britain forms an episode so distinct that it was at one time referred to a separate hero.

The story of Hamlet was known to the Elizabethans in François de Belleforest's *Histoires tragiques* (1559), and as early as 1587 or 1589 Hamlet had appeared on the English stage, as is shown by Nash's preface to Greene's *Menaphon:* "He will afford you whole Hamlets, I should say, handfulls of tragical speeches." The Shakespearian Hamlet owes, however, little but the outline of his story to Saxo. For a discussion of Shakespeare's play and its immediate sources *see* SHAKESPEARE.

See an appendix to O. Elton's trans. of Saxo Grammaticus (1894); I. Gollancz, *Hamlet in Iceland* (1898); H. L. Ward, *Catalogue of Romances,* under "Havelok," vol. i. pp. 423 *seq.; English Historical Review,* x. (1895); F. Detter, "Die Hamletsage," *Zeitschr. f deut. Alter.* vol. xxxvi. (1892); O L Jiriczek, "Die Amlethsage auf Island," in *Germanistische Abhandlungen,* vol. xii. (Breslau) and "Hamlet in Iran," in *Zeitschr. des Vereins für Volkskunde,* x. (1900); A. Olrik, *Kilderne til Sakses Oldhistorie* (2 vols., 1892–94).

HAMLEY, SIR EDWARD BRUCE (1824–1893), British general and military writer, youngest son of Vice-Admiral William Hamley, was born on April 27, 1824, at Bodmin, Cornwall, and entered the Royal Artillery in 1843 He served in the Crimean War, and in 1859 became professor of military history at the new Staff College at Sandhurst, from which in 1866 he went to the council of military education, returning in 1870 to the Staff College as commandant. From 1879 to 1881 he was British commissioner successively for the delimitation of the frontiers of Turkey and Bulgaria, Turkey in Asia and Russia, and Turkey and Greece, and was rewarded with the K.C.M.G. He became a lieutenant-general in 1882, when he commanded the 2nd division of the expedition to Egypt under Lord Wolseley, and led his troops in the battle of Tel-el-Kebir. From 1885 until his death on Aug. 12, 1893, he represented Birkenhead in parliament in the Conservative interest.

Hamley's principal work, *The Operations of War* (1867), became a text-book of military instruction (last edition 1923). *See* his *Life* by Innes Shand (1895).

HAMLIN, HANNIBAL (1809–1891), vice-president of the United States (1861–65), was born at Paris, Me., on Aug. 27, 1809. After studying in Hebron academy, he conducted his father's farm for a time, became schoolmaster, and later managed a weekly newspaper at Paris. He then studied law, was admitted to the bar in 1833, and rapidly acquired a reputation as an able lawyer and a good public speaker. Entering politics as an anti-slavery Democrat, he was a member of the State house of representatives in 1836–40, serving as its presiding officer. He was a representative in Congress from 1843–47, and was a member of the U.S. Senate 1848–56. From the very beginning of his service in Congress he was prominent as an opponent of the extension of slavery; he was a conspicuous supporter of the Wilmot Proviso, spoke against the Compromise Measures of 1850, and in 1856, chiefly because of his party's endorsement of the passage in 1854 of the Kansas-Nebraska bill, which repealed the Missouri Compromise, he withdrew from the Democrats and joined the newly organized Republican Party. The Republicans of Maine nominated him for governor in the same year, and having carried the election by a large majority he was inaugurated in this office on Jan 8, 1857. In February, however, he resigned the governorship, and was again a member of the Senate 1857–61. From 1861 to 1865, during the Civil War, he was vice-president of the United States. While in this office he was one of the chief advisers of President Lincoln, and urged both the Emancipation Proclamation and the arming of the negroes. After the war he again served in the Senate (1869–81), was minister to Spain (1881–83), and then retired from public life. He died at Bangor, Me., on July 4, 1891.

See *Life and Times of Hannibal Hamlin* (Cambridge, Mass., 1899), by C. E. Hamlin, his grandson.

HAMM, a town in the Prussian province of Westphalia, on the Lippe, 19 m. by rail N.E. from Dortmund on the main line Cologne-Hanover. Pop. (1925) 49,777. Hamm, which became a town about the end of the 12th century, was fortified in 1226, and became a member of the Hanseatic League. In 1666 it came into the possession of Brandenburg, and in 1763 its fortifications were dismantled. The town possesses very extensive wire factories and machine works, breweries and manufactories of brushes, baskets, leather, starch, varnish and oil Nearby are some thermal baths, and coal mines.

HAMMĀD AR-RĀWIYA (Abūl-Qāsim Ḥammād ibn Abī Laila Sāpūr [or ibn Maisara]) (A.D. 700), Arabic scholar, was of Dailamite descent, but was born in Kufa. He was reputed to be the most learned man of his time in regard to the "days of the Arabs" (*i.e.,* their chief battles), their stories, poems, genealogies and dialects. He is said to have boasted that he could recite a hundred long *qasīdas* for each letter of the alphabet (*i.e.,* rhyming in each letter) and these chiefly from pre-Islamic times. Hence his name *Hammad ar-Rāwiya,* "the reciter of verses from memory." He was favoured by Yazīd II. and his successor Hishām, who brought him up from Irak to Damascus. To him is ascribed the collecting of the *Mo'allakāt* (*q v*). No diwan of his is extant, though he composed verse of his own.

Biography in McG. de Slane's trans. of Ibn Khallikān, vol. i. and many stories are told of him in the *Kitāb ul-Aghāni,* vol. v.

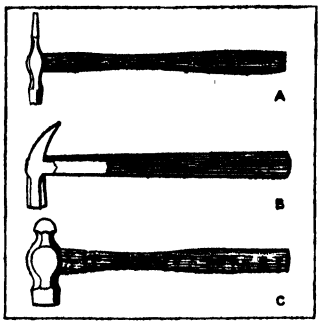
HAMMANN, OTTO (1852–), German journalist and Foreign Office official, was born on Jan. 23, 1852, at Blankenhain. He was Director of the Press Section of the German Foreign Office (1894–1916). Hammann was the trusted adviser of Prince Bülow, who always kept an attentive eye upon public opinion as reflected or created in the press. He had personally played a leading part in the defensive campaign of the Imperial Chancellor, Count Caprivi, and the Foreign Secretary, Baron Marshall von Bieberstein, in the early '90s, against the Bismarckian *fronde.* He embodied a considerable portion of the information he had obtained in the three volumes of *Erinnerungen* which he published after the Revolution: *Der neue Kurs* (1918), *Zur Vorgeschichte des Weltkriegs* (1918) and *Um den Kaiser, Erinnerungen aus den Jahren 1906–1909* (1919).

HAMMARSKJÖLD, HJALMAR (1862–), Swedish statesman, was born at Tuna on Feb. 4, 1862. He studied at Uppsala, where in 1891 he was appointed professor of civil law. He became minister of justice in the Van Otter cabinet, holding this post from 1901–02, when he was appointed president of the Göta high court. In 1905 he was minister of education in the Lundeburg cabinet and also a delegate to the conference with Norway at Karlstad at the time of the dissolution of the union. He was Swedish minister in Copenhagen from 1905–07 when he became governor (landshörding) of the province (län) of Uppsala. He had been Swedish delegate at The Hague conferences in regard to private international law in 1900 and 1904, and from 1904 was Swedish member of The Hague international board of

arbitration. In 1907 he was Sweden's leading delegate to the Hague Peace Conference and in 1909 acted as president of the Franco-German board of arbitration in regard to the Casablanca affair. He presided in 1913 over the Franco-Italian arbitration court regarding the seizure of vessels during the Tripoli War. In Feb. 1914 he succeeded Staaff as prime minister, retaining this post during the World War until 1917 (*see* SWEDEN). Hammarskjöld became a member of the Institut de Droit International and a curator of the Académie de Droit International at The Hague. In Dec. 1924 he was appointed by the Council of the League of Nations chairman of the commission relating to the codification of international law.

HAMMER, JULIUS (1810–1862), German poet, was born on June 7, 1810, at Dresden, and died at Pillnitz on Aug. 23, 1862. Hammer's *Schau' um dich, und schau' in dich* (1851), which made his name, has passed through more than 30 editions. It was followed by *Zu allen guten Stunden* (1854), *Fester Grund* (1857), *Auf stillen Wegen* (1859) and *Lerne, liebe, lebe* (1862).

HAMMER, an implement consisting of a shaft or handle with head fixed transversely to it. The head, usually of metal, has one flat face, the other may be shaped to serve various purposes, *e.g.*, with a claw, a pick, etc. The implement is used for breaking, beating, driving nails, rivets, etc., and the word is applied to heavy masses of metal moved by machinery, and used for similar purposes. (*See* TOOL.) The word is also applied to many objects resembling a hammer in shape or function. Thus the "striker" in a clock, or in a bell, when it is sounded by an independent lever and not by the swinging of the "tongue" is called a "hammer"; similarly, in the "action" of a pianoforte the word is used of a wooden shank with felt-covered head attached to a key, the striking of which throws the "hammer" against the strings. In the mechanism of a fire-arm the "hammer" is that part which by its impact on the cap or primer explodes the charge. (*See* GUN.)



SPECIMENS OF HAMMERS
A, cross pane pin hammer. B, claw hammer. C, ball pane engineer's hammer

The hammer, more usually known by its French name of *martel de fer*, was a mediaeval hand-weapon. With a long shaft it was used by infantry, especially when acting against mounted troops. With a short handle and usually made altogether of metal, it was also used by horse-soldiers.

HAMMERBEAM ROOF, in architecture, an open timber roof in which the trusses have no true cross ties, but are framed together with a series of horizontal and vertical members bracing the main rafter in triangles, and tied together by curved brackets and braces. The horizontal beams are known as hammerbeams In the greater number of cases there is an intermediate tie, about one-third of the way down the rafters, and each truss has one hammerbeam on each side with a post extending from its outer end up to the intersection of rafter and cross tie. The hammerbeam is supported by a bracket from the wall and the posts tied to the cross tie by curved members which sometimes take the form of a complete pointed arch. In the earliest extant example which is also one of the largest, that over Westminster hall, London (1395–99, 68 ft. span), an additional complete pointed arch member adds strength to the construction. The hammerbeam truss was frequently used over the naves of parish churches during the 15th and 16th centuries, as in Bacton church, Suffolk, and in March and Knapton churches, where the hammerbeams are carved with angels. This type of roof was also used over manor and other halls. The great hall of Hampton Court palace (1534–35) and that of Eltham palace (16th century), and the halls of Charterhouse (17th century) and the Middle Temple, London (1570), where there are two rows of hammerbeams, are good examples.


HAMMERBEAM ROOF IN WESTMINSTER HALL, A FINE EXAMPLE OF THE ARCHED TYPE SHOWING ITS GREAT STYLE AND DIGNITY

HAMMERFEST, the most northerly town in Europe. Pop. (1927), 3,470. It is situated on an island (Kvalö) off the north-west coast of Norway, in Finmarken *amt* (county), in 70° 40′ 11″ N., the latitude being that of the extreme north of Alaska. In spite of this, its average January temperature is little below freezing point, owing to the influence of the warm westerly winds and N. Atlantic drift, and the harbour is ice-free. The district around is barren and naturally treeless, but a "forest" of birches has been successfully planted. Hammerfest is 674 m. by sea N.E. of Trondhjem, and 78 S.W. from the North Cape. The narrow strait Strömmen separates Kvalö from the larger Seiland, whose snow-covered hills with several glaciers rise above 3,500 ft., while an insular rampart of mountains, Sorö, protects the strait and harbour from the open sea. The town is timber-built and modern; much of it having been rebuilt after fire in 1890. The sun does not set at Hammerfest from May 13 to July 29. This is the busy season of the townsfolk. Vessels set out to the fisheries, as far as Spitsbergen and the Kara Sea; and trade is brisk, not only Norwegian and Danish but British, German and particularly Russian vessels engaging in it.

Cod-liver oil, train oil and salted fish are exported with some reindeer-skins, fox-skins and eiderdown; and coal and salt for curing are imported. In the spring the great herds of tame reindeer are driven out to swim Strömmen and graze in the summer pastures of Seiland; towards winter they are called home again. From Nov. 18 to Jan. 23 the sun is not seen, and the enforced quiet of winter prevails. Electric light was introduced in the town in 1891, and it is the wireless station for Spitsbergen.

HAMMERHEAD SHARK. Any of several species of ovoviviparous sharks of the genus *Sphyrna*, characterised by the unique configuration of the head, the anterior portion of which resembles a hammer. They are formidable and ferocious and occur in all tropical and sub-tropical seas, particularly in the Indian ocean. The common hammerhead shark (*S. zygoena*), which attains a length of 16 ft., occurs on the milder coasts of Europe and ranges northward along American shores to Massachusetts and California. *See* SHARKS, SELACHIANS.

HAMMER-KOP or **HAMMERHEAD** (*Scopus umbretta*), an African bird, put in a family, *Scopidae*, between the shoe-bills and storks. It inhabits nearly the whole of Africa and Madagascar, frequenting wooded districts. Though not larger than a raven, it builds a nest some six feet in diameter, with a flat-topped roof and a small hole for entrance and exit, placed on a tree or a rocky ledge. In this it lays three to five white eggs. The bird, of brown colour, slightly glossed with purple and its tail barred with black, has a long crest, generally borne horizontally, and that has given rise to its common name. It is also called the tufted umbre, or in French *umbrette*, from the almost uniform earthy brown (*umber*) colour of the plumage. The bird stands beside a stream, with head drawn in like a heron, watching for fish or frogs.

HAMMER-PURGSTALL, JOSEPH, FREIHERR VON (1774–1856), Austrian orientalist, was born at Graz on June 9,

1774. Entering the diplomatic service in 1796, he held a series of appointments in the Near East. He retired from the service in 1835, and died at Vienna on Nov. 23, 1856. For 50 years Hammer-Purgstall wrote incessantly on the most diverse subjects and published numerous texts and translations of Arabic, Persian and Turkish authors. He did for Germany the same work that Sir William Jones (*q.v.*) did for England and Silvestre de Sacy for France. He was an assiduous worker, and in spite of many faults did more for oriental studies than most of his critics put together. His principal work is his *Geschichte des osmanischen Reiches* (10 vols., Pesth, 1827–35; French trans. 1835–43). Among his other works are *Gesch. der Assassinen* (1818; Eng. trans. 1835); *Constantinopolis und der Bosporos* (1822); *Sur les origines russes* (St. Petersburg, 1825); *Geschichte der osmanischen Dichtkunst* (1836); *Geschichte der Goldenen Horde in Kiptschak* (1840); *Geschichte der Chane der Krim* (1856); and an unfinished *Literaturgeschichte der Araber* (1850–56).

For a full list of his works, which amount in all to nearly 100 volumes, including his texts and translations, see *Comptes rendus* of the Acad. des Inscr. et des Belles-Lettres (1857). *See* also Schlottman, *Joseph von Hammer-Purgstall* (Zürich, 1857).

HAMMERSMITH, a western metropolitan borough of London, England, bounded E. by Kensington and S. by Fulham and the river Thames, and extending N. and W. to the boundary of the county of London. Pop (1921) 130,295. The name appears in the early forms of *Hermodewode* and *Hamersmith;* the derivation is probably from the Anglo-Saxon, signifying the place with a haven (*hythe*). Hammersmith is mentioned with Fulham as a winter camp of Danish invaders in 879, when they occupied the island of Hame, identified with Chiswick Eyot. Hammersmith consists of residential streets. Shepherd's Bush in the east is a populous and poor quarter. Boat-building yards, lead-mills, oil mills, distilleries, coach factories, motor works, and other industrial establishments are found in the borough. Old Hammersmith bridge, designed by Tierney Clark (1824), was the earliest suspension bridge erected near London, and was found insecure and replaced in 1884–87. Until 1834 Hammersmith formed part of Fulham parish. Its church of St. Paul was built as a chapel of ease to Fulham, and consecrated by Laud in 1631. The existing building dates from 1890. St. Paul's school, one of the principal public schools in England, was founded in or about 1509 by John Colet, dean of St. Paul's, under the shadow of the cathedral church. But it appears that Colet actually refounded and reorganized a school which had been attached to the cathedral of St. Paul from very early times; the first mention of such a school dates from the early part of the 12th century. The school was moved to its present site in Hammersmith road in 1883. The number of foundation scholars is 153, according to the number of fishes taken in the miraculous draught. The school governors are appointed by the Mercers' Company (by which body the new site was acquired), and the universities of Oxford, Cambridge and London There are, besides, the Edward Latymer foundation school for boys (1624), part of the income of which is devoted to general charitable purposes; the Godolphin school, founded in the 16th century and remodelled as a grammar school in 1861, Nazareth House of Little Sisters of the Poor and other institutions. At Shepherd's Bush are the grounds and buildings first occupied by the Franco-British Exhibition of 1908, including a stadium for athletic displays. In the neighbourhood of the Mall, bordering the river, are the house where Thomson wrote his poem "The Seasons," and Kelmscott house, the residence of William Morris. The parliamentary borough of Hammersmith returns two members.

HAMMER THROWING, a feat consisting of hurling to the greatest possible distance an implement of specified weight and design, styled a "hammer," so that it shall fall within a 90° sector marked upon the ground, while the thrower remains within a 7ft. circle from which the throwing takes place. The sport is probably of Celtic origin. Mention is made in the *Book of Leinster* of the *roth cleas,* or wheel feat, at the Tailteann games at Tara in Ireland. It is believed that the earliest missile employed was a chariot wheel attached to a fixed axle and that a large stone was substituted instead of the wheel at the beginning of the Christian era. Later still, a blacksmith's sledge-hammer was preferred, and the first real hammer throwing became known throughout England, Scotland and Ireland. The sport was encouraged by Edward II. and practised proficiently by Henry VIII.

Quite early in the days of the 19th century hammer throwing competitions became very popular, and men began to cast round for a means of throwing further The oblong hammer head then gave place to a lead or iron ball, weighing 16 lb. or 21 lb., and next, the stiff wooden shaft was replaced with flexible cane or whalebone about ⅛in. in diameter In those days the thrower stood at a mark, whirled the hammer several times round his head and let it fly away backwards over his shoulder. In this style 110ft. was beaten, but 120ft. never fairly reached

A very big improvement came about when the Irish school of athletes evolved the notion that much more force must be generated if the hammer head, in describing the circumference of a circle, was attached not to a fixed, but to a revolving central point, *i.e.*, the thrower's body, which would generate its own momentum. This led to the modern method of delivering the throw at the end of one, two or even three turns within the narrow confines of the 7ft. circle. Another improvement which has made the tremendous modern records possible is the evolution of the present-day implement, which is a "hammer" by title of courtesy alone. The head comprises a lead or brass shell attached by a ball-bearing swivel to a straight length of steel spring wire not less than ⅛in in diameter, terminating in either a single or double loop The total weight of the hammer as thrown is 16 lb and the length over all not more than 4 feet Thus the greatest mechanical advantage, that of having the entire weight of the missile at the end, as well as the least friction, has been obtained.

The second turning movement was introduced into hammer throwing by J. J. Flanagan, an Irish-American. Flanagan set the world's record mark at 172ft. 11in. in 1904; but, meantime, he had been beaten by A. D Plaw, University of California, who was using three turns. Flanagan realized that he had reached his limit with the two turn method and for three years he worked patiently until he was able to control the throw fully with three turns. With this style he still further increased his record to 181 feet Since Flanagan's time there have been two even greater throwers: F. D. Tootell, Bowdoin college, who holds the All-American collegiate record of 181ft. 6½in , and the Irish-American, P. Ryan, who in 1913 set up the wonderful record of 189ft. 6½ inches Ryan stands 6ft. 2in in height and, in his prime, weighed just about 17 stone (238 lb).

One of the most marvellous throwers of all time was the late A. E. Flaxman, who fell in the first battle of the Somme, July 1, 1916. This Yorkshireman stood 5ft 9in in height, weighed less than 11 stone (154 lb), and yet, employing four turns, threw over 150ft., or rather more than one foot of distance for every pound of his own weight.

In Scotland there is still held a championship for throwing the stiff-shafted hammer from the standing position, but this form of throwing is not used elsewhere The orthodox style of throwing the 16 lb. hammer is a championship event in almost every country nowadays, it is also an Olympic event The sport is essentially one which should be practised by big men of exceptional strength and quickness; and whose senses of rhythm and timing are fully developed Some idea may be had of the strength which is necessary for the practice of this sport when it is stated that in the case of a 16 lb hammer being thrown to a distance of even 150ft , the centrifugal force exerted or, in other words, the pull upon the thrower's arms and body is equal to 366 pounds. It is also interesting to note that the velocity of the hammer at the instant of release from the hands is 69ft per second; if the throw is made at the correct angle of 45° the greatest vertical height attained during its flight is 37ft. 6in , and the time of its flight is just over 3 seconds.

Method of Throwing.—The athlete takes up his position at the rear edge of the circle with his back turned towards the direction in which the throw is to be made, feet about 18in. apart. The last joints of the fingers only are inserted in the loops of the

handle, the hammer-head rests upon the ground to the right and so far back that the thrower's hands are on a level with his knee. Next, the hammer is raised and swung three or four times about the head. When sufficient momentum has been set up, the athlete pivots sharply on his left foot, places down the right foot and repeats the evolution two, three or even four times, taking care always to keep his body moving well ahead of the hammer. The speed increases with each turn The throw is made at the end of the final turn by a complete straightening of the body and arms. The delivery is made over the left shoulder, and, immediately afterwards, the thrower reverses his position, so that he ends up facing the direction of the flight of the hammer. The longest throw made with a wooden-shafted hammer was that of T. R. Nicholson, Scotland, 1927, 146ft., when he was nearly 48 years of age.

See F. A. M. Webster, *Athletics* (1925); Silfverstrand and Rasmussen, *Text Book of Athletics* (1926); T. E Jones, *Track and Field* (1926). (F. A. M. W.)

HAMMER-TOE, a painful condition in which a toe is rigidly bent and the salient angle on its upper aspect is constantly irritated by the boot and develops a corn (*q v*). It is treated surgically, not as formerly by amputation of the toe, but the toe is made permanently to lie flat by the simple excision of the small digital joint. Even in extremely bad cases of hammer-toe the operation of resection of the head of the metatarsal phalanx is to be recommended rather than amputation.

HAMMOCK, a hanging bed or couch, perhaps derived from the hamack tree, the bark of which was used by the natives of Brazil to form the nets, suspended from trees, in which they slept.

HAMMOND, HENRY (1605–1660), English divine, was born at Chertsey in Surrey on Aug. 18, 1605. He was educated at Eton and at Magdalen college, Oxford, and took orders in 1629 The earl of Leicester presented him to the living of Penshurst in Kent in 1633. In 1643 he was made archdeacon of Chichester. He was a member of the convocation of 1640, and was nominated one of the Westminster Assembly of divines. Instead of sitting at Westminster he took part in the unsuccessful rising at Tunbridge in favour of King Charles I., and was obliged to flee in disguise to Oxford, then the royal headquarters He accompanied the king's commissioners to London, and afterwards to the Uxbridge convention in 1645, where he disputed with Richard Vines, one of the parliamentary envoys. He attended the king as chaplain during his captivity When Charles was deprived of all his loyal attendants at Christmas 1647, Hammond returned to Oxford and was made subdean of Christ Church, but was removed from all his offices by the parliamentary visitors, who imprisoned him for ten weeks Afterwards he was permitted to retire to the house of Philip Warwick at Clapham, Bedfordshire. In 1650, having regained his full liberty, Hammond betook himself to the friendly mansion of Sir John Pakington, at Westwood, in Worcestershire, where he died on the 25th of April 1660, on the eve of his preferment to the see of Worcester

His Works (4 vols., 1674–84) contain an admirable biography of him by Bishop Fell, reprinted in C. Wordsworth, *Ecclesiastical Biography*, vol. iv. (4th ed., 4 vols., 1853). *See* G. G. Perry, *Life of Henry Hammond* (1862).

HAMMOND, JOHN HAYS (1855–), American mining engineer, was born in San Francisco (Calif.), on March 31, 1855. He studied at the Sheffield scientific school, Yale university until 1876, and afterwards took a course at the Royal school of mines, Freiburg, Saxony In 1880 he was engaged in the U S. geological survey of the California gold fields, afterwards practising as consulting engineer, in which capacity he visited most of the countries of North and South America. In 1893 he became associated with Barnato Bros. and Cecil Rhodes in South Africa, acting as consulting engineer for the Consolidated Gold Fields Company of South Africa, the British South Africa Company, and the Randfontein Estates Gold Mining Company. As one of the leaders of the Rand faction, he was, in January, 1896, after the Jameson raid, arrested and condemned to death, but the sentence was commuted, and later he was released on payment of a $125,000 fine In 1900 he returned to the United States and became largely interested in mining properties and irrigation projects both in the United States and Mexico. He was president of the Panama Pacific Exposition commission to Europe, 1912; chairman of the World Court commission, 1914–15; and chairman of the U.S. coal commission, 1922–23. In 1903 he became general manager and consulting engineer of the Guggenheim Exploration Company. In 1911 he was special ambassador to represent the U S Government at the coronation of King George V.

His son, JOHN HAYS HAMMOND, JR. (1888–), American inventor, was born in San Francisco (Calif.), on April 13, 1888. He studied at the Sheffield scientific school, Yale university, from which he graduated in 1910. Devoting himself to electrical developments and experiment, he invented a torpedo for coast defence controlled by wireless energy, a system of radio control of ships and a system of selective radio telegraphy, an improvement for pipe organ mechanisms, and a new type of reflecting modulator for pianos

HAMMOND, JOHN LAWRENCE LE BRETON (1872–), British author and journalist, was educated at Bradford grammar school and St John's college, Oxford. He was editor of the *Speaker* from 1899 to 1906, when he joined the staff of the *Tribune* as leaderwriter In 1907 he was appointed secretary to the civil service commission He served in the World War with the Lowland division (Sept. 1915 to Aug 1916), and on his discharge obtained a post in the ministry of reconstruction Hammond is the historian of the industrial revolution in England; in his works on this subject, which are indispensable to the student, he had the assistance of his wife Barbara Hammond His chief journalistic work was done on the *Manchester Guardian* His publications include: *Charles James Fox* (1903); *The Village Labourer, 1760–1832* (1911, and later eds); *The Town Labourer 1760–1832* (1917); *The Skilled Labourer 1760–1832* (1919); *Lord Shaftesbury* (1923); *The Rise of Modern Industry* (1925). He was one of the authors of *Liberalism and the Empire* (1900), and collaborated in *Essays on Liberalism by Six Oxford Men* (1900).

HAMMOND, a city of Lake county, Ind., U.S A., on Lake Michigan and the Grand Calumet and the Little Calumet rivers, 18m. S E. of the Chicago "Loop" It is on 9 marked highways, including Federal route 41 and the Indianapolis boulevard, the main thoroughfare into Chicago from the south-east, over which 25,000 vehicles pass daily; it is served by the Chesapeake and Ohio, the Chicago, Indianapolis and Louisville, the Erie, the Michigan Central, the New York Central, the Nickel Plate and the Pennsylvania railways and by four industrial belt lines. Two miles south is the Hammond Ford air-port (1,440ac. of level ground, thoroughly equipped and lighted) from which there is regular freight, passenger and mail service to Detroit and Chicago. The population was 36,004 in 1920 (22 5% foreign-born white) and was estimated locally at 65,000 in 1928. Hammond is one of the fast growing cities in the important industrial district around the foot of Lake Michigan known as the Calumet region. It has an area of 27 sq m., and directly adjoins the cities of Whiting, East Chicago and Calumet city. Manufacturing industries had an output in 1925 valued at $50,874,473. Chief among them are the building of freight and passenger railroad cars, which employs 3,000 men, steel fabrication, oil refining, printing and book-binding, and the manufacture of railroad equipment, chemicals, surgical instruments, prepared stock-feeds and pianos. Several railroads have repair shops here, and there are large iron and brass foundries. A steel plant (designed to employ 15,000 men) is under construction (1928) on a 1,300ac. site. Clearings in 1927 amounted to $298,404,000, and the assessed valuation of property was $85,818,475

Hammond dates from 1868, when George H. Hammond of Detroit established a packing plant here. The settlement at first was called State-Line, but in 1873 the name was changed to honour Hammond. It was chartered as a city in 1883. In 1890 the population was 5,428 By 1900 it was 12,376, and Hammond had become the principal slaughtering and meat-packing centre in Indiana. A little later the removal of one plant caused the loss of this position and a temporary reduction in the aggregate volume

of manufacturing, but this was more than compensated after 1905 by the establishment of new industries to which the present development is due. In 1910 the population had reached 20,925, and in the following decade it increased 72%. The factory output increased 147% in the ten years between 1915 and 1925.

HAMMONTON, a town of Atlantic county, N.J., U.S.A., midway between Philadelphia and Atlantic City, on the Lincoln highway, and served by the Pennsylvania and the Reading railways. The population was 6,417 in 1920 (26% foreign-born white) and was estimated locally at 10,000 in 1928. It is in a fertile region producing especially peaches, berries and poultry; and its manufactures include shoes, clothing, macaroni, cigars, canned fruits, tapestry and cut-glass ware.

HAMMURABI, 6th king of the Amoritic or West Semitic dynasty of Babylonia, reigned 43 years, 2067–2025 B.C. and is one of the most illustrious figures of ancient history. The so-called 1st Babylonian dynasty was founded by Sumu-abu in 2169 B.C. at Babylon, which thus was raised from an unimportant town on the eastern bank of the Euphrates to the dignity of a capital, and a rival of the far more ancient and greater city, Kish, 8 m. to the east. The invasion of Babylonia by the Canaanitic race of the west had already resulted in the founding of a West Semitic dynasty at Isin in 2301 B.C., a city in southern Sumer, which, until the rise of the Canaanitic kingdom of Babylon, shared with Ellasar the control of Sumer and Accad. At first, the kingdom founded at Babylon by this ancestor of the famous line of 11 kings at Babylon had control of only a small region north and south of the capital, and under the first two kings there was even a rival kingdom at Kish, only 8 m away. During the reigns of Hammurabi's five predecessors the kingdoms of Isin and Ellasar successfully maintained control of the whole southern area of Babylonia; and Sinmuballit, predecessor of Hammurabi, conquered and put an end to the kingdom of Isin with the aid of Rim-Sin of Ellasar, in 2076, or only nine years before Hammurabi came to the throne, only to lose it again to Rim-Sin, the powerful king of Ellasar, seven years later, and Hammurabi himself did not gain control of the whole of Babylonia and put an end to the kingdom of Rim-Sin until his 30th year (2038).

Although his father, Sinmuballit, had largely succeeded in bequeathing to his illustrious son the united control of Sumer and Accad, the military and political achievement of Hammurabi in finally establishing a central and efficient Government at Babylon, which included not only Sumer and Accad, but extended northward to the central provinces of the Tigris and Euphrates, must be regarded as one of the most far-reaching events in ancient history. Henceforth Babylon was to be the political and intellectual centre of West Asiatic history right down to the Christian era. His name is particularly associated with the great law code promulgated for the use of the courts throughout the empire. The only fairly complete text of this Semitic code was found at Susa, inscribed on a diorite stela 8 ft. high, which had been taken to Elam as plunder by invaders during the later period of Babylon's decline, probably in the period of the Pashe dynasty (12th–11th centuries). The text is inscribed in 21 horizontal columns on the obverse beneath a bas relief of the king, who stands in attitude of prayer before the seated sun god (Shamash), who delivers to Hammurabi the laws of the kingdom, a *motif* undoubtedly connected with the legend of Moses and the revelation of the Decalogue from Yahweh on Mt. Sinai. The last five or six columns of the obverse have been defaced by the Elamitic invader, who probably intended to inscribe here a relation of his conquest of Babylon. The reverse is complete and carries 28 horizontal columns. The first four columns and top of column five of the obverse, contain the prologue, which is the principal source for Hammurabi's extensive restorations of the temples and cults of Babylonia and Assyria. The last five columns of the reverse contain the epilogue, a glorification of the mighty works of peace executed by Hammurabi. Sixty-five laws are contained on the obverse, and about 40 laws are defaced at the bottom; the reverse contains 183 laws. Fragments of the code as redacted on a series of tablets for use at Nippur in the same period have been excavated there, and fragments of an Assyrian copy of the 7th century were found at Nineveh These partially restore the great gap in the Susa stela.

Hammurabi is generally identified with Amraphel, king of Shinar, who with Arioch of Ellasar, Cheodorla'omar of Elam and Tidal, king of Goiim, invaded Canaan in the days of Abraham Since Hammurabi apparently enjoyed peaceful relations with the powerful Elamtic king, Rim-Sin of Ellasar, and his father, Kudurmabug, *ad-da* of Emutbal and of Amurru, the biblical records appear to harmonize with these facts and the identification has never been successfully disproved.

Although no great literary or historical documents from his reign have survived, a great number of administrative documents and letters from it are known and are constantly increasing. There is little doubt but that the theological reconstruction of the Sumerian pantheon, by which the priests of Babylon raised Marduk, the local deity, to the rank of a great god, began at this time To his and the succeeding reigns of Samsuiluna, Abi-eshu', Ammiditana and Ammizaduga, may certainly be ascribed the gradual completion of the Accadian version of the Epic of Creation in six books or tablets, in which Marduk is made to displace the older Ninurta of the Sumerian legend of Creation. Hammurabi regularly employs *Sumerian* as the language of his records of temple and cult restorations and of other dedicatory inscriptions, as did all his successors

The derivation of his name is disputed; the element *ḫammu, 'ammu, ammu, ammi* is clearly the West Semitic word *'am*, "family, relative," Arabic *"uncle,"* and it is characteristic of West Semitic religion to describe a deity as "father, brother, uncle." A grammatical gloss explains *ḫammu* by *kimtu*, "family." The element *rabi* is usually explained as meaning "great," "the uncle is great." There is another king by this name of the Canaanitish kingdom of Hana, whose capital Tirga is the modern Ashârah on the middle Euphrates, near the mouth of the Ḫabur. This name is spelled Ammurabi, and Ḫammurapiḫ; the Ḫana kingdom is contemporary with the Cassite dynasty of Babylonia. Since the name of the famous king of Babylon is once written *Ammurapi* it has been argued that the name should be pronounced *Hammurapi, Ammurapi,* with the meaning "the uncle is exalted, high," but this suggestion is not generally accepted.

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HAMON, JEAN LOUIS (1821–1874), French painter, was born at Plouha on May 5, 1821. In the year 1848 he made his appearance at the Salon with "Le Tombeau du Christ" (Musée de Marseille). "La Comédie humaine," which he exhibited in 1852 at the Salon turned the tide of his fortune, and "Ma soeur n'y est pas" (purchased by the emperor) obtained a third-class medal in 1853. He travelled in the East and spent some time in Italy, chiefly at Capri. Hamon died on May 29, 1874.

HAMPDEN, HENRY BOUVERIE WILLIAM BRAND, 1ST VISCOUNT[1] (1812–1892), speaker of the House

[1]An earlier viscountcy was bestowed in 1776 on Robert Hampden-Trevor, 4th Baron Trevor (1706–1783), a great-grandson of the daughter of John Hampden, the patriot; it became extinct in 1824 by the death of the 3rd viscount.

of Commons, was the second son of the 21st Baron Dacre, and descended from John Hampden, the patriot, in the female line; the barony of Dacre devolved on him in 1890, after he had been created Viscount Hampden in 1884. He entered parliament as a Liberal in 1852, and for some time was chief whip of his party. He was speaker of the House of Commons from 1872 to 1884. His term of office is memorable for his action on Feb 2, 1881, in refusing further debate on W. E Forster's Coercion bill—a step which led to the formal introduction of the closure into parliamentary procedure He died on March 14, 1892.

HAMPDEN, JOHN (*c.* 1595–1643), English statesman, the eldest son of William Hampden, of Great Hampden in Buckinghamshire, where the family is said to have been established before the Conquest, and of Elizabeth, second daughter of Sir Henry Cromwell, and aunt of Oliver, the future protector, was educated at the grammar school at Thame and at Magdalen college, Oxford In 1613 he was admitted a student of the Inner Temple He first sat in parliament for the borough of Grampound in 1621, representing later Wendover in the first three parliaments of Charles I., Buckinghamshire in the Short Parliament of 1640, and Wendover again in the Long Parliament. In the early days of his parliamentary career he was content to be overshadowed by Eliot, as in its later days he was content to be overshadowed by Pym and to be commanded by Essex

In 1626 Hampden took an active part in the preparation of the charges against Buckingham In January 1627 he was bound over to answer at the council board for his refusal to pay the forced loan. Later in the year he was committed to the gatehouse, and then sent into confinement in Hampshire, from which he was liberated just before the meeting of the third parliament of the reign, in which he once more rendered useful but unobtrusive assistance to his leaders It was not till 1637, however, that his resistance to the payment of ship-money gained for his name the lustre which it has never since lost. (*See* SHIP-MONEY) Seven out of the 12 judges sided against him, but the connection between the rights of property and the parliamentary system was firmly established in the popular mind The tax had been justified, says Clarendon, who expresses his admiration at Hampden's "rare temper and modesty" at this crisis, "upon such grounds and reasons as every stander-by was able to swear was not law" (*Hist.* i. 150, vii 82)

In the Short Parliament of 1640 Hampden led the opposition (May 4) to the grant of 12 subsidies in return for the surrender of ship-money Parliament was dissolved the next day, and on the 6th an unsuccessful search was made among the papers of Hampden and of other chiefs of the party to discover incriminating correspondence with the Scots In the Long Parliament, though Hampden was by no means a frequent speaker, it is possible to trace his course with sufficient distinctness. His power consisted in his personal influence, and as a debater rather than as an orator. Unwearied in attendance upon committees, he was always at hand to second Pym, whom he plainly regarded as his leader Hampden was one of the eight managers of Strafford's prosecution. Like Pym, he was in favour of the more legal and regular procedure by impeachment rather than by attainder; and his influence secured a compromise under which Strafford's counsel were heard as in the case of an impeachment, and thus a serious breach between the two Houses was averted

Hampden was among the opponents of episcopacy. It is not that he was a theoretical Presbyterian, but he distrusted the bishops as he distrusted the monarchy. No serious importance therefore can be attached to the offers of advancement made from time to time to Hampden and his friends. Charles would gladly have given them office if they had been ready to desert their principles. Every day Hampden's conviction grew stronger that Charles would never abandon the position which he had taken up. In August 1640 Hampden was one of the four commissioners who attended Charles in Scotland. He was a warm supporter of the Grand Remonstrance, and was marked out as one of the five impeached members whose attempted arrest brought at last the opposing parties into open collision (*see* also PYM, STRODE, HOLLES and LENTHALL) In the angry scene which arose on the proposal to print the Grand Remonstrance, it was Hampden's personal intervention which prevented an actual conflict, and it was after the impeachment had been attempted that Hampden laid down the two conditions under which resistance to the king became the duty of a good subject. Those conditions were an attack upon religion and an attack upon the fundamental laws. There can be no doubt that Hampden fully believed that both those conditions were fulfilled at the opening of 1642.

When the Civil War began Hampden was appointed a member of the committee for safety, levied a regiment of Buckinghamshire men for the parliamentary cause, and in his capacity of deputy-lieutenant carried out the parliamentary militia ordinance in the county. He took no actual part in the battle of Edgehill. His troops in the rear, however, arrested Rupert's charge at Kineton, and he urged Essex to renew the attack here, and also after the disaster at Brentford. In 1643 he was present at the siege and capture of Reading. But it is not on his skill as a regimental officer that Hampden's fame rests. In war as in peace his distinction lay in his power of disentangling the essential part from the non-essential. In the constitutional struggle he had seen that the one thing necessary was to establish the supremacy of the House of Commons. In the military struggle which followed he saw, as Cromwell saw afterwards, that the one thing necessary was to beat the enemy. He protested at once against Essex's hesitations and compromises. In the formation of the confederacy of the six associated counties, which was to supply a basis for Cromwell's operations, he took an active part His influence was felt alike in parliament and in the field. But he was not in supreme command, and he had none of that impatience which often leads able men to fail in the execution of orders of which they disapprove. His life was sacrificed to his devotion to the call of discipline and duty On June 18, 1643, when he was holding out on Chalgrove Field against the superior numbers of Rupert till reinforcements arrived, he received two carbine balls in the shoulder Leaving the field he reached Thame, survived six days, and died on the 24th He was buried in the church of Great Hampden

Hampden married (1) in 1619 Elizabeth, daughter of Edmund Symeon of Pyrton, Oxfordshire, and (2) Letitia, daughter of Sir Francis Knollys and widow of Sir Thomas Vachell By his first wife he had nine children, one of whom, Richard (1631–1695), was chancellor of the exchequer in William III.'s reign; from two of his daughters are descended the families of Trevor-Hampden and Hobart-Hampden, the descent in the male line becoming apparently extinct in 1754 in the person of his grandson John Hampden.

See S. R. Gardiner's *Hist. of England* and *of the Great Civil War;* the article on Hampden in the *Dict. of Nat. Biography*, by C. H. Firth, with authorities there collected; Clarendon's *Hist. of the Rebellion;* Sir Philip Warwick's *Mems*, p. 239; Wood's *Ath. Oxon*, iii. 59; Lord Nugent's *Memorials of John Hampden* (1831); Macaulay's *Essay on Hampden* (1831). The printed pamphlet announcing his capture of Reading in Dec. 1642 is shown by Firth to be spurious, and the account in *Mercurius Aulicus*, January 27 and 29, 1643, of Hampden commanding an attack at Brill, to be also false, while the published speech supposed to be spoken by Hampden on Jan 4, 1642, and reproduced by Forster in the *Arrest of the Five Members* (1660), has been proved by Gardiner to be a forgery (*Hist. of England*, x. 135). Firth has also shown, in *The Academy* for 1889, Nov. 2 and 9, that "the belief that we possess the words of Hampden's last prayer must be abandoned."

HAMPDEN, JOHN (*c.* 1656–1696), the second son of Richard Hampden (1631–1695), returned to England after residing for about two years in France, and joined himself to Lord William Russell and Algernon Sidney and the party opposed to the arbitrary government of Charles II. With Russell and Sidney he was arrested in 1683 for alleged complicity in the Rye House plot; as he could not pay the fine of £40,000 imposed upon him he remained in prison. In 1685, after the failure of Monmouth's rising, Hampden was again brought to trial, and on a charge of high treason was condemned to death. But the sentence was not carried out, and having paid £6,000 he was set at liberty. In the Convention parliament of 1689 he represented Wendover. He died by his own hand on Dec. 12, 1696. Bishop Burnet, who was one of his friends, described him as "one of the learnedest gentlemen I ever knew."

HAMPDEN, RENN DICKSON (1793–1868), English divine, bishop of Hereford, was born in Barbados, where his father was colonel of militia, and was educated at Oriel College, Oxford. After holding various curacies he returned to Oxford in 1829 and was Bampton lecturer in 1832. His lectures, *The Scholastic Philosophy in its relation to Christian Theology*, were printed in 1833. He became principal of St. Mary's Hall (1833), professor of moral philosophy (1834) and Regius professor of divinity (1836). His nomination by Lord John Russell to the vacant see of Hereford in 1847 was the signal for a violent and organized opposition on account of his supposed Arian leanings; and his consecration in March 1848 took place in spite of a remonstrance by many of the bishops and the resistance of Dr. John Merewether, the dean of Hereford, who voted against the election when the *congé d'élire* reached the chapter. Among the more important of Hampden's later writings were the articles on Aristotle, Plato and Socrates, contributed to the eighth edition of the *Encyclopædia Britannica*, and afterwards reprinted with additions under the title of *The Fathers of Greek Philosophy* (Edinburgh, 1862). He died in London on April 23, 1868.

See Henrietta Hampden, *Some Memorials of R. D. Hampden* (1871).

HAMPDEN, WALTER (1879–), American actor, was born in Brooklyn, N.Y., on June 30, 1879. After graduating from Brooklyn Polytechnic institute in 1900 he spent a year in study at Paris and then joined Frank R. Benson's company in classical repertoire in England, where he made his first stage appearance. With this company, then noted as a training school for actors, Hampden remained three years, playing more than 70 rôles, chiefly in Shakespearian plays Following this he was engaged for three seasons as leading man in the Adelphi theatre, London, where in 1905 he first acted Hamlet, succeeding the younger Irving in the rôle. Returning to America in 1907 he created an impression by his rendition of the title rôles in *The Master Builder* and *The Servant in the House*. Later he gave important performances in *The Yellow Jacket*, *Salome*, *The Tempest* and *The Wayfarer* and gained wider recognition by his tours in Shakespearian repertoire. In 1923–24 he revived *Cyrano de Bergerac*. In 1925 he leased the old Colonial theatre, in which he gave notable performances of *Hamlet* and *The Merchant of Venice* in 1925–26, *The Immortal Thief* and *Caponsacchi* in 1926–27 and *The Enemy of the People* in 1927–28. As a Shakespearian actor Hampden is ranked high, and his representation of Hamlet was generally characterized by dramatic critics as the finest in America since that of Edwin Booth

HAMPDEN-SIDNEY, a village of Prince Edward county, Virginia, U S A , 70m S.W of Richmond, with a population of about 350 in 1928 The nearest railroad station is Farmville, 6m. N.W., on the Norfolk and Western railway. It is the seat of Hampden-Sidney college, founded as an academy in 1775 by the Presbytery of Hanover, and incorporated as a college in 1783. Among the incorporators were Patrick Henry and James Madison. Many of its graduates have been prominent in public life and as educators and preachers.

HAMPSHIRE or **COUNTY OF SOUTHAMPTON** (abbreviated Hants.), a southern county of England, bounded north by Berkshire, east by Surrey and Sussex, south by the English Channel and west by Dorsetshire and Wiltshire. The area is 1,623·5 square miles. Pop. (1921), 1,004,918. It is the county which has grown around the maritime entries of Southampton Water and the Christchurch Avon Its jurisdiction has spread over the hills to the north almost as far as the Kennet, the adjoining county of Berkshire northward having grown valleywards both north and south of the White Horse hills.

Geology.—Somewhat to the north of the centre of the county is a broad expanse of hilly chalk country included in the western downs and exceeding 850 ft. in the Beacon and other hills; the whole of it has been folded, the dip to the north being steeper than that to the south. In the north the chalk disappears beneath Tertiary strata of the London basin, and some little distance south of Winchester it runs in a similar manner beneath the Tertiaries of the Hampshire basin. Scattered here and there over the chalk are small outlying remnants which show that the two Tertiary areas were once continuous The lower Greensand is represented by sandstones and limestones, forming the high ridge that runs on towards Hindhead, then by the sands and clays of the Sandgate beds which lie in the low ground west of the ridge, and finally by the Folkestone beds; all these dip westward beneath the gault. Between the gault and the chalk is the Upper Greensand, with a hard bed of calcareous sandstone, which stands up in places as a prominent escarpment. A gentle anticline brings up the chalk through the Tertiary rocks near Fareham. The Tertiary rocks of the north (London basin) about Farnborough, Aldershot and Kingsclere, comprise the Reading beds and London clay, often covered by heathy commons of the more sandy Bagshot beds The southern Tertiary rocks of the Hampshire basin include the Lower Eocene Reading beds—used for brick-making—and the London clay, which extend from the boundary of the chalk by Romsey, Bishop's Waltham, to Havant. These are succeeded towards the south by Upper Eocene beds, the Bracklesham beds and the Barton clay. The Barton clays are rich in fossils, and the Bagshot beds at Bournemouth contain numerous remains of subtropical plants Clays and sands of Oligocene age (unknown in the London basin) are found near Lymington, Brockenhurst and Beaulieu; they include the Headon beds, with a fluvio-marine fauna, well exposed at Hordwell cliffs, and the marine beds of Brockenhurst

The Solent and the Spithead, which now separate the Isle of Wight from the mainland, are thought to mark the lower course of a river the upper valley of which approximated to that of the present river Frome Southampton Water, Christchurch bay, and the channels separating Hayling and Portsea islands are further evidences of submergence Rivers, once tributaries in a greater system, now find their way independently to the sea The river Avon, in the south-west, rises in Wiltshire, and is joined by the Stour close to its mouth below Christchurch The Lymington or Boldre river rises in the New Forest and enters the Solent through Lymington creek. The Beaulieu in the eastern part of the forest also enters the Solent. The Test rises near Overton in the north, and after its junction with the Anton at Fullerton passes Stockbridge and Romsey, and enters the head of Southampton Water, which also receives the Itchen and the Hamble The Wey, the Loddon and the Blackwater, rising in the north-eastern part of the county, bring that part into the basin of the Thames. The streams from the chalk hills run clear and swift, and the trout-fishing in the county is famous Salmon are taken in the Avon.

History.—The few prehistoric beaker-pots found on the chalk hills of Hampshire may be connected with those of Wiltshire, or may indicate penetration from the coast (*See* Fox, *Arch. Camb.*, 1928) Later, Southampton Water and the Christchurch Avon, with easy access to the chalk downs, encouraged maritime intercourse. Palstaves from Bitterne, near Southampton, and from the New Forest, together with a type of socketed celt found in a hoard at Ventnor in the Isle of Wight, can be matched by many finds in north-west France, and may have been objects of early trade. (*See* Crawford, "Prehistoric Trade between England and France," *L'Anthropologie*, 1913) La Tène I brooches from Winchester and Shoddesdon farm, Weyhill, suggest a continuation of this trade for many centuries (*See* Fox, *Arch. Camb.*, 1927.) The finds at Hengistbury (Christchurch) also point to trade with an iron-using people in south-west France. (*See* Bushe-Fox, "Excavations at Hengistbury Head, Hants," *R.R.C.S.A.*, 1915.)

The earliest English settlers, a Jutish tribe, occupied the northern parts of the Isle of Wight and the valleys of the Meon and the Hamble. Their settlements were, however, soon absorbed in the territory of the West Saxons, who in 495 landed at the mouth of the Itchen under the leadership of Cerdic and Cynric After the battle of Charford in 519 the district was organized as West Saxon territory, and thus became the nucleus of the later kingdom of Wessex. The Northmen first attacked the Hampshire coast in 835, and made their headquarters in the Isle of Wight. Hampshire suffered less from the Conquest than almost any English county, and was a favourite resort of the Norman kings

The alleged destruction of property for the formation of the New Forest is refuted by the Domesday record, which shows that this district had never been under cultivation. Hampshire is first mentioned in the Saxon Chronicle in 755, when the boundaries were practically those of the present day The Domesday survey mentions 44 hundreds in Hampshire, but by the 14th century the number had been reduced to 37. The hundreds of East Medina and West Medina in the Isle of Wight are mentioned in 1316. Constables of the hundreds were first appointed by the Statute of Winchester in 1285, and the hundred court continued to elect a high constable for Fordingbridge until 1878. The chief court of the Isle of Wight was the Knighten court, held at Newport every three weeks The sheriff's court and the assizes and quarter sessions for the county were formerly held at Winchester, but in 1831 the county was divided into 14 petty sessional divisions; the quarter sessions for the county were held at Andover; and Portsmouth, Southampton and Winchester had separate jurisdiction. Southampton was made a county by itself with a separate sheriff in 1447.

In the middle of the 7th century Hampshire formed part of the West Saxon bishopric of Dorchester-on-Thames On the transference of the episcopal seat in 676 it was included in the diocese of Winchester In 1291 the archdeaconry of Winchester was coextensive with the county and comprised ten rural deaneries. In 1850 the Isle of Wight was subdivided into the deaneries of East Medina and West Medina. In 1871 the archdeaconry of the Isle of Wight was constituted, and in 1892 was divided into the deaneries of East Wight and West Wight The historic diocese of Winchester has recently been divided (1924–7), separate bishoprics of Guildford and Portsmouth being created.

Wool and cloth manufactures prospered at Winchester in the 12th century and survived till within recent years. Salt-making and the manufacture of iron from native ironstone also flourished from pre-Norman times until the 19th century. In the 14th century Southampton traded with Venice, and from the 15th to the 18th century many warships were constructed in its docks Silk-weaving was formerly carried on at Winchester, Andover, Odiham, Alton, Whitchurch and Overton, the first mills being set up in 1684 at Southampton by French refugees The paper manufacture at Laverstoke was also started by Huguenot refugees

Antiquities.—The monastery of Hyde, near Winchester, the churches of Christchurch and Romsey, the ruins of Netley abbey, and of Beaulieu abbey in the New Forest, the fragments of the priory of St. Denys, Southampton, the church at Porchester and the slight ruins at Titchfield, near Fareham, and Quarr abbey in the Isle of Wight are treated separately. Other foundations, of which the remains are slight, were the Augustinian priory of Southwick near Fareham, founded by William of Wykeham; that of Breamore, founded by Baldwin de Redvers, and that of Mottisfont near Romsey, endowed soon after the Conquest. Pre-Conquest work is well shown in the churches of Corhampton and Breamore, and very early masonry is also found in Headbourne Worthy church. The most noteworthy Norman churches are at Chilcombe and Kingsclere and (with Early English additions) at Brockenhurst, Upper Clatford, which has the unusual arrangement of a double chancel arch, Hambledon, Milford and East Meon. Principally Early English are the churches of Cheriton, Grately, which retains some excellent contemporary stained glass from Salisbury cathedral; Sopley, which is partly Perpendicular, and Thruxton. The frescoes in Bramley church, ranging in date from the 13th to the 15th century, include a representation of the murder of Thomas à Becket. A fine series of Norman fonts in black marble occurs in Winchester cathedral and the churches of St. Michael, Southampton, East Meon and St. Mary Bourne.

The most notable castles are Carisbrooke, in the Isle of Wight; Porchester, a fine Norman stronghold embodying Roman remains, on Portsmouth harbour; and Hurst, guarding the mouth of the Solent.

Agriculture and Industries.—In 1926, 561,348 ac. (excluding the Isle of Wight) were under crops and grass, of which 312,770 ac were arable land Oats, wheat, turnips and swedes, barley and mangolds are the principal crops; 53,480 ac. are given over to clover and grasses. Barley is usually sown after turnips, and is grown in the uplands. Rotation grasses are grown chiefly in the uplands. Sanfoin is the grass best adapted to a calcareous subsoil. In the lower levels no sanfoin and scarcely any clover is grown, the hay being supplied from the rich water meadows, where the grasses are fit for pasture before any traces of vegetation appear in the surrounding fields. Hops are grown in the eastern part of the county bordering on Surrey Owing to the varieties of soil the rotation observed is very diversified. Most of the farms are large, and there are a number of model farms. The waste land has been mostly brought under tillage, but a very large acreage of the ancient forests is still occupied by wood. In addition to the New Forest there are in the east Woolmer forest and Alice Holt, in the south-east the forest of Bere and Waltham Chase, and in the Isle of Wight, Parkhurst forest. The honey of the county is celebrated. Much attention is paid to the rearing of sheep and cattle. The original breed of sheep was white-faced with horns, but most of the flocks are now of a Southdown variety and are known as "short wools" or "Hampshire downs." The breeding and rearing of horses is widely practised. In the vicinity of the forest pigs are fed on acorns and beechmast

Portsmouth and Gosport are naval centres. Southampton is one of the principal ports in the kingdom. Fancy pottery and terra-cotta are made at Fareham and Bishop's Waltham. At most of the coast towns fishing is carried on, and there are oyster beds at Hayling Island Cowes in the Isle of Wight is the station of the Royal Yacht squadron, and has building yards The principal seaside resorts besides those in the Isle of Wight are Bournemouth, Milford, Lee-on-the-Solent, Southsea and South Hayling. Aldershot is the principal military training centre in the British Isles.

Communications are provided mainly by the lines of the Southern railway company, which also owns the docks at Southampton. The main line serves Farnborough, Basingstoke, Whitchurch and Andover, and a branch diverges southward from Basingstoke for Winchester, Southampton and the New Forest and Bournemouth. An alternative line from eastward to Winchester serves Aldershot, Alton and Alresford The main Portsmouth line skirts the south-eastern border by Petersfield to Havant. There are large workshops at Eastleigh, near Southampton. The G W R company serves Basingstoke from Reading and Whitchurch, Winchester and Southampton from Didcot The Somerset and Dorset line connects Bournemouth with Bath.

The administrative county of Hampshire returns six members to parliament, the divisions being Aldershot, Basingstoke, Fareham, New Forest and Christchurch, Petersfield and Winchester. The administrative county of the Isle of Wight returns one member The county borough of Bournemouth returns one member, Portsmouth three members and Southampton two members. There are 11 municipal boroughs and 16 urban districts. Separate courts of quarter-sessions are held at Andover, Bournemouth, Portsmouth, Southampton and Winchester.

HAMPSTEAD, a north-western metropolitan borough of London, England, bounded E. by St. Pancras and S. by St. Marylebone, and extending N and W. to the boundary of the county of London. Pop. (1921) 86,153. The name, *Hamstede,* is synonymous with "homestead," and the manor is first named in a charter of Edgar (957–975), and was granted to the abbey of Westminster by Ethelred in 986. It reverted to the Crown in 1550, and then had various owners

The surface of the ground is sharply undulating, an elevated spur extending south-west from the neighbourhood of Highgate, and turning south through Hampstead reaches a height of 443 ft. above the level of the Thames. The Edgware road bounds Hampstead on the west. The heath is a fine open space of about 240 acres, including in its bounds the summit of Hampstead hill. It is sandy, in parts well wooded, diversified with several small sheets of water, and to a great extent preserves its natural characteristics unaltered. Of all the public grounds within London this is the most valuable to the populace at large. In 1871 its preservation as an open space was insured, when the lord of the manor gave up his rights. An act of parliament transferred the

ownership to the Metropolitan Board of Works, to which body the London county council succeeded. The heath is continued eastward in Parliament hill (borough of St. Pancras), acquired for the public in 1890; and westward in Golders Hill park: a further extension which is now public property is Kenwood. A Protection Society guards the preservation of the heath. Hampstead has long been a favourite residential quarter, especially for lawyers, artists and men of letters. Among famous residents are found the first earl of Chatham, John Constable, George Romney, George du Maurier, Joseph Butler, author of the *Analogy*, Sir Richard Steele, John Keats, the sisters Joanna and Agnes Baillie, Leigh Hunt and many others. Chatham's residence was at North End; here also Wilkie Collins was born. Three old-established inns are the Bull and Bush, the Spaniards, and Jack Straw's Castle; the Upper Flask inn, now a private house, was the meeting-place of the Kit-Cat club. Chalybeate springs were discovered at Hampstead in the 17th century, and early in the 18th rivalled those of Tunbridge Wells and Epsom, but their fame is lost.

In the south-east Hampstead includes the greater part of Primrose hill The borough has in all about 350 acres of open spaces. The parliamentary borough of Hampstead returns one member.

HAMPTON, WADE (1818–1902), American cavalry leader was born on March 28, 1818 at Columbia, S.C, the son of Wade Hampton (1791–1858), one of the wealthiest planters in the South, and the grandson of Wade Hampton (1754–1835), a captain in the American Revolution and a brigadier-general in the War of 1812 He graduated in 1836 at South Carolina college, and was trained for the law. He devoted himself, however, to the management of his great plantations in South Carolina and in Mississippi, and took part in state politics and legislation. Though his own views were opposed to the prevailing state-rights tone of South Carolinian opinion, he threw himself heartily into the Southern cause in 1861, raising a mixed command known as "Hampton's Legion," which he led at the first battle of Bull Run. During the Civil War he served in the main with the army of Northern Virginia in Stuart's cavalry corps. After Stuart's death Hampton distinguished himself greatly in opposing Sheridan in the Shenandoah valley, and was made lieutenant-general to command Lee's whole force of cavalry. In 1865 he assisted Joseph Johnston in the attempt to prevent Sherman's advance through the Carolinas. After the war his attitude was conciliatory and he recommended a frank acceptance by the South of the war's political consequences. He was governor of his state in 1876–79, being installed after a memorable contest; he served in the U.S. Senate in 1879–91, and was United States commissioner of Pacific railways in 1893–97. He died at Columbus, on April 11, 1902.

See E. L. Wells, *Hampton and Reconstruction* (Columbia, S.C., 1907).

HAMPTON, an urban district of Middlesex, England, 15 m. S.W. of St. Paul's cathedral, London, on the river Thames, served by the S.R. Pop. (1921) 10,675. Close to the river, a mile below the town, stands Hampton Court palace, one of the finest specimens of Tudor architecture, and formerly a royal residence. It was erected by Cardinal Wolsey, who in 1515 received a lease of the old mansion and grounds for 99 years, and he presented the mansion to Henry VIII. in 1526. It became Henry's favourite residence, and he added to the building the great hall and chapel in the Gothic style. Of the original five quadrangles only two remain, but a third was erected by Sir Christopher Wren for William III. In 1649 the manor was sold to a private owner but immediately after came into the hands of Cromwell; and Hampton Court continued to be a royal residence until the time of George II. It was the meeting-place (1604) of the conference held to settle the dispute between the Presbyterians and the state clergy. The state apartments and picture galleries are open to the public. The gardens, laid out in the Dutch style favoured by William III., contain a vine planted in 1768. In the enclosure north of the palace (the Wilderness) is the Maze, a favourite resort. North again lies Bushey park, legally a royal demesne (1,000 acres).

HAMPTON, a city of south-eastern Virginia, U.S.A., 15m. N.W. of Norfolk, on Hampton Roads, at the mouth of the James river; the county seat of Elizabeth City county. It is served by the Chesapeake and Ohio railway and by ferries to Norfolk The population was 6,138 in 1920 (35% negroes) and was estimated locally at 8,000 in 1928. The city ships large quantities of oysters, fish, crab meat, and garden truck. It is the seat of the Hampton Normal and Agricultural Institute (for negroes and Indians), founded in 1868 by the American Missionary Association and chartered independently in 1870. The institute has been a very influential factor in the development of educational theories and opportunities for negroes, training many of their leaders (including Booker T Washington), publishing *The Southern Workman*, and stimulating the establishment of numerous other industrial schools on the same principles Langley field, headquarters of the Second Wing of the Army Air Corps and of the Air Corps Tactical school, is at Hampton; and at Ft. Monroe, which guards the entrance to Hampton Roads, 3m S E, is the Coast Artillery school There is a branch of the National Home for Disabled Volunteer Soldiers at Hampton, and a national cemetery containing over 13,000 graves Hampton was settled in 1610 on the site of an Indian village, Kecoughtan, a name it kept for some time, and was represented at the first meeting of the Virginia House of Burgesses in 1619. It was incorporated as a town in 1887, and became a city in 1908. Since 1920 it has had a commission-manager form of government. It was fired by the British in the war of 1812, and by the Confederates in Aug 1861. During the Civil War a large Union hospital was maintained here in the building of a college established in 1857. St. John's church, built in the year 1727, has the original communion set presented by the Crown.

HAMPTON ROADS, a channel through which the waters of the James, Nansemond and Elizabeth rivers of Virginia, U.S.A, pass (between Old Point Comfort to the north and Sewell's Point to the south) into Chesapeake bay. It is an important highway of commerce, especially for the cities of Norfolk, Portsmouth and Newport News, and is one of the chief rendezvous of the U S. navy. The entrance from Chesapeake bay is defended by Ft. Monroe on Old Point Comfort and by Ft. Wood on a small island near the middle of the channel At Portsmouth, a few miles up the Elizabeth river, is an important navy-yard Hampton Roads is noted historically as the scene (March 9, 1862) of the first battle between iron-clad vessels (*see* MONITOR AND MERRIMAC, BATTLE OF). On Feb. 3, 1865, near Ft. Monroe occurred the meeting on board a steamer of President Lincoln and Secretary Seward with the Confederate commissioners, which is known as the Hampton Roads Conference At Sewell's Point, on Hampton Roads, during the year 1907, was held the Jamestown Tercentennial Exposition.

HAMSTER, a European mammal of the order Rodentia, *Cricetus cricetus* belonging to the mouse tribe, *Muridae*, in which it typifies the sub-family *Cricetinae* (*See* RODENTIA) The hamsters are short-tailed rodents, with large cheek-pouches; the largest is the common *C. cricetus*. Their geographical distribution comprises Europe and Central Asia. Most of the European hamsters show more or less black on the under-parts, but the small species from Greece and Central Asia (*Cricetulus*) are uniformly grey. The common species constructs elaborate burrows containing several chambers, one of which is employed as a granary, and filled with corn for winter use. As a rule, the males, females, and young of the first year occupy separate burrows. During the winter these animals retire to their burrows, awakening about February or March. They are very prolific, the female producing several litters in the year, each consisting of over a dozen blind young; and these, when three weeks old, are turned out to form underground homes for themselves. The burrow of the adult descends 4 or 5 ft. beneath the surface; on retiring for the winter the hamster closes the entrances. Although feeding chiefly on roots, fruits and grain, it eats small quadrupeds, lizards and birds It is fierce and pugnacious, the males fighting for possession of the females Their numbers are kept in check by foxes, dogs, cats and polecats. The skin of the hamster is of some value, and its flesh is used as food. America, especially North America, is the home

of the majority of *Cricetinae*. They are divided into about two dozen genera and the number of species is very large indeed. Both in size and form considerable variability is displayed; the majority of the species are, however, mouse-like, as in the genera *Peromyscus* (white-footed mice) and *Oryzomys* (rice-rats). The subfamily also contains the American Grasshopper Mice *Onychomys*, and Harvest Mice (*Reithrodontomys*) The Florida cotton-rat (*Sigmodon hispidus*) is another representative of the group In the Old World the subfamily is represented by about six genera, three of which *Cricetulus*, *Cricetus*, and *Mesocricetus*) are European, and one (*Mystromys*) is African

HAMSUN, KNUT (1859–), Norwegian author, was born on Aug 4, 1859, at Lom in the Gudbrandsdal valley, the son of poor parents. He started to write at the age of 19 when he was a shoemaker's apprentice at Bodo in north Norway, and for the next ten years earned his livelihood in various ways, *e g.*, as coal trimmer and country schoolmaster He eventually went to America, where he became a tram conductor in Chicago and a farm labourer on the prairies In 1888 he published, in a Danish magazine, the fragment of a novel, *Sult*, which was later translated into English, as *Hunger* This work at once attracted attention by the beauty of style and originality of treatment His works from this time onward revealed a richness of talent which rapidly increased his reputation He is akin to the Russians in his psychological analysis of morbid types, but the American influence is apparent in his use of startling metaphors and the aptness of his expressions An intense love of nature characterizes his work. He is chiefly known to the English-speaking world by three novels, *Hunger*, *Growth of the Soil* and *The Woman at the Well*. In 1920 Hamsun was honored with the award of the Nobel Prize for literature.

HAMTRAMCK, a city of Wayne county, Michigan, U.S.A., completely surrounded by Detroit The population was 48,615 in 1920, and was estimated locally at 60,000 in 1928, of whom about 45,000 were of Polish birth or parentage. It is an important manufacturing community, making chiefly automobiles and their accessories The output of its 24 factories in 1925 was valued at $263,285,887, and in 1927 the assessed valuation of property was $117,177,128. In 1901 a portion of Hamtramck township was organized as a village, consisting then of two factories and a few scattered houses. By 1910 it had a population of 3,559, and in the next ten years that figure was multiplied by 14 In 1922 it was incorporated as a city Township and city were named after Colonel John Francis Hamtramck, the first American commander of the fort at Detroit after the British troops surrendered it in 1796

HAMY, ERNEST THÉODORE (1842–1908), French anthropologist and ethnographer, was born at Boulogne-sur-mer on June 22, 1842. He studied medicine in Paris under Quatrefages, with whom he collaborated in his famous *Crania Ethnica les crânes des races humaines* (1875–82). In 1880 he founded the Ethnological museum in the Trocadero, and acted as director until 1892, when he was appointed professor. Hamy devoted himself to research on the Mexican races and the South African tribes, and concluded that the Hottentots are the result of an ancient cross between these two races. He died in Paris on Nov. 18, 1908 Besides the above-mentioned work, he wrote: *Anthropologie du Mexique* (1884. *seq*), *Decades Americanae* (1899–1902), *Études historiques et géographiques* (1896), *Joseph Dombey* (1905), *Aimée Bonpland* (1906), and edited *Lettres Américaines d'Alex Humboldt* (1905).

HANAPER, a basket to contain a "hanap," *i.e.*, a goblet with a stem The famous Royal Gold Cup in the British Museum is called a "hanap" in the inventory of Charles VI. of France. The wicker basket in which were kept writs and other documents in the chancery was called a "hanaper," and hence it became the name of a department of the chancery, now abolished, under an officer known as the clerk of the hanaper, into which were paid fees for the sealing of charters, patents, writs, etc , and from which issued certain writs under the great seal.

HANAU, a town in the Prussian province of Hesse-Nassau, on the right bank of the Main, 14 m. by rail E. from Frankfort and at the junction of lines to Friedberg, Bebra and Aschaffenburg. Pop. (1925) 38,498.

From the number of finds near Hanau, it would appear that it owes its origin to a Roman settlement. It received municipal rights in 1393, and in 1528 it was fortified and the castle rebuilt. At the end of the 16th century its prosperity received considerable impulse from the accession of the Walloons and Netherlanders Early in the 15th century Hanau became the capital of a principality of the Empire, and in 1785 the province was united to Hesse-Cassel. In 1803 it again became an independent principality. In 1815 it reverted to Hesse-Cassel, and in 1866 it was joined to Prussia.

The streets of the old town are narrow and irregular, but the new, founded at the end of the 16th century by fugitive Walloons and Netherlanders, is built in the form of a pentagon with broad streets crossing at right angles Among the principal buildings are the ancient castle, formerly the residence of the counts of Hanau, who are buried in the old church of St. Mary; the church of St. John, dating from the 17th century, with a handsome tower, and the church in the new town, built by the Walloons in the beginning of the 17th century in the form of two intersecting circles. Hanau is the birthplace of the brothers Grimm, to whom a monument was erected here in 1896 In the neighbourhood of the town are the palace of Philippsruhe and the spa of Wilhelmsbad. Hanau manufactures ornaments of various kinds, cigars, leather, paper, gold, silver and platina wares, chocolate, soap, hats, gloves, machinery, chemicals and lamps. Diamond cutting is carried on and the town has also foundries and breweries. It carries on trade in wood, wine and corn, in addition to its articles of manufacture

HANBURY WILLIAMS, SIR CHARLES (1708–1759), English diplomatist and author, was a son of Major John Hanbury (afterwards Hanbury Williams) (1664–1734), of Pontypool, Monmouthshire, and a scion of an ancient Worcestershire family. He was educated at Eton, where he made friends with Henry Fielding, the novelist. He was elected M P. for Monmouthshire (1734–1747) and subsequently for Leominster (1754–1759). He became known as a gallant and wit about town, and wrote satirical light verse A collection of his poems was published in 1763 and of his *Works* in 1822 In 1746 he was sent on a diplomatic mission to Dresden; and through Henry Fox's influence he was sent as envoy to Berlin (1750), Dresden (1751), Vienna (1753), Dresden (1754) and St. Petersburg (1755–1757); in the latter case he was the instrument for a plan for the alliance between England, Russia and Austria, which finally broke down, to his embarassment He returned to England, and committed suicide on Nov. 2, 1759, being buried in Westminster Abbey.

HANCOCK, JOHN (1737–1793), American revolutionary statesman, was born in that part of Braintree, Mass., now known as Quincy, on Jan. 23, 1737 After graduating at Harvard in 1754, he entered the mercantile house of his uncle, Thomas Hancock of Boston, who had adopted him, and on whose death, in 1764, he fell heir to a large fortune and a prosperous business. In 1765 he became a selectman of Boston, and from 1766 to 1772 was a member of the Massachusetts general court. An event which is thought to have greatly influenced Hancock's subsequent career was the seizure of the sloop "Liberty" in 1768 by the customs officers for discharging, without paying the duties, a cargo of Madeira wine consigned to Hancock Many suits were thereupon entered against Hancock, which, if successful, would have caused the confiscation of his estate, but which undoubtedly enhanced his popularity with the Whig element and increased his resentment against the British Government. He was a member of the committee appointed in a Boston town meeting immediately after the "Boston massacre" in 1770 to demand the removal of British troops from the town. In 1774 and 1775 he was president of the first and second Provincial Congresses respectively, and he shared with Samuel Adams the leadership of the Massachusetts Whigs in all the irregular measures preceding the American Revolution. The famous expedition sent by Gen. Thomas Gage of Massachusetts to Lexington and Concord on April 18–19, 1775, had for its object, besides the destruction of materials of war at Concord, the

capture of Hancock and Adams, who were temporarily staying at Lexington, and these two leaders were expressly excepted in the proclamation of pardon issued on June 12 by Gage, their offences, it was said, being "of too flagitious a nature to admit of any other consideration than that of condign punishment." Hancock was a member of the Continental Congress from 1775 to 1780, was president of it from May 1775 to October 1777, being the first to sign the Declaration of Independence, and was a member of the Confederation Congress in 1785–86. In 1778 he commanded, as major-general of militia, the Massachusetts troops who participated in the Rhode Island expedition. He was a member of the Massachusetts Constitutional Convention of 1779–80, became the first governor of the State, and served from 1780 to 1785 and again from 1787 until his death. Although at first unfriendly to the Federal Constitution as drafted by the convention at Philadelphia, he was finally won over to its support, and in 1788 he presided over the Massachusetts convention which ratified the instrument. Hancock was not by nature a leader, but he wielded great influence on account of his wealth and social position, and was liberal, public-spirited, and, as his repeated election—the elections were annual—to the governorship attests, exceedingly popular He died at Quincy, Mass., on Oct 8, 1793

See Abram E. Brown, *John Hancock, His Book* (Boston, 1898), a work consisting largely of extracts from Hancock's letters; Lorenzo Sears, *John Hancock, the Picturesque Patriot* (1912).

HANCOCK, WINFIELD SCOTT (1824–1886), American general, was born on Feb. 14, 1824, in Montgomery county, Pa. He graduated in 1844 from the Military academy and was breveted first lieutenant for "gallant and meritorious conduct" in the Mexican War. After serving in the West, in Florida and elsewhere he married in 1850 Miss Almira Russell of St Louis; became first lieutenant in 1853, and assistant quartermaster with the rank of captain in 1855 At the outbreak of the Civil War he was ordered East at his own request and on Sept. 23, 1861, was made brig-general of volunteers and assigned to command a brigade in the Army of the Potomac. He took part in the Peninsula campaign, and the handling of his troops in the engagement at Williamsburg on May 5, 1862, was such that McClellan reported "Hancock was superb," an epithet always afterwards applied to him. At the battle of Antietam he was placed in command of the 1st Division of the IInd. Corps, and in November he was made major-general of volunteers, and about the same time was promoted major in the Regular Army In the battle of Fredericksburg (*q.v.*), Hancock's division was among the troops that were ordered to storm Marye's Heights. Out of the 5,006 men in his division 2,013 fell. At Chancellorsville his division received the brunt of the attack of Lee's main army. Soon after the battle he was appointed commander of the IInd. Corps.

In the battle of Gettysburg (*q.v.*) after the defeat of the left wing of the Army of the Potomac and the death of Gen. Reynolds, Hancock arrived on the field with orders from Meade to assume command and to decide whether to continue the fight there or to fall back. He decided to stay, and held Cemetery Hill and Ridge until the arrival of the main body of the Federal Army. During the second day's battle he commanded the left centre of the Union Army, and after Gen. Sickles had been wounded, the whole of the left wing. In the third day's battle he commanded the left centre, upon which fell the full brunt of Pickett's charge, one of the most famous incidents of the war. As the guns of the Confederate Army opened the attack Hancock rode along the front of his line to show his soldiers that he shared the dangers of the cannonade with them. His corps lost in the battle 4,350 out of less than 10,000 fighting men. But it captured 27 Confederate battle flags and as many prisoners as it had men when the fighting ceased Hancock, himself, was struck in the groin by a bullet, but continued in command until the repulse of the attack. Six months passed before he resumed command. In the battles of the year 1864 Hancock commanded at the Wilderness during the second day's fighting, half of the Union Army; at Spottsylvania he had charge of the successful attack on the "salient"; at Cold Harbor his corps formed the left wing in the unsuccessful assault on the Confederate lines In August he was promoted to brig.-general in the Regular Army. His old wound troubling him, he obtained a short leave of absence, expecting to return to his corps. He was, however, detailed to raise a new corps, and later was placed in charge of the "Middle Division" Before he could take the field Richmond had fallen and Lee had surrendered.

After the assassination of Lincoln, Hancock was placed in charge of Washington, and it was under his command that Booth's accomplices were tried and executed In July 1866 he was appointed major-general in the Regular Army. A little later he was placed in command of the department of the Missouri, and the year following assumed command of the 5th Military Division, comprising Louisiana and Texas His policy, however, of discountenancing military trials and conciliating the conquered did not meet with approval at Washington, and he was at his own request transferred

Hancock had all his life been a Democrat. His war record and his personal popularity caused his name to be considered as a candidate for the Presidency, and in 1880 he was nominated for that office by the Democrats, but was defeated by his Republican opponent, Gen. Garfield, by the small popular plurality of 7,000 votes. He died at Governor's island, near New York on Feb. 9, 1886. Hancock was in many respects the ideal soldier of the Northern armies. He was quick, energetic and resourceful, reckless of his own safety, a strict disciplinarian, a painstaking, hard-working officer, a born commander of men Grant said of him, "Hancock stands the most conspicuous figure of all the general officers who did not exercise a separate command He commanded a corps longer than any other, and his name was never mentioned as having committed in battle a blunder for which he was responsible."

A biography of him was written by Gen Francis A. Walker (1894). *See* also *History of the Second Corps*, by the same author (1886).

(F. H. H.)

HANCOCK, a city of Houghton county, Michigan, in the Upper Peninsula, on Portage lake, opposite Houghton It is on Federal highway 41, and is served by the Chicago, Milwaukee, St Paul and Pacific, the Chicago and North Western, the Copper Range and the Mineral Range railways, and by steamers from the Great Lakes through the Portage lake ship canal The population was 7,527 in 1920, of whom 2,119 were foreign-born white, largely from Finland It is the seat of the Finnish Evangelical Lutheran Theological seminary, and of the publication house of the denomination Copper mining and smelting and the manufacture of dairy products are the dominant industries, and the city is growing in popularity as a summer resort and a headquarters for tourists in "Hiawatha Land." The Quincy, Franklin, Hancock, New Baltic and Arcadian mines are in or near the city. Hancock was settled in 1859, incorporated as a village in 1875, and chartered as a city in 1903.

HAND, FERDINAND GOTTHELF (1786–1851), German classical scholar, was born at Plauen in Saxony on Feb 15, 1786, and died at Jena, where he had held a professorship, on March 14, 1851. His most famous work is his (unfinished) edition of the treatise of Horatius Tursellinus (Orazio Torsellino, 1545–99) on the Latin particles (*Tursellinus, seu de particulis Latinis commentarii*, 1829–45). Like his treatise on Latin style (*Lehrbuch des lateinischen Stils*, 3rd ed by H. L. Schmitt, 1880), it is too abstruse for the ordinary student. In his *Ästhetik der Tonkunst* (1837–41) he was the first to introduce the subject of musical aesthetics.

The first part of the last-named work has been translated into English by W E. Lawson (*Aesthetics of Musical Art*, or *The Beautiful in Music*, 1880), and B. Sears's *Classical Studies* (1849) contains a "History of the Origin and Progress of the Latin Language," abridged from Hand's work on the subject. There is a memoir of his life and work by G. Queck (Jena, 1852).

HAND, the terminal part of the human arm from below the wrist, and consisting of the fingers and the palm. The word is also used of the prehensile termination of the limbs in certain other animals. (*See* ANATOMY; SKELETON; and such articles as MUSCULAR SYSTEM and NERVOUS SYSTEM.) There are many transferred applications of "hand," as a substantive and in adverbial phrases

HAND-BALL, a ball game played in a court, the ball being struck against the wall or walls with the hand. Although it is considered a fast game even for men athletically inclined, and one which usually arouses a keen competitive spirit, it can be played in leisurely fashion like tennis or golf by those who seek fun and diversion without extraordinary effort. Played strenuously, it is recommended by some athletic trainers as being better than road running for boxers and wrestlers in preparation for their bouts

Although the game of hand-ball originated in Ireland a thousand years ago, and is often considered one of the national games of that country, it is now played by more men in America than anywhere else in the world Hand-ball courts are installed in practically every gymnasium in America, indoors and out, as well as in men's clubs, fraternal organizations and elsewhere. The first scientific hand-ball player was really developed in the early '50s, when William Baggs of Tipperary originated new ways of hitting the ball in curves, low drives and screw tosses. He was followed in Ireland by David Browning In 1885 John Lawlor of Ireland won the Irish championship The first international match ever played was the Lawlor-Casey match in 1887 with the prize of $1,000 for the best of 21 games, 10 in Cork and 11 in the United States Lawlor won 6 games to 4 in Cork, and Casey, the American champion, won 7 straight in New York, winning the match. Casey, who retained his title against all comers until 1900, when he retired, was spoken of as the "father" of hand-ball in America. McQuade, Alderman Dunne, Judge Dunne, Drew, Cashman, Kelly, Eagan, O'Rourke and Heney were outstanding stars of former days

Since 1900 hand-ball has developed into two separate games, a one-wall game and a four-wall game, both of which are played by amateurs in singles or doubles. Professional games are unheard of now. The one-wall game (A.A U. rules) is played in a court 34 ft. long by 20 ft. wide, with front wall 16 ft high. A "short" line on the floor is 14 ft from the front wall with a second line 9 ft. further back known as the "service" line Twenty-one points constitute a game Preliminary matches consist of two out of three games; semi-final and final matches comprise three out of five games. In serving, the ball must be bounced on the floor within the square formed by the side lines and the short and service lines, and struck on the first bounce. The server must see that the ball will strike the wall and bounce across the short line. Hitting the ceiling, floor or any other part of the room before the front wall, while serving, counts as a lost point. The receiver may strike the ball on the fly or on the first bounce. In singles or doubles, players are entitled to an unobstructed chance at the ball. The ball is $1\frac{7}{8}$ in. in diameter and weighs 2 ounces. There are 37 recognized rules for one-wall hand-ball as adopted at the annual meeting of the A A U. on Nov. 20, 1927.

In the four-wall game of hand-ball a standard court 46 ft. long by 22 ft. wide is bounded by four walls 22 ft. high. A serving space enclosed by two parallel lines, the back line and foul-line, drawn across the width is laid out on the floor of the court. The back line, called the "short" line, divides the court equally; the "front" line is 5 ft in front of it, that is 18 ft from the front wall. At right angles to these lines and 18 in. from the side walls lines are drawn to form a box where the partner to the man who is serving stands with his back to the side wall while the ball is being served. Should he leave the box before the ball crosses the short line, the referee will declare it a "short" ball If the server's partner is hit by the ball while in the box, it is considered a dead ball and the ball is out of play. Missing the ball on the first bounce in serving puts the server out, although he has the privilege of several, but not more than three attempts at bouncing the ball before serving. To be in play the ball must hit the front wall and rebound across the short line before striking the floor. While serving the ball the server must stand in the serving space between the two lines. A served ball which does not rebound beyond the short line before touching the floor is termed a short ball, as is also a served ball which rebounds from the front wall and touches the back wall or ceiling before touching the floor, and a served ball which rebounds from the front wall and touches two side walls before touching the floor. If the server steps over the short line while serving, it is termed a "short" ball. If two short balls are served in succession the server is out. After the ball is served the server's opponents must return the ball to the front wall, before hitting the floor. If the opponents fail to return the ball properly it counts as a tally against the server. If the server or his partner in doubles fails to return the adversary's play properly, the server is out. There are 32 official A.A.U. rules for four-wall hand-ball and this game is usually played indoors exclusively.

The dimensions of the Irish court or alley as given in the playing rules of the Gaelic Athletic Association are: Floor not less than 60 ft nor more than 63 ft long, not less than 28 ft. nor more than 30 ft wide. Height of front wall 30 feet. Height of back wall at least 8 feet.

A A U. Champions of the United States. Singles

Year	*Champion*	*Runner-up*
1919	Wm. Ranft, Los Angeles.	Joe Lacey, Los Angeles.
1920	Max Gold, Los Angeles.	G. Klawiter, Los Angeles.
1921	Dr. Haedge, St Paul.	Wm. Sakmann, New York.
1922	A. J Schinner, Milwaukee.	Wm Sakmann, New York.
1923	J. Murray, San Francisco.	M. Laswell, Los Angeles.
1924	M. Laswell, Los Angeles.	G Klawiter, Los Angeles.
1925	M. Laswell, Los Angeles .	Schaufelberger, Detroit.
1926	M Laswell, Los Angeles	J. Donovan, San Francisco.
1927	Geo. Nelson, Baltimore	F Burke, San Francisco

Year	Champions of Doubles
1919	Ranft and Lacey, Los Angeles.
1920	Klawiter and Retzer, Los Angeles.
1921	Spiegel and Asselin, Detroit
1922	Gold and Laswell, Los Angeles.
1923	Serenberg and Bathey, Detroit.
1924	McMillan and Donovan, San Francisco.
1925	Dworman and Kammann, Detroit
1926	Donovan and McMillan, San Francisco.
1927	Dworman and Kammann, Detroit.

See Spalding's *Hand-ball Guide,* No. 114 (1928); Gaelic Athletic Association, *Playing Rules of Football, Hurling, Rounders and Hand-ball.* (J. B P.)

HANDEDNESS. Why the vast majority of human beings do most things in a right-handed way is a problem which has induced voluminous discussion. Parson, in a recent book, gives some 40 pages of titles of books, pamphlets and articles dealing with various aspects of the problem

Theories of Handedness.—Theories relative to handedness vary in their treatment of it as an acquired or a native trait Those who believe it an acquired habit advance many theories to show how it originates Some relate it to the way a child is held in infancy; others to social training and imitation. Watson, the behaviourist, thinks it a socially conditioned response; forcing the child to eat with the right hand is a potent conditioning factor. The theorists who consider handedness a congenital trait seek to connect it with structural features of the human body. For instance, an appeal has been made in explanation to the unequal visceral distribution in the two halves of the human body and the consequent displacement of the centre of gravity; also to a supposed inequality in a blood supply to the brain, the left cerebral hemisphere, which controls the right half of the body, receiving the greater supply of blood. Many authorities accept the view that right-handedness is due to the functional predominance of the left brain; others cite the dominance of the right eye as explanatory. Ocular dominance and the pre-eminence of the left brain hemisphere must then be explained.

A theory intermediate between explanation of handedness as a habit or dependent upon innate structure, states it originated in primitive warfare, where the stick or sword was wielded by the right hand in order that the left arm and hand might be used for defensive covering of the heart or for holding a shield for this purpose. This racial habit was, according to this theory, transmitted to later generations.

Percentage of Left-handedness.—Acceptance of right-handedness as a native trait is often associated with emphasis on the fact that left-handedness appears to be hereditary in certain family lines. The percentage of left-handedness among normal individuals is estimated to run from 4 to 8%. The percentage is much higher among inmates of institutions for the feebleminded and the psychopathic.

Left-brainedness.—Right-handed persons are left-brained and left-handed persons right-brained. The motor nerves that innervate the two halves of the body as they descend from the cerebral hemispheres cross over from one side to the other Some evidence exists that the left hemisphere is more highly organized than the right. Attempts to determine the relative weight of the two hemispheres encounter many sources of error and the results are inconclusive.

Bilaterality.—The problems of handedness should be restated in terms of laterality of function in general People are right and left footed as well as right and left handed They also are right-eyed or left-eyed in the sense that in unilateral sighting one eye is preferred to the other. About 70% of right-handed persons are also right-eyed; about 50% of left-handed persons are left-eyed Discrepancies between preferred hand and eye, described as crossed dextrality or sinistrality, may originate from interference with natural handedness or arise from development of ocular faults. Possibly they may be due to asymmetrical functioning of the nervous system In any case they appear to be connected with certain psychopathic tendencies

Bilaterality of Structure and Twinning.—It is probable that we must look to investigations on the biology and physiology of twinning for an ultimate explanation of handedness, since current studies suggest that bilaterality of structure is a form of twinning In the twinning relation one twin usually gains a physiological ascendency over the other. Unilaterality of function might arise similarly in man One would anticipate, however, all degrees of asymmetry between the two body halves The goal of the biological process would appear to be the development of a bilaterally symmetrical individual

BIBLIOGRAPHY.—Widely dispersed lists of titles may be found in journals, medical, psychological, physiological and anthropological. For summaries, *see* B. S. Parson, *Left-Handedness* (1924) and J. E. Downey, "Types of Dextrality and Their Implications," in *Amer. Jour. Psychol*, vol. xxxvm. (1927). (J. E. D.)

HANDEL, GEORGE FREDERICK (1685–1759), musical composer, was born at Halle, in Lower Saxony, on Feb 23, 1685. His name was Händel, but, like most 18th century musicians who travelled, he compromised with its pronunciation by foreigners, and when in Italy spelt it Hendel, and in England (where he became naturalized) accepted the version Handel, which is therefore correct for English writers, while Händel remains the correct version in Germany.

LIFE

Early Training.—Handel's father was a barber-surgeon, who disapproved of music and wished George Frederick to become a lawyer. A friend smuggled a clavichord into the attic, and on this instrument, which is inaudible behind a closed door, the little boy practised secretly. Before he was eight his father went to visit a son by a former marriage who was a valet-de-chambre to the duke of Saxe-Weissenfels. The little boy begged in vain to go also, and at last ran after the carriage on foot so far that he had to be taken. He made acquaintance with the court musicians and contrived to practise on the organ when he could be overheard by the duke, who, immediately recognizing his talent, spoke seriously to the father, who had to yield to his arguments

On returning to Halle Handel became a pupil of Zachau, the cathedral organist, who gave him a thorough training as a composer and as a performer on keyed instruments, the oboe and the violin. Six very good trios for two oboes and bass, which Handel wrote in his 11th year, are extant; and when he himself was shown them by an English admirer who had discovered them, he was much amused and remarked, "I wrote like the devil in those days, and chiefly for the oboe, which was my favourite instrument." These trios were mere parerga beside the study and composition of vocal music, and he had to show Zachau a motet every week. By the time he was 12 Zachau thought he could teach him no more, and accordingly the boy was sent to Berlin, where he made a great impression at the court.

His father, however, thought fit to decline the proposal of the elector of Brandenburg, afterwards King Frederick I. of Prussia, to send the boy to Italy in order afterwards to attach him to the court at Berlin. German court musicians, as late as the time of Mozart, had hardly enough freedom to satisfy a man of independent character, and the elder Handel had not yet given up hope of his son becoming a lawyer Young Handel, therefore, returned to Halle and resumed his work with Zachau In 1697 his father died, but the boy with great filial piety, finished the ordinary course of his education, both general and musical, and entered the university of Halle in 1702 as a law student But in that year he succeeded to the post of organist at the cathedral, and after his "probation" year in that capacity he departed to Hamburg, where the only German opera worthy of the name was flourishing under the direction of its founder, Reinhold Keiser

Friendship with Mattheson.—Here he became friends with Mattheson, a prolific composer and writer on music On one occasion they set out together to go to Lubeck, where a successor was to be appointed to the post left vacant by the great organist Buxtehude, who was retiring at the age of 90 Handel and Mattheson made much music on this occasion, but did not compete, because they found that the successful candidate was required to marry the retiring organist's daughter Another adventure might have had even more serious consequences At a performance of Mattheson's opera *Cleopatra* at Hamburg, Handel refused to give up the conductor's seat to the composer when the latter returned to his usual post at the harpsichord after singing the part of Antony on the stage The dispute led to a duel outside the theatre, and, but for a large button on Handel's coat which intercepted Mattheson's sword, there would have been no *Messiah* or *Israel in Egypt* But the young men remained friends, and Mattheson's writings are full of the most valuable facts for Handel's biography. He relates in his *Ehrenpforte* that his friend at that time used to compose "interminable cantatas" of no great merit, but of these no traces now remain, unless we assume that a Passion according to St John, the manuscript of which is in the royal library at Berlin, is among the works alluded to But its authenticity, while strongly upheld by Chrysander, has since been as strongly assailed on internal evidence

On Jan. 8, 1705, Handel's first opera, *Almira*, was performed at Hamburg with great success, and was followed a few weeks later by another work, entitled *Nero* *Nero* is lost, but *Almira*, with its mixture of Italian and German language and form, is extant It contains many themes used by Handel in well-known later works; but the current statement that the famous aria in *Rinaldo*, "Lascia ch'io pianga," comes from a saraband in *Almira*, is based upon nothing more definite than the common form of saraband-rhythm.

Three Years in Italy.—In 1706 Handel left Hamburg for Italy, where he remained for three years, rapidly acquiring the smooth Italian vocal style which thereafter always characterized his work He had before this refused offers from noble patrons to send him there, but had now saved enough money not only to support his mother at home, but to travel as his own master. He divided his time in Italy between Florence, Rome, Naples, and Venice; and many anecdotes are preserved of his meetings with Corelli, Lotti, Alessandro Scarlatti, the founder of the Neapolitan school, or rather of the classical language of music as understood by Handel himself, and Alessandro's unacademic son Domenico, whose wonderful harpsichord technique still furnishes problems for the modern pianoforte virtuoso Handel soon became famous as *Il Sassone* ("the Saxon"), and it is said that Domenico on first hearing him play incognito exclaimed, "It is either the devil or the Saxon!"

There is also a story of Corelli's coming to grief over a passage in Handel's overture to *Il Trionfo del tempo*, in which the violins went up to A in altissimo Handel impatiently snatched away the violin to show Corelli how the passage ought to be played, and Corelli, who had never written or played beyond the third position in his life (this passage being in the seventh), said gently, "My dear Saxon, this music is in the French style, which I do not understand." The story becomes more interesting in view of the fact that Handel's later treatment of the violin is hardly less restrained than Corelli's, though he often wrote for the greatest players of the day.

In Italy he produced two operas, *Rodrigo* and *Agrippina*, the latter a very important work, of which the splendid overture was remodelled 44 years afterwards as that of his last original oratorio, *Jephtha*. He also produced two oratorios, *La Resurrezione*, and *Il Trionfo del tempo*. The latter, 46 years afterwards, formed the basis of his last work, *The Triumph of Time and Truth*, which contains no original matter. All Handel's early works contain material that he used often with very little alteration later on, and, though the famous "Lascia ch'io pianga" does not occur in *Almira*, it occurs note for note in *Agrippina* and the two Italian oratorios. On the other hand the cantata *Aci, Galatea e Polifemo* has nothing in common with *Acis and Galatea*.

Besides these larger works there are several choral and solo cantatas of which the earliest, such as the great *Dixit Dominus*, show in their extravagant vocal difficulty how radical was the change which Handel's Italian experience so rapidly effected in his methods. Handel's success in Italy established his fame and led to his receiving at Venice in 1709 the offer of the post of Kapellmeister to the elector of Hanover, transmitted to him by Baron Kielmansegge, his patron and staunch friend of later years.

Career in England.—Handel at the time contemplated a visit to England, and he accepted this offer on condition of leave of absence being granted to him for that purpose. To England accordingly Handel journeyed after a short stay at Hanover, arriving in London towards the close of 1710. He came as a composer of Italian opera, and earned his first success at the Haymarket with *Rinaldo*, composed, to the consternation of the hurried librettist, in a fortnight, and first performed on Feb. 24, 1711. In this opera the aria "Lascia ch'io pianga" found its final home. The work was produced with the utmost magnificence, and Addison's delightful reviews in the *Spectator* poked fun at it from an unmusical point of view in a way that would have pleased Gluck 50 years afterwards. The success was so great, especially for Walsh the publisher, that Handel proposed that Walsh should compose the next opera and that he (Handel) should publish it! He returned to Hanover at the close of the opera season and composed a good deal of vocal chamber music for the princess Caroline, the step-daughter of the elector, besides the instrumental works known to us as the "oboe concertos."

In 1712 Handel returned to London and spent a year with Andrews, a rich musical amateur, in Barn Elms, Surrey. Three more years were spent in Burlington, in the neighbourhood of London. He evidently was but little inclined to return to Hanover, in spite of his duties to the court there. Two Italian operas and the Utrecht Te Deum, written by the command of Queen Anne, are the principal works of this period. It was awkward for the composer when his deserted master came to London in 1714 as George I. of England. For some time Handel did not venture to appear at court, and it was only at the intercession of Baron Kielmansegge that his pardon was obtained. By his advice Handel wrote the Water Music which was performed at a royal water party on the Thames, and it so pleased the king that he at once received the composer into his good graces and granted him a salary of £400 a year.

Later Handel became music master to the little princesses and was given an additional £200 by the princess Caroline. In 1716 he followed the king to Germany, where he wrote a second German Passion to the popular poem of Brockes, a text which, divested of its worst features, forms the basis of several of the arias in Bach's Passion according to St. John. This was Handel's last work to a German text. A copy much more accurate than Handel's autograph, exists in Bach's handwriting.

Composer and Impresario.—On his return to England he entered the service of the duke of Chandos as conductor of his concerts, receiving a thousand pounds for his first oratorio *Esther*. The music which Handel wrote for performance at Cannons, the duke of Chandos's residence at Edgware, is comprised in the first version of *Esther*, *Acis and Galatea*, and the twelve Chandos Anthems, which are compositions approximately in the same form as Bach's church cantatas but without any systematic use of chorale tunes. The fashionable Londoner would travel nine miles in those days to the little chapel of Whitchurch to hear Handel's music; of the magnificent scene of these visits all that now remains is the church, which is the parish church of Edgware.

In 1720 Handel appeared again in a public capacity as impresario of the Italian opera at the Haymarket theatre, which he managed for the institution called the Royal Academy of Music. Senesino, a famous singer, to engage whom Handel especially journeyed to Dresden, was the mainstay of the enterprise, which opened with a highly successful performance of Handel's opera *Radamisto*. To this time belongs the famous rivalry between Handel and Buononcini, a melodious Italian composer whom many thought to be the greater of the two. The controversy has been perpetuated in John Byrom's well-known lines:

> Some say, compared to Buononcini
> That Mynheer Handel's but a ninny;
> Others aver that he to Handel
> Is scarcely fit to hold a candle
> Strange all this difference should be
> Twixt tweedle-dum and tweedle-dee.

It must be remembered that at this time Handel had not yet asserted his greatness as a choral writer. The fashionable ideas of music and musicianship were based entirely upon success in Italian opera, and the contest between the rival composers was waged on the basis of works which have fallen into almost as complete oblivion in Handel's case as in Buononcini's. Apart from scholarly revivals, none of Handel's 41 Italian operas survives, except in some few detached arias out of each opera: arias which reveal their essential qualities far better in isolation than when performed in groups of between 20 and 30 on the stage, as interruptions to the action of a classical drama which was nothing but an interruption to them. But even under these conditions Handel's inexhaustible inventive power proved decisive; as was shown when he wrote the third act of an opera *Muzio Scevola*, of which Buononcini and Ariosti (Chrysander says Mattei) wrote the other two. Buononcini soon got into discredit by failing to defend himself against the charge of producing as a prize-madrigal of his own a composition which proved to be by Lotti. As a consequence Buononcini left London, and Handel for the next ten years was without a rival in his ventures as an operatic composer.

From Opera to Oratorio.—He was not, however, without a rival as an impresario; and the hostile competition of a rival company which obtained the services of the great Farinelli and also induced Senesino to desert him led to his bankruptcy in 1737, and to an attack of paralysis caused by anxiety and overwork. The rival company, it may be added, also had to be dissolved from want of support. Handel's artistic conscience was that of an opportunist, or he would never have continued till 1741 to work in a field that gave so little scope for his genius. But operas were the only music that was known to pay, and at all events he could supply better operas more quickly and easily than any other living composer. And this he naturally continued to do so long as it seemed the best way to keep up his reputation. But his opportunism did not include a readiness to stand any nonsense; and when the prima-donna Cuzzoni tried to give herself other airs than he had written for her, he held her at arm's length out of a window until she capitulated.

Already before his last opera, *Deidamia*, produced in 1741, Handel had been making a growing impression with his oratorios. In these, freed from the restrictions of the stage, he was able to give scope to his genius for choral writing, and so to develop, or rather revive, that art of chorus singing which is the normal outlet for English musical talent. In 1726 Handel had become a naturalized Englishman, and in 1733 he began his public career as a composer of English texts by producing the second and larger version of *Esther* at the *King's Theatre*. This was followed early in the same year by *Deborah*, in which the share of the chorus is much greater. In July he produced *Athalia* at Oxford, the first work in which his eight-part double choruses appear. The share of the chorus increases in *Saul* (1738); and *Israel in Egypt* (also 1738) is practically entirely a choral work, the solo movements being few and, in spite of their fame, perfunctory. The public, who still considered Italian opera the highest form of musical art, not unnaturally obliged Handel at subsequent per-

formances of this gigantic work to insert more solos.

The Messiah was produced at Dublin on April 13, 1742. *Samson* (which Handel preferred to *The Messiah*) appeared at Covent Garden on March 2, 1744; *Belshazzar* at the King's theatre, March 27, 1745; the *Occasional Oratorio* (chiefly a compilation of the earlier oratorios, but with a few important new numbers), on Feb. 14, 1746, at Covent Garden, where all his later oratorios were produced; *Judas Maccabaeus* on April 1, 1747; *Joshua* on March 9, 1748; *Alexander Balus* on March 23, 1748; *Solomon* on March 17, 1749; *Susanna*, spring of 1749; *Theodora*, a great favourite of Handel's, who was much disappointed by its cold reception, on March 16, 1750; *Jephtha* (strictly speaking, his last work) on Feb 26, 1752, and *The Triumph of Time and Truth* (transcribed from *Il Trionfo del tempo* with the addition of many later favourite numbers), in 1757. Other important works, indistinguishable in artistic form from oratorios but on secular subjects, are *Alexander's Feast*, 1736; *Ode for St. Cecilia's Day* (words by Dryden); *L'Allegro, il pensieroso ed il moderato* (Milton, with a third part by Jennens), 1740; *Semele*, 1744; *Hercules*, 1745; and *The Choice of Hercules*, 1751.

Last Years.—By degrees the enmity against him died away, though he had many troubles In 1745 he had again become bankrupt; for, although he had no rival as a composer of choral music, it was possible for his enemies to give balls and banquets on the nights of his oratorio performances. As with his first bankruptcy, so in his later years, he was scrupulously honourable in discharging his debts, and, like Scott, he continued to work hard to the end of his life. Unlike Scott, he not only completely recovered his financial position (by the year 1750) but he must have made a good deal of money, for he then presented an organ to the Foundling Hospital, and opened it with a performance of *The Messiah* on May 15.

In 1751 his sight began to trouble him; and the autograph of *Jephtha*, published in facsimile by the *Händelgesellschaft*, shows pathetic traces of this in his handwriting, and so greatly reveals his methods of composition, all the accompaniments, recitatives, and less essential portions of the work being evidently filled in long after the rest. By a dramatic coincidence Handel's blindness interrupted him during the writing of the chorus, "How dark, oh Lord, are Thy decrees, . . . all our joys to sorrow turning . . as the night succeeds the day" He underwent unsuccessful operations, one of them by the same surgeon who had operated on Bach's eyes. He was able to see at intervals during his last years, but his sight practically never returned after May 1752

He continued nevertheless superintending performances of his works and writing new arias for them, or inserting revised old ones, and he attended a performance of *The Messiah* a week before his death, which took place, according to the *Public Advertiser* of April 16, not on Good Friday, April 13, according to his own pious wish and according to common report, but on April 14, 1759 He was buried in Westminster Abbey; and his monument is by L. F. Roubilliac, the same sculptor who modelled the marble statue erected in 1739 in Vauxhall gardens, where his works had been frequently performed.

Handel was a man of high character and intelligence, and his interest was not confined to his own art exclusively He liked the society of politicians and literary men, and he was also a collector of pictures and articles of *vertu*. His power of work was enormous, so that the *Händelgesellschaft's* edition of his complete works fills 100 volumes, forming a total bulk almost equal to the works of Bach and Beethoven together. (F Hu ; D. F. T)

MUSIC

Handelian Opera.—No one has more successfully popularized the greatest artistic ideals than Handel; no artist is more disconcerting to critics who expect to follow a great man's mental development easily. Not even Wagner effected a greater transformation in the possibilities of dramatic music than Handel effected in oratorio, yet we have seen that Handel was the very opposite of a reformer. Indeed he hardly took the pains to ascertain what an art-form was, so long as something externally like it would convey his idea But he never failed to convey his idea, and, if the hybrid forms in which he conveyed it had no historic influence and no typical character, they were none the less fit for each case The same aptness and the same absence of method are conspicuous in his style.

The popular idea that Handel's style is easily recognizable comes from the fact that he overshadows all his predecessors and contemporaries, except Bach, and so makes us regard typical 18th century Italian and English style as Handelian, instead of regarding Handel's style as typical Italian 18th century Nothing in music requires more minute expert knowledge than the sifting of the real peculiarities of Handel's style from the mass of contemporary formulae which in his inspired pages he absorbed, and which in his uninspired pages absorbed him

His easy mastery was acquired, like Mozart's, in childhood. The sonatas for two oboes and bass which he wrote in his 11th year are, except in their diffuseness and an occasional slip in grammar, indistinguishable from his later works, and they show a boyish inventiveness worthy of Mozart's work at the same age Such early choral works, as the *Dixit Dominus* (1707), show the ill-regulated power of his choral writing before he assimilated Italian influences Its practical difficulties are at least as great as Bach's though they are not as necessary; but the grandeur of the scheme and nobility of thought are already those for which Handel so often in later years found the simplest adequate means of expression that music has ever attained His eminently practical genius soon formed his vocal style, and long before the period of his great oratorios such works as The Birthday Ode for Queen Anne (1713) and the Utrecht Te Deum show not a trace of extravagance

Operatic Methods.—The only drawback to his practical genius was that it led him to bury perhaps half of his finest melodies, and nearly all the secular features of interest in his treatment of instruments and of the aria forms, in that limbo of vanity, the 18th century Italian opera. The allegation is untrue that his operas are no better than those of his contemporaries, but it is certainly true that he never stirred a finger to improve the condition of dramatic musical art He was notoriously masterful with singers, and was not bound by the operatic conventions of the time. In *Tesco* he not only wrote an opera in five acts when custom prescribed three, but also broke a much more rational rule in arranging that each character should have two arias in succession.

He also showed a feeling for expression and style which led him to write arias of new kinds. But he never made any innovation which had the slightest bearing upon the stage-craft of opera, for he never concerned himself with any artistic question beyond the matter in hand; and the matter in hand was neither to create dramatic music nor to make the story intelligible, but simply to provide a concert of between some 20 and 30 Italian arias and duets, wherein singers could display their abilities and spectators find distraction from the monotony of so large a dose of the aria form (which was then the only opportunity for solo vocal music) in gorgeous costumes and scenery

The Transition to Oratorio.—When the question arose how such musical entertainments could be managed in Lent without protests from the bishop of London, Handelian oratorio came into being as a matter of course But though Handel was an opportunist he was not shallow His artistic sense seized upon the natural possibilities which arose as soon as the music was transferred from the stage to the concert platform; and his first English oratorio, *Esther* (1720), beautifully shows the transition

The subject is as nearly secular as any that can be extracted from the Bible, and the treatment was based on Racine's *Esther*, which was much discussed at the time. Handel's oratorio was reproduced in an enlarged version in 1732 at the King's theatre; the princess royal wished for scenery and action, but the bishop of London protested. And the choruses, of which in the first version there are already no fewer than ten, are on the one hand operatic and unecclesiastical in expression, until the last, where polyphonic work on a large scale first appears, but on the other hand they are all much too long to be sung by heart, as is neces-

sary on the stage In fact, the turning-point in Handel's development is the emancipation of the chorus from theatrical limitations This had as great an effect upon his few but important secular English works as upon his other oratorios. *Acis and Galatea*, *Semele*, and *Hercules* are in fact secular oratorios; the choral music in them is pagan, but it is large, independent, and polyphonic.

Handel's scheme of oratorio is, then, operatic in its origin and has no historic connection with the German Passion music of his time; and nothing is more significant than that the chorus should have so readily assumed its proper place in a scheme which the public at first certainly regarded as a sort of Lenten biblical opera And, as the chorus gains its musical freedom by the disappearance of theatrical necessities, it becomes the more powerful as a means of dramatic expression (as opposed to dramatic action)

Already in *Athalia* the "Hallelujah" chorus at the end of the first act is a marvel of dramatic truth. It is sung by Israelites almost in despair beneath usurping tyranny, and accordingly it is a severe double fugue in a minor key, expressive of devout courage at a moment of depression. On purely musical grounds it is no less powerful in throwing into relief the ecstatic solemnity of the psalm with which the second act opens. Now this sombre "Hallelujah" chorus conveniently illustrates the real originality and creative power of Handel's art It was not originally written for its situation in *Athalia*, but it was chosen for it It was originally the last chorus of the second version of the anthem, "As pants the Hart," from the autograph of which it is missing because Handel cut out the last pages in order to insert them into the manuscript of *Athalia* The inspiration in *Athalia* thus lies not in the creation of the chorus itself, but in the choice of it

In choral music Handel made no more innovation than he made in arias. His sense of fitness in expression was of little use to him in opera, because opera could not become dramatic until musical forms broke with architectural and decorative limitations (*see* GLUCK; MUSIC; SONATA-FORMS; and INSTRUMENTATION) But in oratorio there was no necessity for reforming any art-forms The ordinary choral resources of the time had perfect expressive possibilities where there were no actors and actions to keep waiting. Moreover, when ordinary decorum dictated an attitude of reverent attention towards the subject of the oratorio, then the man of genius could find the true scope for his dramatic sense and base immortal music thereon.

Musical Borrowings.—Handel must be estimated in terms of Shakespearean criticism. Originality, in music as in other arts, lies in the whole, and in a sense of the true meaning of every part When Handel wrote a normal double fugue in a minor key on the word "Hallelujah" he showed that he enjoyed the vigour and dignity of good 18th century double fugues. In putting it at the end of a melancholy psalm he showed his sense of the value of the minor mode When he put it in its situation in *Athalia* he shed upon it the light of a truly conceived dramatic situation. Handel himself did not more often transfer old work to new contexts than the first and greatest reformer of dramatic music who thrust Handelian opera into limbo (*see* GLUCK). Such procedures are interesting enough in any case; but musical criticism is unused to the cases where the borrowed material is not the composer's own; desperate efforts have been made to vindicate Handel or explain away the composers who were to Handel what Holinshed's Chronicles, Sidney's Arcadia, and North's Plutarch were to Shakespeare

On such matters heat is unaccompanied by light. No apology for Handel can plausibly maintain that his enormous physical industry was not compensated for by the Johnsonian indolence of a well-stocked mind. One writer (P. Robinson, *Handel and his Orbit*) tries to explain away Handel's Holinsheds and Plutarchs by pointing out that Urio and Erba, etc., are place-names around the Italian lakes which Handel visited. You cannot explain away Palestrina and half the Italian masters of painting by pointing out that their names are place-names; nor can you thus explain why Handel, who cares so little for art-forms, should faithfully imitate the minutest features of a style 50 years earlier than his own, or why his manuscript of the archaic Erba Magnificat should break off as a copyist breaks off, from the top of the page downwards. Besides, why explain away these Italian masters (whose existence as persons is attested by other evidence) when Handel borrowed a chorus in *Esther* from Graun?

This disposes, on the other hand, of attacks made on Handel's morality in plagiarising from sources that could never be traced in his lifetime. Within four years of Handel's death the child Mozart dedicated a set of sonatas to Queen Charlotte with the assurance that, inspired by her Majesty's protection "je deviendrai immortel comme Händel et Hasse"; and if he had substituted Graun, his patroness and his public would have missed no point but the alliteration. The only plausible reason why Handel did not plagiarise from Bach is that he would have thought any chorus of Bach quite impracticable in England. With the old Erba Magnificat the puzzle is that Handel should have thought such leaden vocal writing worth borrowing for *Israel in Egypt*. He could not add four chords, with the words "my fathers' God" without producing a vocal colour that aggravates rather than relieves the surrounding muddiness.

The most probable explanation is that Handel, who never thought of writing an original eight-part fugue, seriously imagined like an examiner for a university musical doctorate, that eight-part fugues were objects of veneration, and that the British public would be the better for hearing some old Italian masterpieces in this form. At all events he made no attempt to improve the Erba fugues, or even to assign them to texts that gave a tolerable declamation. A fugue on *Sicut erat in principio et nunc et semper* has to be sung to the words "THE earth swal . . . lowéd them."

Plagiarism or Transmutation?—Handel's plagiarisms begin to be interesting when we turn from these wholesale pilferings to his real transmutations of foreign elements. For English readers Sedley Taylor's volume of analysed illustrations (*The Indebtedness of Handel to the works of other Composers*, Cambridge 1906) is indispensable for a true understanding of the case. Its appearance gave rise to renewals of controversy which proved how dangerous it would have been to Handel if the matter had been raised in his lifetime His rival Buononcini was finally discredited by the discovery that he had sent in as his own work for a prize competition a madrigal by Lotti. What, say the moralists, was one madrigal against Handel's wholesale thefts? This query overlooks the distinction between a single prize composition, which is nothing if not wholly original, and a four-hours' entertainment which was so seldom entirely new that it was specially advertised to be so when that statement was permissible.

Hardly any two performances of Handel's oratorios took place, during his lifetime, without the addition and substitution of many favourite airs from other works Later on, in the time of Mozart, performances of operas (which had become much tighter unities than Handelian oratorios) were often adorned with inserted arias by other composers; Mozart's own contributions to other men's operas fill two stout volumes. Music was in the same condition as architecture; and Handel was as indebted to other composers as Wren was to Palladian architects, and as Mozart was (especially in his Requiem) to Handel. And no fear that discovery might discredit him seems to have entered into Handel's mind, for he left his whole musical library to his copyist, and it was from this library that the sources of his work were discovered

The true plagiarist is the man who does not know the meaning of the ideas he copies, and the true creator is he in whose hands they remain or become true ideas. The theme "He led them forth like sheep" in the chorus "But as for his people" is one of the most beautiful in Handel's works, and we may be shocked by the bare statement that it comes from a serenata by Stradella. But, to any one who knew Stradella's treatment of it first, Handel's would come as a greater revelation than if he had never heard the theme before. Stradella makes nothing more of it than an agreeably frivolous tune which lends itself to comedic purposes by repetition, throughout eight pages of patchy aria and ritornello, at an ever-increasing pace What Handel sees in it is what he makes of it, one of the most solemn and poetic things

in music.

Again, how shocking that the famous opening of the "Hailstone chorus" comes from the patchy and facetious overture to this same serenata, with which it is identical for ten bars all in the tonic chord representing, according to Stradella, someone knocking at a door. And how yet more shocking that the chorus "He spake the word, and there came all manner of flies" contains no idea of Handel's own; at least, none except the realistic swarming violin-passages, the general structure, and the vocal colouring, whereas the rhythmic and melodic figures of the voice parts come from an equally patchy *sinfonia concertata* in Stradella's work

The effects of Handel's original inspiration upon foreign material are really the best indication of the range of his style The comic intention of Stradella's doorknocking overture becomes Handel's inspiration in the "Hailstone chorus" In the theme of "He led them forth like sheep" what Stradella thought frivolous Handel makes sublime

The converse process is equally instructive In the short carillon choruses in *Saul*, where the Israelitish women welcome David after his victory over Goliath, Handel uses a delightful instrumental tune which stands at the beginning of a Te Deum by Urio, from which he drew extensively in *Saul, L'Allegro,* the Dettingen Te Deum, and other works. Urio's idea is first to make a jubilant and melodious noise from the lower register of the strings, and then to bring out a flourish of high trumpets as a contrast The tune could not bear and does not receive any further development, beyond statement and counterstatement It has none of the solemnity of church music, and its value as a contrast to the flourish of trumpets depends, not upon itself, but upon its position in the orchestra. Handel did not see in it a fine opening for a Te Deum, but he saw in it a perfect type of popular jubilation, and, taking it at its face value as a popular tune he raised it to a high dramatic level. So he uses it as an instrumental interlude accompanied with a jingle of carillons, while the daughters of Israel sing to a square-cut tune those praises of David which aroused the jealousy of Saul

But now turn to the opening of the Dettingen Te Deum and see realized the other side of Urio's idea, the contrast between a jubilant noise in the lowest part of the scale and the blaze of trumpets at an extreme height In the fourth bar of the Dettingen Te Deum we find the same florid trumpet figures as we find in the fifth bar of Urio's, but at the first moment they are on oboes The first four bars beat a tattoo on the tonic and dominant, with the whole orchestra, including trumpets and drums, in the lowest possible position, with all the drastic power of Handel's genius Then the oboes appear with Urio's trumpet flourishes; the momentary contrast is not less brilliant than Urio's; but when the oboes are immediately followed by the same figures on the trumpets themselves the contrast gains gradation and climax Moreover, these flourishes are more melodious than the sledge-hammer opening, whereas in Urio's scheme they were mere conventionalities coming after a good melody Lastly, Handel's primitive opening rhythmic figures inevitably underlie every subsequent inner part and bass that occurs at every half close and full close throughout the movement, especially where the trumpets are used. And thus every detail of his scheme is rendered alive with a rhythmic significance like that of the themes of Beethoven's second period, whereby he obtains the liveliness of polyphony without fussiness.

Greatness of the Oratorios.—No other great composer has ever so overcrowded his life with occasional and mechanical work as Handel, and in no other artist are the qualities that make the difference between inspired and uninspired pages more elusive The libretti of his oratorios are full of absurdities, except when they are derived in every detail from Scripture, as in *The Messiah* and *Israel in Egypt,* or from the classics of English literature, as in *Samson* and *L'Allegro.* The absurdities, and the way in which all Handel's works exist by taking in each other's washing, only serve to strengthen the conviction of sound musicians that Handel's originality and greatness consist in his grasp of the works as wholes. They would not matter but for the fact that in English oratorio Handel created a true art-form on the largest possible scale.

Though drama, in the proper and Aristotelian sense of action, was inherently beyond the terms of Handel's art, the two main qualities of dramatic language, viz., rhetoric and characterization, are at their highest power in all his music, and are, in spite of all that an obscurantist piety has done to conceal them, a main source of his popularity The 18th century love-affairs of the Israelite warriors and their Israelite maidens cease to resemble the Loves of the Triangles when Handel's music begins to discriminate. It cannot always save the situation, unless we are prepared (as the bishop of London in 1740 was not) to be amused at the contrast between the passionate Elder and the crafty Elder in their trio with the chaste Susannah But it leaves no part of the work altogether lifeless, even where the music is most perfunctory Neither the chorus nor the solo parts admit any lay-figures The heathen are so delightfully pagan that Handel has often been praised for his sympathy with them, but it is a feebly man-about-townish view that thinks his orthodox Jews and Christians less true to their ideals and to life Their music is the work of the man who hoped to die on Good Friday that he might rise with his Christ on Easter Day.

The power of Handel's English declamation is famous and might with advantage be used as a touchstone for the originality of his setting of words. For instance, the theme of "For unto us a child is born" puts an awkward strain on the word "For"; whereas the next theme, "And the government shall be upon his shoulder," is magnificently suggestive of the action symbolical of assuming the load of government. The rest of the chorus "Wonderful Counsellor," etc., obviously goes straight to the point. Now the first two themes come from an earlier Italian duet, of which the first words are *No, da voi non più fidarmi,* so that the word "For" replaces the exclamation "No" The other theme was meant to scold blind Love for its lying cajoleries, the word "shoulder" coinciding with *lusinghe . . re* Handel, seeing in this theme the possibility of a majestic interpretation, put up with a slight inconvenience in the opening theme for the sake of the spacious general structure of the whole movement which was easily expanded to include the new material of "Wonderful Counsellor."

It can hardly be doubted that the melody of "He shall feed his flock like a shepherd" was originally composed to some text, now lost, which gave the awkward expansion and fall of the word "shepherd" (scarcely better on the word "weary") a meaning as convincing as the famous "sheds delicious death" in *Acis and Galatea.*

The Additional Accompaniments Question—There never has been a time when Handel has been overrated, except in so far as other composers have been neglected But this favourite musician of the non-musician suffers grievously from pious misinterpretation and the popular admiration of the wrong externals Chrysander spoke true and winged words about the burial of Handel's art beneath "mammoth" Handel Festivals at the Crystal Palace; but greater damage has been done to performances on a normal scale by the use of "additional accompaniments" in the style of a later symphonic art, started most unfortunately by Mozart (whose share in the work has been corrupted in its turn) and continued throughout the 19th century in progressive stages of insensibility until Handel's style has become as unrecognizable as Nash's Regent street.

But while it is obvious that in *The Messiah* Mozart's orchestral colouring is for the most part an intrusion, the desire for purity of style overreaches itself when it leads to a condemnation of Mozart's work in *Acis and Galatea* and the smaller *Ode to St Cecilia's Day.* (The accompaniments to *Alexander's Feast,* published in Mozart's name, are obviously by no artist of even ordinary competence.) Handel's secular style is by no means remote from Mozart's, and he leaves so much to the discretion of the performer that it is no indiscretion to allow Mozart to convert Handel's often very perfunctory sketch into a perfect Mozart-Handel work of art.

The result is at all events less heterogeneous than the cadenzas inserted by recent *Musikgelehrte* who out of the fullness of

research achieve a style which no real composer at any period would receive without derision

For the rest, when the worst has been said concerning either his own weaknesses or the misdeeds of his editors, musicians will never cease to love and revere Handel as one of the greatest of composers, whose inspired work is a marvel of architectonic power, perfect sense of style, and the power to rise to the most sublime heights by the simplest means.

Works and Editions.—His important works have all been mentioned above with their dates, and a separate detailed list is unnecessary He was an extremely rapid worker, and his later works are dated almost day by day as they proceed From this we learn that *The Messiah* was sketched and scored within 21 days, and that *Jephtha*, with an interruption of nearly four months besides several other delays caused by Handel's failing sight, was begun and finished within seven months, representing hardly five weeks' actual writing.

Handel's extant works may be roughly summarized from the edition of the *Handelgesellschaft* as 41 Italian operas, 2 Italian oratorios, 2 German Passions, 18 English oratorios, 4 English secular oratorios, 4 English secular cantatas, and a few other small works, English and Italian, of the type of oratorio or incidental dramatic music; 3 Latin settings of the Te Deum; the (English) Dettingen Te Deum and Utrecht Te Deum and Jubilate; 4 coronation anthems, 3 volumes of English anthems (Chandos Anthems); 1 volume of Latin church music; 3 volumes of Italian vocal chamber-music; 1 volume of clavier works; 37 instrumental duets and trios (sonatas), and 4 volumes of orchestral music and organ concertos (about 40 works) Precise figures are impossible as there is no means of drawing the line between *pasticcios* and original works The instrumental pieces especially are used again and again as overtures to operas and oratorios and anthems

The complete edition of the German *Handelgesellschaft* suffers from being the work of one man who would not recognize that his musicianship was unequal to the nature of the task, and that the quantity of the task was beyond any single man's power The best editions in vocal score are undoubtedly those published by Novello that are not based on "additional accompaniments" None is absolutely trustworthy, and those of the editor of the German *Handelgesellschaft* are sad proofs of the uselessness of library-scholarship without practical musicianship Yet Chrysander's services in the restoration of Handel are beyond praise His discovery of authentic trombone parts in *Israel in Egypt* is one among many valuable contributions by him to musical history and aesthetics (D. F. T)

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HANDEL-MAZZETTI, ENRICA, BARONESS VON (1871–), Austrian author, was born at Vienna on Jan. 10, 1871 She is the author of many historical novels, and has shown a peculiar aptitude for depicting the manners, customs and modes of thought of earlier times The majority of her books are imbued with the spirit of Roman Catholicism, a result of her religious education at Saint Pölkten, and are, in fact, propagandist stories

Her most important works are: *Meinrad Helmpergers denkwürdiges Jahr* (1900); *Jesse und Marie* (1906); *Die Arme Margaret* (1910); *Stefana Schwertner* (1913, 3 vols.); *Der deutsche Held* (1920); *Das Rosenwunder* (1925).

See E. Korrodi, *Enrica von Handel-Mazzetti* (1909); Brecka, *Die Handel-Mazzetti* (1923); Speckmann, *Quellen und Komposition der Trilogie "Stefana Schwertner"* (1924).

HANDEL FESTIVAL, one of the most famous and long-established of musical festivals, held periodically at the Crystal Palace, London, and designed originally to celebrate the centenary of Handel's death. A preliminary performance took place at the Crystal Palace in 1857. This was followed by the centenary festival of 1859, and thenceforward the festivals have been continued more or less regularly triennially, the successive conductors having been Costa (1857–80), Manns (1883–1900), Cowen (1903–23) and Wood (1926). The programmes are devoted usually to complete oratorios on two days, the *Messiah* being invariably one of them, and to selections on the other.

HANDFASTING, primarily the O.E. synonym for *betrothal* (*q.v.*), and later a form of temporary marriage at one time common in Scotland, the only ceremony being the verbal pledge of the couple while holding hands (A.S. *handfoestnung* pledging one's hand). The pair thus handfasted were, in accordance with Scotch law, entitled to live together for a year and a day. If then they so wished, the temporary marriage could be made permanent; if not, they could go their several ways without reproach, the child, if any, being supported by the party who objected to further cohabitation

HANDICAP, a disadvantageous condition imposed upon the superior competitor in sports and games, or an advantage allowed the inferior in order to equalize the chances of both (from the expression *hand in cap*, referring to drawing lots). The character of the handicap depends upon the nature of the sport. Thus in horse-racing the better horse must carry the heavier weight. In foot races the inferior runners are allowed to start at certain distances in advance of the best (or "scratch") man, according to their previous records In distance competitions (weights, fly-casting, jumping, etc.) the inferior contestants add certain distances to their scores. In time contests (yachting, canoe-racing, etc.) the weaker or smaller competitors subtract certain periods of time from that actually made, reckoned by the mile. In stroke contests (*e.g.*, golf) a certain number of strokes are subtracted from or added to the scores, according to the strength of the players In chess and draughts the stronger competitor may play without one or more pieces. In court games (tennis, lawn-tennis, rackets, etc.) and in billiards, certain points, or percentage of points, sometimes called *bisques*, are accorded the weaker players.

HANDICRAFTS, manual skill, or skilled work with the hand, more generally designating those visual arts which are actually practised by hand and associated with wearing apparel or decoration in the home In a sense handicrafts may be considered as synonymous with arts and crafts (*q.v.*), only of a less broad meaning; arts and crafts including those arts which are practised by hand and those which are practised with the aid of a machine.

HANDL, JACOB, also **HÄNDL** or **HÄHNEL** (*c.* 1550–1591), German composer, was born in Carniola about 1550 The nickname of GALLUS, by which he was generally known, was a play on his surname Hähnel, "little cock" He is known to have been in the service of the Bishop of Olmütz as master of the chapel about 1579, but is principally associated with Prag, where he was for many years organist of St. Johann am Ufer His death took place at Prag on July 18, 1591. Although he hardly merited the name, freely given to him, of "the German Palestrina," he was undoubtedly an important figure in his day. His music shows a definite leaning towards the homophonic style which was so soon to take the place of 16th century polyphony Most of his works were published in his lifetime, the most important being his "opus musicum," containing motets for the whole church year (Prag, 4 vols., 1586–90)

Other works are, 16 masses (1580); *Epicedion harmonicum* (1589); *Moralia* (1596); a motet *a* 4: *Ecce quomodo moritur justus* (used by Handel in his Funeral Anthem) and others for 5, 6 and 8 voices, printed in Bodenschatz's *Florilegium portense;* 11 motets, 3 *responsoria*, a *Miserere*, a *Christus factus est*, and a *Te Deum* are included in Proske's *Musica divina*. A selection of his motets with biographical notes will be found in *Denkmäler der Tonkunst in Oesterreich* vol. VI. 1 (1899). *See* Paul Piok, *Die Messen von Jakobus Gallus* (Vienna, 1917).

HAND PRESSES: *see* PRINTING.

HANDSEL, the O.E. term for earnest money; especially in Scotland the first money taken at a market or fair. "Hand"

indicates the actual putting of the money into the hand Handsels were also presents or earnests of goodwill in the north; thus Handsel Monday, the first Monday in the year, an occasion for universal tipping, is the equivalent of the English Boxing Day

HANDSWORTH. (1) A parliamentary division of Birmingham, England. Pop. (1921) 75,145. (*See* BIRMINGHAM.) (2) An urban district of Yorkshire, 4 m. S E. of Sheffield Pop. (1921) 15,893. In this neighbourhood are extensive collieries.

HAND TENNIS: *see* TENNIS.

HAND-TO-MOUTH BUYING. This American phrase describes a method, involving a notable change in the economic structure of American business, which is the purchase by jobber, retailer and consumer of only such small supplies of goods as are immediately saleable or appropriate for the moment It was a radical departure from the long-prevailing custom of the jobber and retailer ordering and keeping in stock a large assortment of merchandise. Likewise, it was an important change in the buying habits of many American people

Hand-to-mouth buying began on a large scale in 1921, but some of its contributing causes were produced by the outbreak of the World War in 1914. Almost every American industry was pressed to fill orders from Europe When the United States entered the war in 1917, transportation of munitions and other war supplies became a prime object. Manufacturing production had been greatly increased, but the railroads were not equipped to handle the immense volume of goods for both war needs and private consumption Jobbers and retailers were unable to secure promptly goods ordered from the manufacturers. With the war's end in 1918, there was a movement to meet the public demand for goods by over-stocking. In the summer of 1920 a widespread industrial depression set in; the public stopped buying; and dealers were left with overloaded and stale stocks of depreciated value. From the fear of again over-stocking, jobbers and retailers adopted the hand-to-mouth buying policy.

So rapidly did public taste for different styles in many articles change that manufacturers faced a problem of production, and jobbers and retailers felt that they could not afford to risk carrying a large quantity of goods. Great changes in consumer demand had taken place, and these in turn seriously affected mass production of goods. General automobile ownership had removed suburban and rural isolation. Fashion magazines penetrated in the remotest places, and cinema pictures everywhere vividly presented the latest modes. The result was a general popular awakening to an appreciation of "smart" garb and well-designed objects, whether of house decoration, home architecture or other possessions. Consumer demand became more selective and individualistic; manufacturers found that they could no longer impose old stocks unsaleable in cities upon small towns and rural inhabitants. In its condition of post-war prosperity, the American public demanded constant changes in styles and was both able and willing to pay for them No prudent merchant was disposed to buy more of an article than he thought could be sold within six to eight weeks. The great increase in commercial rents in the various American cities caused storekeepers to take smaller shops. From 1918 to 1928 these rent increases approximated 300%. Curtailment of store space supplied another reason for hand-to-mouth buying, and the development of motor truck transportation made it more feasible. By motor truck delivery small orders were rushed to their destination

In 1926 the Farmers Loan and Trust Company of New York city sent a questionnaire to American leaders in industrial and economic thought on the causes and results of hand-to-mouth buying. Many bankers, department store owners, and executives of industrial corporations agreed that large inventories were an evil under modern conditions and that hand-to-mouth buying had become established as a permanent factor.

HAND TREE (*Cheirostemon platanoides*), a tree of the family Sterculiaceae, native to Mexico, which takes its name from the peculiar formation of the flowers, the five bright red stamens of the calyx projecting in such a way as somewhat to resemble the fingers of a human hand—the corolla being absent. It is related to the Baobab of West Africa.

HANDWRITING. Under PALAEOGRAPHY and WRITING, the history of handwriting is dealt with. Questions of handwriting come before legal tribunals mainly in connection with the law of evidence. Proof by comparison of handwritings, with a reference if necessary to three experts as to the handwriting which is to be used for the purposes of comparison, is provided for in the French Code of Civil Procedure (arts. 193 *et seq.*), and in Quebec (Code Proc. Civ. arts. 392 *et seq.*) and St. Lucia (Code Civ. Proc. arts. 286 *et seq.*), the French system has been adopted with modifications. Comparison by witnesses of disputed writings with any writing proved to the satisfaction of the judge to be genuine is accepted in England and Ireland in all legal proceedings whether criminal or civil, including proceedings before arbitrators (Denman Act, 28 & 29 Vict c. 18, 55, 1, 8); and such writings and the evidence of witnesses respecting the same may be submitted to the court and jury as evidence of the genuineness or otherwise of the writing in dispute. It is admitted in Scotland (where the term *comparatio literarum* is in use) and in most of the American States, subject to the same conditions In England, as in the United States, and in most legal systems, the primary and best evidence of handwriting is that of the writer himself. Witnesses who saw him write the writing in question, or who are familiar with his handwriting either from having seen him write or from having corresponded with him, or otherwise, may be called In cases of disputed handwriting the court will accept the evidence of experts in handwriting; *i.e.*, persons who have an adequate knowledge of handwriting, whether acquired in the way of their business or not, such as solicitors or bank cashiers (*R.* v. *Silverlock*, 1894, 2 Q B. 766). In such cases the witness is required to compare the admitted handwriting of the person whose writing is in question with the disputed document, and to state in detail the similarities or differences as to the formation of words and letters, on which he bases his opinion as to the genuineness or otherwise of the disputed document By the use of the magnifying glass, or, as in the Parnell case, by enlarged photographs of the letters alleged to have been written by Parnell, the court and jury are much assisted to appreciate the grounds on which the conclusions of the expert are founded Evidence of this kind, being based on opinion and theory, needs to be very carefully weighed, and the dangers of implicit reliance on it have been illustrated in many cases (*e.g.*, the Beck case in 1904; and see *Seaman* v. *Netherclift*, 18;6, 1 C P D 540). Evidence by comparison of handwriting comes in principally either in default, or in corroboration, of the other modes of proof It has been held in England that in a criminal case where a question of handwriting is raised, the jury should have the assistance of expert evidence (*R.* v. *Rickard*, 1918, 26 Cox C C. 318).

See also as to attestation of documents, BILL OF SALE, EVIDENCE; WILL.

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GRAPHOLOGY

The systematic attempt to read character from handwriting is termed graphology Extravagant and unsubstantiated claims have been made in this field Graphologists have organized a system of reading personality on the basis of such graphic elements as size, line-quality, slant, alignment, continuity and proportions above and below the line. Size has been claimed to be symptomatic of self-feeling. Unusually large handwriting is said to characterize the ambitious, imaginative person; very small writing, the pedantic person. It is, however, recognized that there may be more than one cause for the same effect. Minute writing may be due to myopia; magnification of script may mask loss of motor control The graphologists claim that slant and alignment are symptomatic of emotivity; extreme slant to the right betokens emotional susceptibility; to the left, coldness, emotional repression Falling alignment signifies pessimism; rising alignment, optimism, ambition.

The psychology of handwriting puts graphological affirmations

to the test Binet, for example, checked by means of controlled experiments four assumptions of the graphologists, their claim to read from handwriting sex, age, intelligence and character He found that the success of graphologists in detecting sex from handwriting ranged from 63 to 78 8% and under favourable variable conditions might reach 90%. Inversions of sex signs were, however, common. Many women were found to write masculine hands and a few men feminine ones A sexless hand was also discovered. The interpretation of the results is ambiguous since sex in writing may be an outcome of social factors. On the basis of differences in pressure, speed, size and rhythm, Meumann and Awramoff have also concluded that there are masculine and feminine writing-types. Binet found the graphologists could estimate age on the average within about ten years They were somewhat successful in separating the hands of geniuses from those of average individuals but could not select accurately the handwriting of criminals Other experimentalists have tested out other assumptions of the graphologists. Hull and Montgomery obtained negative results. Downey found some evidence of positive correlation between preoccupation with details and small filiform writing and between an explosive psychic make-up and general pattern

Identification of Handwriting.—The handwriting expert interested in the identification of hands should not be confused with the graphologist who seeks to read character from handwriting The former may have little patience with the claims of the latter. He may urge that individuality of handwriting is wholly a product of external factors such as the system of handwriting learned, the writing apparatus used, occupational requirements and the like, and yet state, as does Osborn, that the mathematical probability of two complete handwritings being identical is one in something more than 68 trillions.

Identification of handwriting is a matter of great importance in law cases which involve questioned documents The handwriting expert utilizes the enlarged photograph, the document microscope, the colour microscope, designed for recording the tints and shades of ink and delicate scales for determining line-width and similar graphic details He also applies stereoscopic photography to determine which line was written first, in the case of lines that cross, and to discover the presence of erasures and changes in paper-fibre. He has also stimulated discussions concerning the limits of variability and of disguise in the hands of individuals.

Graphic Pathology.—Medical graphology is concerned with the changes that take place in writing with the incidence of organic or neural diseases or mental disorders In the case of neural disturbances, changes in writing may result which are, to a certain extent, symptomatic of a given disease. Such changes occur in handwriting in paralysis agitans, tabes, paresis, writer's cramp, senile deterioration. They consist largely of tremors of various sorts, of ataxia or disorder of form, or involve great increase or decrease in graphic size or blurring or fusion of letters or exaggerated spacing of letters. Mental disturbances may also affect handwriting There may be an exaggeration of certain characteristics that appear in script produced under emotional excitement or extreme inhibition, for example, the magnification of movement in the writing of the maniac and its uphill trend, or the tiny script of the melancholiac with its falling alignment. The curiously decorated signatures that betoken grandeur of ideas or morbid vanity may also be cited in this connection, as also the elaborate paraphs or flourishes which are made at the end of a signature sometimes in such a way as to suggest that the penman is protecting himself against blows from the outside. Disturbances of handwriting may possibly result from organic diseases. Very broad claims have been made by Duparchy-Jeannez concerning the possibility of using various graphic signs in the diagnosis of stomach, liver, heart and gastro-intestinal diseases. Curious applications of medical graphology have been made in biographical studies. The question has been raised, for example, whether it is possible to determine from the six defective signatures of Shakespeare that are admittedly genuine, whether or not the poet suffered from a given disease. Beethoven's writing has also been scanned to determine the changes that appear in the script of deaf patients

A curious modification of writing is found in reversed or mirror-script which can be restored to the usual form by reflection from a mirror. It has been thought that mirror-writing is the normal writing of the left hand but it is sometimes written spontaneously by the right hand and it is a common occurrence among young children who are just learning to make letters or digits. The most famous instance of mirror-writing is that of Leonardo da Vinci. *See* CALLIGRAPHY.

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(J. E. D.)

HAN DYNASTIES: *see* MING, SUNG, T'ANG AND HAN DYNASTIES

HANFORD, a city in the central part of California, U S A., 30m S of Fresno; the county seat of Kings county. It is served by the Santa Fe and the Southern Pacific railways The population was 5,888 in 1920; estimated locally at 7,850 in 1928. It lies in the irrigated part of the rich San Joaquín valley, where farming, fruit growing and dairying are the principal industries The city was incorporated in 1891

HANGAR: *see* AIRSHIP SHEDS.

HANGCHOW, one of the most notable of the historic cities of China (30° 15′ N., 120° 16′ E.) Its significance is largely the product of its position. It lies at the mouth of the basin of the Tsien-tang which drains W Chekiang, and at the head of the bay of Hangchow into which the Tsien-tang falls As the natural link between the thickly-peopled plains on either side of Hangchow bay and as the outlet of West Chekiang, Hangchow has come to be the capital of Chekiang province. It has had a wider significance through its position on the south margin of the Yang-tze delta and through its participation in the cultural development of the deltaic cities. It gathers up the southern ends of the waterways of the delta and is the southern terminus of the Grand canal which was, from the time of the Mongols to the mid-19th century, the main avenue of communication between the Yangtze delta and Peking Yet the greatest days of Hangchow were before the completion of the Grand canal as a through route between north and south. It was during the later Sung dynasty (AD 1127–1280), when the Chinese had retreated before the Tartars south of the Yangtze, and had established their capital at Hangchow which became the scene of the intense literary activity of that period, that the city reached the height of its importance Hangchow was then popularly known as King-sze (the capital), from a corruption of which Marco Polo's *Kinsai* was derived.

Hangchow has been a commercial centre of great importance from the T'ang period onwards. Although one of the points where the system of inland waterways which thread the Yangtze delta reaches the sea, Hangchow itself has never been a port for sea-going vessels. From the T'ang to the Yuan periods it utilized Kanfu (or Kanpu) farther down Hangchow bay, and with the continued silting of the bay, its sea-going trade has had to pass through Shanghai. The total trade of the port—Hk. Tls. 29,964,042 in 1926—is of about the same bulk as that of Soochow or Chinkiang, which are also within the delta and on the Grand canal Hangchow is of industrial as well as of commercial importance. The most important industry is silk manufacture, for north-west Chekiang is a famous sericultural region. Like Nanking, Hangchow is a silk-weaving rather than a silk-reeling centre. A considerable number of rice-hulling and cleaning mills reflect the rice culture of the surrounding plains.

The city itself is built at the foot of a beautiful range of hills (the Tien-mu shan or Eye of Heaven mountains) and by the shores of the famous Si-hu, the Western lake The beauty of its buildings and gardens equals the charm of its situation among

hills and valleys studded with some of the most famous monasteries in China Hence the Chinese proverb: "There is Heaven above and Soochow and Hangchow below" To Marco Polo it was incomparably the finest city in the world. This beauty was sadly tarnished by terrible devastations during the Tai p'ing revolt in 1861, but the city, in a somewhat modernized form, has largely recovered its prestige, and with a population of 650,000 still ranks as one of the greatest cities of China.

Hangchow was, especially during 1927 and 1928, of great importance to the contending powers in China When the Nationalist party made Nanking the capital of the republic, Hangchow immediately sprang into greater prominence as the port of that city New regulations were formulated for the defence of the port against river-pirates and a shore Customs board was set up to deal with the smuggling which was a profitable undertaking Early in 1929 there was a clash between the Nationalists and the Customs authorities over a supply of opium which arrived at Hangchow destined for Nanking. Hangchow itself has not frequently suffered the outrages common to most important cities in the active area of hostilities and still preserves many of its beauties in spite of its increased commercial and industrial importance

HANGING, in ancient days, a mark of indignity practised on the lifeless form of criminals As a form of execution it does not appear in the Mosaic legislation It is probable that the Chief Baker in the time of Joseph (Genesis xli. 13) was thus exposed to shame after being killed Under Persian rule gallows were certainly used as a method of execution The case of Haman exemplifies this method (Esther ii 23, vii. 9–10) It was derived by the Anglo-Saxons from their German ancestors (Tacitus, *Germ* 12) In England Henry I decreed that all thieves taken should be hanged (*i.e.*, summarily without trial), and by the time of Henry II hanging was fully established as a punishment for homicide; the "right of pit and gallows" was ordinarily included in the royal grants of jurisdiction to lords of manors and to ecclesiastical and municipal corporations In the middle ages every town, abbey, and nearly all the more important manorial lords had the right of hanging From the end of the 12th century the jurisdiction of the royal courts gradually became exclusive Hanging was substituted in 1790 for burning as a punishment of petty treason (*see* TREASON), and in 1814 for beheading as a punishment for male traitors Formerly in the worst cases of murder it was customary after execution to hang the criminal's body in chains near the scene of his crime This was known as "gibbeting," and, though by no means rare in the earliest times, was, according to Blackstone, no part of the legal sentence. It was not until 1752 that gibbeting was recognized by statute. The Act (25 Geo II c 37) empowered the judges to direct that the dead body of a murderer should be hung in chains, in the manner practised for the most atrocious offences, or given over to surgeons to be dissected and anatomized, and forbade burial except after dissection (*see* Foster, *Crown Law*, 107, Earl Ferrers' case, 1760) The Act of 1752 was repealed in 1828, but the alternatives of dissection or hanging in chains were re-enacted and continued in use until abolished as to dissection by the Anatomy Acts in 1832, and as to hanging in chains in 1834.

In Great Britain criminals are executed by fracturing or dislocating the first three cervical vertebrae and so damaging the vital centres in the spinal cord This is done by placing a noose round the neck and allowing the condemned to fall a distance of 6 to 8 ft before the rope takes the strain. The knot is placed either behind the ear or under the chin, so that the neck may be more readily broken Under the Act of 1868 (31 and 32 Vict c. 24), which was adapted from similar legislation already in force in the Australian colonies convicted murderers are hanged within the walls of a prison. The sentence of the court is that the convict "be hanged by the neck until he is dead." The execution of the sentence devolves on the sheriff of the county (Sheriffs Act, 1887, s. 13). A public notice of the date and hour of execution must be posted on the prison walls not less than 12 hours before the execution and must remain until the inquest is over. The persons required to be present are the sheriff, the gaoler, chaplain and surgeon of the prison, and such other officers of the prison as the sheriff requires; justices of the peace for the jurisdiction to which the prison belongs, and such of the relatives, or such other persons as the sheriff or visiting justices allow, may also attend The death of the prisoner is certified by the prison surgeon, and a declaration that judgment of death has been executed is signed by the sheriff. An inquest is then held on the body by the coroner for the jurisdiction and a jury at which it is usual to allow the attendance of some representatives of the press (*See* further CAPITAL PUNISHMENT)

United States.—Capital punishment has been abolished in Kansas, Michigan, Minnesota, North Dakota, Rhode Island and Wisconsin, except in North Dakota and Rhode Island where it applies if a person serving a life sentence commits murder Electrocution has been substituted for hanging in Alabama, Arkansas, the District of Columbia, Florida, Georgia, Illinois, Indiana, Kentucky, Massachusetts, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont and Virginia Kentucky still inflicts hanging for rape. Execution is by lethal gas in Nevada and in Utah the condemned person has the option of death by hanging or shooting. In the other States hanging remains as the method of legal execution. In States having execution, it is invoked for first degree murder, although in some States the jury may bring about life imprisonment by urging mercy A few of the States permit execution for kidnapping and rape

HANGÖ, a growing port and sea-bathing resort situated on the promontory of Hangoudd, to the extreme south west of Finland, in 59° 46′ N., 22° 57′ E Pop (1925) 7,000 There are two powerful ice-breakers and the port is kept open all the winter, and the mole has been lengthened to Hogholmen, which the largest ships can enter Warehouses and quays are under construction The exports are butter, wood, pulp, paper, tar, game and skins, and the imports cotton, coal, sugar, coffee, wines and spirits, iron and textiles It is connected by railway with Helsingfors and Tammerfors, and is the centre of the Finnish butter export During the period of emigration, owing to political troubles with Russia, over 12,000 Finns sailed from Hango in 1901

HANIËL VON HEIMHAUSEN, EDGAR VON (1870–), German diplomatist and official, was born at Ruhrost on Dec 12, 1870 He studied at Bonn and Berlin, and entered the diplomatic service in 1900 He served in the principal European embassies before he was attached (1911–17) to the embassy at Washington He was a member of the armistice commission at Spa and of the peace delegation at Versailles He was then secretary of State in the Foreign Office and in 1923 became representative of the *Reichsregiment* at Munich

HANIHARA, MASANAO (1876–), Japanese statesman, was born in Yamanashi-Ken. He graduated from Waseda university, Tokyo in 1897 and entered the diplomatic service In 1899 he went to the legation at Seoul (Korea) as attaché being transferred to Washington in the same capacity in 1901 After a year of service there, he was made secretary, invited specially to study American affairs, and later became chief secretary for foreign affairs He felt that American-Japanese relations were unsatisfactory and wished to impress upon the citizens of the United States the necessity for friendly co-operation with the Japanese. He was sent to San Francisco as consul-general in 1916, remaining until the end of 1917 Returning to Tokyo he first became director of political affairs and then in 1919, vice-minister for foreign affairs As vice-minister he was one of the four delegates to the Washington Conference 1921–22 In 1923 he was appointed Japanese ambassador to Washington, and it is maintained in America that his reference, in a public speech, to the "regrettable consequences which would follow the passage" of the immigration bill, was responsible for the bill becoming law. The Japanese Government realizing that some blunder had been made, recalled Hanihara in 1924.

HANK: *see* YARN.

HANKA, WENCESLAUS (1791–1861), Bohemian philologist, was born at Horeniowes, Bohemia, on June 10, 1791. In

1817 Hanka alleged that he had discovered some ancient Bohemian manuscript poems (the Koniginhof ms.) of the 13th and 14th century in the church tower of the village of Kralodwor, or Koniginhof These were published in 1818, under the title *Kralodworsky Rukopis*, with a German translation by Swoboda. Dobrowsky pronounced *The Judgment of Libussa*, another manuscript found by Hanka, an "obvious fraud," and, though Dobrowsky afterwards retracted, the ms is usually regarded as a forgery The originals were presented by the discoverer to the Bohemian museum at Prague, of which he was appointed librarian in 1818 In 1848 Hanka, who was an ardent Panslavist, took part in the Slavonic congress; he was the founder of the political society Slovanska Lipa He was elected to the imperial diet at Vienna, but declined to take his seat. In the winter of 1848 he became lecturer and in 1849 professor of Slavonic languages in the University of Prague, where he died on Jan 12, 1861.

His works include. *Hankowy Pysne* (Prague, 1815), a volume of poems; *Starobyla Skladani* (1817–26), in 5 vols.—a collection of old Bohemian poems, chiefly from unpublished manuscripts; editions of various texts, and a Czech grammar.

HANKEY, SIR MAURICE PASCAL ALERS, G C B. (1919) (1877–), British soldier and politician, was born on April 1, 1877, and educated at Rugby. He joined the Navy in 1895, and served in the Mediterranean from 1899 to 1901 He was then appointed to the Naval Intelligence department (1902–1906) and afterwards served as secretary to the committee of imperial defence (1912), the war cabinet (1916), the imperial war cabinet (1917), the imperial conferences of 1921, 1923 and 1926 and the London conference on reparations (1924). He also acted as secretary to the British delegation at the peace conference in 1919, the Washington conference in 1921, and the Genoa conference in 1922 In 1923 he was appointed clerk of the Privy Council

HANKOW, the greatest commercial city of Central China in 30° 32′ N and 114° 19′ E. Hankow itself lies on the north side of the Yang-tze at the junction of the Han-kiang with the main river Immediately opposite, in the angle of junction, is the older city of Hanyang and a little below the confluence, on the south bank of the Yang-tze is the ancient metropolis of Wuchang, the capital of Hupeh province Hankow, Hanyang and Wuchang really constitute a single urban unit of vast dimensions known to the Chinese under the composite name of Wu-Han. The total population in 1926, as estimated by the Chinese Maritime Customs, was 1,583,900

Communications.—This triple city of Wu-Han has an almost unrivalled geographical centrality which gives its site immense commercial significance The Hupeh basin in which it lies is preeminently the central basin of China, the very heart of the country, and the converging point of routes from every point of the compass If a line is drawn connecting the chief emporia along the periphery of China proper (Peking, Sianfu, Chengtu, Yunnanfu, Canton, Shanghai) we get a roughly circular figure with Wu-Han nearly in the centre The Yang-tze, the greatest of China's arterial waterways, is navigable for large ocean-going vessels, except during the winter dry season, up to the site of the city which can therefore be considered as the head of ocean navigation, although 600 miles from the coast Upstream between Hankow and Ichang, at the outlet of the Yang-tze gorges, it is navigable for vessels of considerable size, and midway in this stretch, at Yochow, the river is the outlet for the large Tung-ting lake into which flows from the south the Siang, the main artery of Hunan, and from the south-west the Yuen-kiang, affording the chief route to Kweichow and south-west China generally. To the east the Po-yang lake, strictly analogous to the Tung-ting lake, receives the waters of the Kan, the second of the two great ways to the south through the south China highlands Kiukiang, at the Yang-tze outlet of this system, may be regarded largely as a feeder of Wu-Han which is centrally placed in relation to the twin basins of Tung-ting and Po-yang.

To the west of the Hupeh basin is the trough of the Yang-tze gorges, difficult indeed, but the only practicable route by which the Red basin of Szechwan can be brought into relation with the heart of China and the ocean. The construction of special steamers for negotiating the gorges even during the dry season now greatly facilitates trade between Chung-king and Hankow. From the north-west comes the Han, navigable for 300 miles above Hankow and the chief route to Sianfu and north-west China

The importance of this convergence of river-routes is now increased by the fact that the main trunk railway of China, destined to link Peking with Canton, here intersects the Yang-tze The railway is in two main sections, the completed section from Peking to Hankow, and the incomplete section from Wuchang to Canton The railway southwards has been finished to a point beyond Changsha and a branch line puts Wu-Han into direct rail connection with the coalfield at Pinghsiang. Among projected railways two are of great importance, an urgently needed line to the Red basin and another to south-west China utilizing the valley of the Yuen-kiang As the meeting point of maritime, river and rail transport, Wu-Han has almost unique advantages as a collecting and distributing centre and its position in this respect may be compared with that of Chicago.

It is connected by regular lines of steamers with Shanghai, Ichang, Changsha and other river ports and is the focus of an enormous junk traffic It is the chief entrepôt for the Central Yang-tze provinces and for west and south-west China particularly for tea, cotton, silk, timber (from western Hunan by the Yuen-kiang), wood-oil and hides.

Industries.—Hankow was one of the first inland cities of China to be opened to foreign trade (1858) and its development as a port in close contact with Europe brought it early under the influence of western industrialism Hanyang was selected by the viceroy Chang Chih-tung in 1891 as the site of the first modern iron and steel works in China This became the property of the Han-yeh-ping Iron and Steel Company, organized in 1908, one of the chief industrial corporations of the middle Yang-tze valley, owning, in addition to the Hanyang iron and steel works, the Tayeh iron mines and the collieries of the Pinghsiang coalfield This company has been largely financed by Japanese loans and one of the most important concessions obtained by Japan in 1915 was an undertaking from the Chinese Government "not to confiscate the company nor, without the consent of the Japanese capitalists, to convert it into a state enterprise, nor cause it to borrow and use foreign capital other than Japanese" In recent years this company and also the Yang-tze engineering works have suffered severely as a result of economic and political disturbances but Wu Han is likely to remain one of the chief centres of the Chinese iron and steel industry

It is also an important centre of textile manufactures, although at present ranking far behind Shanghai. At the end of 1925 there were 27 weaving mills in Hankow 6 in Wuchang and one in Hanyang The cloths produced are mainly plain cloths, including woollen and cotton mixtures and fancy cloths, including artificial silk and brocades, the demand for which is increasing on the Wu-Han market. Dependent on this industry are a large number of dye works, the dyers in the majority of cases being weavers as well. There are five modern-style cotton mills, four of which are in Wuchang In this connection it may be noted that American varieties of cotton have so far yielded much better results in the Hupeh basin than in the Yang-tze delta and that the area under cotton in the region surrounding Wu-Han has been steadily increasing

Another large industry based on local production is represented by the rice mills of which there are over 30 in Wu-Han, all of them employing modern machinery. In addition there are several oil mills, utilizing the large local supplies of beans and many important refineries of wood or *tung* oil, which, as a substitute for linseed and other oils, has a large American and European market There are also flour-mills, cement works, soap and albumen factories, distilleries and a large number of miscellaneous industries. Hankow is also a great banking centre.

Prior to the political disturbances of 1926–27, the rapid increase in Hankow's foreign trade was very remarkable. The value of the trade coming under the cognisance of the Maritime Cus-

toms in 1925 was HK. Tls. 288,761,077 made up as follows: net Foreign imports, 69,365,189; net Chinese imports, 64,309,105; exports, 155,086,283

Political Significance.—Both on account of its intrinsic importance and its situation in relation to the chief routes, the Wu-Han group of cities has figured prominently in the troubled political history of modern China. The revolution of 1911 broke out in the barracks at Wuchang and the low ridges, particularly the Serpents' ridge at Wuchang, which here cross the marshy basin, were of great strategic importance in the subsequent fighting. The line of heights overlooking the Han was the scene of the principal struggle between the imperial and revolutionary troops, the main objective being the government arsenal at Hanyang More recently, the capture of Hankow by the Nationalist armies, advancing northwards from Kwangtung (December 1926), marked the extension of Nationalist power to the middle Yang-tze. It was followed by a serious mob onslaught on the British Concession, the charge of which passed into the hands of the Chinese and for a time business was completely suspended. Finally an agreement was concluded providing for the dissolution of the British Municipal Council and the setting up of a Chinese municipality modelled on that already set up for the former German Concession in Hankow but Sino-British in composition The events at Hankow were also followed by the important communication (Jan. 27 and 28, 1927) to the Chinese authorities both at Peking and Hankow of the proposals of the British Government for modifying their position under the treaties to meet Chinese Nationalist aspirations. Subsequently Hankow was for a short time under the control of a "Communist" Government in opposition to the Nationalist Government at Nanking.

HANLEY, market town; Stoke on Trent county, municipal and parliamentary borough, Staffordshire, England. Pop. (1921) 77,786 In 1910 it amalgamated with neighbouring towns to form the municipal borough of Stoke-on-Trent (*q v.*) which in 1925 became a city.

HANN, JULIUS (1839–1921), Austrian meteorologist and climatologist, was born near Linz, Upper Austria, on March 23, 1839 In 1865 he became editor of the *Zeitschrift der Oesterreichischen Gesellschaft fur Meteorologie*, and from 1877 was occupied in the Central Meteorological Institute at Vienna. In 1873 he was appointed professor of physics at the University of Vienna. He acquired a world-wide reputation for his works on atmospheric dynamics and thermodynamics, the "atmospheric pulse," cyclones and climatology. His principal works are *Die Erde als Ganzes; Die Atmosphäre und Hydrosphare* (1872); *Handbuch der Klimatologie*, 3 v. (1908); *Lehrbuch der Meteorologie*, 3d ed. (1914) and many papers in his own *Zeitschrift* and the reports of the Akademie der Wissenschaften. He died in Vienna on Oct. 1, 1921

HANNA, MARCUS ALONZO (1837–1904), American politician, was born at New Lisbon (now Lisbon), Columbia county (O.), on Sept. 24, 1837. In 1852 he removed with his father to Cleveland. He received his education in the public schools of that city and at the Western Reserve university. He was associated with his father in the wholesale grocery business and became a member of the firm. In 1867 he entered into partnership with his father-in-law, Daniel P. Rhodes, in the coal and iron business. In 1877 the firm became M. A. Hanna & Company and was extended to include the ownership of a fleet of lake steamships constructed in its own shipyards and the control and operation of valuable coal and iron mines. Hanna became largely interested in street railway properties and in various banking institutions, and after 1880 became prominent in the affairs of the Republican party in Cleveland. In 1884 and 1888 he was a delegate to the Republican national convention and was associated with William McKinley in the management of the John Sherman canvass. It was not, however, until 1896, when he personally managed the canvass that resulted in the Republican presidential nomination for William McKinley that he became known throughout the United States as a political manager of great adroitness, tact, and resourcefulness. He was chosen chairman of the Republican national committee and managed with consummate skill the campaign of 1896 against William Jennings Bryan and "free-silver." In March 1897 he was appointed, by Governor Asa S. Bushnell (1834–1904), U S senator from Ohio In the Senate, to which in Jan. 1898 he was elected for the short term ending March 3, 1899, and for the succeeding term, he was recognized as one of the principal advisers of the McKinley administration and his influence was large.

He took a deep and active interest in the problems of capital and labour, was one of the organizers (1901) and the first president of the National Civic Federation, whose purpose was to solve social and industrial problems, and in Dec 1901 became chairman of a permanent board of conciliation and arbitration established by the Federation. After President Roosevelt's policies became defined Senator Hanna was regarded as the leader of the Conservative branch of the Republican party and a possible presidential candidate in 1904. He died at Washington on Feb 15, 1904.

See C. R. Singdey, *Since the Civil War* (1926), R F Dibble, *Strenuous Americans* (1923); and Mark Sullivan, *Our Times*

HANNEN, JAMES HANNEN, Baron (1821–1894), English judge, was born at Peckham in 1821, and educated at St Paul's and at Heidelberg university Called to the bar in 1848, he rapidly made his name both in his own profession and in journalism In 1868 Hannen was appointed judge of the court of Queen's Bench; in 1872 he became judge of the Probate and Divorce court, in 1875 president of the probate and admiralty division of the High Court of Justice, and lord of appeal in ordinary in 1893. His name is associated with many famous cases, notably that of *Farrar* v *Close*, which affected the legal status of trade unions He presided over the Parnell commission, and is said to have written a large part of the report himself Hannen was one of the British arbitrators in the Bering sea enquiry in Paris in 1893. He died on March 29, 1894

HANNIBAL (247–183 B.C.), Carthaginian general. The name of Hannibal was a very common one in Carthage, but the most illustrious of its bearers was the son of Hamilcar Barca Born in 247 B.C., at the age of nine Hannibal was taken by his father to Spain, after swearing eternal hatred against the Romans In Spain he was trained by his father in the art of war He also accompanied him on the expedition in the course of which Hamilcar, having assured the safety of his young son, was killed by the rebellious Oretani (229). Hannibal remained in Spain during the term of government of his brother-in-law, Hasdrubal, who succeeded Hamilcar Barca, and he served under Hasdrubal for some years On the latter's death (221), Hannibal, at the age of little more than 25, assumed command of the army and province of Spain. In 221 also, he conducted a campaign against the Holcades, and in 220 he moved against the Vaccaei, and overcame the Carpetani in a battle near the Tagus. In the following year, notwithstanding a warning received from Roman ambassadors, he laid siege to Saguntum, the only city in eastern Spain south of the Ebro which still resisted his armies, and he took it after an eight months' siege. The Romans, who had threatened war if Hannibal should attack Saguntum, now demanded satisfaction from Carthage and, failing to obtain it, declared war. Thus began one of the most terrible wars of antiquity, the Second Punic War

Inasmuch as he rejected the Roman warning, it is beyond dispute that Hannibal must bear the responsibility in history for initiating the war. On legal grounds we may ask whether in virtue of the treaties, the Romans were entitled to intimate to Hannibal that he must not attack Saguntum, and there can be no doubt as to the answer, in view of what we learn from the very historians who consider that Hannibal's attack on Saguntum was a violation of the treaties. The treaty concluded by the Romans with Hasdrubal prohibited the latter from crossing the Ebro in arms. Saguntum, however, is south of that river, though certain ancient historians committed the gross geographical error of placing it to the north. Again, it is by no means certain that the treaty contained a clause excluding the Greek colonies from the Carthaginian sphere of influence; but even if there was any such clause it did not apply to Saguntum, for it is a mere fable, due to the likeness of names, that Saguntum was a colony of Zacyn-

thus; it was undoubtedly an Iberian city, as is shown by its coins While, however, legally the Romans had no right to intervene on behalf of Saguntum—their own alliance with the Saguntines constituting a violation of Hasdrubal's treaty, which, at all events implicitly, assigned the region to the south of the Ebro to the Carthaginian sphere of influence—politically it is clear that by attacking Saguntum Hannibal accepted responsibility for the war and all its consequences. He did so because he thought it necessary in order to uphold the position of Carthage as a great power, and at the same time he thought that he could win—not realizing the granite solidity of the Italic confederation centred in Rome, which he hoped to dismember by the hammer-blows of his army Thus Hannibal's whole action was based on a grave and fatal error of valuation; but this error was inevitable, because he could have no idea of the solidity of the Roman confederation, which had never yet been tested, except partially and not very thoroughly in the time of Pyrrhus; he could only draw a fallacious analogy with the other, infinitely weaker, confederations with which he was acquainted from history or by personal experience Granted that Hannibal believed in the possibility of a victorious war with Rome, and thought that Carthage was bound to initiate it in order to retrieve the disasters of the First Punic War, we must then consider whether the moment Hannibal selected was a good one, and whether his preparations and his plan of campaign were suited to the exigencies of that moment

The moment itself could not have been better chosen Later on, a victorious war in Italy would have been almost impossible The Romans had indeed, during recent years, discomfited the Boii, and crossing the Po had subjugated the Insubres, but the power of the Gauls was not yet broken; hatred of the victors was still extreme, and the Romans had scarcely begun to establish themselves in the conquered territory At that juncture, therefore, the valley of the Po offered Hannibal an excellent base for a war against Rome, with abundant recruiting material. Had the Romans but been able to consolidate themselves in the Transpadane, he could have had no such hopes Indeed, from then onwards it was already beginning to be a little too late, and Hasdrubal, by allowing the Romans to conquer the Cisalpine Gauls, had paid dearly for the truce during which he had been left free to consolidate the Punic empire in Spain.

With regard to the plan of campaign, modern writers have discussed whether Hannibal was really its author or whether it was not essentially due to Hamilcar Barca, who had entered upon the conquest of Spain with the precise object of subsequently preparing for an invasion of Italy across the Alps with the help of the Gauls, who at that time were still not under Roman dominion There seems no doubt that such was really Hamilcar's intention. That he nourished a deadly hatred for the Romans, that he prepared for a war of revenge after having been forced to give up Sicily to them and watch them seize Sardinia, and that his whole object in founding the empire in Spain was to prepare for that war, is beyond question. But he could have made use in two ways of the strength and wealth which Carthage drew from her Spanish empire against the Romans: either in the way which Hannibal afterwards chose, or by preparing to regain the command of the sea, which had been lost in the First Punic War. As, however, he did not direct the policy of Carthage along this latter channel, it is perfectly legitimate to conclude that it was he who laid the foundation of the plan of campaign which Hannibal subsequently carried out. Hannibal's merit consists in having adopted that plan and putting it into execution with unequalled genius.

Nevertheless, Hannibal's conduct of the war had two fundamental defects. One was that—as his father, Hamilcar Barca, had previously done in Sicily, when he tenaciously defended the last remnants of Carthaginian territory there—he failed to realize with sufficient clearness the absolute necessity of naval supremacy for a definitive victory in the great duel with Rome, and, taking the view that the predominance gained by the Romans in the First Punic War was unalterable, he made no serious attempt at preparing to dispute it. Thus he lessened the efficiency of his conduct of the war; for there is no doubt that the ultimate victory of Rome in the Second Punic War was essentially due to the fact that her naval supremacy was maintained throughout.

Moreover, Hannibal, having to entrust the command of the Spanish forces which were left to themselves when he started for Italy to a tried and faithful officer, selected his brother Hasdrubal, who was certainly in every way loyal, but was very young and quite unequal to his heavy responsibilities—so much so, that he was not merely unable to make head for a moment against a really good general like Scipio (afterwards called Africanus), but was repeatedly defeated by mediocre leaders like the brothers Publius and Gnaeus Scipio, who had small resources and few troops at their command.

Having gone into winter quarters at Cartagena (219–218), Hannibal started slowly towards the Ebro in the spring of 218. not crossing the river till nearly the end of May; he then spent two months in operations against the tribes between the Ebro and the Pyrenees This slow progress was intentional. He was anxious that his opponents should not have the slightest suspicion of his contemplated invasion of the Po valley, and (thinking it possible to stop him near the Rhone with the strong allied city of Marseilles as their base) should not soon enough make efficient preparations in upper Italy for the defence of the passes of the western Alps This must have been exactly what the consul Publius Cornelius Scipio planned when, in the late summer of 218 (he had been detained in Italy by an unexpected rebellion of the Boii), he transported his army of two legions by sea from Pisa to the mouths of the Rhone Here Scipio learned that Hannibal was already north of him, near the right bank of the river. When, after a successful cavalry reconnaissance, he moved northward along the right bank of the Rhone with his legions, he found that Hannibal had crossed the river and was proceeding northward on the left bank with intentions that were not too clear. Hannibal had been anxious to avoid a battle for the time being, and by marching northward to leave Scipio uncertain through which Alpine pass he had chosen to descend into Italy. In these circumstances, Scipio returned to the sea, embarked his legions for Spain with the intention of campaigning against the Carthaginian forces that still remained there, and accordingly entrusted the command to his brother Gnaeus, while he himself sailed from Marseilles for Pisa, whence he hastened to the Po to take command of the two legions stationed there to guard the territory and protect the two recently-founded Roman colonies near the river—Placentia and Cremona. Hannibal, however, as soon as he was assured that the Romans were not contemplating either pursuing him or closing the Alpine passes against him, returned southward, and crossing the pass of Mont Genèvre descended into Italy, into the valley of Susa There he rested his forces, and having taken by assault the city of the Taurini tribe of Gauls, which offered resistance, proceeded to take the offensive, moving so rapidly in the direction of the Po as to anticipate Scipio's offensive.

Hannibal's march was thus, strategically, entirely successful The Romans, failing to anticipate his movements, had not awaited him where with strong forces they could easily have given an initial and perhaps decisive check to his war worn and unacclimatized Africans—that is to say, in Piedmont, between Ivrea and Turin After wasting time in seeking him near the Rhone, they had not acted rapidly enough to encounter him near the passes of the western Alps. Nevertheless, according to our tradition, this strategic success was very dearly bought, for between the Ebro and the Po Hannibal is said to have lost more than 50,000 men—about two-thirds of his army—reaching Italy with 20,000 infantry and 6,000 cavalry. This estimate of his losses is, however, quite inadmissible, and a critical scrutiny must reduce the total Carthaginian losses during the long march to not more than 5,000 or 10,000. It is indeed inconceivable that any army, after undergoing such hardships and suffering such enormous losses, could at once enter upon a victorious campaign; nor can it be supposed that Hannibal made such havoc of the best army Carthage ever had.

A cavalry skirmish between the Ticino and the Sesia, known as the battle of the Ticino, informed Scipio of the enemy's strength and led him to recross not only the Ticino but also the Po, abandoning the Transpadane to Hannibal and organizing his defence to the south of the Po, with the colony of Placentia as its base.

Near Placentia the Romans also concentrated the legions of the other consul, Tiberius Sempronius, who had been recalled from Sicily, where he was making preparations for a descent on Africa. Hannibal, crossing the Po higher up, moved in the direction of Placentia and encamped on the left bank of the Trebia. Here, crossing the river, the four Roman legions attacked him by order of Sempronius. The victory of the Trebia (about Dec. 218) was the first of the three great victories that Hannibal owed to his supreme tactical skill. This battle caused the Romans to abandon the whole of northern Italy except the colonies of Placentia and Cremona, so that in the following year (217) they stood on the defensive in the peninsula, with one army commanded by Gaius Flaminius at Arretium, and the other under Gnaeus Servilius at Ariminum. Eluding the vigilance of Flaminius, Hannibal now succeeded in crossing the Apennines and proceeded to ravage north-eastern Etruria under his very eyes; he then moved unexpectedly from Cortona along the northern shore of Lake Trasimene in the direction of Perusia, as if he intended to attack the other consul, Servilius, who was coming down by forced marches from Ariminum to effect a junction with his colleague in Etruria. Flaminius, who was in the enemy's rear, allowed himself to be surprised on the northern shore of Lake Trasimene, between the pass of Borghetto and Passignano, giving Hannibal the opportunity to gain the second of his great victories (June 217).

The dilatory and cautious methods of the dictator Fabius gave the Romans every facility for preparing for what they thought was bound to be the decisive campaign in the following year, but did not hinder Hannibal from ravaging along the Adriatic as far as Apulia and crossing into Campania, where he laid waste the fertile Ager Falernus. Thereafter, exhibiting admirable judgment and amazing skill in manoeuvre, he evaded the ambushes laid for him with considerably superior forces by the dictator, and returned to northern Apulia to take up his winter quarters (217–216).

Here, skirmishes near Geronium, one of which went in the Romans' favour and the other against them, did not alter the situation. It was altered by Hannibal, who at the end of the winter, without interference from the Roman army that was watching him, suddenly moved further south near the Aufidus and there seized the fortress of Cannae, where the Romans had a large supply depot. He thus secured stores for his army and at the same time had the advantage of moving into an undevastated area well suited to his skilful manoeuvring. Here, near the Aufidus, he was overtaken by the consuls for the year 216, Lucius Aemilius Paulus and Gaius Terentius Varro, with one of the largest armies that Rome had ever put in the field, about 50,000 strong (allowing for the exaggerations of tradition, which sets it at 80,000); their intention was to engage the enemy in a decisive battle. The Romans had two camps, one on either bank of the river, connected by a bridge; Hannibal had a camp on the right bank, further downstream.

The Romans drew up in order of battle on the left bank of the Aufidus, with their front facing the sea and their right resting on the river. If they were defeated, they thought they could fall back either on the left bank towards Asculum or Aquilonia, or, crossing the bridge between the two camps, on the right bank towards Canusium or Venusia. If he gave battle on the Apulian plain, Hannibal had to be prepared to fight with his back to the sea and risk a complete disaster if defeated, since he had no line of retreat. He relied, however, on the efficacy of a manoeuvre that has made the battle of Cannae famous, and has been successfully imitated several times in modern warfare, including the recent World War. Drawing up, as usual, his infantry in the centre and his cavalry on both wings, he advanced impetuously against the enemy with the middle part of the infantry line, consisting of the Gauls and Spaniards, while the detachments of Libyan infantry on both flanks remained inactive. The Romans not merely withstood the attack, but, with the weight of their deep columns, forced the enemy to give back beyond his original position. Thus the Libyan detachments, which had not moved during the attack, were projecting on both sides of the front as it bent before the drive of the legionaries; and now, at a given signal, the Romans, who were penetrating like a wedge into the Carthaginian front, were assailed on either flank, while to complete the enveloping movement there came up from the rear the cavalry, who had routed the Roman cavalry on the wings, and half of whom, giving up the pursuit, had returned to the field of battle. Thus the enveloping movement was completely successful, and, notwithstanding its bravery and its superiority in numbers, the Roman army was utterly defeated. It will be realized that Hannibal's manoeuvre, which brought about the complete encirclement of the enemy, presupposes that the Romans were not so enormously superior in numbers as tradition would suggest. Otherwise, in order to surround them, he would have had to weaken his lines proportionately, to such an extent as to make it almost impossible for them to withstand the enemy's attacks.

This tremendous victory bore its natural fruits. After the battles of the Trebia and Lake Trasimene, the Italic confederation had remained intact. Not one of the confederate cities had passed over to the enemy. Now, however, this terrible hammer-blow detached from the granite mass of the confederation those parts that were least firmly joined to it—first northern Apulia with the powerful city of Arpi, then nearly all the territory of the Caudini and Hirpini, then most of the Lucanians and Bruttians, and lastly Capua, the second city in Italy.

Both by the ancients and in our own day Hannibal has been blamed for not profiting by his victory to march directly on Rome. The criticism is wholly unjustified. Defended by the strong and recently-repaired wall of Servius Tullius, inhabited by a warlike people not accustomed to quail, commanded by a senate that had always known how to face difficult moments, situated on a river that ensured its supplies even if Hannibal had succeeded in blockading it by land, Rome was in such a position that in all probability a move against it would not have had the very slightest hope of success, immediate or remote, and would have prevented Hannibal from exploiting his victory and gaining the practical benefit he obtained by inducing southern Italy to rebel. But at this point comes the end of Hannibal's wonderful series of successes, and the character of the war entirely changes. Legend ascribes this to the fact that Hannibal's troops went into winter quarters at Capua and thus lost the fighting spirit. In reality it was due to the new Roman strategy, which no longer allowed Hannibal to exploit that fighting spirit in great pitched battles. For the Romans now adopted the strategy suggested by Fabius, which earned him the name of *Cunctator*, the Delayer: never to accept battle when the enemy offered it, never to offer it on equal terms, never to attack him in his camp; but to destroy his army in detail as time and opportunity offered, to defend vigorously all the places that had remained loyal to Rome, to try to recover by force or fraud the places that had fallen into Hannibal's hands, profiting by Rome's numerical superiority and Hannibal's inability to keep the two theatres of war, Apulia and Campania, both under his own eye. This plan of campaign undoubtedly called on the Roman people and its allies for immense sacrifices in men and money, and for an indomitable tenacity. Hannibal, inferior in strength and not adequately supported by the Carthaginian Government because the Romans held permanent command of the sea, was obliged to substitute for his audacious and victorious offensives a cautious and not always successful defensive in which all the resources of his genius could not prevent the recovery by the Romans of one place after another that had fallen into his hands; for when superior Roman forces sat down before a city friendly to Carthage his only way of saving it was to give battle with inferior numbers, or to attack the Romans in their firmly-defended entrenchments, offering them the choice of easy victory.

Thus Hannibal's genius was nullified by the force of circumstances. It is not surprising that he lost ground and gained no more great victories in the field. Rather is it surprising that, always unconquered, threading his way among armies superior to his own, without any hope of adequate reinforcements, he succeeded for so many years in gaining still here and there a success, in winning here and there, even if not for long, another position, in retaining possession of a little Italian territory to the

end, and maintaining in it a strong and fairly large army. The weak point in the strategy of attrition adopted by the Romans was the immense effort for which it called, and it is doubtful whether the citizens and their allies would have been equal to such an effort year after year if they had not been comforted by visible successes, which raised their *moral* when it had been lowered by weariness. Nor must it be supposed that because he was reduced to passive resistance, Hannibal had any idea of allowing the Romans to dictate to him, or even of accepting the transformation of the war into a war of pure attrition, as Fabius desired. He was no longer, indeed, in a position to strike unaided such decisive blows as Cannae. But he could hope for some assistance that would change the aspect of the war in Italy—not so much from Africa, whence reinforcements could only reach him intermittently, as from Spain, if Hasdrubal had succeeded in destroying the small forces which the Romans could send there, or from Macedon, if King Philip V., who had been induced by news of Hannibal's success to take up arms against Rome in order to expel the Romans from their possessions in what is now Albania, had ventured to cross the Strait of Otranto and conduct an offensive war in Italy. Hannibal might also hope for assistance from Sicily, which, impressed by the Carthaginian victories, also rebelled against Rome immediately upon the death of the old king Hieron (215), or, at any rate, he might hope that the rebellious Syracusans, with effective help from Carthage, would succeed in containing considerable Roman forces for a long period, and thus indirectly assist him in his war in the peninsula. For reasons over which Hannibal had absolutely no control, none of these hopes were realized except the hope of reinforcements from Spain, which however, as we shall see, arrived too late to change the course of the war in Italy.

Meanwhile, however, the effects of the tenacious Roman resistance and the war of attrition were making themselves inexorably felt. In 213, Casilinum fell into the hands of the Romans, and later they recovered Arpi. True, Hannibal succeeded in surprising the Greek colony of Tarentum, the third city in Italy. This was not in every way of advantage to him; for as he never succeeded in occupying the citadel he was obliged to disperse his forces in a very dangerous manner, and meanwhile in his absence the Romans, with six legions, laid siege to Capua and surrounded it entirely with lines of circumvallation. Hannibal was not deaf to his allies' appeal, and in the spring of 211 he broke into Campania and offered battle to the Romans. They, however, refused to leave their fortified positions, and Hannibal was unable to relieve the city because he could not, without very great risk, persevere in his efforts to break the lines of circumvallation. Accordingly he made a very bold move. Leaving behind him the armies which were besieging Capua, he marched on Rome, and encamped three miles from the walls, between the Anio and the Tiber. The Romans were not intimidated, lining the walls with defending troops, instead of offering battle they sent a force out of the city to encamp a mile from Hannibal. In such circumstances it was madness to attempt an assault upon the walls, and equal madness to delay in the heart of the enemy's country, with difficult communications and with the danger of being surrounded by superior forces. Consequently, after a few days, Hannibal was forced to retire towards Bruttium, without realizing his hope of drawing away to the relief of Rome the powerful armies which were surrounding Capua, and thus securing an opportunity for a pitched battle and giving the besieged the respite of which they stood in need. A slight success over the consul Sulpicious Galba, who was following him up, did not recompense Hannibal for the complete strategic failure of his march, marvellous—almost miraculous—as it was in itself. Merely by remaining firmly at their posts the besiegers of Capua had decided the fate of the city, which not long afterwards opened its gates and received terrible punishment for its treachery. The fall of Syracuse a little earlier had marked the final destruction of the Greek power in Sicily. In 209, Hannibal received another heavy blow in the occupation of Tarentum by Fabius through treachery. In Spain also, after many years of indecisive warfare and following the momentary success represented by the rout of the two Scipios (of which, however, the Carthaginians had not been capable of taking full advantage), their empire was breaking up under the blows of Scipio. At this juncture it occurred to Hasdrubal to go to help his brother in Italy with the troops which he could not usefully employ in the defence of Spain. In the fine season of 208, while Hasdrubal, retracing his brother's route, was descending the Alps and continuing in the direction of central Italy as far as the Metaurus, it would seem that Hannibal, with the object of effecting a junction with him, advanced as far as Larinum, in the country of the Frentani Such, however, was the numerical superiority of the Romans that, while he himself was obliged to proceed northward with extreme slowness and caution, he was unable to prevent the concentration of considerable forces against his brother. The defeat of Hasdrubal at the Metaurus deprived Hannibal of his last hope of making a recovery in Italy, and the fatal news was conveyed to him by the severed head of his brother being cast by the Romans into his camp. Thereupon, abandoning all idea of an offensive, he retired into Bruttium, where he also concentrated the forces of those allies who had remained loyal to him. Here for four more years he withstood the Romans, fiercely contesting every step of their advance, and making them pay heavily for such successes as they gained by their strategy of attrition. Had they persevered in this strategy to the end, it is doubtful indeed whether they would have gained the final decisive victory, and even had they done so they would probably have paid for it by such immense sacrifices that they themselves would have fallen exhausted upon the corpses of their conquered adversaries. Now, however, Publius Cornelius Scipio, the young general who had displayed genius of such a high order in destroying, with very limited resources, the Carthaginian empire in Spain, was anxious to substitute a strategy consisting in boldly taking the offensive in Africa; and, despite the reluctance of the senate, in which a strong party headed by the aged Fabius was opposed to such an audacious policy, regarding it as dangerous and foolish, he succeeded in obtaining permission to carry out his design.

Scipio's marvellous victories, which broke Carthage's principal ally, Syphax, king of the Massaesylian Numidians, and threatened Carthage herself, ultimately compelled Hannibal to abandon Italy in the autumn of 203 in order to go to the help of his country. When he landed with his army at Leptis Minor and encamped near Hadrumetum, the Carthaginians, reduced to the last extremity, had already concluded an armistice and accepted preliminaries of peace with Scipio on extremely severe terms. Meanwhile the forces with which, a little earlier, Hannibal's other brother Mago had tried somewhat unsuccessfully to take the war into Liguria, also collected at Hadrumetum. Mago, recalled, had also embarked for Africa, but had died of wounds during the voyage. The large forces collected at Hadrumetum and the presence of their greatest general now induced the Carthaginians to try once more the test of arms. Almost at the very moment when the ambassadors were returning from Rome with the peace preliminaries approved, the Carthaginians—perhaps with Hannibal's connivance—violated the armistice concluded with Scipio, and the war broke out again. Scipio promptly recalled his faithful ally, Masinissa, king of the Massilian Numidians, whom he had sent into Numidia to fight against Vermina, son of Syphax, king of the Massaesylians, and allied like his father to the Carthaginians. Then, in the fine season of 202, he decided to climb the Bagrada in order to make a junction with the Numidians. Hannibal, who had likewise sent for Vermina, moved from Hadrumetum into the interior to join him, and encamped not far from Scipio, near Zama Regia. Scipio, instead of retiring towards his base, boldly moved forward towards Naraggara, between the Bagrada and the Muchtul, where he effected a satisfactory junction with the Numidian cavalry that Masinissa was bringing him. Hannibal, who had been following him, always in the vain hope of being joined by Vermina, now found himself in a serious position, being something like 125 miles from his base and in the presence of an enemy immensely his superior in cavalry. A meeting between the two commanders, at which Hannibal asked for peace, proved fruitless—because Scipio, realizing the strategic advantage he had

gained, insisted on terms more severe than those which had been agreed to before the breach of the armistice; so that there was nothing for it but battle. Scipio disposed the maniples of his legions in column, in three lines capable of operating independently, and defended his wings with the Italian and Numidian cavalry. Hannibal posted in his first line the Ligurian and Celtic mercenaries who had been under Mago's command, in his second line the native Libyans and the Carthaginian citizens, and in his third, further back as a true reserve, the flower of his army—the veterans of the Italian war. The front was protected by the elephants, the flanks by the cavalry. The elephants' assault was ineffectual owing to the able resistance of the Roman light troops, who succeeded in directing them through the columns of maniples, after passing which they were disposed of by other light troops without having done any serious damage. In the centre, the Carthaginian front line failed to resist the charge of the Roman *hastati*, and defeat seemed inevitable when Scipio, employing a manoeuvre which he himself had first used in the war in Spain, brought up the second- and third-line maniples, the *principes* and the *triarii*, on the flanks of the *hastati*. Hannibal had foreseen this manoeuvre, and countered it by bringing up the African infantry on either side of the mercenaries. But his tactical foresight was not crowned with success. The mercenaries, who were already giving ground, were routed, and the Africans with them. The reserve of Italian veterans remained intact, and Hannibal had disposed them on purpose to attack the legions if the latter should be victorious and should enter upon an undisciplined pursuit. As soon, however, as he perceived that Hannibal's third line was intact, Scipio recalled his men and re-formed them behind the natural breastwork afforded by the bodies of the casualties in the first two Carthaginian lines, having done so, he led them to the attack. Coming up from the rear at the same moment were the Italian and Numidian cavalry under Laelius and Masinissa, who had driven back the weaker Carthaginian cavalry with ease and, abandoning the pursuit in time, were returning to attack the infantry. Hannibal's veterans were thus surrounded and cut up, only very few escaping, among whom, however, was Hannibal himself (Oct. 202).

After this battle, in which, though not victorious, he had given a most wonderful exhibition of his tactical genius, Hannibal advised his fellow-citizens to make peace—indeed, almost forced them to do so—notwithstanding the very severe terms now dictated by the victor. After the conclusion of peace Carthage, despite her defeat, displayed the greatest confidence in Hannibal, and placed him at the head of the Government, thus enabling him to reorganize public affairs. Hannibal, great in administration as in war, speedily restored the State finances—to such an extent that in a short time the Carthaginians were able to make Rome an offer of payment in full of the heavy war indemnity that had been exacted. Rome, however, could not allow Carthage to recover; and so, a few years later, Roman envoys came to the city to accuse Hannibal of conspiring against the peace. He was forced to escape secretly, and took refuge (196) with Antiochus IV. the Great, king of Syria; who, having reunited the old Seleucid empire, was in diplomatic conflict with Rome, since the latter, after her victory in the Second Macedonian War, had established herself in the hegemony of the Balkan peninsula. The diplomatic conflict between Syria and Rome dragged on for some years until in the autumn of 192, in response to an appeal from the Aetolians, who had taken up arms against Rome, Antiochus landed in Greece and began the so-called Syrian War.

To this war he had been incited by the great Carthaginian refugee, who hoped that it might lead to the liberation of his country. Hannibal is said to have asked to be sent to the west with a hundred warships to prepare for a descent on Italy. This was a chimerical project, in view of the failure of the great expedition which he had so carefully prepared and ably conducted in the peninsula. It is much more likely that Hannibal simply asked Antiochus for a small land and sea force, with a view to preparing for a descent on Africa and inducing the Carthaginians to resume the war of independence against Rome and her ally Masinissa in Africa, thus causing a diversion which might also turn greatly to the advantage of the king of Syria. But even if such were the original plans of Hannibal and Antiochus, there was no possibility of carrying them out. When the Aetolians took up arms, intervention by Antiochus in Greece became urgent and could no longer be delayed; and he was obliged to employ all his available land and sea forces in strengthening and maintaining his expeditionary forces in the peninsula. Moreover, it is obvious that, since he could not even find adequate forces in 191 to resist the attack of the Romans and Philip in Greece, he could certainly have none available for a diversion in Africa. When, defeated at Thermopylae (191), he took refuge in Asia Minor, his only thought was—inevitably—to prepare to defend by land and sea his ancestral kingdom, which the Romans were getting ready to attack.

Already in the year 191 the naval battle of the Corycus gave the Romans the command of the Aegaean. It was essential for Antiochus to regain it in the following year. With this object, while his admiral Polyxenides was operating in the Aegaean, Hannibal was sent to Phoenicia to collect a fleet with which to help the principal Syrian squadron. In 190 Hannibal moved north from Phoenicia with 37 warships. Near the promontory of Side he encountered the fleet of the Rhodians, allies of Rome, who disputed his passage. After a fierce fight Hannibal was defeated and forced to retire, nor did he succeed either then or later, in joining with Polyxenides to take part in the decisive struggle. By land as by sea the fortune of war was against the Syrians, and after the defeat of Polyxenides at Myonessus and that of Antiochus at Magnesia (the latter battle took place late in 190 or early in 189) the king was obliged to accept the peace terms imposed by the Romans, which included the surrender of Hannibal.

Hannibal, however, effected his escape, and after many vicissitudes—tradition gives us anecdotes of varying degrees of authenticity—we find him at the court of Prusias, king of Bithynia, one of the few despots who had not yet become dependent on Rome. It was Hannibal who suggested to his protector the magnificent site which was chosen for the foundation of the city of Prusa, the modern Brussa. Later he took part in the war between Prusias and Eumenes II., king of Pergamus, in which he gained his last success, the naval victory of the Bithynian fleet over that of Pergamus, commanded by Eumenes himself, who narrowly escaped capture. The war ended when Rome imposed her mediation on the contending parties. These events, however, drew the attention of the Romans upon Hannibal, and, through Titus Quintius Flamininus, they demanded that Prusias, who also had now been forced by circumstances to become dependent upon them, should surrender him. Prusias was cowardly enough to arrange for the great refugee's arrest; Hannibal, however, seeing his house surrounded by soldiers, committed suicide by taking poison, which he always carried on his person in readiness for emergencies (183).

The great Carthaginian had thus witnessed the complete failure of what had been the whole purpose of his life—the war of revenge by Carthage against Rome. That war had not merely ended in the defeat and destruction of the Carthaginian power, but had made Rome so conscious of her strength, and given rise to such a development of the spirit of militarism and imperialism among the Romans, that they had by now firmly established their predominance over the Eastern Greek world as well. This complete failure can in no way be laid to the charge of Hannibal, who, with unshaken patriotism, until his death employed all the resources of his genius in the unequal struggle, nor would it be fair to impute it to Carthage, whose tenacious resistance was marvellous, having regard to the forces at her command, and was at any rate immensely superior to that of the Hellenic powers, though in many respects the latter were in a much more favourable position. The failure was due to the strength of the Roman people and the Italians so firmly bound to them, to the admirable political-military organization of the Italic confederation, to the almost superhuman spirit of sacrifice exhibited by the Italians during the war, to the strategy of their leaders—the policy of attrition adopted at the beginning by Fabius when it represented

the only possibility of resistance, and the bold offensive policy later adopted by Scipio, who proved himself such a talented pupil of his great adversary as to profit by his own teaching to frustrate his most wonderful tactical inspirations.

Of the great Carthaginian's personality we know but little, and the tradition that has come down to us is often vitiated by the partisan hatred of his adversaries; but all the ancient writers without exception pay homage to his incomparable military genius, and all but a few moderns regard him as one of the greatest warriors of all time. Roman tradition charged him with acts of cruelty, and his memory lived as that of a man "abominated by the fathers" of Italy for the slaughter of their sons. But those of his cruel acts of which there is reliable evidence do not exceed what the customary laws of war in ancient times were cruel enough to permit, and the terrible tragedy of Carthage's struggle for existence affords them an extenuation which is not forthcoming for some of the atrocities committed by the Roman commanders in the second century. Moreover, on more than one occasion he displayed generosity towards a fallen enemy. The "Punic faith" of which the Roman sources accuse him seems to have no more foundation than resides in the military stratagems of which he made free use, and these were certainly far more innocent than the somewhat dishonourable stratagem employed by Scipio Africanus to surprise the camps of Hasdrubal and Syphax. For the rest, Hannibal was a cultured man, acquainted with several languages; he spoke and wrote Greek, and probably had not omitted to study the military science of the Greeks. Many of his sayings are given us by the various sources, and, though not all authentic, taken as a whole they illustrate his rough, frank, soldierly spirit. Little or nothing is known of his private life. We are told that he married a Spanish woman from Castulo, by whom he does not seem to have had any children. The ancient writers, who manage to find more or less well-authenticated scandalous anecdotes about almost all the greatest men of antiquity, laud his morality to the skies, and, much as they hate him, they can find no least speck on his fair fame in this regard. There is only one reference to be found in certain sources to a love affair with a Bruttian girl, but its authenticity is by no means sure, and it is in any case too vague to arouse our curiosity. For the rest, certain charges of avarice which we find in the ancient sources can easily be explained by his constant need of large resources for his political and military activities. Even in this matter, however, his prudent administration of the finances of Carthage bears witness to his integrity. Taken for all in all, we find him one of the noblest, as he is one of the most unfortunate, of the great men of action of antiquity.

BIBLIOGRAPHY.—The history of Hannibal was written very shortly afterwards by Greeks who were in his camp, like Sosilus and Silenus. Sosilus, as also another Greek historian of Hannibal, Chaereas, is reprimanded by Polybius (iii., 25) for his "barber's-shop anecdotes"; but a recently-discovered fragment dealing with the war in Spain (Wilcken, *Hermes*, xli., pp. 103 *sqq.*) does not seem to confirm the condemnation. In addition to these Greek sources, all or nearly all of which are pro-Carthaginian, the ancients had Roman primary sources, chief of which were the *Annales* of Fabius Pictor. Later a full general history of the Second Punic War was composed in Latin by L. Caelius Antipater; it is lost, but, to judge from the fragments, it was of little value. There has come down to us the Greek history of the Second Punic War composed about the middle of the second century B.C. by the Greek historian Polybius of Megalopolis; it is complete as far as the battle of Cannae (bb. iii.), fragmentary thereafter. Polybius combined Carthaginian and Roman sources—in what proportions it is difficult to say, but it is certainly a mistake to suppose that our tradition regarding the Second Punic War is wholly of Roman origin (Dessau, *Hermes*, li., pp. 355 *sqq*), or to try to make a mechanical separation of the Roman and Carthaginian passages in the text of Polybius (Beloch, *Hermes*, l). The full story of the Second Punic War has come down to us in the third decade of Livy; and here again, while we have passages of undoubted annalistic origin and others, particularly dealing with the wars in Sicily and the East, that are mere versions of Polybius, regarding the remainder there are strong differences of opinion among the critics. Of the copious bibliography mention need only be made of Wesselbarth's *Historisch-kritische Untersuchungen zur dritten Dekade des Livius*, and for the rest the student may be referred to the historical works cited below. Of the minor sources, apart from those derived from Livy (Florus, Orosius, etc.), we need only mention here Plutarch's lives of Fabius and Marcellus, Appian's *Hannibalica*, and the fragments of Diodorus and Dion Cassius, all of which narrations appear to be based on the vulgate of Polybius, with additions and errors in varying degrees.

The modern Hannibalic bibliography is enormous. On a single episode in his career—the crossing of the Alps—a whole shelf of monographs could be collected; and no year passes without publications on this subject in various languages, especially English. Neglecting entirely the earlier writings and those that deal with too specialized subjects, we may mention in the first place Mommsen's passage on Hannibal and his wars (*Rom Geschichte*, vol. i., book iii.), and Neumann's *Das Zeitalter der punischen Kriege* (Breslau, 1883), a solid and well-balanced treatise. Acute and original, though frequently hypercritical, is U. Kahrstedt, *Geschichte der Karthager von 218–146* (Berlin, 1919; published as vol. iii. of O. Meltzer's *Geschichte der Karthager*, but entirely different in character from the first two volumes). This work contains an exhaustive discussion of the sources. On the military aspect two works are of fundamental importance, though frequently at variance with each other: these are Delbrück's *Geschichte der Kriegskunst* (2nd ed., Berlin, 1908), book v., and Kromayer's *Antike Schlachtfelder*, iii., 1. Italien and 2. Afrika (Berlin, 1912), in addition, K. Lehmann, *Die Angriffe der drei Barkiden auf Italien* (Leipzig, 1905), may be read with profit. An attempt at a comprehensive political and military appreciation of the history of the Second Punic War, its antecedents and its consequences, is made in De Sanctis, *Storia dei Romani*, especially in vol. iii. 2 (Turin, 1917). For the most recent bibliography reference may be made to the text accompanying Kromayer and Veith's *Schlachten-Atlas*, Röm. Abteilung, Lieig. i. and ii. (Leipzig, 1922). Lastly, special mention must be made of the *Untersuchungen zur Geschichte des zweiten punischen Krieges* collected by E. Meyer in his *Kleine Schriften*, ii. (Halle, 1924), and his drawings of medallions of Hannibal and Scipio in *Meister der Politik* (i. 2nd ed., 1923). (G. DE S.)

HANNIBAL, a city of Marion county, Mo., U.S.A., on the Mississippi river, 120m. above Saint Louis. It is on Federal highways 36 and 61, and is served by the Burlington, the St. Louis and Hannibal and the Wabash railways, and by river steamers and barges. The population was 19,306 in 1920 (9.3% negroes), and was estimated locally at over 21,000 in 1928. Behind the low, level business section of the city rise picturesque bluffs and hills to a height of 200ft. above the river, on which are most of the residences. Riverview park (200ac.) affords magnificent views of the Mississippi valley. The Burlington has large repair shops here, and there are numerous and varied factories, with an output in 1925 valued at $15,852,479. Mark Twain spent his boyhood in Hannibal, which provided the setting of his *Life on the Mississippi*, *Huckleberry Finn*, and *Tom Sawyer*. His home at 316 Hill street, a two-story frame house built by his father John Marshall Clemens in 1844, is maintained by the city as a memorial. A statue of him stands on an eminence in Riverview park, looking out over the river, and there is one of Huck Finn and Tom Sawyer at the foot of Cardiff hill. The cave described in *Tom Sawyer*, 2m. S. of the city, extending south-eastwardly to the Salt river, 9m. away, was used as a hiding-place for slaves escaping by the "Underground Railway," and twice was a refuge for Jesse James. The site of Hannibal was part of old Spanish grants, and this gave rise to much litigation in the early days. The name Hannibal was given by a Spanish surveyor to the small stream (now called Bear creek) which empties into the Mississippi at this point, and was transferred to the settlement. The first settler, Moses D. Bates, arrived in 1818. The town was laid out in 1819 and chartered as a city in 1839.

HANNINGTON, JAMES (1847–1885), English missionary, was born at Hurstpierpoint, Sussex, on Sept. 3, 1847, and was educated at St. Mary's Hall, Oxford. He was curate in charge at Hurstpierpoint when his thoughts were turned to mission work by the murder of two missionaries on the shores of Victoria Nyanza. He sailed on May 17, 1882, at the head of a party of six, for Zanzibar, and thence set out for Uganda; but, prostrated by fever and dysentery, he was obliged to return to England in 1883. On his recovery he was consecrated bishop of Eastern Equatorial Africa (June 1884), and in January 1885 started again for the scene of his mission, and visited Palestine on the way. He reached a spot near Victoria Nyanza in safety. His arrival, however, roused the suspicion of the natives, and under King Mwanga's orders he was lodged in a filthy hut swarming with rats and vermin. After eight days his men were murdered, and on Oct. 29, 1885 he himself was speared in both sides, his last words to the soldiers appointed to kill him being, "Go, tell Mwanga I

have purchased the road to Uganda with my blood "

His *Last Journals* were edited in 1888. *See* also *Life* by E. C. Dawson (1887); and W. G. Berry, *Bishop Hannington* (1908).

HANNINGTON, a shallow lake (7 m. by 2 m.) in Kenya Colony, south of Lake Baringo, just south of the Equator. It lies in the eastern rift-valley, in the shadow of the Laikipia escarpment. It was named after Bishop Hannington; its waters are brackish, its shores having on them remnants of an ancient forest which serve as an eyrie for storks, herons and eagles, whilst on the flat banks congregate thousands of flamingoes. There are valuable guano deposits here.

HANNO, the name of many Carthaginian soldiers and statesmen, the most important of whom are:

1. HANNO, Carthaginian navigator, who flourished *c.* 500 B.C. He wrote an account of a coasting voyage on the west coast of Africa, undertaken for the purpose of exploration and colonization. The original, inscribed on a tablet in the Phoenician language, was hung up in the temple of Melkarth on his return to Carthage. A supposed Greek translation of this is still extant, under the title of *Periplus*, but its authenticity has been questioned. Hanno appears to have advanced beyond Sierra Leone as far as Cape Palmas.

Valuable editions by T. Falconer (1797, with translation and notes) and C. W. Muller in *Geographici Graeci minores*, i.; *see* also E. H. Bunbury, *History of Ancient Geography*, i. and treatise by C. T. Fischer (1893), with bibliography.

2. HANNO (3rd century B.C.), called "the Great," Carthaginian statesman and general, leader of the aristocratic party and the chief opponent of Hamilcar and Hannibal. He appears to have gained his title from military successes in Africa, but of these nothing is known. In 240 B.C. he drove Hamilcar's veteran mercenaries to rebellion by withholding their pay, and when invested with the command against them was so unsuccessful that Carthage might have been lost but for the exertions of Hamilcar (*q.v.*). Hanno subsequently remained at Carthage, exerting his influence against the democratic party. During the Second Punic War he advocated peace with Rome, and according to Livy even advised that Hannibal should be given up to the Romans. After the battle of Zama (202) he was one of the ambassadors sent to Scipio to sue for peace.

Livy xxi. 3 ff., xxiii. 12, Polybius i. 67 ff.; Appian, *Res Hispanicae*, 4, 5, *Res Punicae*, 34, 49, 68.

For others of the name *see* CARTHAGE, HANNIBAL; PUNIC WARS and Smith's *Classical Dictionary*.

HANOI, capital of Tongking and of French Indo-China, on the right bank of one of the mouths of the delta of the Song-koi or Red river, about 80 m. from its mouth in the Gulf of Tongking. Pop. 140,000. The town consists of a European quarter and a crowded native quarter built round a picturesque lake which lies close to the river. The so-called pagoda of the Great Buddha is the chief native building. The river is embanked and is crossed by the Pont Doumer, a fine railway bridge over 1 m. long. Vessels drawing 8 or 9 ft. can reach the town. Hanoi is the seat of the general government of Indo-China, of the resident-superior of Tongking, and of a bishop, who is vicar-apostolic of central Tongking. It is administered by an elective municipal council with a civil service administrator as mayor. It has a chamber of commerce, a chamber of the court of appeal of Indo-China, a civil tribunal of the first order, and is the seat of the chamber of agriculture of Tongking. Its industries include cotton-spinning, brewing, distilling and the manufacture of tobacco, earthenware and matches; native industry produces carved and inlaid furniture, bronzes and artistic metalwork, silk embroidery, etc. Hanoi is the junction of railways to Hai-Phong, its seaport, Lao-Kay, Vinh, and the Chinese frontier via Lang-Son. It is in frequent communication with Hai-Phong by steamboat.

See C. Madrolle, *Tonkin du sud: Hanoi* (1907).

HANOTAUX, ALBERT AUGUSTE GABRIEL (1853–), French statesman and historian, was born at Beaurevoir, Aisne, on Nov. 19, 1853. He studied at the École des Chartes, and became *maître de conférences* in the École des Hautes Études. In 1879 he entered the ministry of foreign affairs as archivist, and rose step by step through the diplomatic service, being appointed councillor of embassy at Constantinople in 1885. In 1886 he was elected Republican deputy for Aisne, but, defeated in 1889, he returned to his diplomatic career. On May 31, 1894 he became foreign minister in the Dupuy cabinet. With one interruption (during the Ribot ministry, Jan. 26–Nov. 2, 1895), he held this portfolio until June 14, 1898. During his ministry he developed the *rapprochement* of France with Russia, visiting St. Petersburg with the President, Félix Faure, and sent expeditions to delimit the French colonies in Africa. The Fashoda incident of July 1898 was a result of this policy, and Hanotaux's distrust of England is frankly stated in his literary works.

During the World War Hanotaux, who was already known as a distinguished historian, and had been elected to the French Academy on April 1, 1897, was active as propagandist. He was employed on more than one semi-official mission, notably to the Vatican. In 1921 he was the third French delegate to the League of Nations Assembly.

Hanotaux's works include, *Origines de l'institution des intendants de provinces* (1884), the authoritative study on the intendants, *Études historiques sur les XVIe et XVIIe siècles en France* (1886), *Histoire de Richelieu* (2 vols. 1888), *Histoire de la France contemporaine, 1871–1900* (4 vols. 1903–8), the standard history of contemporary France; *Histoire de la Guerre de 1914* (9 vols. 1914 ff.), *Le Traité de Versailles* (1919); *Histoire de la Nation française* (15 vols. 1920–4); *La Bataille de la Marne* (2 vols. 1923). He also edited the *Instructions des ambassadeurs de France à Rome, depuis les traités de Westphalie* (1888).

HANOVER, formerly an independent kingdom of Germany, but since 1866 a province of Prussia, bounded on the north by the North Sea, Schleswig-Holstein, Hamburg and Mecklenburg-Schwerin, east and south-east by Prussian Saxony, Brandenburg and Brunswick, south-west by Lippe and the Prussian provinces of Hesse-Nassau and Westphalia, and west by Holland. These boundaries include the republic of Oldenburg and the free state of Bremen, the former stretching southward from the North Sea nearly to the southern boundary of Hanover. A small part of the province in the south is separated from Hanover proper by the interposition of part of Brunswick. In 1873 the province was increased by the addition of the Jade territory (purchased by Prussia from Oldenburg), south-west of the Elbe, with the naval station and arsenal of Wilhelmshaven. The area of the province is 14,897 sq. miles.

The plain of Hanover is mainly sandhills, heath and moor. On the Elbe and near the North Sea, rich meadows are preserved from encroachment of the sea by dikes and ditches. The so-called *Luneburger Heide* in the north is an expanse of moor and fen, with oases of beech and oak woods, extending almost due north from the city of Hanover to the southern arm of the Elbe at Harburg. The south part of the province is hilly, rising to the forested Harz mountains. The east part of the northern plain is covered with fir forests. The Elbe forms the north-east boundary and receives the navigable Jeetze, Ilmenau, Luhe, Seve, Este, Schwinge and Medem; the Weser drains the centre, with its tributary the Aller (navigable from Celle downwards); and the Ems, the west, with its tributaries Aa and Leda. Numerous canals connect these river systems. A few small lakes are found here and there in the province.

The climate in the coastal lowlands is moist and foggy, in the plains mild, on the Harz mountains severe and variable. In spring the prevailing winds are easterly, in summer they blow from the south-west. In the town of Hanover the average monthly temperature ranges from 32° F. in January to 63° F. in July, and the average annual rainfall is about 23·5 in. In the west the Herauch, a thick fog arising from the burning of the moors, is of frequent occurrence.

The population in 1925 was 3,190,619, giving a density of 214 to the sq. m. (English). The province is divided into the six *Regierungsbezirke* (or departments) of Hanover, Hildesheim, Lüneburg, Stade, Osnabrück and Aurich, and these again into *Kreise* (circles, or local government districts)—82 in all. The chief towns are Hanover, Osnabrück, Hildesheim, Wesermünde, Wilhelmshaven, Harburg, Lüneburg, Celle, Göttingen and Emden. Above 80% of the population are Protestant. A court of appeal for the province sits at Celle.

The province has the university of Göttingen, a technical college in Hanover, an academy of forestry in Münden, a mining college in Clausthal, and a veterinary college in Hanover.

The greater part of the soil is of inferior quality, and one-third of the province is uncultivated moor and heath; about half the remainder is arable and the rest pasture and forest. The best agriculture is to be found in the districts of Hildesheim, Calenberg, Gottingen and Grubenhagen, on the banks of the Weser and Elbe, and in East Friesland Rye is widely grown for bread Flax is extensively cultivated and exported, chiefly in the form of yarn Potatoes, hemp, turnips, hops, tobacco and beets are also grown, the latter in connection with the sugar industry Apples, pears, plums and cherries are the principal fruits cultivated, while the wild red cranberries from the Harz and the black bilberries from the Lüneburger Heide form an important article of export

Hanover is renowned for its cattle and live stock. The Lüneburger Heide yields excellent sheep, while horses are reared in Aurich and Stade, in Hildesheim, Hanover and in Celle. Bees are principally kept on the Lüneburger Heide, and the yield of honey is considerable Large flocks of geese are kept in the moist lowlands The rivers yield trout, salmon (in the Weser) and crayfish The sea fisheries are important and have their chief centre at Wesermünde

The Harz mountains are rich in silver, lead, iron and copper; coal is found around Osnabruck, on the Deister, at Osterwald, etc., lignite in various places; salt-springs exist at Egestorfshall and Neuhall near Hanover, and at Lüneburg; and petroleum is obtained south of Celle. In the cold regions of the northern lowlands peat occurs.

Works for the manufacture of iron, copper, silver, lead, vitriol and sulphur are carried on. The iron works are important: smelting is carried on in the Harz and near Osnabruck; there are extensive foundries and machine factories at Hanover, Linden, Osnabrück, Hameln, Wesermünde, Harburg, Osterode, etc., and manufactories of cutlery in the towns of the Harz and in the Sollinger Forest Linen yarn and cloth are largely manufactured, and bleaching is engaged in extensively; woollen cloths are made in the south about Einbeck, Göttingen and Hameln; cotton-spinning and weaving have their seats at Hanover and Linden. Glass houses, paper-mills, potteries, tile works and tobacco-pipe works are numerous. There are numerous tobacco factories, tanneries, breweries, vinegar works and brandy distilleries. Shipbuilding is an important industry, especially at Wilhelmshaven, Papenburg, Leer, Stade and Harburg; and at Münden river-barges are built.

The carrying trade of Hanover is largely absorbed by Hamburg and Bremen, while the Weser forms the chief commercial artery of the province. The province has good roads connecting the chief towns and is intersected by trunk lines of railway; notably the lines from Berlin to Cologne, from Hamburg to Frankfort-on-Main, from Hamburg to Bremen and Cologne, and from Berlin to Amsterdam.

HISTORY

The name Hanover (*Hohenufer*=high bank), originally confined to the town which became the capital of the duchy of Luneburg-Calenberg, came gradually into use to designate, first, the duchy itself, and secondly, the electorate of Brunswick-Lüneburg; and it was officially recognized as the name of the state when in 1814 the electorate was raised to the rank of a kingdom.

The early history of Hanover is merged in that of the duchy of Brunswick (*q.v.*), from which the duchy of Brunswick-Lüneburg and its offshoots, the duchies of Lüneburg-Celle and Lüneburg-Calenberg, have sprung. In 1692, in return for lavish promises of assistance to the empire and the Habsburgs, the emperor granted Duke Ernest Augustus of Calenberg the rank and title of elector of Brunswick-Lüneburg with the office of standard bearer in the Holy Roman empire. Indignant protests followed, but in 1708 George Louis, the son and successor of Ernest Augustus, was recognized as an elector by the imperial diet. Through his mother, the elector George Louis became, by the terms of the Act of Settlement of 1701, king of Great Britain and Ireland in 1714.

Under British Sovereignty.—From this time until the death of William IV in 1837, Lüneburg or Hanover, was ruled by the same sovereign as Great Britain. Both George I. and George II. preferred Hanover to England as a place of residence, and it was a frequent and perhaps justifiable cause of complaint that the interests of Great Britain were sacrificed to those of the smaller country But George III was more British than either his grandfather or his great-grandfather, and owing to a variety of causes the foreign policies of the two countries began to diverge in the later years of his reign. During the Napoleonic wars Hanover was occupied by Prussia in 1805, but after the battle of Jena (1807) became part of the kingdom of Westphalia The northern portion was added to France in 1810. The elector was granted the title of king by the Vienna Congress, which restored the independence of Hanover On the conclusion of peace in 1814 the estates of the several provinces of the kingdom were fused into one body, consisting of 85 members, but the chief power was exercised as before by the members of a few noble families. In 1819, however, this feudal relic was supplanted by a new constitution. Two chambers were established, the one formed of nobles and the other of elected representatives; but although they were authorized to control the finances, their power with regard to legislation was very circumscribed. This constitution was sanctioned by the prince regent, afterwards King George IV.; but it was out of harmony with the new and liberal ideas which prevailed in Europe, and it hardly survived George's decease in 1830 The revolution of that year compelled George's brother and successor, William, to dismiss Count Munster, who had been the actual ruler of the country, and to name his own brother, Adolphus Frederick, duke of Cambridge, a viceroy of Hanover, one of the viceroy's earliest duties being to appoint a commission to draw up a new constitution. This was done, and after William had insisted upon certain alterations, it was accepted and promulgated in 1833. Representation was granted to the peasants; the two chambers were empowered to initiate legislation; ministers were made responsible for all acts of government; a civil list was given to the king in return for the surrender of the Crown lands; and, in short, the new constitution was similar to that of Great Britain.

King Ernest Augustus.—By the law of Hanover a woman could not ascend the throne, and accordingly Ernest Augustus, duke of Cumberland, the fifth son of George III., and not Victoria, succeeded William as sovereign in 1837, thus separating the crowns of Great Britain and Hanover after a union of 123 years Ernest, a prince with very autocratic ideas, had disapproved of the constitution of 1833, and his first important act as king was to declare it invalid. He appears to have been especially chagrined because the Crown lands were not his personal property, but the new arrangements were quite repugnant to him. Seven Gottingen professors who protested against this proceeding were deprived of their chairs; and some of them, including F. C. Dahlmann and Jakob Grimm, were banished from the country for publishing their protest. To save the constitution an appeal was made to the German Confederation, which Hanover had joined in 1815; but the federal diet declined to interfere, and in 1840 Ernest altered the constitution to suit his own illiberal views. Recovering the Crown lands, he abolished the principle of ministerial responsibility, the legislative power of the two chambers, and other reforms, virtually restoring affairs to their condition before 1833. The inevitable crisis was delayed until the stormy year 1848, when the king probably saved his crown by hastily giving back the constitution of 1833. Order, however, having been restored in 1850 he dismissed the Liberal ministry and attempted to evade his concessions; a bitter struggle had just broken out when Ernest Augustus died in Nov. 1851. During this reign the foreign policy of Hanover both within and without Germany had been coloured by jealousy of Prussia and by the king's autocratic ideas. Refusing to join the Prussian *Zollverein*, Hanover had become a member of the rival commercial union, the *Steuerverein*, three years before Ernest's accession; but as this union was not a great success the *Zollverein* (*q.v.*) was joined in 1851. In 1849, after the

failure of the German parliament at Frankfort, the king had joined with the sovereigns of Prussia and Saxony to form the "three kings' alliance"; but this union with Prussia was unreal, and with the king of Saxony he soon transferred his support to Austria and became a member of the "four kings' alliance."

Annexation to Prussia.—George V., the new king of Hanover, who was unfortunately blind, sharing his father's political ideas, at once appointed a ministry whose aim was to sweep away the constitution of 1848. This project, however, was resisted by the second chamber of the *Landtag*, or parliament; and after several changes of government a new ministry advised the king in 1855 to appeal to the diet of the German Confederation. This was done, and the diet declared the constitution of 1848 to be invalid. Acting on this verdict, not only was a ministry formed to restore the constitution of 1840, but after some trouble a body of members fully in sympathy with this object was returned to parliament in 1857. But these members were so far from representing the opinions of the people that popular resentment compelled George to dismiss his advisers in 1862, and the more liberal government which succeeded did not enjoy his complete confidence In 1865 a ministry was once more formed which was more in accord with his own ideas. This contest soon lost both interest and importance owing to the condition of affairs in Germany. Bismarck, the director of the policy of Prussia, was devising methods for the realization of his schemes, and it became clear after the war over the duchies of Schleswig and Holstein that the smaller German states would soon be obliged to decide definitely between Austria and Prussia After a period of vacillation Hanover threw in her lot with Austria, the decisive step being taken when the question of the mobilization of the federal army was voted upon in the diet on June 14, 1866. At once Prussia requested Hanover to remain unarmed and neutral during the war, and with equal promptness King George refused to assent to these demands Prussian troops then crossed his frontier and took possession of his capital. The Hanoverians, however, were victorious at the battle of Langensalza on June 27, 1866, but the advance of fresh bodies of the enemy compelled them to capitulate two days later. By the terms of this surrender the king was not to reside in Hanover, his officers were to take no further part in the war, and his ammunition and stores became the property of Prussia. The decree of Sept. 20, 1866, formally annexed Hanover to Prussia, when it became a province of that kingdom, while King George from his retreat at Hietzing appealed in vain to the powers of Europe For some years many of the Hanoverians remained loyal to their sovereign, some of them serving in the Guelph Legion, which was maintained largely at his expense in France, where a paper, *La Situation*, was founded by Oskar Meding (1820–1903) and conducted in his interests

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HANOVER, capital of the Prussian province of the same name, situated in a sandy, fertile plain on the Leine, which here receives the Ihme, and at the crossing of the main lines of railway, Berlin to Cologne and Hamburg to Frankfort-on-Main. Pop., including Linden (1925), 422,708. The town of Hanover is first mentioned during the 12th century, when it belonged to the family of Welf, who became dukes of Brunswick. It joined the Hanseatic League, and was later the residence of the electors of Hanover. In 1866 it was annexed by Prussia, after having been the capital of the kingdom of Hanover since its foundation in 1815. The Leine flows through the city, having the old town, with narrow streets and old-fashioned gabled houses, on its right. In its centre lies the Markt Kirche, a red-brick edifice of the 14th century, with its interior restored in 1855, and containing fine stained-glass windows. On the market square, is the red-brick mediaeval town hall (Rathaus), containing the civic archives and museum. The new town surrounds the old on the north and east. Among the other churches are the Neustädterkirche, with a shrine containing the tomb of Leibnitz; the Kreuzkirche, built about 1300, with a curious steeple, and the Aegidienkirche. Of secular buildings the most remarkable is the royal palace—Schloss—built 1636–40. In its chapel are preserved the relics of saints which Henry the Lion brought from Palestine Its museums have important art collections. The Welfenschloss has been occupied since 1875 by the technical high school, an academy with university privileges. Close to it lies Herrenhausen, the summer palace of the former kings of Hanover, with fine gardens, an open-air theatre, a museum and an orangery, and approached by a grand avenue over a mile in length.

Hanover's railway connections have enormously developed its trade and manufactures. Almost all industries are represented; chief among them are machine-building, the manufacture of india-rubber, cotton, cork, hardware, chemicals, cocoa, asphalt, tobacco, pianos, furniture and groceries. The commerce consists principally in wine, hides, horses, coal, wood and cereals There are extensive printing establishments It is the birthplace of Sir William Herschel, the astronomer, and the philosopher Leibnitz died there in 1716

HANOVER, a town of Jefferson county, Ind., U.S.A., on the Ohio river, 5m. below Madison, the nearest railway station The population was 360 in 1920. At the edge of the town, on a bluff 500ft above the river, is Hanover college (Presbyterian), opened in a log cabin in 1827 as an academy, and incorporated as a college in 1833 Its theological department was established as a separate institution and moved to New Albany in 1840, and thence in 1859 to Chicago, becoming (1886) the McCormick Theological seminary.

HANOVER, a borough of York county, Pa., U.S.A., in the fertile Conewago valley, 36m. S. by W. of Harrisburg and 6m. from the southern boundary of the State It is at the intersection of several old turnpikes, and is served by the Pennsylvania and the Western Maryland railways. The population was 8,664 in 1920 (98% native white) and was estimated locally at 15,000 in 1928. It is the trading point for a rich farming region, and is also a busy industrial centre, with 111 plants, producing a great variety of goods, valued at $17,000,000 annually. Hanover was laid out in 1763 or 1764, by Col. Richard MacAllister, and was incorporated as a borough in 1815. The first settlers were largely Germans, and it was named after the German city On June 30, 1863, a cavalry engagement was fought in the vicinity, preliminary to the battle of Gettysburg, between the forces of Gen. H. J. Kilpatrick (Union) and Gen. J. E. B. Stuart (Confederate)

HANRIOT, FRANÇOIS (1761–1794), French revolutionist, was born at Nanterre (Seine) of poor parentage. He became one of the orators of the *sans-culottes*, and commanded the armed force of that section during the insurrection on Aug. 10, 1792 and the massacres of September. He was appointed by the Commune to the command of the armed forces of Paris on May 30–31, from June 2 to June 11, and again after the failure of his impeachment in the Convention, from July 1 until the revolution of the 9th Thermidor (July 27, 1794) He was then arrested, after a vain attempt to rescue Robespierre, and was guillotined with Robespierre and his friends on the 10th Thermidor of the year II. (July 28, 1794).

HANSARD, LUKE (1752–1828), English printer, was born in St. Mary's parish, Norwich, educated at Boston grammar school, and apprenticed to Stephen White, a Norwich printer. As soon as his apprenticeship had expired Hansard started for London with only a guinea in his pocket, and became a compositor in the office of John Hughs (1703–71), printer to the House of Commons. In 1774 he was made a partner, and in 1800 the business came completely into his hands. He printed the *Journals of the House of Commons* from 1774 till his death. The promptitude and accuracy with which he printed parliamentary papers were often of the greatest service to the Government—notably on one occa-

sion when the proof-sheets of the report of the Secret Committee on the French Revolution were submitted to Pitt 24 hours after the draft had left his hands. He devised numerous expedients for reducing the expense of publishing the reports; and in 1805, when his workmen struck at a time of great pressure, he and his sons themselves set to work as compositors. Luke Hansard died on Oct. 29, 1828.

His son, THOMAS CURSON HANSARD (1776–1833), established a press of his own in Paternoster Row, and began in 1803 to print the *Parliamentary Debates*, which were not at first independent reports, but were taken from the newspapers. After 1889 the debates were published by the Hansard Publishing Union Limited The original business remained in the hands of his younger brothers, James and Luke Graves Hansard (1777–1851). The firm was prosecuted in 1837 by John Joseph Stockwell for printing by order of the House of Commons, in an official report of the inspector of prisons, statements regarded by the plaintiff as libellous. Hansard sheltered himself on the ground of privilege, but it was not until after much litigation that the security of the printers of Government reports was guaranteed by statute in 1840

HANS DER BÜHELER (HANS VON BUHEL), German poet of the 15th century, was born probably in Buhl, near Rastatt. While in the service of the archbishop of Cologne, he wrote two narrative poems. The first, *Die Königstochter von Frankreich* (1400, ed Merzdorf, 1867), was based on a 13th century poem, *Mai und Beaflor;* the second, *Diocletians Leben* (1412, ed. Keller, 1841), relates the story of the seven white masters

See G. Seelig in *"Strazburger Studien,"* vol. iii. (1888); K Buschagens, *Hans von Buhel* (1921); Wellen, *Über den Stil der "Konigstochter von Frankreich"* (1921).

HANSEATIC LEAGUE. It is impossible to assign any precise date for the beginning of the Hanseatic League or to name any single factor which explains the origin of that loose but effective federation of north German towns. Associated action and partial union among these towns can be traced back to the 13th century. In 1241 we find Lubeck and Hamburg agreeing to safeguard the important road connecting the Baltic and the North sea. The first known meeting of the "maritime towns," later known as the Wendish group and including Lubeck, Hamburg, Luneburg, Wismar, Rostock and Stralsund, took place in 1256. The Saxon towns, during the following century, were joining to protect their common interests, and indeed at this period town confederacies in Germany, both north and south, were so considerable as to call for declaration against them in the Golden Bull of 1356 The decline of the imperial power and the growing opposition between the towns and the territorial princes justified these defensive town alliances, which in south Germany took on a peculiarly political character. The relative weakness of territorial power in the north, after the fall of Henry the Lion of Saxony, diminished without however removing this motive for union, but the comparative immunity from princely aggression on land left the towns more free to combine in a stronger and more permanent union for the defence of their commerce by sea and for the control of the Baltic.

While the political element in the development of the Hanseatic League must not be underestimated, it was not so formative as the economic The foundation was laid for the growth of German towns along the southern shore of the Baltic by the great movement of German colonization of Slavic territory east of the Elbe. This movement, extending in time from about the middle of the 11th to the middle of the 13th century and carrying a stream of settlers and traders from the north-west, resulted not only in the Germanization of a wide territory but in the extension of German influence along the sea-coast far to the east of actual territorial settlement. The German trading towns, at the mouths of the numerous streams which drain the north European plain, were stimulated or created by the unifying impulse of a common and long-continued advance of conquest and colonization.

The impetus of this remarkable movement of expansion not only carried German trade to the east and north within the Baltic basin, but reanimated the older trade from the lower Rhine region to Flanders and England in the west. Cologne and the Westphalian towns, the most important of which were Dortmund, Soest and Munster, had long controlled this commerce but now began to feel the competition of the active traders of the Baltic, opening up that direct communication by sea from the Baltic to western Europe which became the essential feature in the history of the League. The necessity of seeking protection from the sea-rovers and pirates who infested these waters during the whole period of Hanseatic supremacy, the legal customs, substantially alike in the towns of north Germany, which governed the groups of traders in the outlying trading posts, the establishment of common factories, or "counters" (Komtors) at these points, with aldermen to administer justice and to secure trading privileges for the community of German merchants—such were some of the unifying influences which preceded the gradual formation of the League. In the century of energetic commercial development before 1350 the German merchants abroad led the way.

The Gothland Association.—Germans were early pushing as permanent settlers into the Scandinavian towns, and in Wisby, on the island of Gothland, the Scandinavian centre of Baltic trade, equal rights as citizens in the town government were possessed by the German settlers as early as the beginning of the 13th century. There also came into existence at Wisby the first association of German traders abroad, which united the merchants of over 30 towns, from Cologne and Utrecht in the west to Reval in the east. We find the Gothland association making in 1229 a treaty with a Russian prince and securing privileges for their branch trading station at Novgorod According to the "Skra," the by-laws of the Novgorod branch, the four aldermen of the community of Germans, who among other duties held the keys of the common chest, deposited in Wisby, were to be chosen from the merchants of the Gothland association and of the towns of Lübeck, Soest and Dortmund. The Gothland association received in 1237 trading rights in England, and shortly after the middle of the century it also secured privileges in Flanders. It legislated on matters relating to common trade interests, and, in the case of the regulation of 1287 concerning shipwrecked goods, we find it imposing this legislation on the towns under the penalty of exclusion from the association. But with the extension of the east and west trade beyond the confines of the Baltic, this association by the end of the century was losing its position of leadership Its inheritance passed to the gradually forming union of towns, chiefly those known as Wendish, which looked to Lubeck as their head In 1293 the Saxon and Wendish merchants at Rostock decided that all appeals from Novgorod be taken to Lübeck instead of to Wisby, and six years later the Wendish and Westphalian towns, meeting at Lübeck, ordered that the Gothland association should no longer use a common seal. Though Lübeck's right as court of appeal from the Hanseatic counter at Novgorod was not recognized by the general assembly of the League until 1373, the long-existing practice had simply accorded with the actual shifting of commercial power. The union of merchants abroad was beginning to come under the control of the partial union of towns at home.

A similar and contemporary extension of the influence of the Baltic traders under Lübeck's leadership may be witnessed in the west. As a consequence of the close commercial relations early existing between England and the Rhenish-Westphalian towns, the merchants of Cologne were the first to possess a gild-hall in London and to form a "hansa" with the right of admitting other German merchants on payment of a fee. The charter of 1226, however, by which Emperor Frederick II. created Lübeck a free imperial city, expressly declared that Lübeck citizens trading in England should be free from the dues imposed by the merchants of Cologne and should enjoy equal rights and privileges. In 1266 and 1267 the merchants of Hamburg and Lübeck received from Henry III. the right to establish their own hansas in London, like that of Cologne. The situation thus created led by 1282 to the coalescence of the rival associations in the "Gild-hall of the Germans," but though the Baltic traders had secured a recognized foothold in the enlarged and unified organization, Cologne retained the controlling interest in the London settlement until 1476. Lübeck and Hamburg, however, dominated the German trade in the ports of the east coast, notably in Lynn and Boston,

while they were strong in the organized trading settlements at York, Hull, Ipswich, Norwich, Yarmouth and Bristol. The counter at London, first called the Steelyard in a parliamentary petition of 1422, claimed jurisdiction over the other factories in England

The Counter of Bruges.—In Flanders, also, the German merchants from the west had long been trading, but here had later to endure not only the rivalry but the pre-eminence of those from the east. In 1252 the first treaty privileges for German trade in Flanders show two men of Lübeck and Hamburg heading the "Merchants of the Roman Empire," and in the later organization of the counter at Bruges four or five of the six aldermen were chosen from towns east of the Elbe, with Lubeck steadily predominant The Germans recognized the staple rights of Bruges for a number of commodities, such as wool, wax, furs, copper and grain, and in return for this material contribution to the growing commercial importance of the town, they received in 1309 freedom from the compulsory brokerage which Bruges imposed on foreign merchants The importance and independence of the German trading settlements abroad were exemplified in the statutes of the "Company of German merchants at Bruges," drawn up in 1347, where for the first time appears the grouping of towns in three sections (the "Drittel"), the Wendish-Saxon, the Prussian-Westphalian and those of Gothland and Livland Even more important than the assistance which the concentration of the German trade at Bruges gave to that leading mart of European commerce was the service rendered by the German counter of Bruges to the cause of Hanseatic unity. Not merely because of its central commercial position, but because of its width of view, its political insight and its constant insistence on the necessity of union, this counter played a leading part in Hanseatic policy It was more Hanse than the Hanse towns.

The last of the chief trading settlements, both in importance and in date of organization, was that at Bergen in Norway, where in 1343 the Hanseatics obtained special trade privileges. Scandinavia had early been sought for its copper and iron, its forest products and its valuable fisheries, especially of herring at Schonen, but it was backward in its industrial development and its own commerce had seriously declined in the 14th century. It had come to depend largely upon the Germans for the importation of all its luxuries and of many of its necessities, as well as for the exportation of its products, but regular trade with the three kingdoms was confined for the most part to the Wendish towns, with Lubeck steadily asserting an exclusive ascendancy. The fishing centre at Schonen was important as a market, though, like Novgorod, its trade was seasonal, but it did not acquire the position of a regularly organized counter, reserved alone, in the north, for Bergen. The commercial relations with the north cannot be regarded as an important element in the union of the Hanse towns, but the geographical position of the Scandinavian countries, especially that of Denmark, commanding the Sound which gives access to the Baltic, compelled a close attention to Scandinavian politics on the part of Lübeck and the League and thus by necessitating combined political action in defence of Hanseatic sea-power exercised a unifying influence

Energetic and successful though the scattered trading settlements had been in establishing German trade connections and in securing valuable trade privileges, the middle of the 14th century found them powerless to meet difficulties arising from internal dissension and still more from the political rivalries and trade jealousies of nascent nationalities. Flanders became a battle-field in the great struggle between France and England, and the war of trade prohibitions led to infractions of the German privileges in Bruges. An embargo on trade with Flanders, voted in 1358 by a general assembly, resulted by 1360 in the full restoration of German privileges in Flanders, but reduced the counter at Bruges to an executive organ of a united town policy. It is worth noting that in a document connected with this action the union of towns, borrowing the term from English usage, was first called the "German Hansa." In 1361 representatives from Lübeck and Wisby visited Novgorod to recodify the by-laws of the counter and to admonish it that new statutes required the consent of Lübeck, Wisby, Riga, Dorpat and Reval. This action was confirmed in 1366 by an assembly of the Hansa which at the same time, on the occasion of a regulation made by the Bruges counter and of statutes drawn up by the young Bergen counter, ordered that in future the approval of the towns must be obtained for all new regulations.

Hanseatics in England.—The counter at London was soon forced to follow the example of the other counters at Bruges, Novgorod and Bergen After the failure of the Italians, the Hanseatics remained the strongest group of alien merchants in England, and, as such, claimed the exclusive enjoyment of the privileges granted by the *Carta Mercatoria* of 1303 Their highly favoured position in England, contrasting markedly with their refusal of trade facilities to the English in some of the Baltic towns and their evident policy of monopoly in the Baltic trade, incensed the English mercantile classes, and doubtless influenced the increases in customs duties which were regarded by the Germans as contrary to their treaty rights Unsuccessful in obtaining redress from the English Government, the German merchants finally, in 1374, appealed for aid to the home towns, especially to Lubeck. The result of Hanseatic representations was the confirmation by Richard II. in 1377 of all their privileges, which accorded them the preferential treatment they had claimed and became the foundation of the Hanseatic position in England

In the meanwhile, the conquest of Wisby by Waldemar IV of Denmark in 1361 had disclosed his ambition for the political control of the Baltic. He was promptly opposed by an alliance of Hanse towns, led by Lubeck The defeat of the Germans at Helsingborg only called into being the stronger town and territorial alliance of 1367, known as the Cologne Confederation, and its final victory, with the peace of Stralsund in 1370, which gave for a limited period the four chief castles on the Sound into the hands of the Hanseatic towns, greatly enhanced the prestige of the League.

The assertion of Hanseatic influence in the two decades, 1356 to 1377, marks the zenith of the League's power and the completion of the long process of unification Under the pressure of commercial and political necessity, authority was definitely transferred from the Hansas of merchants abroad to the Hansa of towns at home, and the sense of unity had become such that in 1380 a Lübeck official could declare that "whatever touches one town touches all." But even at the time when union was most important, this statement went further than the facts would warrant, and in the course of the following century it became less and less true Dortmund held aloof from the Cologne Confederation on the ground that it had no concern in Scandinavian politics. It became, indeed, increasingly difficult to obtain the support of the inland towns for a policy of sea-power in the Baltic. Cologne sent no representatives to the regular Hanseatic assemblies until 1383, and during the 15th century its independence was frequently manifested. It rebelled at the authority of the counter at Bruges, and at the time of the war with England (1469–74) openly defied the League. In the east, the German Order, while enjoying Hanseatic privileges, frequently opposed the policy of the League abroad, and was only prevented by domestic troubles and its Hinterland enemies from playing its own hand in the Baltic After the fall of the order in 1467, the towns of Prussia and Livland, especially Danzig and Riga, pursued an exclusive trade policy even against their Hanseatic confederates Lubeck, however, supported by the Bruges counter, despite the disaffection and jealousy on all sides hampering and sometimes thwarting its efforts, stood steadfastly for union and the necessity of obedience to the decrees of the assemblies. Its headship of the League, hitherto tacitly accepted, was definitely recognized in 1418.

The League Assembly.—The governing body of the Hansa was the assembly of town representatives, the "Hansetage," held irregularly as occasion required at the summons of Lubeck, and, with few exceptions, attended but scantily. The delegates were bound by instructions from their towns and had to report home the decisions of the assembly for acceptance or rejection. In 1469 the League declared that the English use of the terms "societas," "collegium" and "universitas" was inappropriate to so loose an organization. It preferred to call itself a "firma con-

federatio" for trade purposes only It had no common seal, though that of Lubeck was accepted, particularly by foreigners, on behalf of the League. Disputes between the confederate towns were brought for adjudication before the general assembly, but the League had no recognized federal judiciary. Lubeck, with the counters abroad, watched over the execution of the measures voted by the assembly, but there was no regular administrative organization. Money for common purposes was raised from time to time, as necessity demanded, by the imposition on Hanse merchandise of poundage dues, introduced in 1361, while the counters relied upon a small levy of like nature and upon fines to meet current needs Even this slender financial provision met with opposition. The German Order in 1398 converted the Hanseatic poundage to a territorial tax for its own purposes, and one of the chief causes for Cologne's disaffection a half-century later was the extension from Flanders to other parts of the Netherlands of the levy made by the counter at Bruges. Since the authority of the League rested primarily on the moral support of its members, allied in common trade interests and acquiescing in the able leadership of Lubeck, its only means of compulsion was the "Verhansung," or exclusion of a recalcitrant town from the benefits of the trade privileges of the League. A conspicuous instance was the exclusion of Cologne from 1471 until its obedience in 1476, but the penalty had been earlier imposed, as in the case of Brunswick, on towns which overthrew their patrician Governments It was obviously, however, a measure to be used only in the last resort and with extreme reluctance.

The decisive factor in determining membership in the League was the historical right of the citizens of a town to participate in Hanseatic privileges abroad At first the merchant Hansas had shared these privileges with almost any German merchant, and thus many little villages, notably those in Westphalia, ultimately claimed membership Later, under the Hansa of the towns, the struggle for the maintenance of a coveted position abroad led to a more exclusive policy. A few new members were admitted, mainly from the westernmost sphere of Hanseatic influence, but membership was refused to some important applicants. In 1447 it was voted that admission be granted only by unanimous consent. No complete list of members was ever drawn up, despite frequent requests from foreign powers. Contemporaries usually spoke of 70, 72, 73 or 77 members, and perhaps the list is complete with Daenell's recent count of 72, but the obscurity on so vital a point is significant of the amorphous character of the organization

The towns of the League, stretching from Thorn and Krakow on the east to the towns of the Zuider Zee on the west, and from Wisby and Reval in the north to Göttingen in the south, were arranged in groups, following in the main the territorial divisions Separate assemblies were held in the groups for the discussion both of local and Hanseatic affairs, and gradually, but not fully until the 16th century, the groups became recognized as the lowest stage of Hanse organization. The further grouping into "Thirds," later "Quarters," under head-towns, was also more emphasized in that century.

Decline of the League.—In the 15th century the League, with increasing difficulty, held a defensive position against the competition of strong rivals and new trade-routes. In England the inevitable conflict of interests between the new mercantile power, growing conscious of its national strength, and the old, standing insistent on the letter of its privileges, was postponed by the factional discord out of which the Hansa in 1474 dexterously snatched a renewal of its rights. Under Elizabeth, however, the English Merchant Adventures could finally rejoice at the withdrawal of privileges from the Hanseatics and their concession to England, in return for the retention of the Steelyard, of a factory in Hamburg In the Netherlands the Hanseatics clung to their position in Bruges until 1540, while trade was migrating to the ports of Antwerp and Amsterdam. By the peace of Copenhagen in 1441, after the unsuccessful war of the League with Holland, the attempted monopoly of the Baltic was broken, and, though the Hanseatic trade regulations were maintained on paper, the Dutch with their larger ships increased their hold on the herring fisheries, the French salt trade and the Baltic grain trade. For the Russian trade new competitors were emerging in southern Germany. The Hanseatic embargo against Bruges from 1451 to 1457, its later war and embargo against England, the Turkish advance closing the Italian Black sea trade with southern Russia, all were utilized by Nuremberg and its fellows to secure a land-trade outside the sphere of Hanseatic influence. The fairs of Leipzig and Frankfurt-on-Main rose in importance as Novgorod, the stronghold of Hanse trade in the east, was weakened by the attacks of Ivan III The closing of the Novgorod counter in 1494 was due not only to the development of the Russian State but to the exclusive Hanseatic policy which had stimulated the opening of competing trade routes.

Within the League itself increasing restiveness was shown under the restrictions of its trade policy. At the Hanseatic assembly of 1469, Danzig, Hamburg and Breslau opposed the maintenance of a compulsory staple at Bruges in the face of the new conditions produced by a widening commerce and more advantageous markets. Complaint was made of south German competition in the Netherlands. "Those in the Hansa," protested Breslau, "are fettered and must decline and those outside the Hansa are free and prosper." By 1477 even Lubeck had become convinced that a continuance of the effort to maintain the compulsory staple against Holland was futile and should be abandoned But while it was found impossible to enforce the staple or to close the Sound against the Dutch, other features of the monopolistic system of trade regulations were still upheld It was forbidden to admit an outsider to partnership or to co-ownership of ships, to trade in non-Hanseatic goods, to buy or sell on credit in a foreign mart or to enter into contracts for future delivery The trade of foreigners outside the gates of Hanse towns or with others than Hanseatics was forbidden in 1417, and in the eastern towns the retail trade of strangers was strictly limited. The whole system was designed to suppress the competition of outsiders, but the divergent interests of individuals and towns, the pressure of competition and changing commercial conditions, in part the reactionary character of the legislation, made enforcement difficult. The measures were those of the late-mediaeval town economy applied to the wide region of the German Baltic trade, but not supported, as was the analogous mercantilist system, by a strong central government.

Among the factors, economic, geographic, political and social, which combined to bring about the decline of the Hanseatic League, none was probably more influential than the absence of a German political power comparable in unity and energy with those of France and England, which could quell particularism at home, and abroad maintain in its vigour the trade which these towns had developed and defended with their imperfect union. Nothing was to be expected from the declining empire. Still less was any co-operation possible between the towns and the territorial princes. The fatal result of conflict between town autonomy and territorial power had been taught in Flanders. The Hanseatics regarded the princes with a growing and exaggerated fear and found some relief in the formation in 1418 of a thrice-renewed alliance, known as the "Tohopesate," against princely aggression. But no territorial power had as yet arisen in north Germany capable of subjugating and utilizing the towns, though it could detach the inland towns from the League. The last wars of the League with the Scandinavian powers in the 16th century, which left it shorn of many of its privileges and of any pretension to control of the Baltic basin eliminated it as a factor in the later struggle of the Thirty Years' War for that control. At an assembly of 1629, Lübeck, Bremen and Hamburg were entrusted with the task of safeguarding the general welfare, and after an effort to revive the League in the last general assembly of 1669, these three towns were left alone to preserve the name and small inheritance of the Hansa which in Germany's disunion had upheld the honour of her commerce. Under their protection, the three remaining counters lingered on until their buildings were sold at Bergen in 1775, at London in 1852 and at Antwerp in 1863.

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HANSEN, CHRISTIAN FREDERIK (1756–1845), Danish architect, was born at Copenhagen on Feb. 29, 1756. In 1804 he was appointed professor at the Academy, and head of the department of architecture. He was responsible for the rebuilding of the king's palace at Christiansborg, which had been burnt down in 1794, and he also designed the Frauenkirche in Copenhagen. He died on July 10, 1845.

HANSEN, EMIL CHRISTIAN (1842–1909), Danish botanist, was born on May 8, 1842, at Ribe, Jutland. He studied art at Copenhagen but in 1871 turned to science. From 1877 he was head of the physiological department of the Carlsburg institute. Hansen's researches were concerned chiefly with fungi and alcoholic fermenting yeasts. He was able to prove that there are different species of yeast and that they may be cultivated from a single cell. The yeast grown from single cells is now largely used in the bottom-fermentation breweries of the Continent. Hansen died at Copenhagen on Aug. 26, 1909. Besides numerous articles in periodicals, he wrote *Untersuchungen aus der Praxis der Gärungsindustrie* (2 vols., 3rd. ed., 1892–95 Eng. trans., 1896) and *Gesammelte theoretische Abhandlungen über Gärungsorganismen* (1911).

HANSEN, JENS ANDERSEN (1806–1877), Danish politician, was born on Jan. 7, 1806, at Odense. He was a master shoemaker, but later became the editor of the weekly democratic paper *Almuevennen* (1842), and of the *Morgenposten* (1856–64). In 1849 he became the leader of the liberal peasants party, whom he represented in the *Reichsrat* from 1856–66. An opponent of the Eiderdänen, he fought continually for the improvement of the conditions of the peasants.

He wrote *Vor Forfataings Historie 1848 til 1866* (2 vols., 1868–72), *Memoirenbruchstück, mit livs Historie og Gjerning* (1875).

HANSEN, PETER ANDREAS (1795–1874), Danish astronomer, was born on Dec. 8, 1795, at Tondern, in the duchy of Schleswig. He learned the trade of a watchmaker, but in 1820 went to Copenhagen, where he won the patronage of H. C. Schumacher. He acted as Schumacher's assistant in work connected with the Danish survey, chiefly at the new observatory of Altona, 1821–25. Thence he passed on to Gotha as director of the Seeberg observatory. Hansen studied the problems of gravitational astronomy. A research into the mutual perturbations of Jupiter and Saturn secured for him the prize of the Berlin Academy in 1830, and a memoir on cometary disturbances was crowned by the Paris Academy in 1850. In 1838 he published a revision of the lunar theory, entitled *Fundamenta nova investigationis*, etc., and the improved Tables of the Moon based upon it were printed in 1857, at the expense of the British government, and were immediately adopted in the *Nautical Almanac*, and other Ephemerides. A theoretical discussion of the disturbances embodied in them (still familiarly known to lunar experts as the *Darlegung*) appeared in the *Abhandlungen* of the Saxon academy of Sciences in 1862–64. Hansen received the Royal Astronomical Society's gold medal in 1842, and communicated to that society in 1847 a paper on a long-period lunar inequality (*Memoirs Roy. Astr. Society*, xvi.), and in 1854 one on the moon's figure (*Ib.* xxiv.). He was awarded the Copley medal by the Royal Society in 1850, and his Solar Tables, compiled with the assistance of Christian Olufsen, appeared in 1854. Hansen gave in 1854 the first intimation that the accepted distance of the sun was too great by some millions of miles (*Month. Notices Roy. Astr. Soc.* xv. 9). He died on March 28, 1874, at the new observatory in Gotha, erected under his care in 1857.

See *Vierteljahrsschrift astr. Gesellschaft*, x. *Month. Notices Roy. Astr. Society*, xxxv., *Proc. Roy. Society*, xxv; R. Wolf, *Geschichte der Astronomie*, *Wochenschrift fur Astronomie*, xvii. (account of early years by E. Heis), *Allgemeine deutsche Biographie* (C. Bruhns).

HANSI, a town of British India, in the Hissar district of the Punjab, on a branch of the Western Jumna canal. Pop. (1921) 15,425. Hansi is one of the most ancient towns in northern India, the former capital of the tract called Hariana. At the end of the 18th century it was the headquarters of the famous Irish adventurer George Thomas; from 1803 to 1857 it was a British cantonment, and it became the scene of a murderous outbreak during the Mutiny. A ruined fort overlooks the town, which is a centre of local trade, with factories for ginning and pressing cotton.

HANSOM, JOSEPH ALOYSIUS (1803–1882), English architect and inventor, was born in York on Oct. 26, 1803, and died in London on June 29, 1882. He went from his father's joinery shop to be articled to an architect in York. In 1831 his designs for the Birmingham town hall were accepted and executed. In 1834 he registered and sold for £10,000 the design for a "Patent Safety Cab," which, as subsequently improved, became popular as the "hansom" cab. In the same year he joined Owen's Grand Trades Union. He erected a number of important buildings between 1854 and 1879, including churches, schools and convents for the Roman Catholic Church, of which he was a member. The cathedral, Plymouth, and the Jesuit church, Manchester, rank among his chief works. *See* "Memoir" in the *Builder*, July 8, 1882.

HANSON, JOHN (1715–1783), American patriot, was born in Charles county, Md., on Apr. 3, 1715, and educated in England. He became a political leader of note in Maryland, serving in the house of delegates, 1757–81, upon many important committees during the Revolutionary War, and as a representative of Maryland in the Continental Congress, 1781–83. On Nov. 5, 1781, he was elected by the Continental Congress "President of the United States in Congress Assembled," which office he held one year and resigned on account of feeble health. Because he was the first President under the Articles of Confederation he is sometimes referred to as "the first president of the United States," although he had none of the powers of the first president under the Constitution. He died at Oxen Hills, Md., on Nov. 27, 1783.

HANSON, SIR RICHARD DAVIES (1805–1876), chief justice of South Australia, was born in London on Dec. 6, 1805. Admitted a solicitor in 1828, he practised for some time in London. In 1838 he went with Lord Durham to Canada as assistant-commissioner of inquiry into crown lands and immigration. In 1840, on the death of Lord Durham, whose private secretary he had been, he settled in Wellington, New Zealand. He there acted as crown prosecutor, but in 1846 removed to South Australia. In 1851 he was appointed advocate-general of that colony. In 1856 and again from 1857 to 1860 he was attorney-general and leader of the government. In 1861 he was appointed chief justice of the supreme court of South Australia and was knighted in 1869. He died in Australia on March 4, 1876.

HANSSON, OLA (1860–1925), Swedish writer, was born at Hönsinge (Schönen) on Nov. 12, 1860. He wrote mainly in German, but his best works are the lyrics inspired by the beauty of his native country. Both in his life and his books his morbid character is apparent, particularly in his first novel *Sensitiva Amorosa* (1887). He died on Sept. 26, 1925. In 1889, Hansson married Laura Marholm, author of several plays and novels.

Ola Hansson's most important works are: *Parias* (1890); *Vor der Ehe* (1895); *Ein Erzieher* (1895); *Jung Ofeg's Lieder* (1892). A collection of his poems appeared in 1901 as *Gedichte in Vers und Prosa,* and a Swedish collection in 1926. His later works include: *Das Verlorne Land* (1906); *Neue Lieder* (1907); *Auf dem Altar der Heimat* (1908).

HANSTEEN, CHRISTOPHER (1784–1873), Norwegian astronomer and physicist, was born at Christiania (Oslo) on Sept. 26, 1784. From the cathedral school he went to the university of Copenhagen, where he studied mathematics. In 1807 he began the inquiries in terrestrial magnetism with which his name is especially associated. He took in 1812 the prize of the Danish Royal Academy of Sciences for his reply to a question on the magnetic axes. Appointed lecturer in 1814, he was in 1816 raised to the chair of astronomy and applied mathematics in the university of Christiania. In 1819 he published a volume of researches on terrestrial magnetism, *Untersuchungen über den Magnetismus der Erde,* with a supplement containing *Beobachtungen der Abweichung und Neigung der Magnetnadel* and an atlas. Hansteen wished to determine the number and position of the earth's magnetic poles and to obtain observations for this purpose he travelled over Finland and the greater part of his own country; and in 1828–30 he undertook, in company with G. A. Erman, and with the co-operation of Russia, a government mission to western Siberia. A narrative of the expedition soon appeared (*Reise-Erinnerungen aus Sibirien,* 1854; *Souvenirs d'un voyage en Sibérie,* 1857); but the chief work was not issued till 1863 (*Resultate magnetischer Beobachtungen,* etc.). In 1833 an observatory was erected in the park of Christiania and Hansteen was appointed director. On his representation a magnetic observatory was added in 1839. He wrote (1842) *Disquisitiones de mutationibus quas patitur momentum acus magneticae,* and contributed various papers to scientific journals, especially the *Magazin for Naturvidenskarberne,* of which he became joint-editor in 1823. He superintended the trigonometrical and topographical survey of Norway, begun in 1837. In 1861 he retired from active work, but still pursued his studies, his *Observations de l'inclination magnétique* and *Sur les variations séculaires du magnétisme* appearing in 1865. He died on April 11, 1873.

See *Proc. of Amer. Acad.* (1874).

HANTHAWADDY, a district in the Pegu division of Lower Burma, the home district of Rangoon, from which the town was detached to make a separate district in 1880. It has an area of 1,866 sq.m., with a population in 1921 of 492,429, of whom 43,429 lived in the two towns of Syriam, where the oil refineries are situated, and Thôngwa. Ma-ubin and Hanthawaddy are the two most densely populated districts in the province. It consists of a vast plain stretching up from the sea, and lies on either side of the Rangoon river by which the port of Rangoon is approached from the sea. The country is intersected by numerous tidal creeks, many navigable by large boats and some, like the Bassein creek which connects the Rangoon river with the To or China Bakir mouth of the Irrawaddy, by steamers. The Twanté canal affords a more direct communication between the Rangoon and China Bakir rivers, and is used by the regular steamer services between Rangoon and Bassein across the delta. The British Admiralty oiling base, constructed between 1922 and 1927, lies on the east bank of the Rangoon river in the Hanthawaddy district. Cultivation in the district is almost wholly confined to rice, and there are considerable tracts of unreclaimed marshland.

HANUKKAH (lit. dedication, *cf.* Num. vii.), the feast instituted by Judas Maccabaeus on 25 Kislew, 165 B.C., for the purification of the Temple, on the third anniversary of the setting up of the "Abomination of Desolation" (Dan. xi. 31; 1 Macc. i. 41–64, iv. 59; 2 Macc. vi. 2; Mark xiii. 14) by Antiochus Epiphanes. The name חנוכה corresponds to ἐγκαίνια (John x. 22). Wellhausen maintained that Hanukkah represents a primitive winter solstice festival. On this *see* ch. xii. of C. C. Keet (*Liturgical Use of Psalter,* London, 1928). The feast lasts eight days, but the legend in 2 Macc. i. 18 is probably not the reason for this. One light is kindled on the first night, an extra one being added on each successive night, Hillel's rule thus prevailing over that of Shammai. The scroll of Antiochus still survives in some liturgies. For the service *see* the prayer books of S. Singer (Ashkenazic rite, London, 1928, and I. Abraham's notes in the annotated edition) and M. Gaster (Sephardic rite, with variants, Oxford, 1901); I. Elbogen in *Jüd. Gottesdienst* (Frankfurt a. M. 1924; G. F. Moore, *Judaism,* ii. 49, Harvard, 1927). The *Jewish Encyclopedia* (*s.v.*) article contains numerous illustrations of Hanukkah lamps: *see* also the catalogue of the Anglo-Jewish Historical exhibition of 1887 (published by the *Jewish Chronicle,* London). Specimens will be found in museums and private collections. In modern days services for Jewish soldiers in the British army are held on *Hanukkah.*

HANUMĀN, in Hindu mythology, the monkey-god, a central figure in the *Rāmāyana.* Child of a nymph by the wind-god, he aided Rāma to recover his wife, Sīta, from the demon Ravana, bridging the strait between India and Ceylon with boulders brought from the Himalayas, with the help of a host of monkeys. Temples in his honour are numerous, especially in southern India. He is also a popular deity in Japan, where many temples are erected to his honour and districts of towns bear his name. The hanumān monkey (*Pygathrix entellus*), called after the god, is one of the commonest Indian monkeys. (*See* PRIMATES.)

HANUSCH, FERDINAND (1866–1923), Austrian politician, was born Nov. 9, 1866 in Oberndorf, Silesia, the son of a poor Silesian weaver. After a childhood of crushing poverty, Hanusch became in 1900 secretary of the Austrian Textile Workers' Union. In 1907 he entered Parliament as a deputy. He was a pioneer of the Austrian trade union movement, especially in his own branch of industry, and did much to improve conditions for this class of labour, which were abnormally bad. In Oct. 1918 he became secretary of state of the new ministry of social welfare, and was author of most of the social legislation of the period, including the eight-hour day, the Works Councils act, the law compelling employers of 14 hands or more to increase their staffs by 20% in order to reduce unemployment, and the laws dealing with the unemployment dole. He was universally respected for his personal probity and first-hand knowledge of labour problems and conditions. He died Sept. 28, 1923.

HANWAY, JONAS (1712–86), English traveller and philanthropist, was born at Portsmouth on Aug. 12, 1712. In 1743 he became a partner with Dingley, a merchant in St. Petersburg. He travelled across Russia to Persia where he suffered many hardships and difficulties. Hanway returned in 1750 to London, where he died on Sept. 5, 1786. He is said to have been the first Londoner habitually to carry an umbrella, and he lived to triumph over all the hackney coachmen who tried to hoot and hustle him down. Hanway was a prison reformer, and he attacked the employment of children as chimney sweeps.

Hanway left 74 printed works, mostly pamphlets; the only one of literary importance is the *Historical Account of British Trade over the Caspian Sea, with a Journal of Travels,* etc. (London, 1753). On his life, *see* also Pugh, *Remarkable Occurrences in the Life of Jonas Hanway* (London, 1787); *Gentleman's Magazine,* vols. xxxii., lvi., vol. lxv.; *Notes and Queries,* 1st series, i.; 3rd series, vii.; 4th series, viii.

HANWELL, urban district of Middlesex, England, 10½ m. W. of St. Paul's cathedral, London. Pop. (1921) 20,481. It is a residential suburb of London. Many of its inhabitants are employed in metal industries, in electrical works and in furniture factories. The mental hospital has accommodation for over 2,500 patients. Before the Norman period the manor of Hanwell belonged to Westminster Abbey.

HAPARANDA, a town of Sweden in the district (*län*) of Norbotten, at the head of the Gulf of Bothnia. Pop. (1928) 2,624. It lies about 1½ m. from the mouth of the Torne river, on the frontier with Finland, opposite the town of Torneå. The towns are divided by a marshy channel. Haparanda was founded in 1812, and at first bore the name of Karljohannstad. Some shipbuilding is done and tar is exported. Sea-going vessels load and unload at Salmio, 7 m. from Haparanda. Mean temperature, February 10·6°; July 59·0°. Rainfall, 16·5 in. annually. Up the Torne valley (54 m.) is the hill Avasaxa, whither pilgrimages were formerly made in order to stand in the light of the sun at midnight on St. John's day (June 24).

HAPUR, a town of British India in the Meerut district of the United Provinces, 18 m. S. of Meerut. Pop. (1921) 20,388. It is said to have been founded in the 10th century, and was granted by Sindhia to his French general Perron at the end of the 18th century. Several fine groves surround the town, but the wall and ditch have fallen out of repair, and only the names of the five gates remain. Considerable trade is carried on in sugar, grain, cotton, timber, bamboos and brass utensils. Babugarh, an important depot and farm for military remounts adjoins the town.

HARA, TAKASHI (1856–1921), Japanese politician, was born at Morioka. After studying law and practising journalism he entered the diplomatic service, and was *chargé d'affaires* in Paris in 1886. In 1892 he was appointed director of the commercial bureau at the Foreign Office, and in 1895 became vice-minister of the department He acted as minister to Korea from 1896–97, when he became chief editor of the Osaka *Mainichi.* Still deeply interested in politics he became the leading spirit of the Seiyu-Kai (Liberal) party. From the end of 1900 to May 1901 he was minister of communications in the Ito ministry. He then became chief editor of the Osaka *Shimpo,* and was elected a member of the House of Representatives for Morioka in 1902. Definitely abandoning journalism he was appointed minister for home affairs in the first Saionji ministry of 1906, in the second Saionji ministry of 1911 and in the Yamamoto ministry of 1913. On Sept 29, 1918 Hara, as the first commoner to become prime minister of Japan, formed a cabinet based, for the first time in the history of Japanese politics, on strictly parliamentary principles. He was assassinated by a demented youth in Tokyo on Nov. 4, 1921.

HARA-KIRI, self-disembowelment (Japanese *hara,* belly, and *kiri,* cutting), the method of suicide permitted to offenders of the noble class in feudal Japan and later the national form of honourable suicide. The more commonly used modern term is *Seppuku,* the Chinese reading of the same characters Hara-kiri was a growth of mediaeval militarism, prompted by the desire of the noble to escape the humiliation of falling into an enemy's hands. By the end of the 14th century the custom had become a valued privilege. Hara-kiri was of two kinds, obligatory and voluntary. The first is the more ancient. An official or noble, who had broken the law or been disloyal, received a message from the mikado, couched always in gracious terms, courteously intimating that he must die. The mikado usually sent a jewelled dagger with which the deed might be done The suicide made dignified preparations for the ceremony. In his own baronial hall, or in a temple, a dais, 3 or 4 in from the ground, was constructed Upon this was laid a rug of red felt. The suicide, clothed in his ceremonial dress, and accompanied by his second (Kaishaku), took his place on the mat, the officials and his friends ranging themselves in a semi-circle. The weapon was then handed to him with many obeisances by the mikado's representative, and he made a public confession of his fault. A moment later he plunged the dagger into his stomach below the waist on the left side, drew it slowly across to the right and, turning it, gave a slight cut upward. At the same moment the Kaishaku, who crouched at his friend's side, leaping up, brought his sword down on the outstretched neck. The bloodstained dagger was taken to the mikado as a proof of the consummation of the act. The performance of hara-kiri carried with it certain privileges. If it was by order of the mikado half only of a traitor's property was forfeited to the State. If the gnawings of conscience drove the disloyal noble to voluntary suicide, his dishonour was wiped out, and his family inherited all his fortune.

Voluntary hara-kiri was the refuge of men rendered desperate by private misfortunes, or was committed from loyalty to a dead superior, or as a protest against what was deemed a false national policy. This voluntary suicide still survives, a characteristic case being that of the citizen who despatched himself in 1925 as a protest against the Government's foreign policy. The popularity of this self-immolation is testified to by the fact that for centuries no fewer than 1,500 hara-kiris are said to have taken place annually, at least half being entirely voluntary. Stories of amazing heroism are told in connection with the performance of the act. Obligatory hara-kiri was actually abolished in 1868.

See A. B. Mitford, *Tales of Old Japan;* Basil Hall Chamberlain, *Things Japanese* (1898).

HARALD I. (850–933), surnamed Haarfager ("Fairhair"), first king over Norway, succeeded on the death of his father Halfdan the Black in A.D. 860 to the sovereignty of several small and somewhat scattered kingdoms, which had come into his father's hands through conquest and inheritance and lay chiefly in south-east Norway. (*See* NORWAY.) In 866 he made the first of a series of conquests over the many petty kingdoms which then composed Norway; and in 872, after a great victory at Hafrsfjord near Stavanger, he found himself king over the whole country. His realm was, however, threatened by dangers from without, as large numbers of his opponents had taken refuge, not only in Iceland, then recently discovered, but also in the Orkneys, Shetlands, Hebrides and Faeroes, and in Scotland itself; and from these winter quarters sallied forth to harry Norway as well as the rest of northern Europe. Their numbers were increased by malcontents from Norway, who resented Harald's claim of rights of taxation over lands which the possessors appear to have previously held in absolute ownership. At last Harald was forced to make an expedition to the west to clear the islands and Scottish mainland of Vikings. Numbers of them fled to Iceland, which grew into independent commonwealth, while the Scottish isles fell under Norwegian rule. The latter part of Harald's reign was disturbed by the strife of his many sons. He gave them all the royal title and assigned lands to them which they were to govern as his representatives; but this arrangement did not put an end to the discord, which continued into the next reign When he grew old he handed over the supreme power to his favourite son Erik "Bloody Axe," whom he intended to be his successor. Harald died in 933, in his 84th year.

The tale goes that the scorn of the daughter of a neighbouring king induced Harald to take a vow not to cut or comb his hair until he was sole king of Norway and that ten years later he was justified in trimming it whereupon he exchanged the epithet "Shockhead" for the one by which he is usually known

HARALD II., surnamed Graafeld, a grandson of Harald I., became, with his brothers, ruler of the western part of Norway in 961; he was murdered in Denmark in 969.

See H Hermannson, *Islandica III.* (Bibliography of the Sagas of the Kings of Norway) (1910). A. Bugge, *Norges Historie* Vol. I. part II. (1909–10).

HARALD III. (1015–1066), king of Norway, surnamed Haardraade, which might be translated "ruthless," was the son of King Sigurd and half-brother of King Olaf the Saint. At the age of fifteen he was obliged to flee from Norway, having taken part in the battle of Stiklestad (1030), at which King Olaf met his death. He took refuge for a short time with Prince Yaroslav of Novgorod (a kingdom founded by Scandinavians), and thence went to Constantinople, where he took service under the empress Zoe, whose Varangian guard he led to frequent victory in Italy, Sicily and North Africa, also penetrating to Jerusalem. In the year 1042 he left Constantinople, the story says because he was refused the hand of a princess, and on his way back to his own country he married Ellisif or Elizabeth, daughter of Yaroslav of Novgorod. In Sweden he allied himself with the defeated Sven of Denmark against his nephew Magnus, now king of Norway, but soon broke faith with Sven and accepted an offer from Magnus of half his kingdom. In return for this gift Harald is said to have shared with Magnus the enormous treasure which he had amassed in the East. The death of Magnus in 1047 put an end to the growing jealousies between the two kings, and Harald turned his attention to subjugating Denmark, which he ravaged year after year; but in 1064 he gave up the attempt and made peace. In 1066, possibly instigated by the banished Earl Tostig, he invaded England. In September 1066 he landed in Yorkshire with a large army, reinforced from Scotland, Ireland and the Orkneys; took Scarborough by casting flaming brands into the town from the high ground above it; defeated the Northumbrian forces at Fulford; and entered York on Sept. 24. But

on the 25th the English Harold arrived from the south, and routed his forces at Stamford Bridge after the fall of their king. His many victories in the face of great odds prove him to have been a remarkable general, of never-failing resourcefulness and indomitable courage, in spite of the fact that he was an unpopular king.

HARALD IV. (d. 1136), king of Norway, surnamed Gylle (probably from *Gylle Krist, i.e.*, servant of Christ), was born in Ireland about 1103. About 1127 he went to Norway and declared he was the son of King Magnus III. (Barefoot), who had visited Ireland just before his death in 1103, and consequently a half-brother of the reigning king, Sigurd. He appears to have submitted successfully to the ordeal of fire, and the alleged relationship was acknowledged by Sigurd on condition that Harald did not claim any share in the government of the kingdom during his lifetime or that of his son Magnus. Harald kept this agreement until Sigurd's death in 1130 Then war broke out between himself and Magnus, who was captured in 1134, blinded, and imprisoned. Harald now ruled the country until 1136, when he was murdered by Sigurd Slembi-Diakn, another bastard son of Magnus Barefoot. Four of Harald's sons, Sigurd, Ingi, Eysteinn and Magnus, were subsequently kings of Norway.

HARAR, a province and city of Abyssinia. The province is one of the largest and most fertile in the country, situated at an elevation of some 4 000 to 5,000 feet above sea-level, enjoying a pleasant climate, and rich in varied cultivation. It is under the personal governorship of Ras Tafari the regent and heir to the throne, proclaimed Negus in 1928, and is administered by Dajazmach Imeru his uncle, as sub-governor. It is famous for its excellent coffee, which is grown extensively and largely exported

Along its northern extremity runs the Franco-Ethiopian railway from Jibuti to Addis Ababa, on which 311 kilo. from Jibuti is the town of Diredawa the most progressive town in Abyssinia with a population of over 30,000 rejoicing in roads, a water supply and electric light; it was for many years the terminus of the railway 35 miles S W of Diredawa lies the town of Harar, the capital of the province and for long its most important centre until the advent of the railway transferred its commercial predominance to Diredawa

It is still, however, the centre of the caravan trade of the province and in addition to coffee there is a good deal of trade in durra, the Kat plant (used by Mohammedans as a drug), ghee, cattle, mules and camels, skins and hides, ivory and gums Cotton goods form the bulk of the import trade Harar is built on the slopes of a hill at an elevation of over 5,000 feet. A lofty stone wall, pierced by five gates and flanked by twenty-four towers, encloses the city, which has a population of about 40,000. The streets are steep, narrow, dirty and unpaved, the roadways consisting of rough boulders The houses in general are made of undressed stone and mud and are flat-topped, the general aspect of the city being Oriental and un-Abyssinian. A few houses, including the palace of the governor and the foreign consulates, are of more elaborate and solid construction than the majority of the buildings.

Harar is believed to owe its foundation to Arab immigrants from Yemen in the 7th century of the Christian era In the region of Somaliland, now the western part of the British protectorate of that name, the Arabs established the Moslem state of Adel or Zaila, with their capital at Zaila on the Gulf of Aden, Harar becoming the seat of government in 1521. A subsequent Emir of Harar Mohammed surnamed Grañ (left-handed) probably a Somali, is famous for his invasion of Abyssinia, of which country he was virtual master for several years until his defeat and death in 1541. It was first visited by a European in 1854 when (Sir) Richard Burton spent ten days there in the guise of an Arab. In 1875 Harar was occupied by an Egyptian force and remained in the possession of Egypt until 1885, when the garrison was withdrawn in consequence of the rising of the Mahdi in the Sudan A son of the ruler who had been deposed by Egypt was installed as Emir, the arrangement being carried out under the superintendence of British officers. The new Emir held power until January 1887, in which month Harar was conquered by Menelek II., king of Shoa (afterwards emperor of Abyssinia). The governorship of Harar was by Menelek entrusted to Ras Makonnen, who held the post until the time of his death in 1906.

The Harari proper are of a stock distinct from the neighbouring peoples, and speak a special language. Hararese is "a Semitic graft inserted into an indigenous stock" (Sir R. Burton, *First Footsteps in East Africa*). The Harari are Mohammedans of the Shafa'i or Persian sect, and they employ the solar year and the Persian calendar. In addition to the native population there are in Harar colonies of Abyssinians, Somalis and Gallas. By the Somalis the place is called Adari, by the Gallas Adaray.

See Abyssinia; Somaliland Also P. Paulitschke, *Harar: Forschungsreise nach den Somâl- und Galla-Landern Ost-Afrikas* (Leipzig, 1888). (C. F. R.)

HARBIN, the chief city of Central Manchuria. It lies on the right bank of the Sungari river in the province of Kirin in 45° 30′ N. lat. and 126° 40′ E. long., 220 miles N.N.E. of Moukden and 250 miles W.N.W. of Vladivostok, with both of which towns it is connected by railway. The growth of the town has been phenomenal. In 1898 Harbin was only a local wheat market. To-day it is a populous industrial city and a centre of keen international rivalry. It is the second largest town in Manchuria with a population of about 220,000, highly composite in character. The largest single element is the 194,000 Chinese, mainly in the Fu-Chia-tien suburb, whilst Russians preponderate amongst the remainder The city has three distinct sections: the Pristan (or "wharf"), the main business quarter, New Harbin (on the plateau behind the "wharf" district), the administrative quarter, and Old Harbin, now the foreign residential quarter. Harbin is the creation of the Chinese Eastern railway, being administered by a mixed council appointed by the railway and occupying 1,400 acres of the 29,000 acres leased to the company. The surrounding plain, composed mainly of fertile black loam and some yellow clays, is very suitable for the growth of wheat, maize, corn and that very adaptable plant, the soya bean. Harbin is also well situated in relation to markets. By the Chinese Eastern Railway, both the eastern and western frontiers can be reached in five hours, whilst it is only a journey of eight hours to Changchun where connection is made with the South Manchuria Railway leading to Monkden, Dairen and Korea. The Sungari river is navigable during the months from April to October, but only bulky produce such as timber favours this route. The rapid increase recorded in motor vehicles throughout Harbin, is in itself most significant and provides a welcome relief to the existing pressure on the railway facilities

Harbin is the focus of movements influencing Manchuria and on the economic side this rôle is evidenced by the diversified character of its industries. The main industries have an agricultural basis, such as flour milling, soya bean factories, distilleries, leather, etc. In 1926 there were more than 60 factories manufacturing soya bean products (flour, cake, oil) and in the same year there were 17 wheat flour factories and 7 large firms making alcoholic liquors. In these enterprises the Chinese are now the largest investors, although there is much Russian and Japanese capital involved. To cope with the demands of these firms and numerous other concerns, there are six electric light and power companies. Harbin exports bean products, wheat and wheat flour, soap, dyes, leather products and tobacco. The outlets of Harbin are Vladivostok and Dairen via Changchun. Harbin's exports show an increasing tendency to go along the Suifenho-Vladivostok route, despite the efforts of the (Japanese) South Manchuria railway. The imports of the Harbin district are, however, mainly of Japanese origin, comprising textile goods, tobacco, sugar, cutlery and hardware. The total trade of Harbin district according to the statistics for 1926 was 78,891,478 Hk. Tls. of which 60,698,431 Hk. Tls were exports and 15,826,851 Hk. Tls. were foreign imports.

HARBINGER, originally one who provided shelter for an army (from M.E. *herbergere,* formed from O.H. Ger. *heri,* an

army, and *bergen*, shelter). The meaning was enlarged to include any place where travellers could be lodged, and also the person who provided lodgings, or one who went on before a party to secure lodgings; hence, figuratively, in literature a fore-runner. A harbinger was also the herald sent to announce the king's coming, and until 1846 a Knight Harbinger was an officer in the royal household.

HARBINGER OF SPRING (*Erigenia bulbosa*), a small North American plant of the parsley family (Umbelliferae), native to moist low woods from southern Ontario to Minnesota and southward to Pennsylvania, Alabama and Missouri. It is a low, smooth, almost stemless perennial, rising from a deep round tuber and bearing near the ground from two to four compound leaves thrice divided into narrow leaflets and a flower-stalk (scape), 3 to 9 in. high, terminating in small umbellate clusters of white flowers. In the southern part of its range the plant blooms as early as February and at the north in April, whence its name. It is somewhat rare and local in many sections but is especially abundant in the vicinity of Washington, D.C.

HARBORD, JAMES GUTHRIE (1866–), American soldier, was born at Bloomington, Ill., March 21, 1866. He graduated from the Kansas State Agricultural college, Manhattan, Kan., taking the degree of B S. in 1886. He joined the 4th Infantry in 1889 and was commissioned in the cavalry in 1891. Serving in the 5th, 10th, 11th and 1st Cavalry, he became a major in 1914. From 1903–14 he served in the Philippine Constabulary. He became brigadier general in 1917, and was chief of staff of the A E.F. in France 1917–18. He commanded the Marine Brigade near Château-Thierry, June 1918, being appointed major general on June 26. He commanded the 2nd Div. A E.F. in the Soissons offensive under Mangin, July 1918, after which he was placed in command of Service of Supply. He was reappointed chief of staff A.E.F., May 26, 1919, and was head of the American military mission to Armenia, Aug. 1919. He served as deputy chief of staff, U.S. Army, 1921–22. Retiring from the army Dec. 29, 1922, he became president of the Radio Corporation of America. He published *Leaves from a War Diary*, in 1925.

HARBOURS. A harbour is a sheltered area of water wherein vessels may take refuge and may safely lie at anchor or moored to buoys. In some cases the harbour forms an intermediate access channel or sheltered anchorage lying between the open sea and the docks or quays at which the business of a port is carried on. In many harbours enjoying sufficient protection, natural or artificial, there is no definite line of demarcation between this intermediate area and that occupied by the open basins, quays and jetties where vessels berth, some convenient and well sheltered position being selected for this purpose. In some harbours there is, however, an outer protected area providing comparatively tranquil water, even in stormy weather, from which an inner harbour may be entered. The inner harbour, protected by piers or minor breakwaters, is usually provided with tidal quays at which vessels berth, as at Holyhead, or affords access to closed docks.

Harbours are necessary to all classes of seagoing vessels. The requirements of shipping do indeed vary, within wide limits, as regards the accommodation, facilities, degree of shelter and depth of water to be provided; and, whilst one harbour may be capable of accommodating all or any classes of vessel, the circumstances of another may limit its usefulness to small craft. Many tidal harbours, owing to limitations of depth, can be entered only at or near high water. Some of minor importance are dry, or nearly dry, at low water, and vessels using them must take the ground. The present article describes some of the more important and typical examples, both natural and artificial, the principles on which artificial harbours are—or should be—planned, and the means by which natural facilities have been improved and supplemented by artificial works. The guiding principles to be followed in the making of small harbours are the same, *mutatis mutandis*, as those which are applicable to the great achievements of maritime engineering construction on which millions of money have been expended.

Breakwaters, which constitute the principal protection works of most artificial harbours, are described in a separate article; for the interior works and facilities of a port *see* Docks, river and estuarine harbours are also referred to in the article River Engineering; and for the lighting and buoying of harbours *see* Lighthouses and Buoys. *See* also Dredging and Jetty and, for further particulars of individual harbours, under place names, *e.g.*, Cherbourg, Rio de Janeiro.

Classification.—Harbours may be classified in several ways: 1. *Natural harbours*, possessing, in a large degree, natural shelter. These require only the provision of such facilities as docks or piers, and sometimes deepening by artificial means, to make them serviceable as shipping ports. Such are the landlocked harbours of Hongkong, Rio de Janeiro, New York, Portsmouth and Sydney. Some estuarine harbours, such as those formed by the lower tidal compartments of the Thames, Mersey and Yangtse, also come under this heading.

2. *Harbours possessing partial natural shelter improved by artificial means, e.g.*, Plymouth and Table Bay.

3. *Harbours entirely (or almost entirely) of an artificial nature* formed on open sea coasts. A notable example of this class is Madras harbour (fig. 2).

Another classification, of an arbitrary and somewhat artificial nature, divides harbours according to their respective purposes, *e.g.*, harbours of refuge, commercial harbours, naval harbours and fishery harbours. It may be explained here that the term "harbour of refuge" (now almost obsolete) ordinarily denotes a harbour constructed specifically and primarily for the purposes of shelter (usually for small craft), and not as an essential factor of a naval or commercial port.

Still another method classifies harbours according to their physical characteristics and the nature of the artificial works employed for their creation or improvement; as for instance:—(*a*) lagoon harbours, (*b*) jetty harbours, (*c*) harbours formed by converging breakwaters projected from the shore, (*d*) those protected by breakwaters parallel with the shore, (*e*) those formed by the projection of breakwaters from one or both horns of a bay, and (*f*) harbours where island breakwaters cover and protect embayments

EARLY HISTORY

There is no conclusive evidence as to the date or the locality of the first artificial harbour construction. The use of natural havens and places of shelter must, of course, have been contemporary with the origins of navigation, and there are evidences of intercourse between Egypt and Crete in the pre-dynastic period of Egypt over 6,000 years ago. There are remains of very ancient harbour works in Crete, but, owing to earth movements most of them are under water. M. Gaston Jondet claims, in *Les ports submergés de l'ancienne Ile de Pharos* (Institut Egyptien, 1916), to have discovered at Alexandria vestiges of an ancient harbour in the Cretan manner, but the date and origin of these remains have been disputed (*see* also Sir A. Evans' *The Palace of Minos*, vol. i., 1921, and authorities there cited). These works are said to date from *c.* 2000 B.C. and to have been constructed on the seaward side of the island of Pharos, whereas the later harbour of Alexander (*c.* 332 B.C.) was placed between the island and the mainland. The Cretans did not confine their maritime adventure to the eastern Mediterranean, and Sir Arthur Evans is of opinion that there was trade between Crete and Britain in the early Bronze Age, between 1600 and 1200 B.C., centuries before the first coming of the Phoenicians to Britain. The Phoenicians built harbours at Sidon and Tyre in the 13th century B.C. The second city of Tyre was built on a small island off the coast. On either side of this island harbours were constructed protected by moles which appear to have been formed of rubble stone surmounted by masonry walls. These harbours and the city were of considerable extent and importance. In 332 B.C. Alexander the Great captured and destroyed the city, after building a causeway from the mainland to the island, and the port fell into decay. The causeway held up the drifting sands which accumulated on either side of it and the site of Tyre is now a peninsula.

It was after the capture of Tyre that Alexander founded the city of Alexandria and built the second harbour He connected

the island of Pharos with the mainland by a causeway, called the Heptastadion, which had two bridged openings in it. Later the famous lighthouse of the Pharos was built and moles were constructed affording additional protection to the east and west harbours on either side of the causeway (*see* E. Quellennec, *Egyptian Harbours*, XIV. Int Congress of Nav. 1926).

Many other Mediterranean harbours, both natural and artificial, were of considerable commercial or military importance in Greek and Roman times. The natural harbours of Tarentum (Taranto) and Brundisium (Brindisi) are still in use. Ostia, once the port of Rome, is said by some classical writers to have been founded in the 7th century B C, but the port of the empire was built by Claudius and extended by Trajan about 100 A.D. (See *Proc.* Inst C E. Vol. IV., 1845). In Trajan's reign Civita Vecchia, 30 m north of the Tiber mouth, was founded and Ostia was eventually abandoned as a port on account of the silting up of the approaches to it. The site of the harbour is now over 2 m. from the sea.

In mediaeval times the prosperity of such Mediterranean cities as Venice and Genoa led to the building of harbour works for the accommodation of their seaborne trade. Some of the early works at Genoa and on the Venetian lagoons remain to this day. Natural harbours suitable to the needs of the trade of the middle ages are more numerous in northern Europe than in the tideless Mediterranean sea, and for many centuries these natural facilities, combined in some cases with artificial works of the simplest character, sufficed for the shipping of the times.

One of the earliest protection works built at a seaport in England was the Cobb at Lyme Regis dating from the 14th century. This was a pier or jetty constructed of rough boulders held in place between rows of oak piles. A pier occupying the same site still bears its name. Harbour works are said to have existed about 1250 at Hartlepool and at Arbroath in Scotland *c.* 1394 Dover was a busy port in the time of Henry VIII., and a stone and timber breakwater was built there in his reign. Towards the end of the 16th century the first of the jetties at the entrance to the Yare at Yarmouth was constructed; and in the 17th century protection piers were built at Whitby and Scarborough, portions of which still exist. It was not, however, until the second half of the 18th century when John Smeaton (*q v.*) began his career, that the building of harbour works on any considerable scale was undertaken in England Smeaton must be regarded as the founder in England of the science of harbour engineering. His work and that of his successors. Thomas Telford and John Rennie, permanently established British seaports in the forefront of progress in harbour construction.

On the other side of the channel, Havre, Dieppe, Rochelle and Dunkirk were among the earliest ports to embark on harbour construction; in Bélidor's *Architecture Hydraulique* (Paris, 1737–53) is a detailed account of the early harbour at Dunkirk as well as of other ancient port works.

PRINCIPLES OF DESIGN

In designing the works of a harbour one of the most important considerations is that of exposure. Such information as can be obtained from reliable charts must be supplemented by more detailed marine surveys and soundings, and the nature of the sea bed must be ascertained by borings and probings. Among the points to be noted are:—the geological and other physical characteristics of the site; the slope of the sea bed; the depth of water seaward of the proposed site as well as over it; the presence of any outlying reefs, rocks, shoals or islands of which advantage can be taken as affording protection, or as good foundations for sheltering works; and the tidal phenomena, such as the vertical range. Investigation must be made of the nature and directions of the currents and tidal streams; the effect of littoral drift; the nature and extent of natural shelter; the directions of the prevailing and of the strongest winds; the line of maximum exposure, or the greatest fetch or reach of the sea in any unobstructed line of direction; the probable maximum height of the waves due to the exposure; and the direction from which the heaviest seas come. These and other considerations determine the character of the works to be constructed. In the case of harbours proposed to be made at the mouths of rivers or in estuaries, many other problems relating to river flow, bars, the maintenance of channels, etc., call for investigation.

There is a great diversity in the height of waves experienced in different positions on the same coastline. In some places shores lie open to the full force of the ocean waves while other parts of the same coast are protected by projecting headlands or islands, or by outlying reefs or sandbanks. Then again, inlets and enclosed arms of the sea, creeks, and river mouths, estuaries and land-locked lagoons provide sites more or less sheltered from wind and waves according to the degree of natural protection afforded them. At the other extreme is the exposed open site where breakwaters are necessary to protect an anchorage harbour, and where secondary breakwaters or piers may be required to provide local and complete shelter for the inner works of the port.

In planning a harbour to be formed in an exposed situation, certain important points must be kept in view, *e g*, (1) The entrance should be so placed as to afford ample sea room, free from rocks and shoals on a lee shore, for a vessel when on the point of entering or immediately after leaving the shelter of the outer and covering breakwater or breakwaters (2) The alignment of the works should be such as to minimize the wheeling effect of waves around a breakwater head and the projection of seas across the entrance. (3) If possible the entrance should be so placed that one breakwater overlaps the other in such a way that some shelter from the direction of the heaviest seas is afforded to a ship when passing the harbour entrance. (4) The entrance should be planned so as to avoid strong currents sweeping across it (5) Ample expending beaches or wave traps should be provided inside a harbour whose entrance is exposed, to allow the waves that pass the entrance to spend and break themselves For this reason such a harbour surrounded with vertical walls, where there is not ample spending room, becomes a "boiling pot" of reflected waves; and in these circumstances sloping walls are preferable.

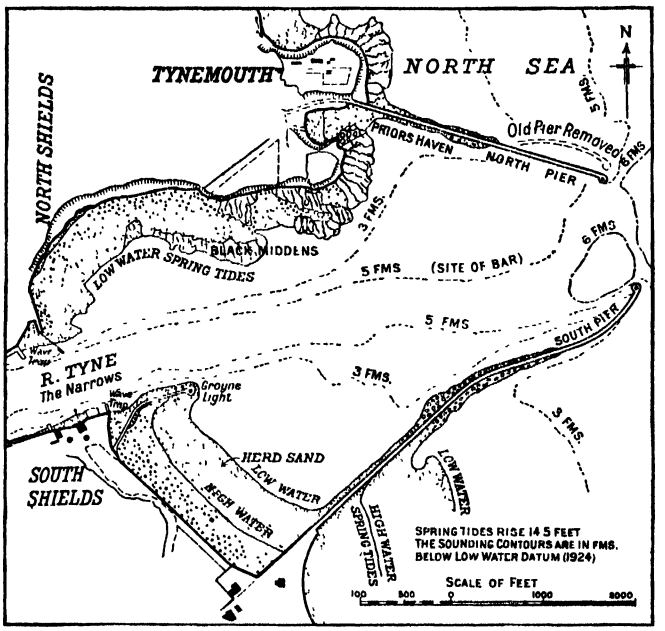


FIG. 1.—TYNEMOUTH HARBOUR

(6) The width of entrance, while being sufficient for the safe passage of ships, should be restricted as much as practicable; for upon the relation of the entrance width to the internal width and area of the harbour largely depends the reduction of range[1]

[1] *Range,* applied to waves, denotes the vertical rise and fall of sea waves particularly when they are propagated into a harbour; *windlop* describes the short wind waves generated in narrow waters as distinct from the ocean wave. The amplitude of the vertical motion of a ship due to range of waves is known as *scend; tidal range* is the vertical rise and fall of a tide; *tidal rise* the height of a tide at high-water above the chart datum which is usually the level of the lowest low-water.













PHOTOGRAPHS, (1) COMPAGNIE AERIENNE FRANCAIS, (2) FAIRCHILD AERIAL SURVEYS, INC., (3) BURTON HOLMES FROM EWING GALLOWAY, (4) AEROFILMS FROM EWING GALLOWAY, (5) THE KEYSTONE VIEW COMPANY, INC., (6) UNDERWOOD AND UNDERWOOD

BAY, ESTUARY AND DEEP WATER RIVER HARBOURS

1. The outer harbour and locks at Le Havre, an important French port of call and transit, situated on the English channel. Originally laid along the estuary of the Seine, the port has since been extended into more exposed water. There are more than 8 miles of quayage
2. View of Inner New York harbour, showing Upper Bay which is the immediate mouth of the East river (left) and the North river (right). Both rivers are important in coastwise and inland commerce and are lined with wharfage accommodating the largest vessels
3. Hongkong harbour as seen from the heights above Victoria, capital of the Island of Hongkong. The harbour, which is 10 sq.m. in area and possesses an east and a west entrance, is one of the chief ports on the coast of China, serving as a transshipping point for goods passing to and from the outer world
4. Docks, half-tide docks and locks at Liverpool, used by large ocean vessels. The docks, which have a combined lineal quayage of 38¼ miles, are on both sides of the Mersey river and cover a total water area of about 700 acres
5. Hamburg, the largest seaport on the continent of Europe, situated on the Elbe river 75 miles from its mouth. The port has a quay length of 20 miles and a total water area (1928) of 4,095 acres, of which 2,184 acres are devoted to ocean-going ships
6. View of Rio de Janeiro, looking over Botafogo suburb and bay to the bay entrance which lies between the Sugar Loaf (right) and the Pico (left). The entrance is about a mile wide and open to vessels of the largest draught. In 1928 there were 3,800 yds. of commercial quays

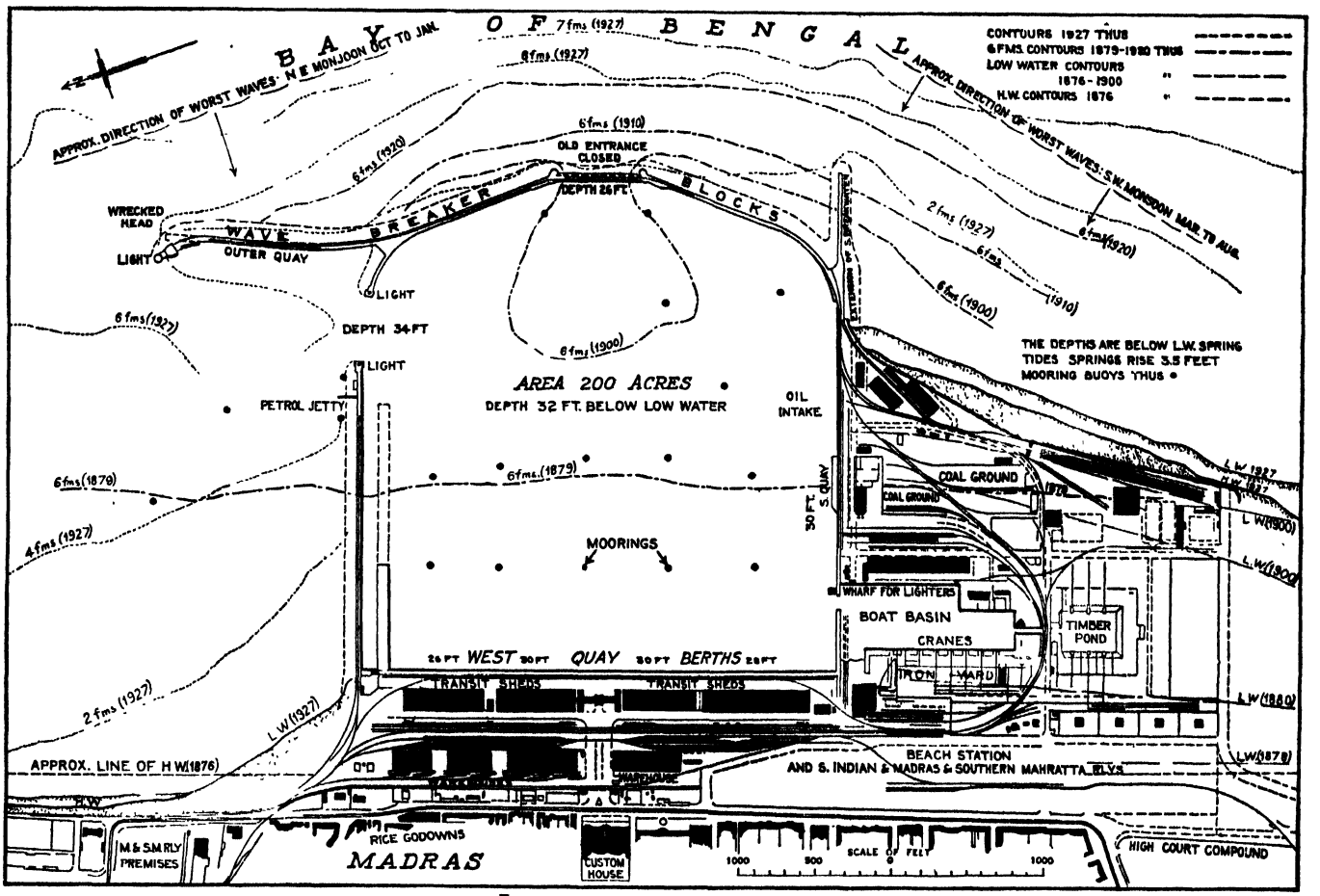


FIG. 2.—MADRAS HARBOUR IN 1927

in the latter. (7) The entrance width to a tidal harbour must not however be so restricted as to produce through the opening a current interfering with safe navigation. (8) The approaches to the entrance from seaward should not be obstructed by submerged dangers in or close to the recognized channel. If there be any such dangers in the vicinity of the harbour entrance they must be removed or, at least, suitably marked. (9) There should be sufficient extra depth of water (over the nominal depth of the harbour) in the approaches and at and near the entrance to allow for the effect of range.

Waves.—The action of waves on solid structures is discussed under BREAKWATER (*q.v.*), and for theories concerning them and their phenomena *see* WAVES and TIDES; the writings of the authorities mentioned in those articles should also be consulted. Here we will mention one matter closely connected with the selection of harbour sites.

The height of waves largely depends on what is termed the "fetch," that is, the distance from the weather shore, where their formation commences. According to Thomas Stevenson the following empirical formula is nearly correct for waves in the heaviest gales:—Height of wave from trough to crest in feet $=1.5\sqrt{d}$, where d is the maximum fetch in nautical miles. This formula presupposes unobstructed deep water, for waves of great height cannot reach any coast line or artificial obstruction unless there is an unbroken stretch of deep water for their propagation. Reefs and sandbanks, even though entirely submerged, materially reduce the range of undulation; and a sudden change in the level of the sea bed, even in comparatively deep water, may produce a breaking wave. Moreover, it seldom happens in the heaviest gales that the wind is blowing for a sufficient length of time from the direction of and along the whole extent of the greatest fetch to bring about the generation of waves of the maximum possible height. The formula therefore gives too high a value when applied to a fetch exceeding about 500 miles The heights of waves are increased when they are propagated up funnel shaped or converging channels and are decreased when they pass into expanding channels.

Effect of the Angle of Incidence of Waves.—If the line of the outer face of a harbour work, such as a breakwater, is at right angles to the direction of the waves, the blow delivered by a wave against the solid structure will be at its maximum. When, however, seas strike the face in an oblique direction so as to be deflected towards the breakwater head and harbour entrance, the waves will sweep across the entrance, or wheel round the head, thus causing a turbulent cross sea at the point where vessels enter or leave the harbour. It is an advantage when the face of the breakwater can be aligned so that the heaviest seas assail it obliquely at such an angle that the waves are deflected away from the entrance and towards the inner or shore end of the structure. But in such cases the shore must be adequately protected, naturally or artificially, against scour.

It is a matter of common observation that the direction of waves is sometimes changed on passing a headland and that they will wheel round and enter a bay on the lee side of the head and break on a lee shore. A similar effect is often noticed in the case of islands and it frequently occurs at the head of breakwaters. The phenomenon is no doubt due to the frictional retardation of the inshore portion of the wave in shallow water. The deflection of waves during their passage up a wide channel between two shores is susceptible of similar explanation. Even if the wind is blowing and the waves are travelling up the channel in the direction of the centre line, the waves will be deflected and curve round so as to approach the shore on lines almost parallel with it

Spending Beaches and Range.—The best method of quickly reducing the height of waves entering a harbour is to secure their lateral expansion. This may be effected by widening the harbour immediately inside the entrance and providing for expending beaches; or by intercepting, by means of spurs, groynes or wave traps, the ends of the entering waves, thus admitting of endwise expansion after the interception has taken place or by a com-

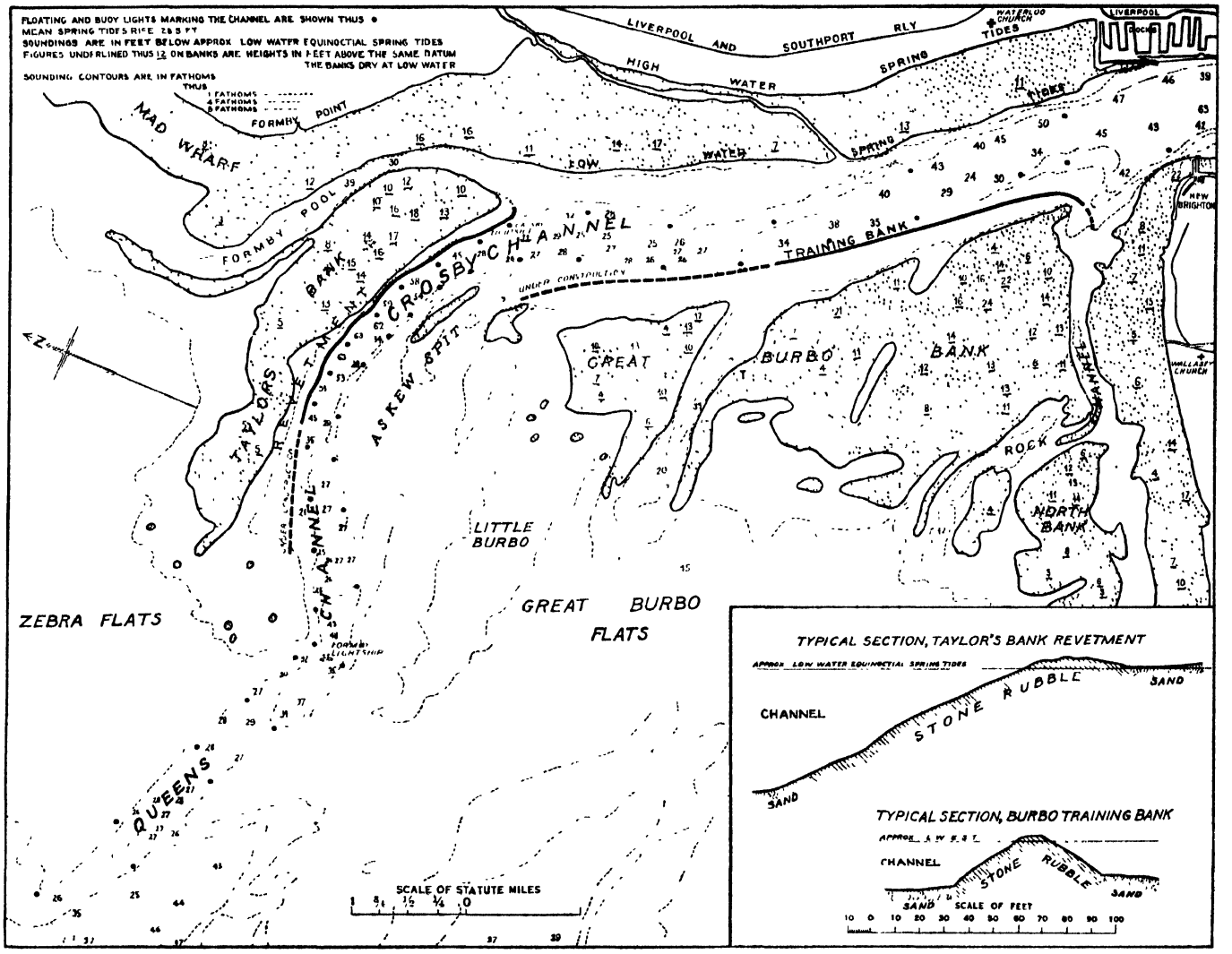


FIG 3.—LIVERPOOL BAY AND MERSEY ENTRANCE CHANNELS, 1926

bination of these means. (See *Proc.* Inst. C.E. vol ccix., 1921.) The first method is the more effective and is to be preferred for harbours whose entrances are exposed to heavy seas The harbour at the Tyne entrance (fig. 1) illustrates the combined effect of widening within the breakwater heads, expending beaches and wave traps. Waves 30 ft. in height have been observed just outside the entrance during a sustained gale from the north-east. The reduction of range between the pier heads and the Narrows at Shields, a mile inshore, is over 90%. The entrance between the outer pier heads is 1,180 ft., and the greatest width in the outer harbour is about 5,000 feet. The arrangement of breakwaters and spending beaches in the outer harbour at Sunderland, and in that at Ymuiden, is somewhat similar to the Tyne. Wave traps are frequently introduced in the planning of jetty harbours. (*See* below.)

TYPES OF HARBOURS

Natural Harbours.—A sheltered anchorage in its simplest form is sometimes found under the lee of outlying reefs, sand-banks or islands. Where there is good holding ground and the shelter afforded is sufficient to give protection from heavy seas, such an anchorage is termed a *Roadstead.* Examples are the Downs under the shelter of the Goodwin Sands; Dunkirk road, under the lee of the Braekbank sand; Yarmouth roads and the anchorages in sheltered positions in some wide estuaries such as that of the Thames. Others are found in deep embayments where shelter is afforded from the worst winds by projecting headlands, as in Weymouth and Portland roads. A well-known example of a roadstead protected by an island is that sheltered by the Isle of Wight.

Natural havens to which the term harbour is ordinarily applied are those inlets or arms of the sea which are almost completely land-locked. Where such natural shelter is found combined with ample depth of water, both in the approaches and in the anchorage, and in positions convenient for sea-borne trade, it is of great value to shipping; such havens, even without artificial works, serve as harbours of refuge, and the necessary interior works of a port can usually be constructed in them without difficulty and at much less cost than in an exposed and open situation. Well-known examples in addition to those already mentioned are the harbours of Port Royal and Kingston in Jamaica, Southampton Water, the land-locked sea inlets of San Francisco, Cromarty Firth, Scapa Flow, Milford Haven, Queenstown, Falmouth and Kiel. In many situations, however, there are large enclosed water areas having openings into the sea which are either obstructed by a bar at the entrance, as in the lagoon harbour of Venice and the enclosed bay harbour of Durban, or are shallow. Works of considerable magnitude are often required for the improvement and maintenance of such harbours.

Estuary Harbours and Entrances.—Some rivers which possess sufficient depth of water in the tidal compartment for the navigation of vessels of considerable draught up to the docks or wharves of the port, are obstructed in the estuary, or where they discharge into the open sea, by banks of sand or silt which, sometimes, are liable to change of position. In other estuaries the approach channels from the open sea to the river proper may be sufficient for all the requirements of shipping while the river channels are of insufficient depth.

Not only are such obstructions or "bars" met with in the

estuaries of rivers which discharge into seas that are either tideless or of small tidal range, but they are frequently present when the rise and fall of the tide is considerable, as in the Mersey (fig. 3). Rivers opening out into large expanding estuaries, such as the Severn, Scheldt and Clyde, are usually free from bars; and rivers which gradually widen out as they approach the sea are not ordinarily impeded by bars, though they may be obstructed by sand-banks, as in the Thames and Humber, through which the tidal streams form good channels to the sea. The formation of a navigable channel through a bar, or the improvement of natural channels to provide for the increased draught of vessels, has been effected in a few cases by dredging alone, in some by training works or jetties, and in many cases by a combination of the two methods. The Mersey at Liverpool and the harbour of New York are notable examples of the first case of estuarine conditions embracing the presence of a bar with deep water in the river above it.

The Mersey Entrance.—The inner estuary of the Mersey has a depth in some places of about 63 ft. at low water, but the bar in the principal sea channel of the estuary, in its natural condition up to 1890, had no more than 11 ft. depth over it at low water spring tides, and 32 ft. at high water neap tides. The bar is about 11 m. seaward of the river entrance between Seaforth and New Brighton. Since 1890 the formation and maintenance of a deeper channel through the bar have been problems of great difficulty and dredging by means of powerful sand-pump dredgers, commenced on an experimental scale in that year, has been carried

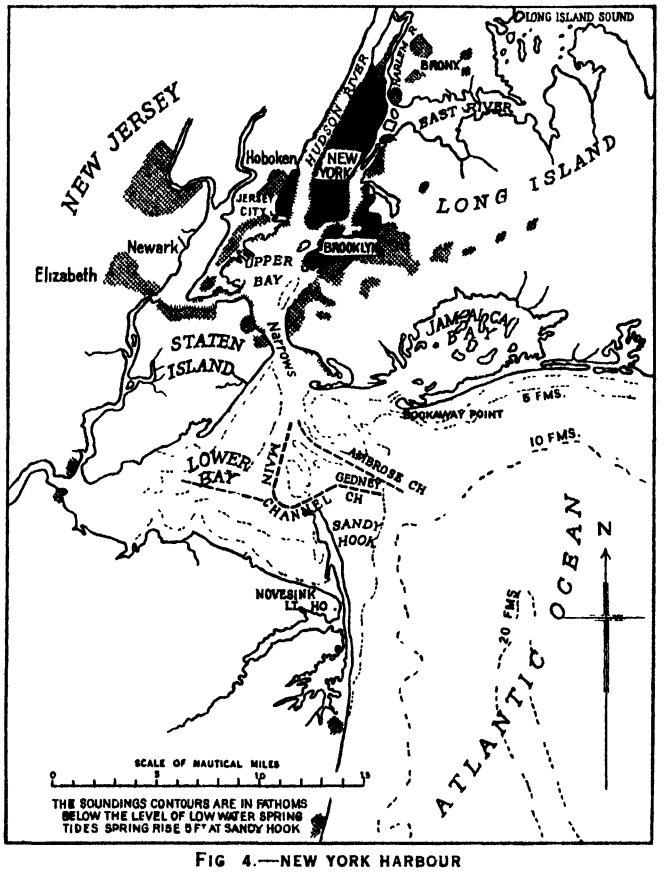


FIG 4.—NEW YORK HARBOUR

on almost continuously. The quantity of material removed in recent years from the bar and sea channels averages about 20,000,000 tons annually. Since 1907 rubble-stone training walls or submerged revetments, brought up to just above low water, have been constructed, first on the concave east side of the Crosby channel and later on its west side, mainly with the object of fixing the channel and preventing its encroachment on the Taylor's bank (fig. 3). In spite of these training works and intensive dredging the minimum depth in the Mersey approach channels has not been increased beyond the 26 ft. at lowest water available in 1907.

New York Harbour Entrance.—Until 1885 the natural channels in the southern approach to New York harbour sufficed for all the requirements of shipping. The Gedney channel had then a depth of about 24 ft. at low water and about 28 ft. at high water neap tides. Above the sandbanks which obstruct the Lower Bay there is ample natural depth—over 44 ft. at low water—up to the principal piers in the harbour (fig. 4). In 1885 the deepening of the Gedney channel by suction dredging was commenced, and by 1892 30 ft. at low water had been obtained over a channel width of 1,000 ft. Early in the present century an entirely artificial and shorter dredged cut—the Ambrose channel—with a low water depth of 40 ft. and 2,000 ft. wide, was formed through the sand banks. The dredging of the Gedney channel was the earliest successful attempt to maintain an open channel through exposed sandbanks by means of dredging alone. Such attempts had been made, for instance, at the bar at the mouth of the practically tideless Mississippi where, for years before the training works were commenced (*see* RIVER ENGINEERING) a dredger was employed for forming a channel for the waiting vessels, the channel, however, silting up almost as rapidly as it was made.

Other Instances of Dredging.—Suction dredging has, in recent years, been carried out with success in the course of the improvement of the open sea channels of many estuaries, as for instance, in the Scheldt which gives access to Antwerp; in the Rio de la Plata in the approaches to Buenos Aires and Montevideo, and in the sea approaches to Brisbane (Queensland). The success of dredging operations on a large scale in sandy estuaries has only been made possible by the improvements effected, since about 1890, in the construction of large and powerful sand pump dredgers (*q.v.*). Some of these are capable of raising 10,000 tons of material per hour.

Lagoon and Jetty Harbours.—The formation or improvement of harbours on the sea coast by the construction of jetties across the beach and foreshore, at points where river mouths or lagoons, or, in some cases, low marshy land afforded suitable sites, has been practised for over two hundred years.

Lagoons.—A marine lagoon is a shallow lake separated from the sea by a narrow belt of coast formed of deposit from a deltaic river or of sand dunes heaped up by onshore winds along a sandy shore. Many such lagoons possessing good natural shelter have outlets which are maintained through the fringe of coast, even when the tidal rise is quite small, by the scour of the water flowing into and out of the large expanse at each tide, aided by the discharge from any rivers falling into it. These outlets afford navigable access to the lagoon in which, moreover, natural channels are formed by the action of the currents. Owing to the scour of the issuing current becoming gradually too enfeebled, on entering the open sea, to overcome the heaping up action of the waves along the shore, the sea entrance to a lagoon is however usually obstructed by a bar which tends to form a continuous beach across the opening.

The depth over the bar in front of a lagoon entrance can sometimes be improved by concentrating the current through the outlet by jetties on each side. This has been done with success and, up to a point, without recourse to dredging, in the cases of the three entrances to the lagoon harbour of Venice at Malamocco, Lido and Chioggia, where the tidal range at springs is no more than 3½ ft. (fig. 5). At Malamocco the low-water depth on the bar was increased from 11½ to 31 ft., and at the Lido entrance from 8 to over 22 feet. The two training jetties at Chioggia are not yet completed (1928) but the depth over the bar has already been increased to 20 feet. Since 1921, however, the Lido entrance has been dredged in order to maintain a low-water depth of 24 feet.

Dredging, in combination with the scour induced by jetties constructed since 1909, has provided a deep entrance channel through the bar at Rio Grande do Sul on the south-east coast of Brazil which formerly obstructed the access to a series of deep land-locked lagoons of very large area. On the other hand dredging alone is relied on (1928) to form and maintain a deep channel through the bar which fronts the narrow entrance to a lagoon of great extent and depth at Cochin on the south-west coast of India, and the construction of jetties is not intended.

Jetty Harbours in English Channel, etc.—On the sandy shores of the English Channel and North Sea there are several well-known harbours where, formerly, flat marshy ground, lying below the level of high water and shut off from the beach by dikes or sand-dunes, was connected with the sea by a small creek or river. In their original condition these ports presented some resemblance, although on a very small scale, to lagoons. Such are

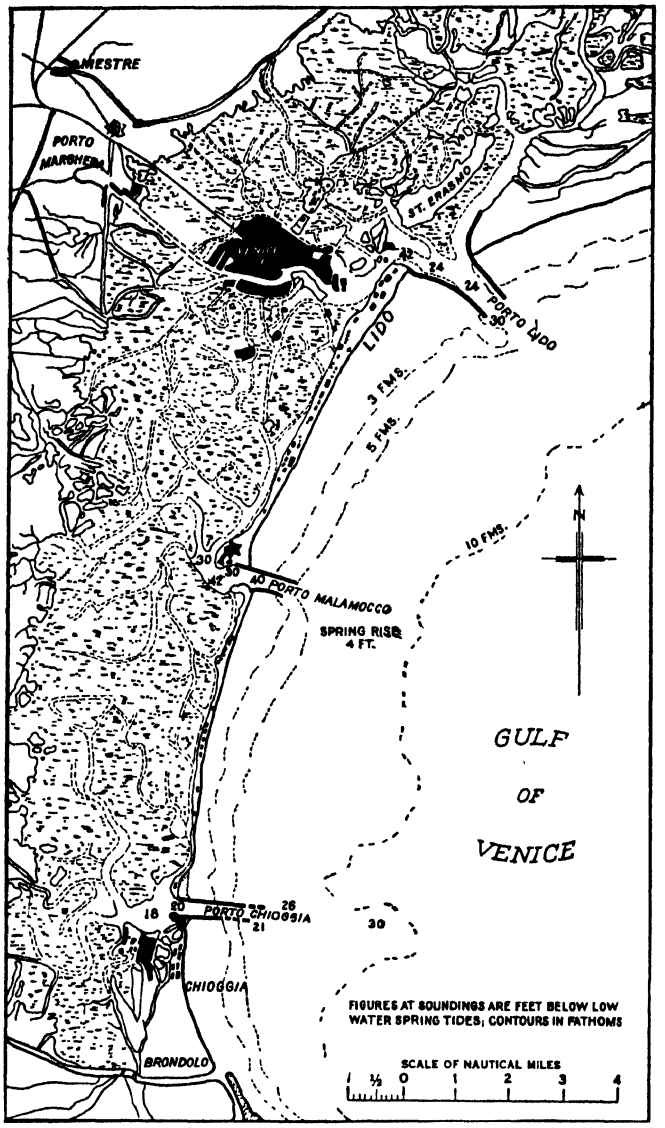


FIG. 5.—THE VENETIAN LAGOON

the old harbours of Dieppe, Boulogne, Calais, Dunkirk, Nieuport and Ostend. The influx and efflux of the water from these enclosed, tide-covered areas, through a narrow opening, sufficed to maintain a shallow channel to the sea across the foreshore, deep enough near high-water for vessels of small draught. When the increase in draught necessitated the provision of an improved channel, the scour of the issuing current was concentrated by erecting jetties across the beach. This obstruction to the littoral drift of sand caused an advance of the low-water line as the jetties were carried seaward so that their further extension was eventually abandoned, as occurred at Dunkirk. Moreover, reclamation of the low-lying areas was gradually effected, thus reducing the tidal scour. Sluicing basins were therefore formed into which the tide flowed; the water being shut in at high tide by gates or sluices was released at low water producing a rapid current through the channel. The sluicing current, however, gradually lost its velocity in passing down the channel and was only effective near the basin outlet and down to a moderate depth below low water. The introduction of powerful mechanical dredging appliances and, in particular, the improvement in suction dredgers led to the substitution of dredging for artificial sluicing (now seldom resorted to), and made it possible to form and maintain channels of uniform depth within the harbour and also, where necessary, seaward of the jetty heads to deep water.

During the past half century jetty construction has been applied with varying success to the improvement of harbour entrances on a much larger scale than in the Channel ports, not only in Europe but in America and other parts of the world, particularly where a river having a considerable flow or an extensive backwater provides the means for effective scour. Instances where scour alone has been effective in securing depths sufficient for large vessels are rare, and dredging has generally to be resorted to for this purpose. It should be noted here that entrances formed by jetties with a narrow channel between them are, from the point of view of the navigator, unsatisfactory in positions of considerable exposure on the open coast, particularly at ports used by large vessels.

Jetty Harbours in N. America.—In the United States there are many examples of jetty harbours. At Charleston (S.C.), for instance, a land-locked bay 15 sq m. in extent and with ample depth of water, provides an adequate harbour, but the narrow entrance was obstructed by a bar. Converging entrance jetties, each over 2 m. long, with openings at their inner ends, were constructed to concentrate the scour, due to the tidal range of about 5½ ft. at springs, and to protect the channel from littoral drift. The jetties, however, caused an advance of the foreshore and a corresponding progression seaward of the bar with the result that extensive dredging is required to maintain a low-water depth of 32 ft. beyond the ends of the jetties and in the channel. At Aransas Pass (Texas) in the Gulf of Mexico, two jetties have been constructed at the narrow sea entrance to a lagoon or enclosed bay through which a dredged channel, 21 m. long, and 25 ft deep has been made between the pass and the port of Corpus Christi. In this case also the channel between the jetties has been formed and is maintained entirely by dredging.

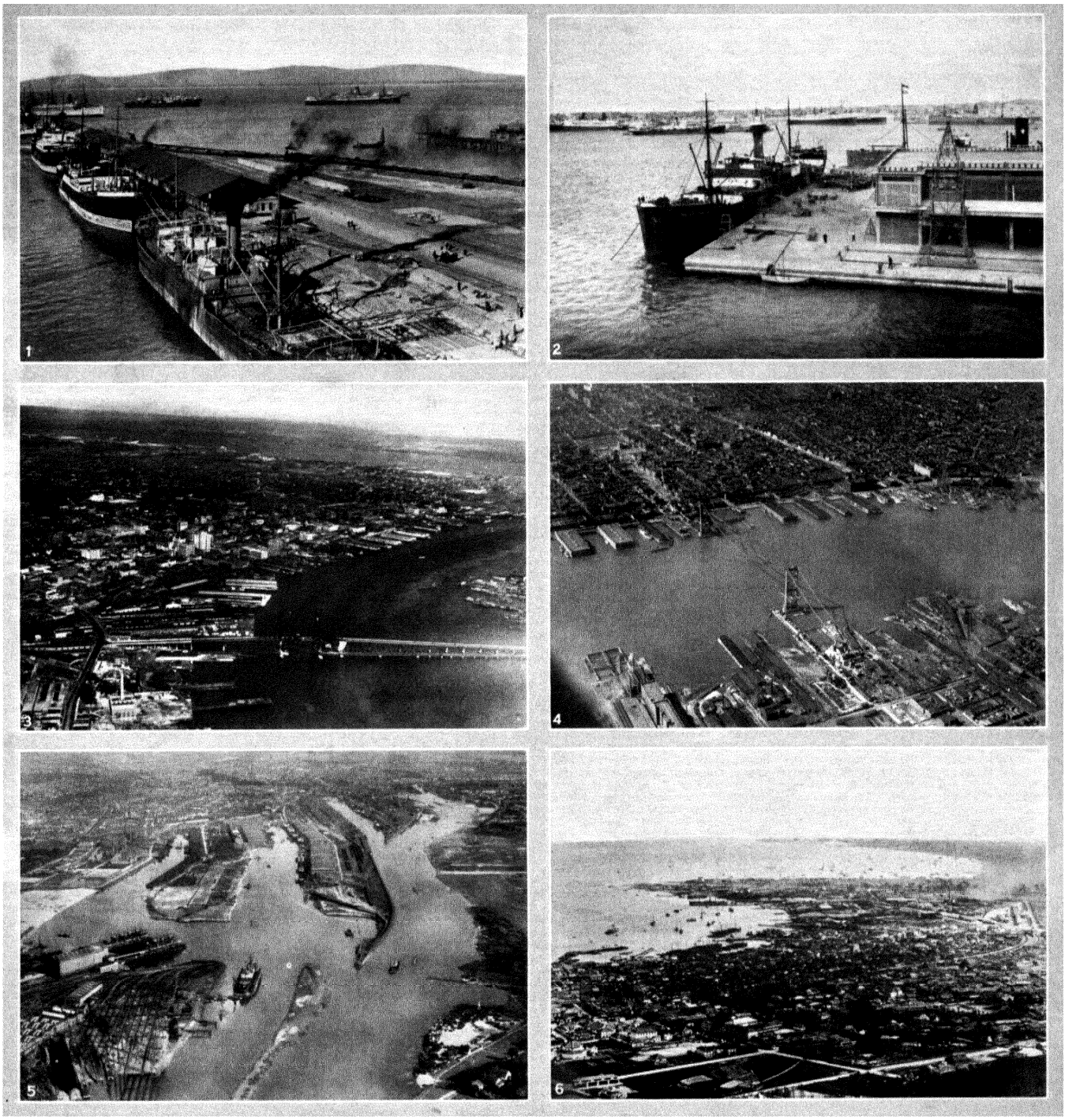
Among other jetty entrances to lagoon-type harbours in the Gulf of Mexico, where the tidal range is insignificant, rarely exceeding 1 ft., are those at Sabine Pass, leading to the port of Orange; and in the Bolivar channel at Galveston giving access to Galveston bay and the inland port of Houston. At both of these suction dredging is necessary to maintain depths of from 30 to 35 ft. in the entrances. Two parallel jetties at Tampico, constructed in 1890–92, at the mouth of the Panuco, proved successful in bringing about the scouring of the channel from a depth of 8 to 24 ft. (See *Proc.* Inst. C E, vol cxxv, 1896.)

Lagoons of Coral Formation.—Lagoons of coral formation and waters sheltered by coral reefs often furnish valuable natural harbours as in many of the islands of Oceania; examples are Pango-Pango in the Samoan Islands and Honolulu in the Hawaiian group. In them the problems presented by sandy bars and entrance channels do not as a rule arise. Port Sudan in the Red Sea is an example of a deep-water inlet, bordered by coral reefs rising to just above water level, which has been converted into a useful commercial port by the construction of low quay walls along the margin of the steep-to coral. The entrance is a natural opening 900 ft. in width through the coral reef.

Other Jetty and Bar Harbours.—The physical features of semi-artificial harbours formed in lagoons, backwaters, enclosed bays and at the mouths of barred rivers, differ so much that they exhibit an almost endless variety of works applied to their formation and improvement. A few examples only can be mentioned here.

Hook of Holland.—When the artificial channel for the river Maas was cut, during the 'seventies of the last century, from Rotterdam to the North Sea at the Hook, the sea entrance was flanked by diverging jetties. Rapid silting in the entrance led to the construction of a third and internal jetty to contract the channel to a width of 2,100 ft. and thereby increase the scour. Dredging has, however, to be carried on periodically to maintain the low-water depth of 30 ft.

Durban.—The entrance to the land-locked harbour of Durban (see *Proc.* Inst. C.E., vol. clxvi., 1906; cxciii., 1914; cxcvi., 1914)



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NATURAL AND ARTIFICIAL BAYS AND DEEP WATER RIVER HARBOURS

1. Wharf at Cape Town, the principal passenger and mail port of South Africa. The harbour consists of two basins covering a combined area of 75½ acres with a depth ranging from 10 to 40 feet. Railway trains (centre) serve the main wharves
2. Unloading cargo at Alexandria, the chief Egyptian port on the Mediterranean, partly formed by a breakwater and divided into an inner and an outer harbour. A network of railways linking it to the interior enables it to handle about 80% of the country's shipping
3. The waterfront at Jacksonville, Florida, an important shipping centre on the St. John's river, 27 miles above the government jetties at the river's mouth. It has a 30 foot channel to the sea and is served by coastwise and ocean vessels
4. The waterfront at Philadelphia, one of the largest American deep water river harbours, as seen from Camden, N. J. Situated on the Delaware river 88 nautical miles from the Capes of Delaware bay, it has port facilities for accommodating 100 deep draught steamships at once
5. Aerial view of the port of Bremen, the second port of Germany, situated on the river Weser, 46 miles from the North Sea. The total water area (1927) is 126 acres, with docks approximating 18½ miles in length. The river is kept open in winter by ice-breakers
6. Shanghai, China, one of the world's great seaports, on the Huangpu; an estuarine harbour 12 m. from the Yang-tze river near its outlet to the Pacific. It serves Central and much of North China, engaging in river, coastal and, particularly, trans-oceanic shipping

is between two nearly parallel breakwaters or jetties about 600 ft. apart, though the channel is no more than 400 ft. wide (fig. 6). Before 1883, when the first breakwater was begun, the bar at the entrance often shoaled so much that there was sometimes less than 3 ft. of water over it. The constant travel of littoral drift from south to north across the harbour mouth almost completely neutralized the scour induced by the great volume of water flowing

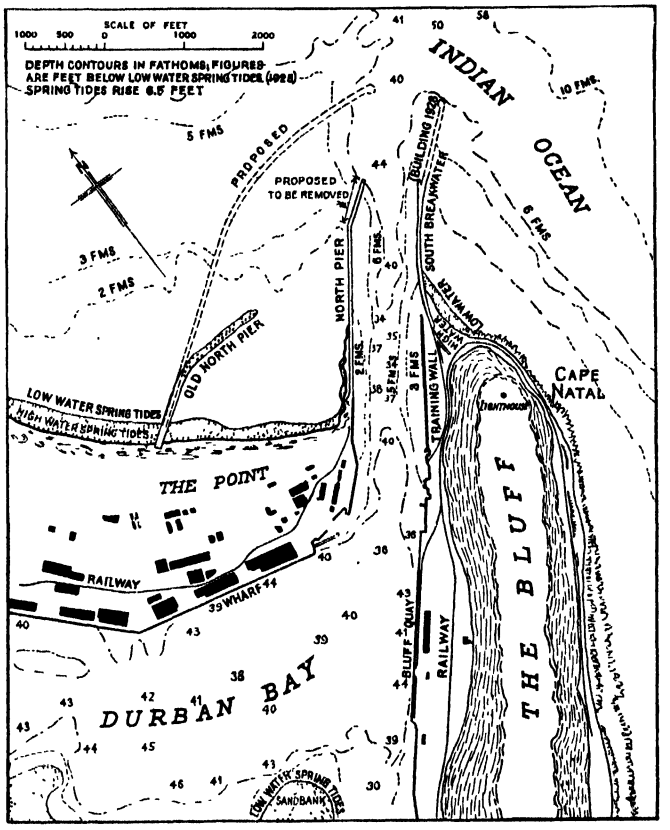


FIG 6.—DURBAN HARBOUR ENTRANCE

between the piers every tide, into and out of the large land-locked bay; and it was not until intensive suction dredging was employed, about 1896, that the low-water depth in the entrance was increased beyond 16 ft. It has since been steadily improved by continuous dredging until now a depth of about 36 ft. is available. Narrowness of the channel between the jetties, which are in an exposed position open to the Indian Ocean, has always made the entrance a difficult one. The increase in the dimensions of vessels using the harbour has, in recent years, led to demands for an enlarged entrance and steps will, no doubt, in due course be taken to give effect to this want.

Karachi and Vizagapatam.—Karachi, on the coast of Sind, is a natural harbour, with an ample backwater, extensive creeks, and a tidal range of 8½ ft., which has been developed by building entrance jetties and dredging. Somewhat similar natural conditions exist at Vizagapatam (spring rise 4½ ft.), a port halfway between Madras and Calcutta, where there is a tidal creek and backwater of lagoon character with a narrow and shallow entrance in an exposed position on the coast line. For many years various plans for making a deep-water harbour, somewhat after the Madras model and seaward of the creek entrance, have been considered. None of them has been adopted; but deep-water internal port works are (1928) being constructed in the backwater and an interesting and bold attempt is being made to form and maintain, by dredging, a channel of 30 ft. at low water through the narrow entrance and into the backwater, protected by a rubble stone jetty on its northern side only. The construction of a second parallel jetty may be found necessary later.

Lagas, the principal part of Southern Nigeria, has an entrance 1,700 ft. wide, formed by dredging between converging jetties of rubble stone.

Australian Bar Harbours.—The harbour of Newcastle (N.S.W.), the principal coal port of Australia, is in a backwater into which flows the Hunter river. The entrance was obstructed by a sand bar with less than 13 ft. over it at low water. Jetties constructed to shelter and improve the passage over the bar, where the spring rise is 5 ft., had little effect in the latter direction, but since 1905 dredging has increased the depth to about 26 ft., and a moderate amount of sand dredging suffices to maintain the channel depths. The width of channel between the jetties at the entrance, about 1,400 ft., is larger, on account of the exposure, than is usual in jetty harbours. Range in the harbour is considerable and the slight divergence of the jetties tends to increase it. Wavetraps have been formed at the sides of the channel between the jetties.

Fremantle harbour, the principal port of Western Australia, at the mouth of the Swan river, has been made by the removal of a bar of rock and sand which completely blocked the entrance to the river. At the site of this bar and within it there is now a harbour 36 ft deep at low water protected by jetty breakwaters. The river mouth is sheltered by outlying islands and shoals and the sand travel is not a serious problem.

New Zealand Bar Harbours.—Otago harbour, one of the few New Zealand natural harbours at which improvement works in the entrance have been necessary, is in the South Island. A training mole at the bar entrance, training works in the inner channel and a moderate amount of dredging have been effective in providing a channel with a least depth of 30 ft. at low water where formerly a sandy bar and inner shoals restricted it to about 15 ft. (See *Proc.* Inst. C.E., vol. cx., 1892; cxxi., 1895; and cc., 1915.) The harbour is a long narrow sea inlet at the head of which, about 11 m. from the entrance, is situated the town of Dunedin.

Westport, on the W. coast of the South Island and the principal coal port of the dominion, furnishes an example of the provision of wave traps (fig. 7) in an entrance between converging training jetties or breakwaters built in 1886–93. The position is one of moderate exposure, the entrance being open to the Pacific. The combined effect of the contracted river and tidal scour and a moderate amount of dredging has increased the low-water depth over the bar from 4 to about 18 ft., the rise of springs being 9½ ft. (See *Proc.* Inst. C.E., vol. cxii., 1893; cxxxvi., 1899.)

BREAKWATERS

Bay Harbours Protected by a Single Breakwater.—The adoption of a deep-water bay for a harbour reduces the necessity for providing artificial shelter and, in most situations, secures a site not exposed to silting, where sheltering works do not inter-

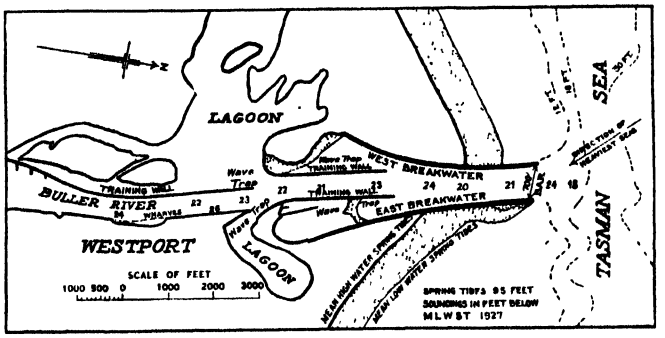


FIG. 7.—WESTPORT HARBOUR, NEW ZEALAND

fere with any littoral drift along the open coast. In favourable situations a deep and narrow bay or inlet may be sheltered by a single breakwater extended out from one shore across the outlet of the bay, having a single entrance between its extremity and the opposite shore. Sometimes—where the exposure is from one direction only approximately parallel with the coast line at the site, and there is some natural shelter in the opposite direction—a single breakwater extending at right angles to the shore, with a bend or curve inwards at its outer end, suffices to afford the necessary shelter. As examples of this form of harbour construction

may be mentioned Newhaven breakwater, protecting, on the west side, the approach to the river port which is somewhat sheltered from the moderate easterly storms by Beachy Head; and Table Bay breakwater, which shelters the harbour from the N.W., protection on the opposite side being afforded by the wide sweep of the coast-line of Table Bay. Other examples are Holyhead, Fishguard, Brixham, Victoria (B.C.), Los Angeles and Valparaiso and

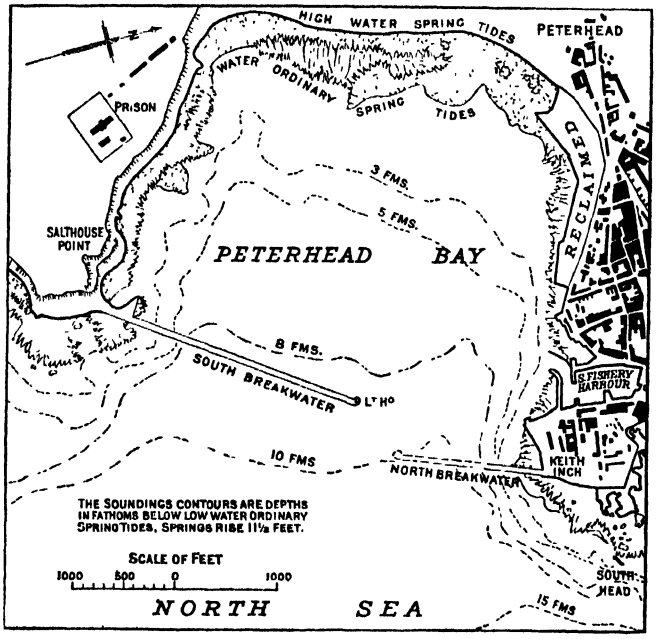


FIG. 8.—PETERHEAD HARBOUR

other harbours on the Chilean coast. The Folkestone harbour pier is an example of a single curved breakwater, sheltering the harbour formed on its E. and N. sides, which also has berths on its outer face. These are used by the cross-channel steamships in heavy weather from the E. or N.E., at which times the inner berths are much exposed.

Fishguard.—The harbour here was made by the building (1900–18) of a breakwater across Fishguard bay. The internal shelter has been increased by the subsequent construction of a second breakwater thrown out from the shore in the middle of the bay. The principal object of this addition was, however, to tranquilize the waters in the berths alongside the steamship quays at the head of the harbour.

Los Angeles Harbour.—An important artificial harbour has been formed here on the Californian coast by building (1898–1910) a breakwater over 2 m. long from the southern arm of San Pedro bay. (See *Proc.* Inst. C.E., vol. cxcv., 1914.) It is one of the few large breakwater harbours in an exposed position on the sea coasts of the United States made to provide outer anchorage of, and the entrance to, a commercial port. The breakwater is curved in plan and extends across the bay in an easterly direction terminating in a depth of 48 ft. at low water. It is of the usual American type comprising a rubble mound and solid superstructure. A large inner harbour, basins and piers have been formed along the shores of the bay and in a lagoon near by at Wilmington (*see* DOCKS). These are afforded ample shelter by the breakwater (fig. 9). The exposure on the E. is limited by the curving coast line.

Chilean Ports.—The breakwater at Valparaiso (*see* BREAKWATER) is a remarkable structure projecting from the western shore of Valparaiso bay. It will have its termination in a depth of 180 ft. of water. The water area, which will be fully sheltered by the completed breakwater, is small and the cost (reported to be £2,500 per lineal metre for the extension) very large in proportion to the benefit to be derived. (See *Proc.* Inst. C.E., vol. ccxiv., 1923 and xivth., Int. Nav. Congress, Cairo, 1926, *Proc.* Paper 29 bis.)

Single breakwaters have also been built in the bays of San Antonio (1911–18) and Antofagasta (1918–27). In each of these cases the breakwater is bent in plan having two straight arms connected by a curved portion. The sites are somewhat more sheltered than Valparaiso bay and the depths of water considerably less. At both harbours piers and other inner port works are being constructed under the lee of the breakwater.

Table Bay.—The harbour of Cape Town is generally known by the older name of Table Bay. The present rubble mound breakwater dates from 1860; it has been extended seaward several times and at present (1928) 1,500 ft. is being added which will make the total length about 1 m.; the head of the extension, which is of concrete blockwork, will be in a depth of about 46 ft. at low water. The breakwater projects from the W. side of Table Bay in an easterly direction. Under its shelter is an inner harbour

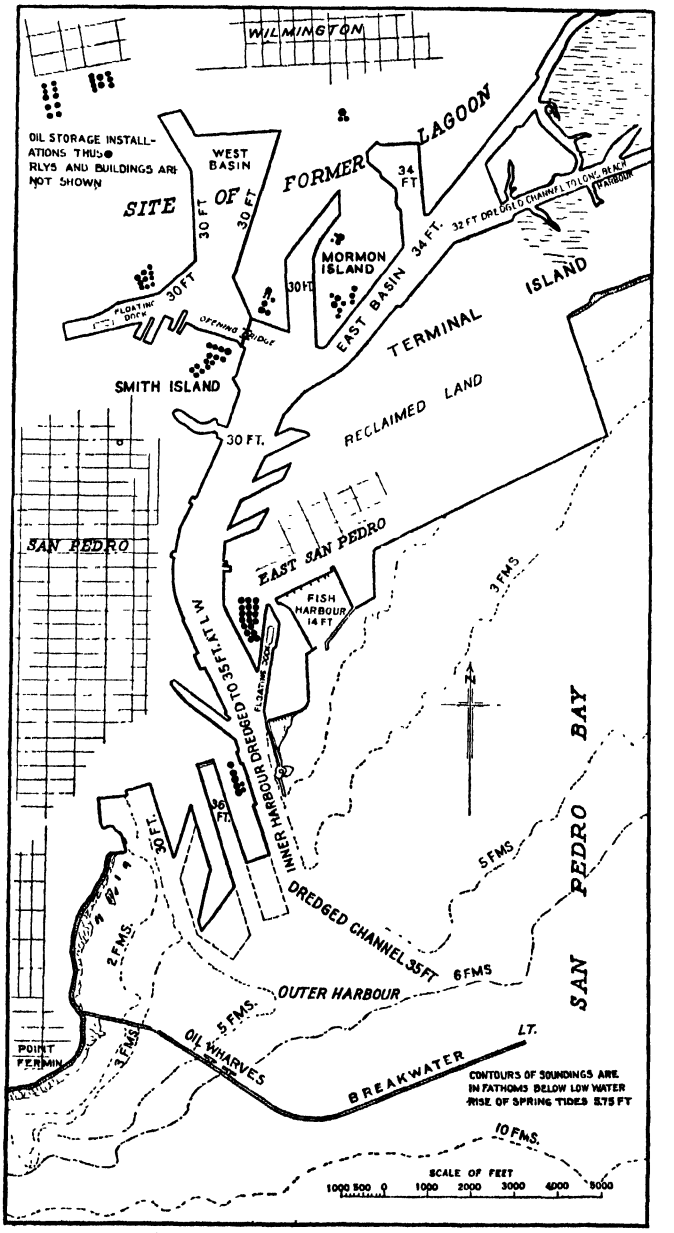


FIG. 9.—LOS ANGELES HARBOUR, 1927

having a water area of 75 acres with quays and jetties; and the building of a new and larger inner harbour farther to the S.E. has been commenced.

Island Breakwaters Protecting Embayments.—In the case of a deep, fairly land-locked bay or inlet of the sea, a detached breakwater across the outlet, leaving an entrance between each extremity and the shore, is sometimes sufficient to give the additional shelter necessary to form a safe harbour and anchorage. This form of protection is usually only practicable when there is deep enough water near the shore, on one or both sides, to afford

suitable entrance.

Plymouth.—The best known example is the breakwater affording the artificial protection necessary to convert the natural harbour of Plymouth into a place of almost perfect shelter. Plymouth Sound, one of the most famous and historic roadsteads of the world, and the deep inlets or creeks above it form a harbour into which fall the rivers Tamar and Plym The breakwater is 1 m. in

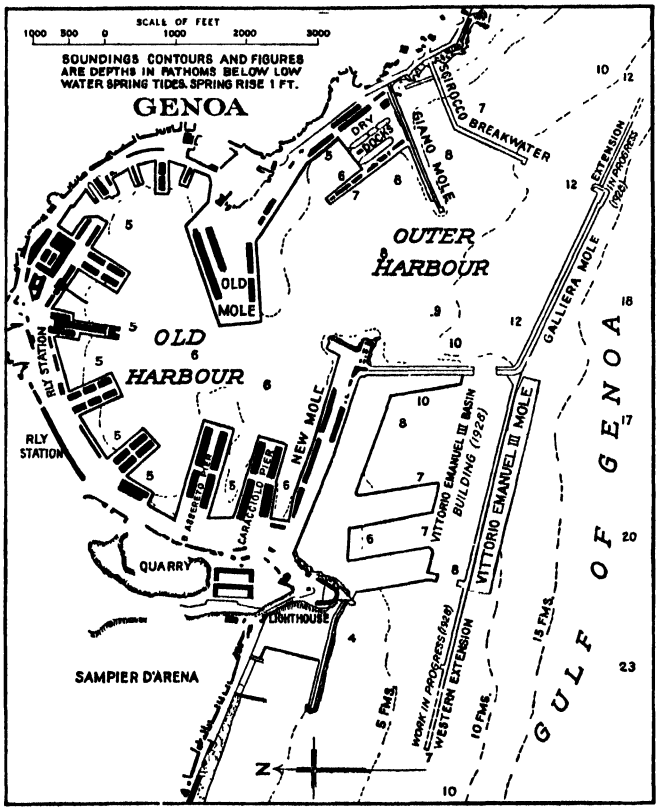


FIG 10.—GENOA HARBOUR

length stretching across the middle part of the sound. Begun by John Rennie in 1812, it was completed about 1827. In the harbour itself are the naval dockyard establishments at Devonport and Keyham, and small commercial dock and port works at Millbay and in the Cattewater.

Cherbourg.—The breakwater across the wider but shallower bay forming Cherbourg harbour and roadstead is another example of an island structure but in a more open and exposed position than Plymouth. Begun in 1784, its construction was continued under Napoleon, but it was not completed until 1858. Over 2¼ m. in length it is built, for the most part, in a depth of about 42 ft. at low water. It is of composite construction, a solid superstructure surmounting a rubble stone mound. The sheltered water area is over 2,000 acres in extent, but not more than one quarter of this is of sufficient depth for large vessels. The two entrances on the E. and W. are between the breakwater ends and islands which are themselves joined to the mainland by breakwater walls.

Delaware Bay.—The Delaware breakwaters at Cape Henlopen, the S. horn of the entrance to Delaware Bay, are both of the island type. The first, built (1828–69) inshore under the shelter of the headland, is the prototype of American rubble-mound breakwaters. The national harbour of refuge of about 800 acres formed outside the old breakwater by the U.S. Government (1897–1901) is protected by a rubble-mound breakwater 8,040 ft. in length built in a depth at low water of about 30 ft.

Another American island breakwater of the mound type, commenced in 1884 with the object of forming a harbour of refuge in Sandy Bay near Rockport (Mass.), has had a disastrous history of storm damage and the work is still unfinished. The position is one of great exposure for which the rubble-mound type is unsuited.

Island breakwaters frequently form portions of the artificial protection of harbours in conjunction with breakwaters projected from the shore line. Some examples of this combination are referred to hereunder.

Bay Harbours with Two or More Breakwaters.—The method most generally adopted for the completion of the shelter of deeply indented bay harbours is the construction of a breakwater extended across the outlet from each shore, leaving a single entrance between their ends, where usually the deepest water is found as at Peterhead and Monaco. If one breakwater placed somewhat farther out is made to overlap an inner one, and so cover it to some extent from the direction of the heaviest seas, a more sheltered entrance is sometimes obtained. This arrangement was adopted when additional protection works were built at the entrance to the old bay harbour at Genoa (fig. 10) and for the harbour in Bilbao bay at the mouth of the Nervion. The breakwaters at Valetta (Malta) and those at the entrance to the almost land-locked Spanish naval harbour at Cartagena are also planned in this way. Many harbours formed in wide or open bays, and in other positions where some abrupt projection from the coast line has been utilized as providing shelter from one quarter, have their protection completed by two or more breakwaters enclosing the site. Dover (fig. 11) and Colombo (fig. 12) furnish typical and somewhat similar examples. Both of these were begun as single breakwater harbours, and their conversion into enclosed harbours was not completed until many years later.

The extension of artificial shelter has often been brought about not only by the demand for more complete protection against heavy seas and consequent range in a harbour, but also by the growth in the dimensions of ships and the increase in the trade of a port. Thus, greater depth of water and extended accommodation have been obtained at one and the same time with the improvement of the shelter by building additional breakwaters.

In some instances a wide or exposed entrance to a harbour formed by breakwaters thrown out from the shore has been sheltered by an island breakwater built in front of the opening and thus providing two entrances, one at each end of the island structure; Bizerta (Tunis), and Cette furnish examples. In other cases, as at Dover, Portland and Colombo, the line of breakwaters enclosing the harbour has been made discontinuous, two, and in some cases more, openings being formed between them. The Gibraltar harbour works (1893–1904), made in the sheltered bay of Algeciras on the W. of the Rock, include a detached mole with two entrances between it and the breakwaters which are connected with the shore.

Dover.—This is an example of an artificial harbour formed on a coast of moderate exposure—the narrowest part of the Straits of Dover. The nucleus of the harbour which exists to-day was the

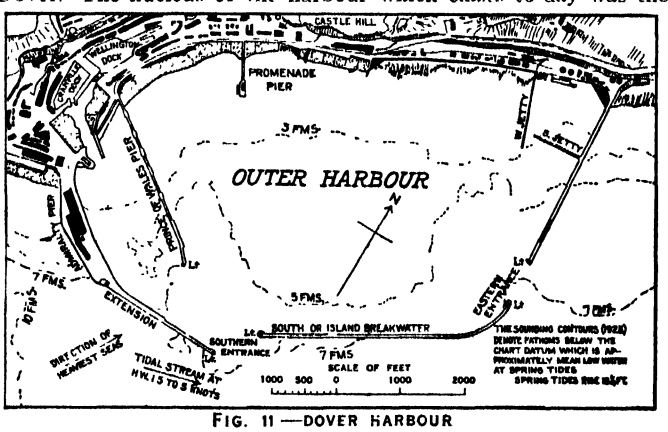


FIG. 11.—DOVER HARBOUR

Admiralty pier, commenced in 1844 and extended to form the western arm of the outer harbour The pier afforded shelter from the S. and W., and protection from the N. is given by the coast line and was increased later by the building of the Prince of Wales pier. The works carried out between 1897 and 1909 enclose a low-water area of 690 acres and comprise, in addition to the Admiralty pier, now 4,000 ft. long, an island breakwater of 4,212 ft. and an eastern arm of 2,942 ft. connected with the shore (*see* BREAKWATER). The harbour was handed over by the Admiralty to the Dover Harbour Board in 1923 for commercial use, and it is

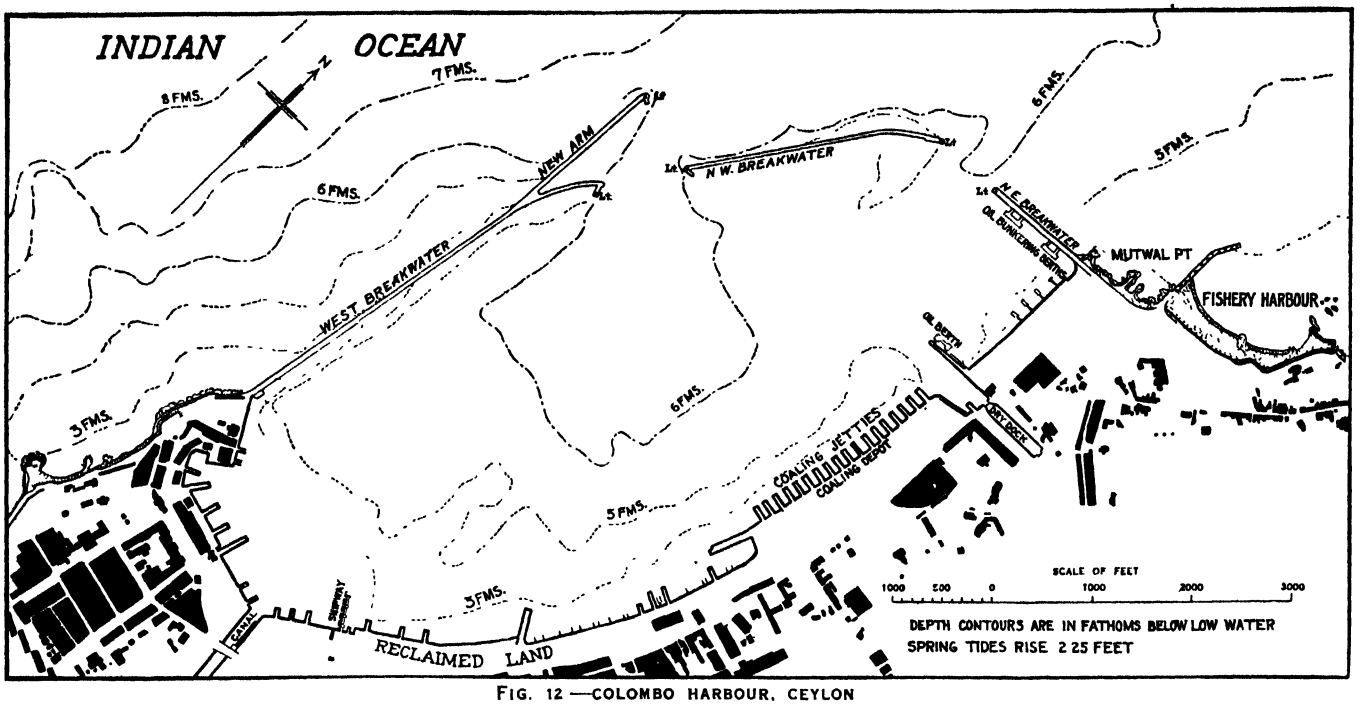


FIG. 12.—COLOMBO HARBOUR, CEYLON

now (1928) proposed, with the object of reducing the severe range in the harbour, to close the western entrance (740 ft.), leaving only the eastern opening (650 ft.) available for shipping.

Portland.—The refuge and Admiralty harbour of Portland furnishes an instance of the conversion of a naturally sheltered roadstead into an enclosed harbour by the construction of breakwaters projecting from the horns of a bay. The Isle of Portland—actually a peninsula joined to the mainland of Dorset by the Chesil Bank—shelters the roads from the S. and the anchorage is exposed to storms only from E. to S. The southern, or inner, and the eastern, or outer, breakwaters were begun in 1849 and completed in 1872, the latter being in 8 to 10 fm. at low-water. Later two additional breakwaters were added, one projecting from the Bincleave rocks near Weymouth on the N. side, and the other, an island structure, on the N.E. of the harbour. The last was finished in 1904, the building of the later breakwaters being carried out, partly at any rate, as a protection against torpedo attack. There are three entrances between the four breakwaters; but one of them, the southern, was closed in 1914 by sinking a block-ship in it, and it is not proposed to re-open it. The breakwaters have a total length of 3¼ m. and shelter a water area of 4 sq.m. Portland is one of the largest artificially enclosed harbours in existence.

Colombo.—The artificial harbour at Colombo (fig. 12), begun in 1875, occupies an exposed situation in an embayment on the W. coast of Ceylon. The site is sheltered to some extent from southerly winds and to a lesser degree from the N. The breakwaters are fully exposed to westerly gales from the Indian Ocean. The S.W. breakwater, the first to be constructed, is 4,212 ft. long and was completed in 1885 (*see* BREAKWATER). Two additional breakwaters, the N.W. and N.E., 2,670 ft. and 1,080 ft. respectively, were built between 1892 and 1906, thus completing the enclosure of the harbour except for two openings of 800 and 700 ft. respectively. The shelter afforded was still insufficient to tranquilize the northern part of the water area, where are situated most of the coaling and oil berths, during the S.W. monsoon. Consequently a sheltering arm, 1,800 ft. in length, was completed in 1912 as an extension of the original S.W. breakwater. The harbour has a water area of 643 acres at low-water; there is a low-water depth of 36 ft. or more, and the harbour has been deepened from time to time to keep pace with the increased draught of vessels. The western entrance has a depth of 40 ft. at low water.

Peterhead.—The shelter afforded by the original single breakwater of the national harbour of refuge at Peterhead is now (1928) being supplemented by a second and shorter breakwater built out from the northern horn of the bay for a distance of 1,500 ft., thus reducing the width of entrance to about 700 ft. (fig. 8). The two breakwaters will enclose an area of about 280 acres at low tide. The S. breakwater (2,850 ft.), built mainly by convict labour, was commenced by Sir John Coode in 1888 and completed in 1912. Its end is in 55 ft. of water at low tide. The northern breakwater was not begun until 1912, although it formed a part of the original design. These works are exposed to severe storms from the N. and E. and are called upon to withstand a wave impact as great as any assailing harbour structures in Europe.

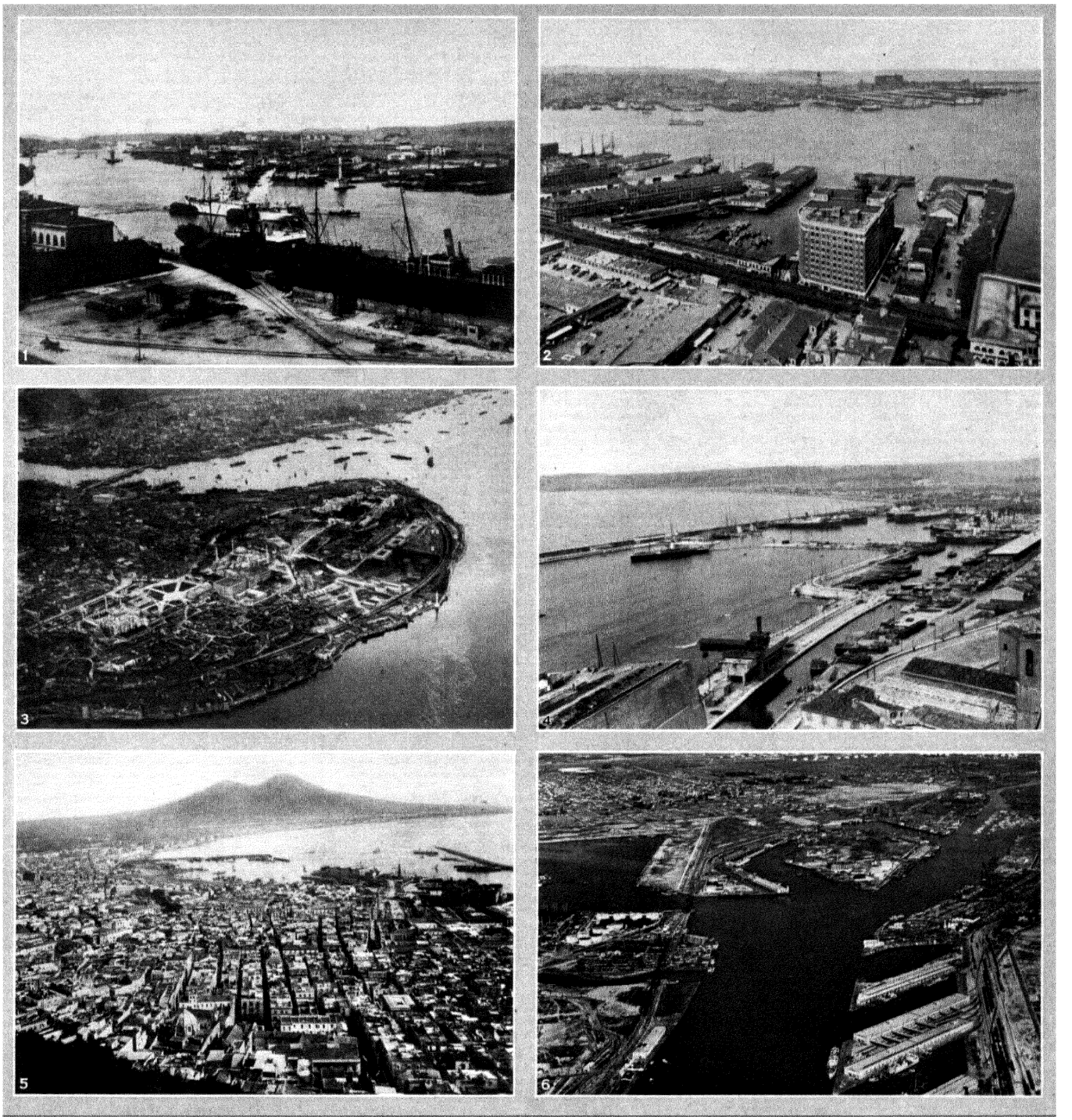
Havre.—The outer harbour at Havre furnishes an example of a port, originally formed in a sheltered embayment along the margin of an estuary, where it has been necessary to build long breakwaters extended into more exposed waters, in order to provide the additional accommodation demanded by its increasing trade

EXPOSED POSITIONS

Artificial Harbours on Open Coasts.—It sometimes happens that harbours have to be constructed where little or no natural shelter exists. When, in such cases, the only possible site is an open sandy shore, considerable littoral drift may occur. Breakwaters, carried out from the shore at some distance apart, and converging to a central entrance of suitable width, provide the requisite shelter. Such works may be necessary, not only on open unindented coasts, but also to afford increased shelter at a river mouth on an unprotected coast line. Harbours of this description have, for instance, been made at Madras and Ymuiden on open shores; whilst the breakwaters at the mouth of the Tyne, and those at Sunderland, furnish examples of the protection of river entrances.

If there is little littoral drift from the most exposed quarter, the amount of sand brought into the harbour during storms can be readily removed by dredging. The quantity is, moreover, smaller in proportion to the depth into which the entrance is carried; and the scour across the projecting ends of the breakwaters tends, in some cases, to keep the outlet free from deposit. If a river discharges into the harbour the detritus and matter in suspension brought down by it must also be taken into consideration.

Where there is littoral drift in both directions on an open sandy coast, due to winds blowing alternately from opposite quarters, sand accumulates in the sheltered angles outside the harbour on both sides at the junction of the breakwater with the shore line.



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NATURAL AND ARTIFICIAL HARBOURS OF EUROPE AND AMERICA

1. View of the waterfront at Gothenburg (Göteburg), the first port in Sweden, situated on the river Göta about five miles from the Cattegat. The harbour has been recently enlarged and is now the principal port of embarkation for Swedish emigrants to America
2. Boston harbour as seen from the Customs House tower, looking toward East Boston. The wharfage extends for 8 miles with a berthing space of 40 miles. The main ship channel is 35 feet deep at low water, enabling the port to accommodate the largest vessels afloat
3. Aerial view of Constantinople, showing its harbour, the Golden Horn, an inlet of the Bosporus about 4 miles long. It is divided by Galata Bridge into an outer harbour and an inner harbour and naval port
4. View of Marseilles on the Mediterranean coast of France, showing the Bassin de La Jolliette, part of the great range of basins enclosed by the breakwater (background) which extends for more than 3½ miles parallel with the coast. In the foreground (left) is Fort St. Jean
5. General view of Naples, the second port of Italy. The harbour, overshadowed by Mount Vesuvius, reaches across the bay from west to east for a distance of 2 miles and is protected by breakwaters. It has a depth ranging from 30 to 35 feet
6. View of the inner harbour of Los Angeles showing Terminal Island (left), Mormon Island and Wilmington (background) and Smith Island (right). The channel has been dredged to a depth of 35 feet, the East Basin (right) to 34 feet and the West Basin (left) to 30 feet

This has occurred at Ymuiden. Silting also frequently occurs just inside the breakwater heads under the shelter of the arms The worst results occur when the littoral drift is mainly in one direction, so that the projection of a solid breakwater out from the shore causes a very large accretion on the side facing the exposed quarter, whilst, owing to the arrest of the travel of sand, erosion of the beach occurs beyond the lee breakwater (*see* COAST PROTECTION). Such effects have been produced by the works at Port Saïd and Madras. The harbour of Salina Cruz on the Pacific coast of the Isthmus of Tehuantepec, where two breakwaters projecting from the shore were built (1900–6), rapidly sanded up and narrow channels to the berths are only maintained by constant dredging.

Madras and Ymuiden Harbours.—Considering first of all harbours formed by converging breakwaters on an open unindented coast, the two examples mentioned above are both typical and instructive. Madras furnishes an instance of difficulties and unforeseen happenings overcome by continuous effort and drastic modification of the original plans. At Ymuiden the original forecast of the designers has been more nearly, but not entirely, realized The harbour of Madras, begun in 1877, comprised, when first completed, two breakwaters 3,000 ft apart carried straight out to sea at right angles to the shore for 3,000 ft. with two return arms inclined slightly to seaward. The breakwaters originally enclosed an area of 220 acres and left a central entrance, 515 ft. wide, facing the Indian ocean in a depth of about 8 fm. The position and form of this entrance were determined mainly on navigational grounds as suitable to the needs of the sailing vessels, still at that time largely employed in the eastern trade. The breakwaters, in a position of extreme exposure on an open coast without any natural shelter, have suffered severe damage from the sea on many occasions necessitating rebuilding from time to time. The great drift of sand from S to N. resulted in an advance of the shore against the outside of the S breakwater as it was projected seaward (fig. 2), and erosion, but to a lesser extent, occurred beyond the N. breakwater. The progress of the foreshore in course of time extended so far seawards as to produce shoaling at the entrance; so rapidly in fact that in the ten years from 1893 the depth was diminished by 10 ft. Moreover, the original entrance, facing east, was exposed to the full force of waves during both the N.E. and the S W. monsoons. At these seasons the range within the harbour was severe and at times vessels could not ride at moorings in safety. A new entrance was therefore constructed by forming an opening in the breakwater on the N. side of the harbour, protected by a sheltering arm, the original eastern entrance being closed when the new entrance had been made (1906–11). The harbour is now comparatively tranquil and vessels are able at all times to lie at the quays in safety.

The advance of the shore line seawards on the S. side of the harbour still appears to average over 25 ft. a year, but the rate of progression tends to decrease as the sand deposit extends into deeper water. The drift of sand along the outside face of the eastern breakwater wall has been checked, at any rate temporarily, by the construction of an extension seaward of the S. breakwater 700 ft. in length which was begun in 1924. This spur breakwater or groyne is protected by concrete blocks placed pell mell on each side. Incidentally the accretion of sand on the S. side of the harbour is not an unmixed evil for the value of the land so formed is increasing with the expansion of the city and much of it has been sold for over £3,000 per acre. Since the tranquilizing of the water area in 1911, the quay accommodation has been largely increased (see *Proc.* Inst. C.E., *Passim*).

The harbour at Ymuiden, constructed during the 'seventies of the last century, is an entirely artificial one formed, on the open sandy shore and bed of the North Sea, to serve as the entrance to the Amsterdam ship canal. The breakwaters, each about a mile in length, are converging and the entrance faces W. A dredged channel extends from deep water outside the breakwaters to the canal locks. This channel is (1928) being deepened to 40 ft. below mean sea level (spring rise, 5½ ft.). The actual entrance to the canal channel is between parallel jetties built on the original foreshore where the cut through the sand dunes was first made. The entrance between the breakwater heads is about 800 ft. in width, the harbour widening to 3,800 ft. at the shore line, thus providing broad expending beaches on either side of the canal entrance. The construction of the large entrance lock (1928) (*see* CANALS and DOCKS) has necessitated the sacrifice of a part of the northern spending beach to the formation of an additional and wider canal entrance. In order to compensate for this loss the inner portion of the N. breakwater is being reconstructed so as to form a large wave trap on the N. side of the new channel jetties. The advance of the shore on both sides of the harbour at Ymuiden appears to have reached its limit only a short distance out from the old shore line on each side. The only evidence of drift consists in the advance seawards of the line of soundings alongside, and in the considerable amount of sand which enters the harbour and has to be removed by bucket dredging. For dredging outside the breakwaters suction dredgers are employed. A condition of balance has now been reached. Dredging operations, fairly uniform and continuous in amount (about 1,700,000 c yd. per annum), but not economically burdensome in proportion to the commercial importance of the harbour, serve to maintain the required depths of water. It is interesting to note here that an early instance of the employment of sand-pump dredgers was in connection with the construction of the harbour by British engineers about 1874 (see *Proc.* Inst. C.E., vol. lxii., 1880).

Port Saïd Harbour, at the Mediterranean entrance of the Suez canal, is interesting as an example of the successful formation of an artificial harbour on an open shore where the littoral drift is almost wholly in one direction The exposure is moderate and the sea bed slopes very slowly towards deep water. Owing to the prevalence of N W. winds, the drift is from W. to E , and is augmented by the alluvium issuing from the Nile. The original harbour was formed by two converging breakwaters or jetties, of which the western has been extended seaward from time to time as successive deepenings of the canal were effected. Its total length in 1927 was 6,565 yd. and its termination in a depth of water of 38 ft. (*see* E. Quellennec, *Breakwaters of Egyptian Harbours,* Paper 31 bis , and P. Solente, Paper 54; XIV. Int. Congress of Navigation, Cairo, 1926). The outer portion is a submerged mound serving merely to prevent sand and silt from entering the dredged channel except around the seaward extremity; a further extension was being made in 1928. The E. breakwater, on the less exposed side, is 2,625 yd. long (fig. 13). The shore has advanced considerably against the outer face of the W. breakwater and at the same time erosion has taken place on the E. side of the E. breakwater. The advance on the western side between 1858 and 1926 was 2,750 ft., but the rate of progress has been decreased in recent years as a result of the deeper water to be filled by the sand deposit. Though the progress seawards of the lines of soundings close to the harbour continues a depth of about 40 ft. below normal low water is maintained without difficulty by the continuous working of powerful bucket dredgers in the channel and outer approaches.

The Tyne and Sunderland.—The breakwaters at the mouths of the Tyne and Wear furnish outstanding instances of the successful adoption of the converging plan in situations where a river outfalls on an exposed coast line and there is no protecting estuary or sheltered sea inlet (see *Proc.* Inst. C.E., vol. clxxv., 1910 and cclx., 1921). In the case of the Tyne sand travel has occasioned no difficulty, neither has erosion taken place on the lee side of the harbour, a small rocky headland less than a mile S. forming a natural groyne which has trapped sand and shingle in the embayment between it and the S. pier. At Sunderland some accumulation, though not to a serious extent, has occurred on the N. side of the harbour works and erosion of the foreshore to the S. has necessitated the carrying out of costly protection works. The building of the Tyne breakwaters (fig. 1) was commenced in 1855; they were originally designed to terminate in a depth of 15 ft. at low water, but when more than half finished it was decided to extend them seaward to near the 6 fathom contour. This involved changes in the plan of the harbour and accounts

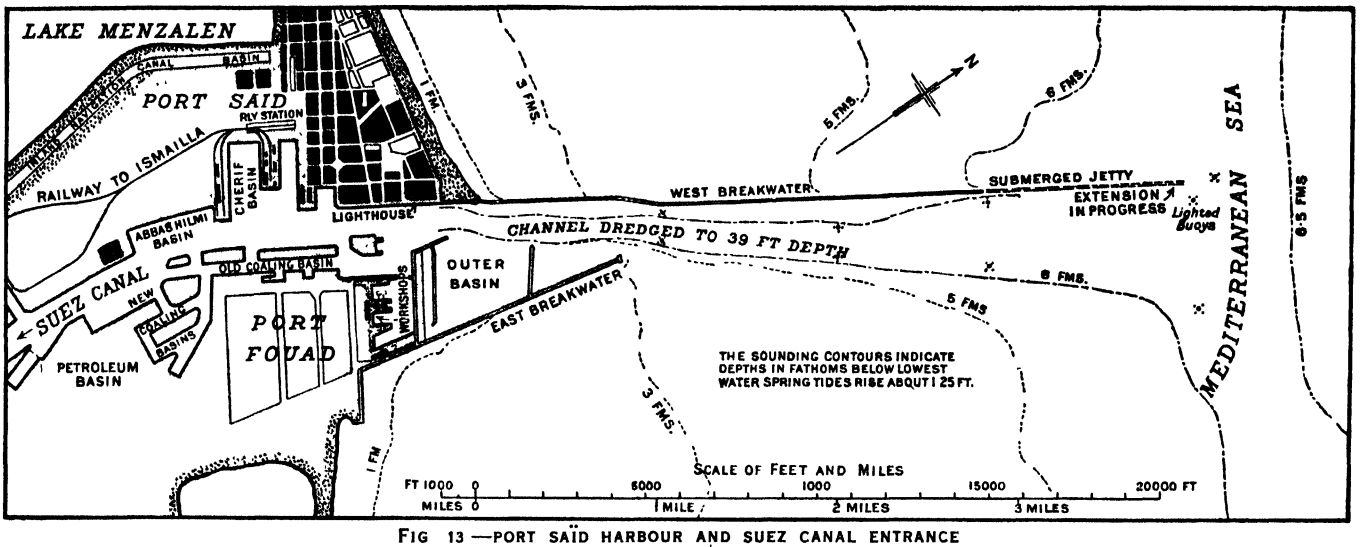


FIG 13 —PORT SAÏD HARBOUR AND SUEZ CANAL ENTRANCE

for the somewhat peculiar curved form of the S pier The N. pier was originally completed in a similar manner but the outer portion was partially destroyed (1895–6) and subsequently rebuilt on a straight line (*see* BREAKWATER).

The formation of the outer harbour at Tynemouth has provided a safe deep-water approach to the river whose mouth was, about the middle of the last century, obstructed by a sand bar with no more than 5 ft. depth at low water and was, moreover, notorious on account of the difficulty of entrance and the frequency of wrecks The channel from the harbour to the docks is dredged to 30 ft. at low water spring tides (*see* RIVER ENGINEERING).

Casablanca —A recent example of harbour construction carried out on a large scale on an exposed shore is the making of this artificial port on the Atlantic, the largest and most important harbour in French Morocco (fig 14) The construction of a small inshore harbour and jetty was commenced in 1907; the sheltering harbour enclosing about 350 acres, for the most part having a depth of 30 ft or more at L.W., was begun in 1913, and the main

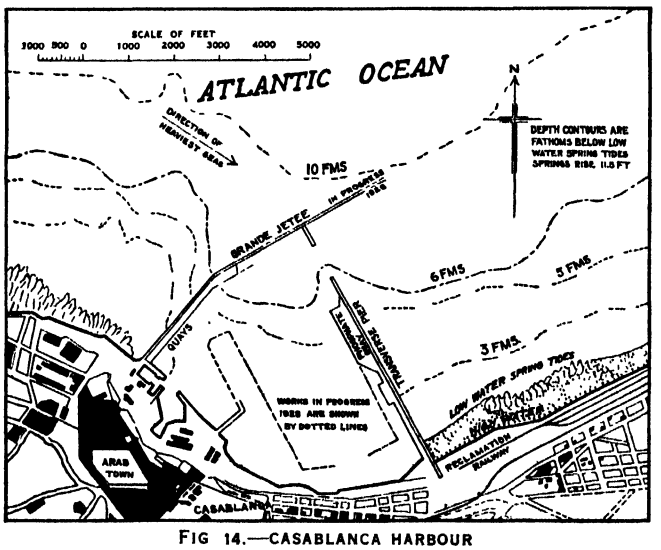


FIG 14.—CASABLANCA HARBOUR

works completed in 1927. The N. and more exposed breakwater is now (1928) being extended to a total length of 7,215 ft The works are fully exposed to the Atlantic swell and there is little natural protection, but extensive and well equipped quays are provided alongside the transverse breakwater

Takoradi.—The artificial deep water harbour of Takoradi, on the Gold Coast (constructed 1921–28), affords an instance of advantage being taken of a rocky reef extending out from the shore to form the foundation for a large part of the main protecting breakwater, which is of the rubble mound type The plan of the harbour is in some ways similar to that of Casablanca, the main breakwater affording shelter on the side exposed to the prevailing winds and heaviest seas, while a transverse breakwater built under its lee has wharves constructed along its side, and the deep water entrance between the breakwater heads is well sheltered The site selected for the harbour is on an open coast, but is free from the trouble of littoral drift.

Boulogne.—The old harbour of Boulogne is of the conventional jetty type common to the French and Belgian ports of the English Channel and North Sea. The formation of a large outer harbour sheltered by breakwaters projected from the shore was commenced as far back as the 'eighties of the last century. The S. or Carnot breakwater has now been built to a length of about 8,300 ft but the N breakwater has not yet been begun. When completed, the enclosed low-water area will be over 1½ sq.m. and the entrance will be in 36 ft. depth at low-water The Carnot breakwater is Γ shaped in plan; its shore end is over 6,000 ft S. of the jetty entrance to the inner harbour, the intervening foreshore forming an ample expending beach Boulogne harbour is not free from the troubles arising from littoral drift. The sand travel along the shore from south to north has already led to considerable accretion along the outer face of the Carnot breakwater and the depth contours are being gradually pushed seaward.

Breakwaters Connected with the Shore by an Open Viaduct.—Proposals have been brought forward from time to time to evade the advance of the foreshore against a solid obstacle by extending an open viaduct across the zone of littoral drift inshore, and forming a closed harbour, or a sheltering breakwater against which vessels can lie, farther seaward and beyond the influence of accretion. It should, however, be pointed out that the single curved arm breakwater can afford adequate protection only in situations of moderate exposure and where the harbour is naturally sheltered on its open side.

Zeebrugge Harbour.—This principle was carried out on a fairly large scale at the port of call formed by the sheltering breakwater constructed (1900–9) in front of the entrance to the Bruges ship canal at Zeebrugge on the sandy North Sea coast. A solid breakwater, provided with a wide quay furnished with sidings and sheds, and curving round towards the E so as to overlap the entrance to the canal and shelter an ample water-area, is approached by an open steel and iron viaduct extending out 1,000 ft. from low water into a depth of 20 ft The solid breakwater is carried out into a depth of 33 ft. at L.W. near the head. It was hoped that by thus avoiding interference with the littoral drift close to the shore, coming mainly from the W., the accumulation of silt and sand to the W. of the harbour, and also in the harbour itself, would be prevented, or at any rate reduced to a very moderate amount. These hopes have not, however, been realized, and considerable dredging is necessary in the harbour and at the entrance to the canal in order to maintain the required depths. The prob-

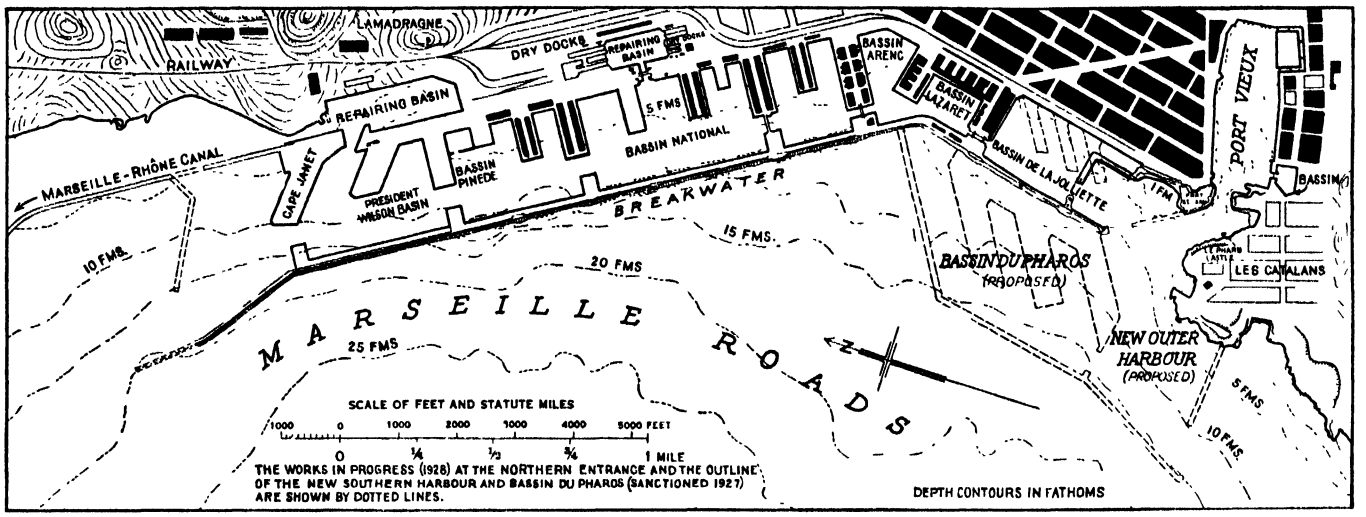


FIG. 15.—PORT OF MARSEILLE

able explanation of the failure to avoid the troubles of sand accretion and silting is, in this as in other similar cases where the accretion has been still more serious, that the shelter caused by anything in the nature of an island near the shore must result in interference with the natural littoral current and drift and consequent stoppage of the travelling material

Ceará and Rosslare.—A plan somewhat similar to that adopted later at Zeebrugge was carried into effect at Ceará on the N E coast of Brazil about 1886. Sand accumulated very rapidly, both inside and outside the harbour; in a few years the low water line had receded as far as the breakwater head and the harbour was ultimately abandoned (see *Proc.* Inst. C.E., vol. clvi., 1904). Rosslare harbour, near Wexford, on the S E. coast of Ireland, is another and more favourable example of this type of construction Here also, however, dredging has to be carried on periodically to maintain the requisite depths for the safe passage of vessels

Port Elizabeth.—The protected harbour which, after years of preliminary discussion, is now being made in the waters of the wide Algoa bay at Port Elizabeth, will eventually enclose about 680 acres between two curved breakwaters. The eastern or outer arm was begun in 1922 and will afford shelter from S.E. and E winds and the heavy seas from that quarter. It starts from the head of the Dom Pedro jetty, a steel openwork structure, 1,400 ft. long, dating from the period of the second Boer war, in about 25 ft at low-water and will terminate in a depth of about 45 ft This plan has been adopted with the object of leaving open the space covered by the jetty to allow the current to sweep through and in the hope that this will prevent the sand from silting the harbour or accumulating outside as has happened at Madras. The outer breakwater will be, when completed, about 1½ m. in length, and is being built of sloping blocks of stone (*See* BREAKWATER.)

DEEP WATER CONSTRUCTION

Harbours Sheltered by Works Parallel to Coast.—Many important modern harbours of artificial construction in the Mediterranean and other tideless seas have been formed by building sheltering breakwaters in deep water at some distance from the shore and more or less parallel with it, leaving openings at one or both ends, or at intervals. Under the shelter of these breakwaters inner port works have been constructed (*see* DOCKS). This characteristic of Mediterranean harbours is due, first of all, to the absence of good river harbours; for in tideless seas the rivers are usually barred by deltas at their outlets, as the Rhone and Tiber. Secondly, many ancient ports were formed in narrow sheltered sea-inlets as, for instance, the old harbour of Marseilles; or in small bays as at Genoa, Naples and Trieste. In course of time the maritime commerce of such ports outgrew the limited resources of the old harbours and it became necessary to provide enlarged accommodation near by and in deeper water. The only sites available for such extensions have usually been in more open and exposed situations in deep water fronting the adjacent coast line. Moreover, the great depths of water near the shore at many Mediterranean ports, as for example, Marseille and Naples, make lateral extensions more economical and practically convenient than seaward enlargements

Marseille.—The great breakwater at Marseille (*see* DOCKS) has a total length of more than 3½ m along the shore (fig. 15), and the range of basins enclosed by it is still being extended both N. and S.

Genoa, the greatest port of Italy, was a centre of maritime trade long before the days of Columbus, whose statue overlooks the harbour and who was a native of the city The old harbour is in a semi-circular bay less than ¾ m. in width at its entrance Around its shores moles and jetties were built from time to time, first in sheltered positions and later in more exposed parts of the bay open to the S.; still later protection moles were thrown out from the two horns of the bay, and the continued expansion of the port has necessitated the construction of an island breakwater—the Galliera mole—(begun in 1877 and still being extended) stretching E. and W. in front of the old harbour at a distance of over ½ m. from the shore (fig. 10), and built in water from 50 to 80 ft. deep Under its shelter port works have been constructed which are further sheltered by subsidiary moles projected more or less at right angles to the shore.

Trieste.—The Adriatic port of Trieste furnishes another example of lateral expansion. The old port, situated in a small sheltered bay, called the Doganale Basin, is now used mainly for coastwise shipping. Along the coast to the northward and again to the southward across the entrance to the Bay of Muggia, several island breakwaters, having an aggregate length of over 2 m., have been built to shelter the port works which stretch along the coast line.

Naples.—The old harbour of Naples was formed by building small moles or breakwaters in sheltered positions on the western side of the bay. The San Vincenzo breakwater, which is the nucleus of the modern harbour, was begun in 1836. The harbour now reaches across the wide bay from west to east for a distance of over 2 m. and is protected by a series of breakwaters parallel with the shore. Practically the whole of the modern harbour, having a sheltered area of about 1 sq m., is in deep water and little dredging has been required except alongside some of the quays.

Lateral Breakwaters in Sheltered Positions.—In large land-locked natural harbours and arms of the sea lateral breakwaters parallel with the shore form convenient and effective means of providing shelter from the short wind waves which are generated in them and protection from so much of the ocean swell as may be propagated into the enclosed water area. Behind the shelter of such works, wharves and other port works can be constructed where vessels may berth without risk of damage. In this

manner the naval and commercial harbours in the land-locked Rade at Brest are protected by island breakwaters fronting them. Another example is the harbour of Kobe, situated in a sheltered part of the inland sea of Japan, where wide, solid and well equipped piers, projecting 1,000 to 1,500 ft. from the shore, have been afforded additional protection by the construction of a series of island breakwaters generally parallel with the shore in depths of 35 to 45 ft. These works are still in course of construction (1928).

Many of the ports on the shores of the Great Lakes of North America also furnish examples of lateral breakwater protection as, for instance, Chicago, Buffalo, Port Arthur and Toronto. American lake breakwaters are commonly formed of rubble stone mounds or of timber cribwork filled with stone (*see* BREAKWATER). Breakwaters made in comparatively sheltered positions such as these are naturally of less massive construction than those required in situations exposed to the full force of ocean waves.

Entrances.—Seamen always wish for a wide entrance to a harbour as giving greater facility for safe access; on the other hand, it is important to keep the width as narrow as practicable consistent with easy access, to exclude waves and swell as much as possible and secure tranquillity inside The result of this conflict is often a compromise. Examples which illustrate the divergence of practice in the dimensions of entrances to artificial harbours have already been mentioned; these differences are mainly due to the equally wide variations in circumstances and exposure, and no generally applicable rule or guiding principle can be formulated, though some authorities maintain that the space between breakwater heads should never be less than the over-all length of the largest vessel expected to enter the port The advantages which can sometimes be secured by overlapping breakwaters, covering island breakwaters and double entrances, have already been mentioned; on one point, however, there can be no difference of opinion; that is, the increasing length and beam of ocean-going vessels require the provision of entrances of ample width, and the more exposed such entrances are to heavy cross seas and strong cross currents the wider they must be in the interests of the navigator. The difficult nature of the present Durban entrance is an example of this In tidal harbours, and in those with a large volume of river water discharge, an undue restriction of the width of the entrance may produce a current unsafe for navigation. A strong outgoing stream meeting on-shore waves at an entrance is bound to increase the turbulence and create a dangerous sea at a critical point.

The Natural Harbours of America.—The North American continent is well endowed with naturally sheltered harbours in positions where they serve the necessities of sea-borne trade In the United States deep water river harbours meet these needs at such ports as New York, at the mouth of the Hudson; Philadelphia, on the Delaware, 88 nautical miles from the sea entrance to Delaware Bay; Portland and Astoria (Oregon), on the Columbia, where, however, dredging has been necessary to deepen parts of the river; and Newport News and other places on the James river, Virginia. Deep land-locked bays or sea inlets provide the harbours of Baltimore, at the head of Chesapeake Bay; Portland (Maine); Boston; and San Francisco; and those at Seattle, Tacoma and other ports in Puget Sound.

Two of the most important Canadian ports, Montreal and Quebec, are situated on the magnificent river St. Lawrence, the former 550 m. from the Gulf of St Lawrence. Halifax in Nova Scotia is in a large land-locked, deep-water harbour free from ice all the year round. Vancouver harbour, in the sheltered Burrard inlet, is one of the finest on the Pacific coast and is capable of internal development on a large scale. Victoria and Esquimalt harbours are in well protected inlets at the southern end of Vancouver Island; and Prince Rupert, in British Columbia, is a comparatively new deep water port on a narrow and well sheltered arm of the sea.

The finest and most beautifully situated natural harbour in South America is that formed by the land-locked bay of Rio de Janeiro. Buenos Aires, Montevideo and Bahia Blanca are all estuary ports in sheltered positions, but where dredging operations are necessary to form and maintain deep water channels.

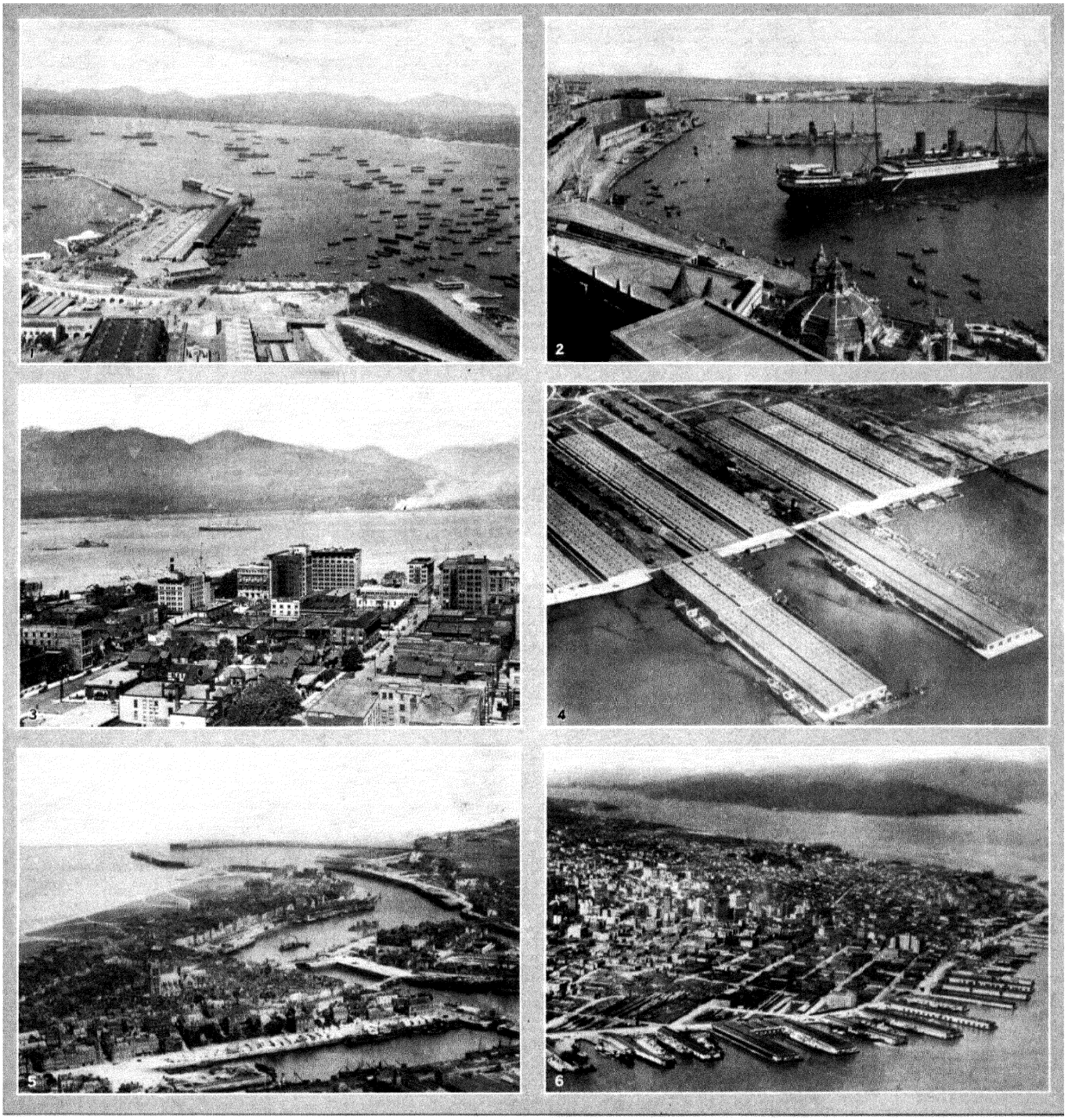
New York Harbour.—The harbour of New York (fig. 4) is one of the most perfect natural havens in the world. It enjoys the advantages of ample water area and depth, shelter, good access, a small tidal range—no more than 5 ft. at springs—and moderate tidal streams. The outer harbour, or Lower Bay, is sheltered by the New Jersey shore and Sandy Hook on one side, and by Long Island on the other. The inner harbour is entered through a channel, called the Narrows, between Staten Island on the W. or New Jersey shore, and Brooklyn on the E. It comprises the deep Upper Bay, the rivers which isolate Manhattan Island, namely, the Hudson, East and Harlem, and numerous bays and creeks of which Newark Bay is the most important. The shore lines, under the jurisdiction of the Port of New York Authority (constituted in 1921), have a combined length of over 480 m., and, if the total berthing space of the piers be added, this figure is increased by about 150 m. Excluding the Lower Bay, the sheltered water area within the jurisdiction of the Port Authority is approximately 150 sq m In recent years the development of the trade of the port has led to the building of shipping piers on an extensive scale in positions remote from the old centre of trade in Manhattan Island. In this way Staten Island, Jersey City, Newark and the Long Island shores have become busy centres of maritime trade More recently still, Jamaica Bay, a sheltered inlet on the S. side of Long Island with access direct from the Lower Bay, has been developed as a new centre of port activity.

The entrance to the Lower Bay is open to the Atlantic, but shelter is afforded by outlying sandbanks Sandy Hook itself is a long, low spit of sand. Until about 1885 the natural channels through the banks afforded, when suitably marked and buoyed, ample depth and width for all ships using the port. The subsequent deepening of the sea channels, consequent on the growth in the dimensions of transatlantic vessels, has already been referred to. The depths in the sea approaches are now maintained by periodical suction dredging.

The entrance to the harbour through Long Island Sound from the N. and E. is sheltered, but the channel is obstructed by rocky islets and reefs The navigation of this approach was at one time difficult and even dangerous, but it has been much improved by the removal of many of the rocks by blasting and dredging, notably in the neighbourhood of Hell Gate. The Federal authorities, who are responsible for the improvement and maintenance of channels and all aids to navigation in United States harbours and navigable rivers, are now (1928) engaged in still further improving the channels of the Sound and East river, and a low-water depth of 40 ft. over a width of 1,000 ft. is aimed at. A large proportion of the berths alongside piers and wharves in New York harbour have depths of 30 ft. or more at low-water and in some of them more than 40 ft. depth is available.

San Francisco —The land-locked bay of San Francisco is 55 m. long and has a water area of about 420 sq.m with about 200 m. of shore line. Two large rivers, the Sacramento and San Joaquin, flow into it. The entrance to the bay, known as the Golden Gate, is a mile wide and has a greatest depth of 360 ft.; but a bar outside the Golden Gate has a minimum natural depth over it of 33 ft. at high water (springs rise 5½ ft.). The dredging of a channel, 40 ft. deep at low water, through this bar was done in 1924–26. There is also a comparatively narrow channel—the North or Bonita channel—affording an entrance to the harbour, which has a natural depth of 54 feet. The usual American plan of waterfront piers has been followed in the development of the port works at San Francisco.

The Natural Harbours of Australasia.—Some of the most important harbours of Australia and most of the frequented harbours in New Zealand are of natural formation. Pre-eminent is the great land-locked harbour of *Sydney*, one of the finest and most beautiful in the world. No artificial protection is required and no deepening or enlargement of its entrance channel has been necessary to meet the needs of the largest ships. The outer entrance, facing S.E. between two bluffs, known as the north and south Heads, is less than a mile in width at its narrow-



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NATURAL AND JETTY HARBOURS OF EUROPE AND AMERICA

1. View of Gibraltar harbour on the bay of Algeciras, showing commercial moles used as a wharf for naval destroyers, and one of the three breakwaters, two of which are connected with the shore on north and south. The third, a detached mole (not shown), is on the west. The port has been valued chiefly as a naval harbour
2. Grand harbour of Valetta, Malta, a bay harbour further protected by two breakwaters. It affords anchorage for the largest war vessels
3. Vancouver, B.C., Canada's chief western port and one of the finest natural harbours on the Pacific coast. Situated on Burrard inlet, an arm of the strait of Georgia, it is the principal westward outlet of Alberta's wheat crop and is served by many steamship lines
4. Army and navy supply base in Hampton Roads, Norfolk, Va., a natural harbour large enough to accommodate 1,000 vessels. The base was established in 1917 and represents an investment of $30,000,000. It has been leased by the city
5. Aerial view of Dieppe, France, on the English Channel. The entrance from the outer harbour is protected by jetties (background) and leads into the winding Arques river along which are quays for the accommodation of vessels drawing up to 20 feet
6. View of waterfront, San Francisco, showing the Golden Gate (above), the entrance to San Francisco bay, a natural land-locked harbour 55 miles long and well equipped with docking and berthing facilities

est part and has a minimum depth in the channel, nearly ½ m. wide, of 84 feet. The outer part of the harbour is known as Port Jackson, so named by Captain Cook in 1770. Its shores, as well as those of the upper harbour near and above Sydney, are indented by many sheltered coves. The tidal rise is about 5 ft. at springs and shipping is berthed at open piers. The trade of the port is large, Sydney ranking fifth among the empire ports in this respect. Although only 12 m. in a straight line from the Heads to the upper limit of the harbour, the total length of the indented shore line is 188 miles. Of its water area of 23 sq m. nearly 5 sq.m. have a depth of over 35 ft. at low water. Channels 40 ft. deep have been dredged where necessary to give access to the overseas piers some of which have berths 45 ft deep at low water.

Melbourne is less fortunately placed than is Sydney, for the city itself is situated on the shallow river Yarra, which discharges into the large land-locked Port Philip Bay. In its natural state the river had a depth of little more than 13 feet. In recent years dredging at the entrance to the bay and in the approach channels to the wharves at Hobson Bay has increased the minimum depth at low water to 34 feet.

Tasmania has several fine natural harbours. *Hobart* is a port on the wide 60 ft. deep river Derwent. There is a perfect approach to the river entrance; no dredging is required; open jetties furnish all the needs of shipping and the capacity for extension is almost unlimited. The Tamar provides in its lower reaches a sheltered deep water harbour for the port of *Launceston.*

New Zealand is rich in good natural harbours. *Port Lyttleton* in the South Island is a sheltered deep water inlet with no bar. Dredging has only been required to deepen and maintain a channel in the approaches to the inner harbour. *Wellington*, at the southern end of the North Island, is a splendid land-locked harbour with over 30 sq m. of sheltered water, from 6 to 14 fathoms in depth. The entrance is 3,600 ft. in width with a depth of 42 ft. at low water. Open wharves, most of which have a low water depth of over 30 ft , and some as much as 36 ft., project from the shores of the inner or Lambton harbour. *Auckland* harbour, also in the North Island, is an arm of the sea, with an entrance over ½ m. wide, well protected by outlying islands, providing deep water accommodation for the largest vessels.

The Harbours of the East.—The great majority of the important harbours east of Suez are natural havens Some possess such advantages of depth and shelter that little more than the provision of wharves and other internal port works has been necessary to convert them into first class ports. In others dredging and river training works have been required. Great artificial harbour works in exposed situations such as those at Colombo and Madras are rare in the East; but harbour works on a very large scale have been made in recent years in sheltered waters, particularly in Japan and the Dutch East Indies and at Singapore. A few only of the more important harbours not already referred to can be mentioned here. The harbour of *Bombay* is a well sheltered arm of the sea situated between the island of Bombay and the mainland. *Calcutta* and *Rangoon* are river ports in both of which sand bars and shoals are serious problems (*see* RIVER ENGINEERING); *Singapore,* one of the greatest trading ports of the east, occupies a sheltered position, protected by outlying islands and shoals, with a deep water anchorage. The new naval base is being made in and on the shores of the channel which separates the island of Singapore from the mainland of Johore (*see* DOCKS). *Hongkong* island is situated at the mouth of the Canton river Between it and the mainland at Kowloon is a natural and well sheltered deep-water harbour of great extent. *Kobe* and *Osaka* are large breakwater harbours in sheltered positions in the inland sea of Japan. *Yokohama,* the principal port of Japan, is in the land-locked bay of Tokyo. The port works, including the breakwaters over 12,00 ft. in total length, were partially wrecked by the great earthquake of Sept. 1, 1923, but all the damage has been made good and large additions are being made to the harbour accommodation. *Dairen,* the principal port of Manchuria, has been energetically developed in recent years by the Japanese. It is in a sheltered bay where two island breakwaters and two breakwaters projected from the shore, having a total length of over 2½ m., cover a protected water area of 780 acres. At *Manila,* in the Philippines, breakwaters have been made in an almost land-locked bay to protect a harbour of 1,250 acres.

BIBLIOGRAPHY.—*See* the lists of authorities quoted under BREAKWATERS and DOCKS. The latest series of Sailing Directions published, with annual supplements, by the Hydrographic Department of the Admiralty contains full descriptions of the harbours of the world, and the Admiralty Charts include large scale plans of most of them. (N. G. G.)

HARBURG, a seaport town in the Prussian province of Hanover, on the left bank of the southern arm of the Elbe, 6 m. by rail S. of Hamburg. Pop. (1925) 72,947.

Harburg belonged originally to the bishopric of Bremen, and received municipal rights in 1297. In 1376 it was united to the principality of Luneburg, along with which it fell in 1705 to Hanover, and in 1806 to Prussia. It is situated at the junction of the main lines of railway from Bremen and Hanover to Hamburg. It possesses a palace, which from 1524 to 1642 was the residence of the Harburg line of the house of Brunswick. The leading industries are the crushing of palm-kernels, for which it is famous, and linseed and the manufacture of india-rubber, gutta-percha, phosphates, nitrate and jute. Machines are manufactured here; beer is brewed, and shipbuilding is carried on

HARCOURT, a noble French family which took its name from the village of Harcourt (Eure), and traces its origin back to the 11th century. The fief of Harcourt was raised to a countship in 1338, and passed in the 15th century, by a marriage, into the house of Lorraine. HENRI DE LORRAINE, COMTE D'HARCOURT (1601–1666), nicknamed Cadet la perle, fought in Italy against Spain in 1639, and captured Turin He took sides with Condé in the Fronde, but made his submission in 1654.

The most distinguished among the younger branches of the family are those of Montgomery and of Beuvron. To the former belonged Jean d'Harcourt (d. 1452), bishop of Amiens and Tournai, archbishop of Narbonne and patriarch of Antioch; and Guillaume d'Harcourt, count of Tancarville, and viscount of Melun (d. 1487), who was head of the administration of the woods and forests in the royal domain.

From the branch of the marquises of Beuvron sprang Henri d'Harcourt, marshal of France, and ambassador at the Spanish court, who was made duke of Harcourt (1700) and a peer of France (1709); also François Eugène Gabriel, count, and afterwards duke, of Harcourt, who was ambassador first in Spain, and later at Rome, and died in 1865

The English family of Harcourts trace their descent to Ivo de Harcourt, son of William de Harcourt who acquired English land at the date of the Conquest

See G. A de la Rogne, *Histoire généalogique de la maison d'Harcourt* (4 vols., 1662); P. Anselme, *Histoire généalogique de la maison de France,* v. 114, etc.; and Dom le Noir, *Preuves généalogiques et historiques de la maison de Harcourt* (1907); and the HARCOURT PAPERS.

HARCOURT, LEWIS VERNON HARCOURT, 1ST VISCOUNT (1863–1922), British politician, was born in London on Feb. 1, 1863, the elder son of Sir William Harcourt (*q.v.*). He was educated at Eton and afterwards travelled, becoming well known for his interest in art In 1809 he married the only daughter of Walter H. Burns, of New York. From 1904 to 1916 he was Liberal M P. for the Rossendale division of Lancs., and on the formation of Sir Henry Campbell-Bannerman's Government (1905) he became first commissioner of works. In 1910 he became secretary of State for the colonies in the Asquith Cabinet, and on the formation of the Coalition Government in 1915 again became first commissioner of works. In 1917 he was raised to the peerage. He died in London on Feb. 24, 1922, being succeeded in the title by his son, William Edward Harcourt (b. 1908).

HARCOURT, SIMON HARCOURT (*c.* 1661–1727), 1ST VISCOUNT, lord chancellor of England, only son of Sir Philip Harcourt of Stanton Harcourt, Oxfordshire. On the accession of George I. he was deprived of office and retired to Cokethorpe, where he enjoyed the society of men of letters, Swift, Pope, Prior and other famous writers being among his frequent guests With Swift, however, he had occasional quarrels, during one of which the great satirist bestowed on him the sobriquet of "Trimming Harcourt." In 1721 Harcourt was created a viscount and returned

to the privy council; and on several occasions during the king's absences from England he was on the council of regency. He died in London on July 23, 1727.

HARCOURT, SIR WILLIAM GEORGE GRANVILLE VENABLES VERNON (1827–1904), English statesman, was the second son of Canon William Vernon, who took the name of Harcourt on the succession of his father Edward, Archbishop of York to the Harcourt estates in 1830 Canon Harcourt is separately noticed William was born at the Old Residence, York, on Oct. 14, 1827. He was educated privately at Dumford, near Salisbury, and at Preston, where he witnessed the bread riots of 1842 From his tutor at Preston he went up to Trinity college, Cambridge, graduating with a first in classics and a senior optime in the mathematical tripos. He was a member of the famous Society of the Apostles at Cambridge, and among his close friends were Fitzjames Stephen and Julian Fane. He was called to the bar at the Inner Temple in 1854, became a Q C. in 1866, and was appointed Whewell professor of international law, Cambridge, 1869. He quickly made his mark in London society as a brilliant talker; he wrote for *The Morning Chronicle* and *Saturday Review*, and began in 1862 to write letters to *The Times* over the signature of "Historicus" on questions of international law arising out of the American Civil War. The earlier letters were directed against the recognition of the Southern States as belligerents in the American Civil War and towards defining the duties of neutrality on the part of England. These letters had a profound effect on public opinion. He maintained that the launching of the "Alabama" was an illegal act, and throughout the period was in close touch with Lord John Russell and Lord Clarendon.

He entered parliament as Liberal member for Oxford, and sat from 1868 to 1880, when, upon seeking re-election after acceptance of office, he was defeated by Hall. A seat was, however, found for him at Derby, by the voluntary retirement of Plimsoll, and he continued to represent that constituency until 1895, when, having been defeated at the general election, he found a seat in West Monmouthshire He was appointed solicitor-general and knighted in 1873; and, although he had not shown himself a very strenuous supporter of Gladstone during that statesman's exclusion from power, he became secretary of state for the home department on the return of the Liberals to office in 1880. His name was connected at that time with the passing of the Ground Game Act (1880), the Arms (Ireland) Act (1881), and the Explosives Act (1883). As home secretary at the time of the dynamite outrages he acted promptly, and the Explosives Act was passed through all its stages in the shortest time on record He was constantly in conflict with the Irish members in the House of Commons. In 1884 he introduced an abortive bill for unifying the municipal administration of London. He was indeed at that time recognized as one of the ablest and most effective leaders of the Liberal party; and when, after a brief interval in 1885, Gladstone returned to office in 1886, he was made chancellor of the exchequer. The government fell on the Home Rule queston in July. In Jan. 1887 Harcourt, who had been a close ally of Joseph Chamberlain before the split in the Liberal party over Home Rule, now made an effort to secure reunion, and the Round Table Conference of Herschell, Harcourt, Morley, Chamberlain and Trevelyan met at his house. It failed disastrously.

Between 1880 and 1892 Harcourt acted as Gladstone's loyal and indefatigable lieutenant in political life. In 1892 he became chancellor of the exchequer for the second time. In 1894 he introduced and carried a memorable budget, which equalized the death duties on real and personal property and put the budget on a basis which enabled it to stand the strain of the South African War. After Gladstone's retirement in 1894 and Lord Rosebery's selection as prime minister, Sir William became the leader of the Liberal party in the House of Commons, but it was never probable that he would work comfortably in the new conditions His title to be regarded as Gladstone's successor had been too lightly ignored, and from the first it was evident that Lord Rosebery's ideas of Liberalism and of the policy of the Liberal party were not those of Harcourt. Their acute differences were patched up from time to time, but the combination could not last. At the general election of 1895 the divisions in the party were obvious. The effect of Harcourt's abortive Local Veto Bill on the election was seen in his defeat at Derby, which gave the signal for the Liberal rout. In Dec. 1898 the crisis arrived, and he resigned his leadership of the opposition, alleging as his reason, in letters exchanged between John Morley and himself, the cross-currents of opinion among his old supporters and former colleagues.

Harcourt strongly condemned the government's financial policy and their attitude towards the Transvaal in 1899–1900; and was a constant critic of Chamberlain's policy At this time he engaged in a violent controversy, conducted in letters to *The Times*, against ritualism in the Church of England. His last great political effort was against Chamberlain's tariff reform proposals. In March 1904, just after he had announced his intention not to seek election again to parliament, he succeeded, by the death of his nephew, to the family estates at Nuneham. But he died suddenly there on Oct. 1 in the same year. He married, first, in 1859, Thérèse Lister (d. 1863), a niece of the 4th Lord Clarendon (*q.v.*), by whom he had one son, Lewis Vernon Harcourt (*q.v.*); and secondly, in 1876, Elizabeth, widow of T. Ives and daughter of J. L. Motley, the historian, by whom he had another son, Robert (b. 1878). Lady Harcourt survived until 1928.

Sir William Harcourt was one of the great parliamentary figures of the Gladstonian Liberal period He was essentially an aristocratic type of the late 19th century Whig, with a remarkable capacity for popular campaign fighting He had been, and remained, a brilliant journalist in the non-professional sense He was one of those who really made the *Saturday Review* in its palmy days, and the "Historicus" letters on international law published in *The Times* showed him to be a great international lawyer In later years he found himself somewhat isolated and disappointed. A tall, fine man, with the grand manner, he was, throughout a long career, a great personality in the life of his time.

See A. G. Gardiner, *The Life of Sir William Harcourt* (2 vol., 1923).

HARCOURT, WILLIAM VERNON (1789–1871), founder of the British Association, was born at Sudbury, Derbyshire, in 1789, a younger son of Edward Vernon [Harcourt], archbishop of York. He served for five years in the British navy and then went up to Christ Church, Oxford, took holy orders, and held a living at Bishopthorpe, Yorkshire. He was one of the founders of the Yorkshire Philosophical Society and its first president. The laws and the plan of proceedings for the British Association for the Advancement of Science were drawn up by him; and Harcourt was elected president in 1839. In 1824 he became canon of York and in 1837 rector of Bolton Percy. His spare time until quite late in life was occupied with scientific experiments. Inheriting the Harcourt estates in Oxfordshire from his brother in 1861, he removed to Nuneham, where he died in April 1871.

HARDANGER FJORD, an inlet on the west coast of Norway, penetrating 70 m. inland apart from the deep fringe of islands off its mouth, the distance from the sea to the head of the fjord being 114 miles. Its extreme depth is about 350 fathoms. With Torö at the entrance, the general direction is north-east from that point. Magnificent mountains, from which pour many waterfalls flank the fjord. The main fjord is divided into parts under different names, and there are many fine branch fjords. The fjord is frequented by tourists, and the principal stations have hotels. The outer fjord is called the Kvindherredsfjord, flanked by the Melderskin (4,680 ft.); then follow Sildefjord and Bonde Sund, separated by Varalds island. Here Mauranger-fjord opens on the east; from Sundal on this inlet the great Folgefond snowfield may be crossed. Bakke and Vikingnaes are stations on Hisfjord, Nordheimsund and Östensö on Ytre Samlen, which throws off a fine narrow branch northward, the Fikensund. There follow Indre Samlen and Utnefjord, with the station of Utne opposite Oxen (4,120 ft.), and its northward branch, Gravenfjord, with the beautiful station of Eide at its head, whence a road runs north-west to Vossevangen. From the Utne terminal branches of the fjord run south and east; the

Sörfjord, steeply walled by the heights of the Folgefond, with the frequented resort of Odde at its head; and the Eidfjord, with its branch Osefjord, terminating beneath a tremendous rampart of mountains, through which the sombre Simedal penetrates. Vik is the principal station on Eidfjord, and Ulvik on a branch of the Ose, with a road to Vossevangen. A small stream entering Sörfjord forms in its upper course the Skjaeggedalsfos, of equal height with the Vöringfos, and hardly less beautiful.

HARDCORE, a term applied in the building and contracting trades to any clean hard material, other than gravel, suitable for making up roads, pathways, the solid ground floors of buildings, etc. Thus broken bricks or stone, broken up concrete, etc., are all used as hardcore. Material for good work should be clean and entirely free from organic matter. The rise of wages since 1913 has greatly increased the cost of hardcore, as so much labour has to be expended in preparing and transporting it. In 1928 a cubic yard of clean hardcore in London cost six shillings delivered.

HARDEE, WILLIAM JOSEPH (1815–1873), American soldier, was born in Savannah, Ga., on Nov. 10, 1815 and graduated from West Point in 1838. As a subaltern of cavalry he was employed in 1839 on a special mission to Europe to study the cavalry methods in vogue He was promoted captain in 1844 and served with distinction under Generals Taylor and Scott in the Mexican War After the war he served as a substantive major of cavalry under Col Sidney Johnston and Lieut. Col Robert E Lee. For some time before 1856 he was engaged in compiling the official manual of infantry drill and tactics which, familiarly called "Hardee's Tactics," afterwards formed the text-book for the infantry arm in both the Federal and the Confederate armies. From 1856 to 1861 he was commandant of West Point, resigning his commission on the secession of his State in the latter year. Entering the Confederate service as a colonel, he was shortly promoted brigadier-general. He distinguished himself greatly by his tactical leadership on the field of Shiloh, and was immediately promoted major-general As a corps commander he fought under Gen. Bragg at Perryville and Stone river, and for his distinguished services in these battles was promoted lieutenant-general. He served in the latter part of the campaign of 1863 under Bragg and in that of 1864 under J. E Johnston. When the Civil War came to an end in 1865 he retired to his plantation near Selma, Alabama. He died at Wytheville, Va., on Nov. 6, 1873

See James Kendall Hosmer, *Outcome of the Civil War,* "American Nation" series, vol. xxi. (1907).

HARDEN, MAXIMILIAN (1861–1927), German journalist, founder and editor of *Die Zukunft,* was born in Berlin on Oct. 20, 1861. He commenced journalism as a keen admirer of Bismarck, and *Die Zukunft,* founded in 1892, made its name by its attacks on the court camarilla, which resulted in a prosecution for libel in 1907. Harden's statements proved to be justified, and Count Kuno von Moltke, who had instituted the prosecution, withdrew from the case and Prince P. Eulenburg fled the country. During the war Harden was a candid critic of the German Government and the German high command. He was just as unsparing in his criticisms of the German revolutionary government and of subsequent administrations. He died on Oct. 30, 1927.

Many of his writings and essays were published under the title of *"Kopfe"* (1910–24, 4 vols.). See *Kautsky and Harden,* by H. Delbruck (1920).

HARDENBERG, KARL AUGUST VON, Prince (1750–1822), Prussian statesman, was born at Essenroda, Hanover, on May 31, 1750. He studied at Leipzig and Göttingen, and entered the Hanoverian civil service in 1770. Finding the promotion slow, he spent some time in travel, visiting the South German courts and those of France, Holland and England. On his return he married the countess Reventlow, became privy councillor and a count. He then went to London in the hope of obtaining the post of Hanoverian envoy there, but his wife formed a liaison with the prince of Wales, and he was forced to leave the Hanoverian service. He entered (1782) that of Brunswick, but here again his wife's conduct made his position untenable. They were divorced, and he then married a divorced woman. In 1792 Hardenberg was made administrator of the principalities of Ansbach and Bayreuth, which had just fallen to Prussia. He filled this difficult office with great skill, and used it to expand Prussian influence in South Germany. He then received a rising commission as Prussian envoy to the Rhenish courts, and presently succeeded Count Goltz as Prussian plenipotentiary at Basle where he signed (Feb. 28, 1795) the treaty with France.

In 1797, on the accession of Frederick William III., Hardenberg became a member of the Prussian cabinet He acted as deputy for the foreign minister, Hangwitz, in 1803, and in 1804 succeeded him. The king desired to continue the policy of Prussian neutrality, though he had made an agreement with Russia to take up arms in case of further aggression by Napoleon in north Germany If there was to be war, Hardenberg would have preferred the French alliance, which was the price Napoleon demanded for the cession of Hanover to Prussia; for the Eastern Powers would scarcely have conceded, of their free will, so great an augmentation of Prussian power. But he still hoped to gain the coveted prize by diplomacy, backed by the veiled threat of an armed neutrality. Napoleon's contemptuous violation of Prussian territory by marching three French corps through Ansbach turned the scale, and the king signed (Nov 3) with the tsar Alexander the terms of an ultimatum to be laid before the French emperor. The battle of Austerlitz, however, compelled submission. Prussia, indeed, by the treaty signed at Schönbrunn on Dec. 15, 1805, received Hanover, but in return for all her territories in South Germany. One condition of this arrangement was the retirement of Hardenberg, whom Napoleon disliked. He was again foreign minister for a few months after the crisis of 1806 (April–July 1807); but Napoleon's resentment was implacable, and one of the conditions of the terms granted to Prussia by the Treaty of Tilsit was Hardenberg's dismissal.

After the enforced retirement of Stein in 1810 and the interlude of the feeble Altenstein ministry, Hardenberg was again summoned to Berlin, this time as chancellor (June 6, 1810). The campaign of Jena had profoundly affected him. He broke with the old diplomacy, and was inspired with a passionate desire to restore the position of Prussia and crush her oppressors. In his retirement at Riga he had worked out a plan for reconstructing the monarchy on Liberal lines; and though circumstances did not admit of his pursuing an independent foreign policy, he prepared for the struggle with France by carrying out Stein's far-reaching schemes of social and political reorganization. The military system was completely reformed, serfdom was abolished, municipal institutions were fostered, the civil service was thrown open to all classes, and great attention was devoted to the educational needs of every section of the community

After the Moscow campaign of 1812, Hardenberg, supported by the noble Queen Louise, determined Frederick William to take advantage of Gen. Yorck's loyal disloyalty, and declare against France. He was rightly regarded by German patriots as the statesman who had done most to encourage the spirit of national independence; and immediately after he had signed the first Peace of Paris he was raised to the rank of prince (June 3, 1814) in recognition of the part he had played in the War of Liberation.

Hardenberg now had an assured position in that close corporation of sovereigns and statesmen by whom Europe, during the next few years, was to be governed. He accompanied the allied sovereigns to England, and at the congress of Vienna (1814–15) was the chief plenipotentiary of Prussia. But from this time the zenith of his influence, if not of his fame, was passed. In diplomacy he was no match for Metternich At Vienna, in spite of the powerful backing of Alexander of Russia, he failed to secure the annexation of the whole of Saxony to Prussia; at Paris, after Waterloo, he failed to carry through his views as to the further dismemberment of France; he had weakly allowed Metternich to forestall him in making terms with the States of the Confederation of the Rhine, which secured to Austria the preponderance in the German federal diet; on the eve of the conference of Carlsbad (1819) he signed a convention with Metternich, by which—to quote the historian Treitschke—"like a penitent sinner, without any formal *quid pro quo,* the monarchy of Frederick the Great yielded to a foreign Power a voice in her internal affairs."

At the congresses of Aix-la-Chapelle, Troppau, Laibach and Verona the voice of Hardenberg was but an echo of that of Metternich

The cause lay partly in the difficult circumstances of the loosely-knit Prussian monarchy, but partly in Hardenberg's character, which had deteriorated with age. He continued amiable, charming and enlightened as ever; but the excesses which had been pardonable in a young diplomatist were a scandal in an elderly chancellor, and could not but weaken his influence with so pious a *Landesvater* as Frederick William III. Hardenberg clung to office, and when the tide turned strongly against Liberalism he allowed himself to drift with it. He died at Genoa, on Nov. 26, 1822.

See L. v. Ranke, *Denkwurdigkeiten des Staatskanzlers Fursten von Hardenberg* (5 vols., Leipzig, 1877); J. R. Seeley, *The Life and Times of Stein* (3 vols., Cambridge, 1878), E. Meier, *Reform der Verwaltungsorganisation unter Stein und Hardenberg* (*ib.*, 1881); Chr. Meyer, *Hardenberg und seine Verwaltung der Furstentumer Ansbach und Bayreuth* (Breslau, 1892); Koser, *Die Neuordnung des preussischen Archivwesens durch den Staatkanzler Fursten v. Hardenberg* (Leipzig, 1904), F. Hartung, *Hardenberg und die preussische Verwaltung in Ansbach-Bayreuth, 1792-1806* (1906); P. Haake, *Der preussische Verfassungskampf vor hundert Jahren* (1921)

HARDENING. In metallurgy this term has two meanings. First, the hardening of tool-steel throughout in order to fit it for cutting purposes, or to withstand wear when used as a pin, roller, cam, tappet, etc. Second, the surface or case-hardening or carburising of wrought-iron or mild-steel to give it a hard skin suitable for wearing purposes. The first-named treatment is performed by heating the steel to a red or white heat and cooling in water, oil, lead, mercury or in air or a blast according to circumstances. The second by heating the article in a furnace in contact with a case-hardening material which thus penetrates and adds carbon to the surface, and then quenching the steel while red hot. Leather cuttings, hoof parings, horns, bones are packed in a box with the steel and put in the furnace for a period, or a prepared powder is used instead of those substances. The furnaces are much the same as those described under ANNEALING. The principal difficulties to contend with in the process are cracking in the case of tool-steels, and warping in case-hardening. *See* TEMPERING.

HARDERWYK, a seaport in the province of Gelderland, Holland, on the shores of the Zuider Zee, 17 m. by rail N.N.E. of Amersfoort. Pop. (1926) 8,701. It is a quaint old town, standing in the midst of a patch of fertile ground. Harderwyk is a depot for recruits for the Dutch colonial army and contains a small fort and barracks. The principal buildings are the town hall, with some ancient furniture, and a large 15th century church with a notable square tower. Agriculture, fishing, and a few domestic industries form the only employment of the inhabitants. As a seaport its trade is now confined exclusively to the Zuider Zee.



BY COURTESY OF THE WILD FLOWER PRESERVATION SOCIETY

HARDHACK (SPIRAEA TOMENTOSA), A PLANT WHOSE ROOTS ARE SOMETIMES USED AS AN ASTRINGENT AND THE FLOWERS USED AS TONIC

HARDHACK (*Spiraea tomentosa*), a North American shrub of the rose family (Rosaceae), called also steeple-bush, native to open grounds from Nova Scotia to Manitoba and southward to Georgia and Kansas. It has an upright, woolly, reddish-brown stem, 2 to 4 ft. high, bearing ovate, pointed, sharply-toothed leaves, which are greyish or yellowish woolly beneath, and a slender, steeple-like flower-spike crowded with tiny deep pink flowers, blooming in late summer. The hardhack, which is sometimes planted for ornament, is especially abundant in eastern New York and New England, where in many localities it occurs in weedlike profusion, becoming pestiferous in meadows and pastures. (*See* SPIRAEA.)

HARDICANUTE [more correctly HARTHACNUT] (*c.* 1019–1042), son of Canute, king of England, by his wife Emma. On the death of Canute in 1035 the claims of Hardicanute were supported by Emma and her ally, Godwine, earl of the West Saxons, in opposition to those of Harold, Canute's illegitimate son, who was backed by the Mercian earl Leofric and the chief men of the north. Godwine held Wessex for a time on Hardicanute's behalf. Harold's party rapidly increased; and early in 1037 he was definitely elected king. Emma was driven out and took refuge at Bruges. In 1039 Hardicanute joined her, and together they concerted an attack on England. Next year Harold died; and Hardicanute succeeded. His short reign was marked by great oppression and cruelty. He caused the dead body of Harold to be dug up and thrown into a fen; the exaction of a heavy geld for the support of his foreign fleet in Worcestershire, provoked a rising whereupon he burned the city of Worcester to the ground and devastated the surrounding country; in 1041 he permitted Edwulf, earl of Northumbria, to be treacherously murdered after having granted him a safe-conduct. He died on June 8, 1042.

HARDIE, JAMES KEIR (1856–1915), British Labour leader, was born on Aug. 15, 1856, at Legbrannock, Lanarkshire. His early life was one of great hardship, he was employed in the mines from the age of ten. Originally a Liberal in politics, he started, with some friends, in 1887 the *Miner*, afterwards the *Labour Leader*, the first Socialist paper in western Scotland. In the same year he opened the attack, as delegate of the Ayrshire miners at the Trades Union Congress, upon the dominant Liberal members of the parliamentary committee, and continued this struggle, in which his chief allies were John Burns and Tom Mann, up to the decisive defeat of Henry Broadhurst, M.P., his chief opponent, at the Liverpool Congress in 1890. In 1888 he entered politics as an "Independent Labour" candidate for Mid-Lanark, polling only 617 votes; in 1892 he was elected on the same programme for South West Ham, but did not retain the seat in 1895. In 1900 he was elected for Merthyr. He was very largely responsible for the foundation of the Scottish Labour Party in 1888, and the Independent Labour Party (I.L.P.) in 1893. His first great triumph came in 1899, when the Trades Union Congress was induced to authorize the formation of labour representation committees in conjunction with the I.L.P. and other Socialist bodies. Socialist-Labour candidates were, for the first time, run systematically at the ensuing election, and at the 1906 election 29 were returned to parliament. This number was raised to over 40, but the Socialist character of the party was "diluted" by the adhesion *en bloc* of most of the Liberal miners' M.P.'s. Hardie was selected as first chairman, and during the years before the World War had as chief tasks firstly, the persuading of the Liberal trade union representatives to advance further on the Socialist path; secondly, the extension of Socialism by public propaganda outside. In attempting these, he was severely criticized by the Social-Democrats as compromising and muddled in theory; for the right wing of the Labour Party he was too rugged. But there was no doubt of his success, as chief propagandist for the I.L.P., in spreading Socialist tenets in every manufacturing and mining district, until, in 1914, there was scarcely a big industrial town in which there was not a powerful and active I.L.P. or other Socialist branch. For such pioneer work his strong personality, his unquestioned honesty and his lovable character notably fitted him.

In concert with Edouard Vaillant he had made a vain endeavour to bind the Socialist International to calling a general strike in the event of war. The complete failure of this body to act in 1914 was a great disappointment to Hardie; the progress of the war seemed to be undoing his life's work; depression and dejection hastened his death in 1915.

See W. Stewart, *J. Keir Hardie* (1921); D. Lowe, *From Pit to Parliament* (1923).

HARDING, CHESTER (1792–1866), American portrait painter, was born at Conway, Mass., on Sept. 1, 1792. Brought

up in the wilderness of New York State, Harding, as a lad of splendid physique, standing over 6ft. 3in., marched as a drummer with the militia to the St. Lawrence in 1813. He became subsequently chairmaker, peddler, innkeeper, and house-painter, painting signs in Pittsburgh, Pa., and eventually going on the road, self-taught, as an itinerant portrait painter. He made enough money to take him to the schools at the Philadelphia Academy of Design, and he soon became proficient enough to gain a competency, so that later he went to England and set up a studio in London. There he met with great success, painting royalty and the nobility, and, despite the lack of education in boyhood, and social experience, he became a favourite in all circles. Returning to the United States, he settled in Boston and painted portraits of many of the prominent men and women of his time. He died on April 1, 1866.

HARDING, WARREN GAMALIEL (1865–1923), 29th President of the United States, was born at Corsica (then Blooming Grove), Morrow county, Ohio, on Nov. 2, 1865, son of George Tyron Harding, a farmer and country doctor, and Phebe Elizabeth Dickerson. He studied in the common schools, and from 14 to 17 at the Ohio Central college at Iberia. He taught in a country school for a year, read law for a short time, worked in a newspaper office and in 1884 became editor and proprietor of the *Marion Star*. On July 8, 1891, he married Florence Kling. Having attracted the notice of Senator Joseph B. Foraker, he was encouraged to enter State politics, and was early recognized as an effective speaker. He served two terms in the Ohio senate (1900–04), and during the second was influential in securing Senator Foraker's re-election to the U S Senate. From 1904 to 1906 he was lieutenant-governor of Ohio, but in 1910, when nominated for governor by the Republicans, was defeated by a plurality of 100,000. In the campaign of 1912 his paper supported President Taft. In 1914 he defeated Foraker in the Republican primaries as candidate for the U S. Senate, and was elected with a majority of 100,000 for the term of 1915–21; his friendship with Foraker remained unchanged.

In 1916 Mr. Harding was delegate-at-large from Ohio to the Republican National Convention, of which he was chosen permanent chairman In the Senate he was regarded as a "safe" man, who could be relied upon to support orthodox Republican policies. In 1915 he urged "preparedness" for naval defence. In 1916 he voted against the confirmation of Louis D. Brandeis as associate justice of the U.S. Supreme Court In 1917 he gave his support to the declaration of war against Germany, and also to all the war measures, including the Selective Draft and Espionage bills. He favoured the death penalty for spies, but after the war advocated amnesty for political prisoners He opposed the suggested Federal control of food and fuel. He favoured the Prohibition amendment and voted for the Volstead Act over the President's veto. He favoured the anti-strike clause of the Cummins Railway bill, and voted for return of the lines to their owners within a year after the end of the war. He was for exempting American shipping from Panama Canal tolls and also supported woman suffrage. He was opposed to the Covenant of the League of Nations, holding that "either the Covenant involves a surrender of national sovereignty and submits our future destiny to the League, or it is an empty thing, big in name, and will ultimately disappoint all of humanity that hinges its hopes upon it." He voted for the Lodge resolution of ratification of the Versailles Treaty, with reservations, and against the Underwood resolution of unconditional ratification. He maintained that Americans should show chief concern for America, and opposed all tendencies toward internationalism. He supported the Knox resolution declaring that war with Germany was ended.

At the Republican National Convention in 1920 Mr. Harding was not at first among the prominent candidates for president. On the first ballot he received 65½ votes (493 being necessary for choice), 39 of these being from his own State. On the eighth ballot he received 133½ votes, on the ninth 374½ votes, and on the tenth he secured the nomination with 692½ votes, the result being due largely to the support of certain influential U.S. Senators, delegates to the convention, who hoped that as president he would be amenable to the Senate. He did not "stump" the country, but conducted his campaign from the "front porch" of his own home. Mr. Harding based his campaign chiefly upon criticism of the Wilson administration, denouncing especially the excessive power that, as he maintained, had been exercised by the executive as a result of war centralization; he demanded as speedy as possible a return to normal conditions, political and industrial.

While opposing the Covenant of the League of Nations, Mr. Harding gave to many of his supporters the impression that he desired an "association of nations," which, without the characteristics of a super-State (such as he believed the League to be), might safeguard peace. But he retained the political support of many who were opposed, like Senators Borah and Johnson, to any sort of international association. In the November elections he won an overwhelming victory over James M. Cox, the Democratic nominee, also from Ohio; he carried, generally by immense majorities, all the northern States and all but one of the States on the border between North and South, and he cut down materially the Democratic majorities in the South The electoral vote was 404 for Harding against 127 for Cox. The popular vote was 16,138,000 for Harding against 9,142,000 for Cox. In Ohio the popular vote was 1,182,000 for Harding against 780,000 for Cox. The sweeping character of his victory was due less to his own personal strength than to the national reaction against the Democratic Party and the popular feeling against President Wilson. Mr. Harding resigned from the U.S Senate in Dec 1920, and was inaugurated on March 4, 1921, the sixth President to come from Ohio.

President Harding's cabinet, like most cabinets, was a *mélange* of men of native ability and political or industrial experience and Party leaders who claimed office as a reward for services rendered the new President. The outstanding names were those of Charles E. Hughes and Herbert C. Hoover, who became Secretary of State and of Commerce respectively. The distinguished career of the former and the widespread confidence in his ability and political integrity had marked him for the most important position in the Cabinet; and there had been a general demand that the new administration should utilize the organizing ability displayed by Hoover in many fields. The choice of Andrew W. Mellon, a wealthy banker and ironmaster of Pittsburgh, as Secretary of the Treasury, was welcomed by men of business. Political and personal debts were paid by the choice of Albert B. Fall as Secretary of the Interior, Harry M. Daugherty as Attorney General and Will H. Hays as Postmaster General. The conduct of administrative and political affairs by these and others less prominent in the new administration, later brought intense criticism upon the President and the Republican Party.

Mr. Harding's inaugural address, and his first message to Congress, delivered in person on April 12, voiced his desire to return to "normalcy," as he expressed it. Retrenchment in expenditure formed a major item in his programme, together with a prompt and thorough revision of taxation. He advocated the adoption of a national budget system, and the Congress having passed a Budget bill similar to that vetoed by Wilson in 1920, he approved it on June 10, 1921; it provided for a Budget Bureau in the Treasury Department and the appointment of a director of the budget, the first being Charles G. Dawes, formerly general purchasing agent of the American Expeditionary Force. President Harding's first budget was presented on Dec. 5, 1921. The President was insistent upon the need of repealing the excess profits taxes and reducing transportation taxes and income surtaxes. The need of financial retrenchment led to his opposing the proposal that war veterans should receive a cash bonus In this matter, as in others, he proved his ability at this early stage to resist political pressure. As regards the tariff he advocated, as a temporary stop-gap, the passing of the emergency tariff, which had been vetoed by President Wilson, but which with slight alteration was approved by Harding on May 27, 1921. He urged the need of adopting a permanent tariff policy, and on Dec. 5, 1921, suggested a "flexible tariff" which might provide for the adjustment of rates to meet unusual and changing conditions. Such

adjustments might be made, in his opinion, by the executive on the advice of the Tariff Commission

As regards domestic legislation, the President, in general, assumed the rôle of moderator. He disclaimed any desire to enlarge the powers and responsibilities of the executive, which, he declared, were already too large; and he aimed at close co-operation with Congress. Foreign policy was largely determined by Hughes, financial by Mellon, and the problem of unemployment was thrown upon Hoover. The President, however, frequently played an active rôle in the conferences necessary to secure general agreement, as on Aug. 9, 1921, when an accord was reached between the Treasury and the Representatives on the taxation plan.

The foreign policy of the administration at first seemed likely to emphasize independence of action, in contradistinction to that of President Wilson; the threatened war between Panama and Costa Rica was prevented by a sharp note from Secretary Hughes; the claims of the Japanese to a mandate over Yap were stoutly denied; the administration refused to follow Great Britain in resuming trade relations with Soviet Russia. President Harding made plain in his first message that the United States would not enter the League of Nations. In rejecting the League Covenant, he said, "we make no surrender of our hope and aim for an association to promote peace, in which we would most heartily join." The President advocated a declaration of peace with Germany by resolution, and the immediate negotiation of a treaty. This policy was adopted by Congress, which agreed upon a joint peace resolution, signed by him on July 2. On Aug. 25, 1921, a treaty with Germany was signed, embodying the President's plan of including most of the stipulations of the Versailles Treaty, but repudiating adherence by the United States to any clause referring to the League of Nations. This treaty and similar pacts with Austria and Hungary were ratified by the Senate on Oct. 18, 1921.

The most important step taken by President Harding during the first year of his administration was the calling of an international conference on the limitation of armaments. On May 25, 1921, the Senate adopted an amendment of Senator Borah to the Navy bill, authorizing and inviting the President to call such a conference. Mr. Harding's preliminary invitations to the principal naval Powers (Great Britain, Japan, France and Italy) were sent July 10, and formal invitations Aug. 11. He indicated his belief that the question was closely connected with the problems of the Pacific and Far East, and invitations were also sent accordingly to China and to the smaller European Powers with Far-Eastern interests—Holland, Belgium and Portugal. The invitations were accepted, and the conference assembled at Washington on Nov. 12. The President made it clear that he regarded the conference merely as a step in securing international understanding and good-will; he advocated the convening of succeeding conferences as a possible means of securing an international association for the promotion of peace, and he approved the principle of substituting an understanding between the United States, Great Britain, France and Japan regarding Far-Eastern problems for the existing Anglo-Japanese Treaty. *See* WASHINGTON CONFERENCE.

The Washington Conference was the highwater mark of the Harding Administration. Thereafter he faced the development of blocs in the Republican Party which destroyed its solidarity, and the growth of criticism which was manifested in the elections of 1922, as a result of which the Republican majority in the House was reduced. The administrative incompetency of office-holders in Washington was widely heralded and there was more than a suspicion of corrupt dealing on the part of cabinet members and their political followers, who were known to be close to the President. Government investigations later verified such suspicions and revealed an extent of political immorality in Washington such as had no parallel in recent times. Harding himself enjoyed personal popularity; his nature was kindly and genial, and there was general confidence in his honesty and devotion to his duties; but he was regarded as easy-going in his relations with friends and disinclined to scrutinize their activities critically. Resentment was voiced against the Republican national organization controlled by the Old Guard; there was outspoken criticism of the new tariff; keen discontent among the farmers led to the election to the Senate of Shipstead and Magnus Johnson. Again the threat of a Third Party became imminent.

In the summer of 1923 Mr. Harding set forth on a tour across the United States and to Alaska, designed to reassure the farmers and reawaken enthusiasm for the administration. The President, already tired, became ill on the trip back from Alaska and was stricken with pneumonia in San Francisco. On Aug. 2, 1923, he died suddenly. (C. SEY.)

HARDINGE, HENRY HARDINGE, VISCOUNT (1785–1856), British field marshal and governor-general of India, was born at Wrotham, Kent, on March 30, 1785. He entered the army in 1799 as an ensign in the Queen's Rangers, a corps then stationed in Upper Canada. He served right through the peninsular campaigns, and in the Waterloo campaign was British commissioner at Prussian headquarters. He was wounded at Ligny on June 16, 1815, where he lost his left hand by a shot, and thus was not present at Waterloo, fought two days later. He received a pension of £300, a K.C.B., and Wellington presented him with a sword that had belonged to Napoleon. In 1820 and 1826 Sir Henry Hardinge was returned to parliament as member for Durham; and in 1828 became secretary for war in Wellington's ministry, a post which he also filled in Peel's cabinet in 1841–44. In 1830 and 1834–35 he was chief secretary for Ireland. He succeeded Lord Ellenborough as governor-general of India. During his term of office (1844–48) the first Sikh War broke out; and Hardinge, waiving his right to the supreme command, magnanimously offered to serve as second in command under Sir Hugh Gough; but disagreeing with the latter's plan of campaign at Ferozeshah, he temporarily reasserted his authority as governor-general (*see* SIKH WARS). After the Sobraon campaign he was created a viscount, and received a pension of £3,000 for three lives. Hardinge's term of office in India was marked by many social and educational reforms. In 1852 he succeeded Wellington as commander-in-chief of the British army. In the Crimean War he endeavoured to direct the army on Wellington's principles—a system not altogether suited to the changed mode of warfare. In 1855 he was promoted field marshal. Hardinge resigned in July 1856, and died on Sept. 24, of the same year at South Park near Tunbridge Wells.

See C. Hardinge, *Viscount Hardinge* (Rulers of India series, 1891); and R. S. Rait, *Life and Campaigns of Viscount Gough* (1903).

HARDINGE OF PENSHURST, CHARLES HARDINGE, 1ST BARON (1858–), British diplomat, was born in London on June 20, 1858, second son of the 2nd Viscount Hardinge. He was educated at Harrow and Trinity College, Cambridge, and in 1880 entered the diplomatic service. He became secretary of legation at Teherān in 1896, and in 1898 went to St. Petersburg (Leningrad) as secretary of embassy. In 1903 he returned to England and became assistant under-secretary for foreign affairs, and later (1906–10) permanent under-secretary. In the latter capacity he accompanied Edward VII. on his foreign visits. He was created K.C.M.G. in 1904, G.C.M.G. in 1905 and K.G. in 1916. From 1904 to 1906 he was ambassador to Russia, and in 1910 was appointed Viceroy of India and raised to the peerage. Lord Hardinge returned to England in 1916 and was reappointed to the post of permanent under-secretary of foreign affairs. In Nov. 1920 he succeeded Lord Derby as ambassador in Paris, retiring in 1922.

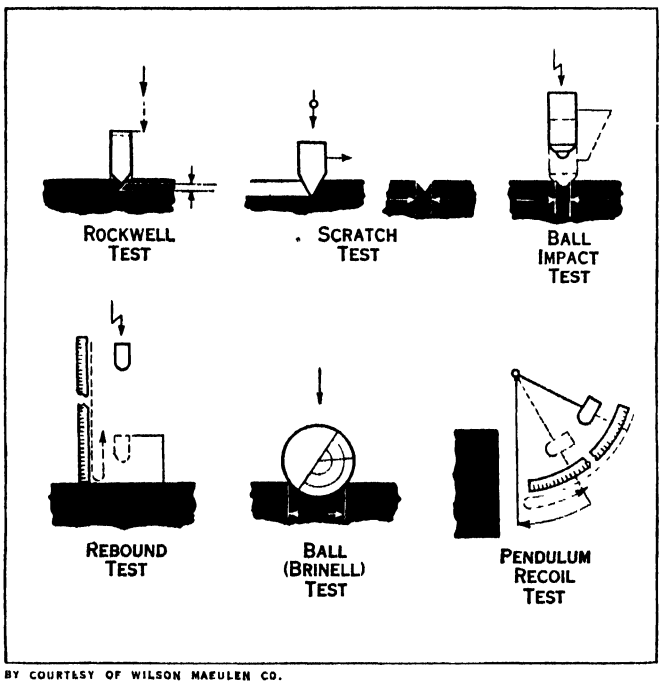
HARD MONEY, a term used in the United States of America, but not in Great Britain, to designate metallic money and to distinguish it from paper money. It came into existence in the days of the Greenback Party. (*See* GREENBACKS.)

HARDNESS TESTING. Hardness in the widest sense is that property of any material which causes it to resist deformation by external forces. It is necessary to know the exact degree of hardness of a metal so that, by using a metal corresponding to a given analysis and subjecting it to heat treatment, it can be brought to its maximum strength. It is therefore desirable to have some exact method of determining hardness so that a standard quality of the product may be obtained. Tests are made to determine the uniformity of the grade of the metal; the tensile

and other strengths in relation to its hardness; the frictional and antifrictional qualities in accordance with its hardness; the elimination and checking of flows in defective materials; the exactness of temper (*see* TEMPERING) in heat treatment; and the homogeneity of the metal. Fig. 1 shows the various methods used in the determination of the hardness of a material.

The scratch test as proposed by Mohs is one of the oldest methods of testing, and is used by geologists to determine to some degree the hardness of rock and other similar substances. The scratch test, perfected by Martens, depends upon the width of scratch produced by dragging across the surface of the material a diamond point under a definite load. The average width of the scratches, measured by microscope, is checked against a chart with calibrated numbers on it. A hard surface gives a narrow scratch, and a soft one a wide scratch.

About 1900, J. A Brinnell brought out a method of testing which consists in measuring the indentation produced by forcing in the material a hardened steel ball of definite size, under a steady pressure. The Brinnell machine operates on the hydraulic principle and is provided with a dead-weight roller valve for maintaining the desired load on the plunger, at one end of which is located the ball that is used to make the indentation. This consists of a spherical piston, accurately fitted to a cylinder which is connected to a pressure chamber. This piston carries a cross-bar and weight The maximum pressure is limited by the weights, and when the desired pressure is reached the piston rises in the cylinder. The load remains constant as long as the piston chamber is full of oil, and the oil is put under a pressure by a hand-operated plunger pump The pressure varies from 50 to 3,000 kg , according to the part or kind of material being tested. The area of the impression is obtained with a measuring microscope, with a magnification of ten, which permits the reading in



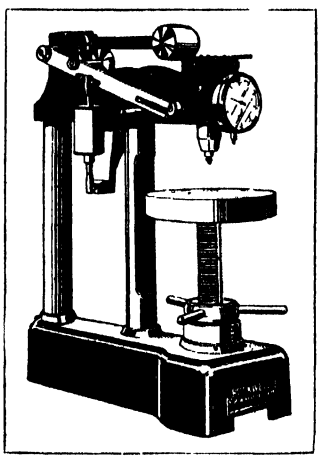
BY COURTESY OF WILSON MAEULEN CO.

FIG. 1 —VARIOUS METHODS FOR DETERMINING THE HARDNESS OF SUBSTANCES

hundredths of millimetres; this measurement is checked against a chart which gives the degree of hardness.

The *scleroscope,* invented by A. F. Shore, is another important method of testing hardness. This instrument operates on the rebound principle, and has a diamond pointed cylindrical hammer (weighing less than an ounce) encased in a vertical glass tube which guides the hammer. This tube has a scale giving the different degrees of hardness, with the numbers starting from the bottom upward, as the high numbers up the scale represent the harder metals. The hammer is brought to the top of the tube by a vacuum, and then, being released, falls on the part to be tested. The height of the rebound is noted on the scale as well as the point where the hammer stops momentarily before it falls downward again, and the degree of hardness is thus determined.

Fig 2 shows the Rockwell hardness-testing machine. This method of testing is of the latest type, and has gained considerable headway in nearly all lines of industries in the United States and other parts of the world The results obtained by this method are quick and accurate; little experience is required by the operator It is well adapted to mass production methods of manufacturing, on account of the quickness to which a test can be made, averaging about 5 sec per test. The principle consists of impressing a hardened steel or diamond point into the surface to be tested, and measuring the depth of the penetration—the resistance of the metal indicating the degree of hardness The test points and weights used are of such small size that no damage is done to the piece tested The averaging depth of the penetration in the softest of steel is only about 0·008 inch. Because of the accuracy required, a positive mechanical means of depth measurement is used. This consists of the dial, shown in fig 2, which is calibrated with this mechanism so that a reading can be made quickly.



BY COURTESY OF WILSON MAEULEN CO.

FIG. 2 —THE ROCKWELL MACHINE USED IN TESTING THE HARDNESS OF METALS

HARDOI, a town and district of British India, in the Lucknow division of the United Provinces. The town is 63 m. N.E of Lucknow by rail Pop. (1921) 14,412. It has a wood-carving industry, saltpetre works, and an export trade in grain.

The DISTRICT OF HARDOI has an area of 2,332 sq m. It is a level district watered by the Ganges, Ramganga, Deoha or Garra, Sukheta, Sai, Baita and Gumti—the three rivers first named being navigable by country boats. Towards the Ganges the land is uneven, and often rises in hillocks of sand cultivated at the base, and their slopes covered with lofty *munj* grass. Several large *jhils* or swamps are scattered throughout the district, the largest being that of Sāndi, which is 3 m. long by from 1 to 2 m. broad. Large tracts of forest jungle still exist. Leopards, black buck, spotted deer, and *nilgai* are common; the mallard, teal, grey duck, common goose, and all kinds of waterfowl abound. In 1921 the population of the district was 1,084,410. Hardoi contains a larger urban population than any other district in Oudh.

The first authentic records of Hardoi are connected with the Mohammedan colonization. Bāwan was occupied by Sayyid Salar Masaud in 1028, but permanent occupation did not begin till 1217. Between Bilgram and Sandi was fought the great battle between Humayun and Sher Shah, in which the former was utterly defeated. Hardoi, along with the rest of Oudh, became British territory under Lord Dalhousie's proclamation of Feb. 1856.

HARDOUIN, JEAN (1646–1729), French classical scholar, was born at Quimper in Brittany. About the age of 16 he was admitted into the order of the Jesuits. He eventually became librarian of the Collège Louis le Grand in Paris, and died there on Sept 3, 1729. He edited Pliny's *Natural History* for the Delphin series and in the course of this work became interested in numismatics. His work in this department was marred, like the rest of his work, by a passion for originality. It includes *Nummi antiqui populorum et urbium illustrati* (1684), and *Antirrheticus de nummis antiquis* (1689). He also supervised the *Conciliorum collectio regia maxima* (1715), holding the view that all councils prior to the council of Trent were fictitious. Among his many paradoxical theories, the most remarkable is that contained in *Prolegomena ad censuram veterum scriptorum,* to the effect that the vast

majority of the existing classical works are spurious productions of the works of the 13th century.

See A. Debacker, *Bibliothèque des écrivains de la Compagnie de Jésus* (1853).

HARDT, THE, a mountainous district of Bavaria, forming the northern end of the Vosges range. It is, in the main, an undulating plateau of sandstone, of a mean elevation of 1,300 ft., and the highest point is the Donnersberg (2,254 ft.). The eastern slope, towards the Rhine, is diversified by deep well-wooded valleys, such as the Lauter and the Queich, and by conical hills surmounted by ruins of feudal castles and monasteries, *e.g.*, the Madenburg near Eschbach, the Trifels (long the dungeon of Richard I. of England), and the Maxburg near Neustadt. Three-fifths of the area is occupied by forests, principally oak, beech and fir. The lower eastern slope is highly cultivated and produces excellent wine.

HARDWAR, an ancient town of British India, and Hindu place of pilgrimage, in the Saharanpur district of the United Provinces, on the right bank of the Ganges, at the point where the Ganges debouches from the foot-hills of the Himalayas into the plains. Pop. (1921), 30,764. The position is of great natural beauty, and the river at this point has special sanctity. The town is of great antiquity, and has borne many names. It was originally known as Kapila from the sage Kapila Hsüan Tsang, the Chinese Buddhist pilgrim, in the 7th century visited a city which he calls Mo-yu-lo, the remains of which still exist at Mayapur, a little to the south of the modern town. Among the ruins are a fort and three temples, decorated with broken stone sculptures. The goal of the vast numbers of Hindus who visit Hardwar is the Hari-ka-charan, or bathing *ghat*, with the adjoining temple of Gangadwara. The *charan* or foot-mark of Vishnu, imprinted on a stone let into the upper wall of the *ghat*, forms an object of special reverence; and water from the pool below is carried off all over India, for use on solemn occasions A great assemblage of people takes place annually, at the beginning of the Hindu solar year, (April–May), when the sun enters Aries. Since 1892 many sanitary improvements have been made for the benefit of the annual concourse of pilgrims In early days riots and also outbreaks of cholera were of common occurrence It is at Hardwar that the main Ganges canal takes off from the river; and the headworks are an engineering feat of much interest.

HARDWARE, a term applied to a large variety of metal goods, especially domestic ironmongery and appliances, hand tools, small metal manufactures such as stoves used in building, garden appliances, etc Next to food and clothing, hardware is perhaps the chief necessity of humanity. In Britain alone a research into retail sales based upon the actual stock replacements of hardware retailers over a period of six months (*Hardware Trade Journal*, vol. cxvii., 1924) showed on a conservative basis a turnover of £120,000,000, or approximately £3 per head of the population, per annum. The per head consumption, however, is considerably greater, for there are in addition millions annually spent on builder's hardware for new buildings of all kinds, and by gas and electricity supply undertakings on lighting, cooking and heating appliances which do not come into the retail accounts.

Inventive genius is constantly widening the scope of the trade, and the tendency is specially marked in the multiplicity of modern labour-saving appliances for the house It is impossible to indicate accurately the relative importance of various sections of the trade, but the furnishing side covers a large part of it.

Birmingham, "the city of a thousand trades," is known the world over as the great hardware metropolis, practically every class being made there. One leading branch is the manufacture of "hollow-ware"—cast-iron, galvanized, enamelled and aluminium products for domestic and other uses. Cast-iron pots are still largely sold both for home and export, but the trade has suffered from the competition of enamelled goods and the newer aluminium ware. A notable development in the enamelled branch has been the introduction of colours. Aluminium hollow-ware—which may be cast, deep-drawn under heavy pressure, or spun from the flat disk of metal—enjoys increasing popularity, on account of its cleanliness, lightness and purity. Cast aluminium ware is the most expensive kind and is largely used for ships and hotel kitchens. The manufacture of hearth suites, curbs and companion sets, and fire screens, is another great industry. New metals and finishes to eliminate labour of cleaning have been adopted; the goods are made in copper, Grecian bronze, satin brass, oxidized silver and stainless steel. Birmingham is a centre for electro-plated ware, and also for brassfoundry.

Cutlery and electro-plate trades have been centred in Sheffield for generations. Machine processes and mass production methods are increasingly applied in the cutlery industry. Hand-forged crucible steel blades are still made, but machine processes have been brought to a fine pitch of perfection, and the tradition for quality products is well maintained. The manufacture of stainless steel (*q.v.*) by Mr. Harry Brearley in the Brown-Firth Research Laboratory prior to the World War, was one of the most far-reaching developments in the history of steel; not only has it largely revolutionized the cutlery trade, but it has proved of great value in the engineering and allied industries. Just as progress has been recorded in regard to steel for cutlery purposes, so also there have been important developments in subsidiary materials. Handles of xylonite are now used for most table knives. Great improvements have been made in precision grinding, and especially in measures for safeguarding the health of the workers engaged in grinding operations. Changes have been made in the razor section. Safety razor blades are produced—millions per week—in the United States, Great Britain and Germany.

In plated goods, an innovation is the use of chromium. Chromium plating applied to base metal is used not only for flat-ware like spoons and forks, but for hollow-ware, plumbers' fittings, bathroom taps, plugs, and wastes, and other goods for domestic and industrial uses where the "stainless" requisite is desirable

Builders' Hardware.—This is produced in many centres. Light castings—stoves, ranges, grates, baths and rainwater pipes—are staple manufactures of Falkirk, where the industry was established in 1759. Stoves and ranges for solid fuel have long been made; now, in addition, the industry is meeting new needs for cooking and heating appliances using gas or electricity. Here again stainless steel is being more extensively utilized. Mechanical methods are rapidly superseding old laborious hand practice Machine moulding, for instance, is extending. Large outputs of light castings are made from foundries at Rotherham, Leeds, Warrington, Birmingham, in the Black Country and at Luton Wire manufacture is the chief industry of Warrington; and wire netting works are situated there and also in Manchester, Norwich, and London

Willenhall and Wolverhampton are the most important centres for locks and latches. Corrugated iron is largely produced in London, Ellesmere Port, Glasgow and South Wales, and in the West Riding of Yorkshire; metal casements are made in Essex; plumbers' brassfoundry and fittings in various centres, but largely in Birmingham, and screws and nails also in the Midlands. There are still a few hand nail makers in the Black Country, but their output is negligible compared with the production of modern factories. Birmingham's output of screws is over a million per week, and there is a big output also at Leeds. Sheffield manufacturers produce saws and wood-working tools, engineering tools and appliances, tools for road making and agricultural work and garden requisites. In the Midlands there are works devoted to the manufacture of edge tools, and particularly tools for use on plantations in tropical countries. Agricultural implement making is carried on in Scotland, in the West Riding of Yorkshire and in the Eastern counties; motor lawn mowers and electrically driven lawn mowing machines are among the latest developments in this branch of the industry. The domestic washing machine trade is carried on in Lancashire, Yorkshire and in Glasgow; and Keighley (Yorks) is the leading centre of production for laundry machinery. Carpet sweepers and domestic mops are largely produced in Lancashire; and brushes of all kinds at Oldham, St. Albans, London and Wymondham.

An outstanding feature of the hardware trade is its tremendous scope and its varied range of patterns. The best minds in the trade are now directed towards simplification by the elimination

of many patterns and sizes. Great progress has already been made in the United States with standardization, through the Division of Simplified Practice, Department of Commerce, Washington, and something has been done in Great Britain, largely as a result of the work of the British Engineering Standards Association. A conference on the subject was held at the Board of Trade in 1928. (N. F.)

THE UNITED STATES

At the beginning of the 19th century this term meant chiefly mechanics' tools and builders' hardware, but in 1928, in the United States, it included all small metal articles used in the construction of houses or for household purposes, tools of mechanics' trades, furnishing goods for kitchen and dining room service, tin plate, sheet iron, nails, screws, fence wire, etc. It is not uncommon for a large hardware house to have in its catalogues nearly 100,000 kinds and sizes of articles. In the early American colonial period supplies were brought from the mother countries of Europe. As the colonies assumed a definite shape, the village blacksmith established the foundation of American hardware manufacture, by making bars for doors, tools and implements for agriculture. But greater development was both necessary and desirable due to the isolation of the colonies and the finding of coal and minerals in great abundance. Small home manufacture grew up to supply local demands, but the greatest part of the manufactured goods were imported. Immigrants brought their own tools, the patterns of which were at once copied and improved. Village blacksmiths in Connecticut and thereabouts began to make farm implements and simple hand tools about 1850, and in 1860 American manufacturers began to pull trade away from competitors by virtue of higher quality goods Labour-saving machinery was introduced later and foreign-made articles could not compete.

The hardware-manufacturing industry had its beginnings in New England. The business gradually spread into the middle Atlantic States, especially New York and Pennsylvania. In the latter part of the 19th century New York became the undisputed centre of the trade. Here were located the majority of the great importing houses, and here also were founded and flourished the jobbers who distributed to the retail trade. With the growth of the country new advance manufacturing centres were created, and New York was no longer the pre-eminent trade centre. Since 1875 the States of Ohio, Indiana, Illinois and Michigan have been large producers. More recently Wisconsin, Iowa and Minnesota also have been important manufacturers of hardware.

Builders', cabinet and furniture hardware, which includes trimmings such as knobs, handles, pulls, hinges and lock supports and such kindred items, and cabinet, desk, draw, sewing machine, phonograph and piano locks, are manufactured in Pennsylvania, Wisconsin, Illinois and in several of the New England States, particularly Connecticut. Shelf hardware and padlocks are also made in the New England States, as well as in Pennsylvania and New York. Piano hardware is another group of products made largely in New England. Tools for working in wood, such as hammers, chisels, saws, planes, augers, in fact a complete line of carpenters' and cabinet-makers' tools, are produced in the New England States, Pennsylvania, New York and Ohio, and these States are renowned for the excellent hand and power saws, which they produce. Most screws, including machine screws and wood screws, are produced in Rhode Island and Connecticut.

(W. H. Se.)

HARDWICKE, PHILIP YORKE, 1st earl of (1690–1764), English lord chancellor, was born at Dover on Dec. 1, 1690, the son of Philip Yorke, an attorney. Called to the bar at the Middle Temple in 1715, he afterwards joined Lincoln's Inn, of which he was bencher and treasurer in 1724. He sat in parliament for Lewes 1719 and Seaford 1722–34; was solicitor general (1720), attorney general (1723), lord chief justice and baron Hardwicke (1733), lord chancellor (1737). For many years from 1743 onwards Lord Chancellor Hardwicke held the controlling power in the Government. During the king's absences on the Continent he presided over the council of regency, and he had to cope with the Jacobite rising of 1745. After Culloden he presided at the trial of the Scottish Jacobite peers. He carried out the great reform of 1746, which swept away the private heritable jurisdictions of the Scottish landed gentry; among his other great legal services was the reform of the English marriage laws

Hardwicke, who was created earl in 1754, retired with Newcastle in Nov. 1756, but he helped to secure the coalition between Newcastle and Pitt in 1757. He died in London on March 6, 1764.

Hardwicke was not a statesman of the first rank, but he was one of the greatest judges who ever sat on the English bench. Lord Campbell pronounces him "the most consummate judge who ever sat in the court of chancery, being distinguished not only for his rapid and satisfactory decision of the causes which came before him, but for the profound and enlightened principles which he laid down, and for perfecting English equity into a systematic science." He held the office of lord chancellor longer than any of his predecessors, with a single exception; and Campbell asserts that as an equity judge Hardwicke's fame "has not been exceeded by that of any man in ancient or modern times. His decisions have been, and ever will continue to be, appealed to as fixing the limits and establishing the principles of the great juridical system called Equity, which now not only in this country and in our colonies, but over the whole extent of the United States of America, regulates property and personal rights more than the ancient common law." Hardwicke had prepared himself for this great and enduring service to English jurisprudence by study of the historical foundations of the chancellor's equitable jurisdiction, combined with profound insight into legal principle, and a thorough knowledge of the Roman civil law, the principles of which he scientifically incorporated into his administration of English equity in the absence of precedents bearing on the causes submitted to his judgment.

Nor was the creation of modern English equity Lord Hardwicke's only service to the administration of justice. Born within two years of the death of Judge Jeffreys, his influence was powerful in obliterating the evil traditions of the judicial bench under the Stuart monarchy and in establishing the modern conception of the duties and demeanour of English judges.

Bibliography.—The contemporary authorities for the life of Lord Chancellor Hardwicke are voluminous, being contained in the memoirs of the period and in numerous collections of correspondence in the British Museum. *See*, especially, the *Hardwicke Papers;* the *Stowe MSS;* *Hist MSS. Commission* (Reports 2, 3, 4, 6, 8, 9, 11); Horace Walpole, *Letters* (ed. by P Cunningham, 9 vols., London, 1857–59); *Letters to Sir H. Mann* (ed. by Lord Dover, 4 vols, London, 1843–44). *See* also Lord Campbell, *Lives of the Lord Chancellors,* vol. v. (8 vols., London, 1845); Edward Foss, *The Judges of England,* vols. vii. and viii. (9 vols. London, 1848–64); George Harris, *Life of Lord Chancellor Hardwicke;* with *Selections from his Correspondence, Diaries, Speeches and Judgments* (3 vols., London, 1847).

HARDWICKE STAKES: *see* Horse Racing.

HARDWOODS. A term applied in commercial usage to woods that are close in grain, heavy, and therefore hard and strong. It is not a scientific classification. The chief hardwoods in common use are oak, chestnut, elm, beech, ash, mahogany, walnut, maple, teak, sycamore, rosewood and greenheart. These are all the products of broad-leaved or foliage trees. Many beautiful and valuable hardwoods are known to the botanist, and indeed to the timber trade, which are not generally used by furniture manufacturers. Among these may be mentioned Indian laurel, Australian blackwood, silky oak and Australian walnut. (*See* Timber.)

HARDY, ALEXANDRE (1569?–1631), French dramatist, was born in Paris. He was one of the most fertile of all dramatic authors, and himself claimed to have written some 600 plays, of which, however, only 34 are preserved. He seems to have been connected all his life with a troupe of actors headed by a clever comedian named Valleran-Lecomte, whom he provided with plays. Hardy toured the provinces with this company, which gave some representations in Paris in 1599 at the Hôtel de Bourgogne.

Valleran-Lecombe occupied the same theatre in 1600–03, and again in 1607, apparently for some years In consequence of disputes with the Confrérie de la Passion, who owned the privilege of the theatre, they played elsewhere in Paris and in the provinces

for some years; but in 1628, when they had long borne the title of "royal," they were definitely established at the Hôtel de Bourgogne. Hardy's numerous dedications never seem to have brought him riches or patrons. His most powerful friend was Isaac de Laffemas (d. 1657), one of Richelieu's most unscrupulous agents, and he was on friendly terms with the poet Théophile, who addressed him in some verses placed at the head of his *Théâtre* (1632), and Tristran l'Hermite had a similar admiration for him Hardy's plays were written for the stage, not to be read; and it was in the interest of the company that they should not be printed and thus fall into the common stock But in 1623 he published *Les Chastes et loyales amours de Théagène et Cariclée*, a tragi-comedy in eight "days" or dramatic poems; and in 1624 he began a collected edition of his works, *Le Théâtre d'Alexandre Hardy, parisien*, of which five volumes (1624–28) were published, one at Rouen and the rest in Paris. These comprise eleven tragedies: *Didon se sacrifiant, Scédase ou l'hospitalité violée, Panthée, Méléagre, La Mort d' Achille, Coriolan, Marianne*, a trilogy on the history of Alexander, *Alcméon, ou la vengeance féminine;* five mythological pieces; 13 tragi-comedies, among them *Gésippe*, drawn from Boccaccio; *Phraarte*, taken from Giraldi's *Cent excellentes nouvelles* (1584); *Cornélie, La Force du sang, Félismène, La Belle Égyptienne*, taken from Spanish subjects; and five pastorals, of which the best is *Alphée, ou la justice d'amour.*

Hardy's importance in the history of the French theatre can hardly be overestimated. Up to the end of the 16th century mediaeval farce and spectacle kept their hold on the stage in Paris. The French classical tragedy of Étienne Jodelle and his followers had been written for the learned, and in 1628 when Hardy's work was nearly over and Rotrou was on the threshold of his career, very few literary dramas by any other author are known to have been publicly represented. Hardy educated the popular taste, and made possible the dramatic activity of the 17th century. He had abundant practical experience of the stage, and modified tragedy accordingly, suppressing chorus and monologue, and providing the action and variety which was denied to the literary drama He was the father in France of tragi-comedy, but cannot fairly be called a disciple of the romantic school of England and Spain It is impossible to know how much later dramatists were indebted to him in detail, since only a fraction of his work is preserved, but their general obligation is amply established

See *Le Théâtre d'Alexandre Hardy*, edited by E. Stengel (Marburg and Paris, 1883–84, 5 vols); E. Lombard, "Étude sur Alexandre Hardy," in *Zeitschr. für neufranz. Spr. u. Lit* (Oppeln and Leipzig, vols. i and ii, 1880–81); K. Nagel, *A. Hardy's Einfluss auf Pierre Corneille* (Marburg, 1884); and especially E. Rigal, *Alexandre Hardy . . .* (1889) and *Le Théâtre français avant la période classique* (1901).

HARDY, THOMAS (1840–1928), English novelist and poet, was born in Dorsetshire on June 2, 1840. His family was one of the branches of the Dorset Hardys, formerly of influence in and near the valley of the Frome, claiming descent from JOHN LE HARDY of Jersey (son of Clement Le Hardy, lieutenant-governor of that island in 1488), who settled in the west of England. His maternal ancestors were the Swetman, Childs or Child, and kindred families, who before and after 1635 were small landed proprietors in Melbury Osmond, Dorset, and adjoining parishes.

Early Life.—He was educated at local schools, 1848–54, and afterwards privately, and in 1856 was articled to John Hicks, an ecclesiastical architect of Dorchester. In 1859 he began writing verse and essays, but in 1861 was compelled to apply himself more strictly to architecture, sketching and measuring many old Dorset churches with a view to their restoration In 1862 he went to London (which he had first visited at the age of nine) and became assistant to the late Sir Arthur Blomfield, R A. In 1863 he won the medal of the Royal Institute of British Architects for an essay on *Coloured Brick and Terra-cotta Architecture*, and in the same year won the prize of the Architectural Association for design In March 1865 his first short story was published in *Chambers's Journal*, and during the next two or three years he wrote a good deal of verse, being somewhat uncertain whether to take to architecture or to literature as a profession In 1867 he left London for Weymouth, and during that and the following year wrote a "purpose" story, which in 1869 was accepted by Messrs. Chapman and Hall. The manuscript had been read by George Meredith, who asked the writer to call on him, and advised him not to print it, but to try another, with more plot. The manuscript was withdrawn and rewritten, but never published.

Novels.—In 1870 Hardy took Meredith's advice too literally, and constructed a novel that was all plot, which was published in 1871 under the title *Desperate Remedies*. In 1872 appeared *Under the Greenwood Tree*, a "rural painting of the Dutch school," in which Hardy had already "found himself," and which he has never surpassed in happy and delicate perfection of art *A Pair of Blue Eyes*, in which tragedy and irony come into his work together, was published in 1873. In 1874 Hardy married Emma Lavinia, daughter of the late T. Attersoll Gifford of Plymouth. His first popular success was made by *Far from the Madding Crowd* (1874), which, on its appearance anonymously in the *Cornhill Magazine*, was attributed by many to George Eliot. Then came *The Hand of Ethelberta* (1876), described, not inaptly, as "a comedy in chapters"; *The Return of the Native* (1878), the most sombre and, in some ways, the most powerful and characteristic of Hardy's novels, *The Trumpet-Major* (1880); *A Laodicean* (1881); *Two on a Tower* (1882), a long excursion in constructive irony; *The Mayor of Casterbridge* (1886); *The Woodlanders* (1887); *Wessex Tales* (1888); *A Group of Noble Dames* (1891); *Tess of the D'Urbervilles* (1891), Hardy's most famous novel; *Life's Little Ironies* (1894); *Jude the Obscure* (1895), his most thoughtful and least popular book; *The Well-Beloved*, a reprint, with some revision, of a story originally published in the *Illustrated London News* in 1892 (1897).

In all this work Hardy is concerned with one thing, under two aspects; not civilization, nor manners, but the principle of life itself, invisibly realized in humanity as sex, seen visibly in the world as what we call nature. He is a fatalist, perhaps rather a determinist, and he studies the workings of fate or law (ruling through inexorable moods or humours), in the chief vivifying and disturbing influence in life, women His view of women is more French than English; it is subtle, a little cruel, not as tolerant as it seems, thoroughly a man's point of view, and not, as with Meredith, man's and woman's at once He sees all that is irresponsible for good and evil in a woman's character, all that is untrustworthy in her brain and will, all that is alluring in her variability. He is her apologist, but always with a reserve of private judgment. No one has created more attractive women of a certain class, women whom a man would have been more likely to love or to regret loving. In his earlier books he is somewhat careful over the reputation of his heroines; gradually he allows them more liberty, with a franker treatment of instinct and its consequences. *Jude the Obscure* is, perhaps, the most unbiased consideration in English fiction of the more complicated questions of sex. There is almost no passion in his work, neither the author nor his characters ever seeming able to pass beyond the state of curiosity, the most intellectually interesting of limitations, under the influence of any emotion. In his feeling for nature, curiosity sometimes seems to broaden into a more intimate communion. The heath, the village with its peasants, the change of every hour among the fields and on the roads of that English countryside which he has made his own—the Dorsetshire and Wiltshire "Wessex"—mean more to him, in a sense, than even the spectacle of man and woman in their blind and painful and absorbing struggle for existence. His knowledge of women confirms him in a suspension of judgment; his knowledge of nature brings him nearer to the unchanging and consoling element in the world. All the entertainment which he gets out of life comes to him from his contemplation of the peasant, as himself a rooted part of the earth, translating the dumbness of the fields into humour. His peasants have been compared with Shakespeare's; he has the Shakespearean sense of their placid vegetation by the side of hurrying animal life, to which they act the part of chorus, with an unconscious wisdom in their close, narrow and undistracted view of things

The order of merit was conferred upon Hardy in July 1910, and in his later years he received increasing recognition, not only as a great novelist but also as a poet, until by common consent he was admitted the undisputed sovereign of English letters. His great epic-drama *The Dynasts* (1904–08), a chronicle play of England's struggle against Napoleon, with an accompaniment of philosophic comment chanted by a chorus of "phantom intelligences," was in part produced at the Kingsway theatre, London, in the early months of the World War, and again at Oxford in 1920. Several volumes of lyrical poetry followed (*Selected Poems* in 1916; *Collected Poems* in 1919—but now incomplete). His first wife died in 1912, and in 1914 he married Florence Emily, daughter of Edward Dugdale, herself a writer of children's books and articles in periodicals. Both on his 70th and his 80th birthday he received, in his house near Dorchester (from which, latterly, he seldom moved), tributes of respect and admiration representing the English-speaking world.

Three Periods.—Thomas Hardy's career naturally divides itself into three periods The first of these contains his work as a novelist, and ends with *Jude the Obscure* in 1896 (*The Well-beloved*, published in book form in 1897, appeared serially in 1892). Throughout the series of the novels these gradually become more and more insistent—first as an element of irony, but later as the tragic essence of the narrative—a characteristic metaphysic, in which the strivings and passions of individuals are in fruitless conflict with the inexorable process of the world. *Jude the Obscure*, despite its splendid qualities, made it clear that such a theme could not be adequately developed in the form of the novel; a form was required in which the author could speak out his own convictions without violating aesthetic propriety

Accordingly, the second period consists of *The Dynasts*, the three parts of which were issued separately in 1904, 1906, 1908; no doubt the greatest single achievement of his career. It may be said that this great poem was written in order to give full utterance, in artistic form, to his peculiar metaphysic. That, however, was not its originating intention, which was simply to celebrate as a chronicle play England's part in the Napoleonic wars. But as the conception grew and deepened, and as to the human action the superhuman comment of "phantom intelligences" was added, the poem became the summation of Hardy's vision of life; and thereby achieved a unity which, in its intrinsic grandeur, and in its perfect command over immense wealth of matter, can only be compared with such monuments of man's destiny as *Faust* and *Paradise Lost*. In diction, however, *The Dynasts* will not bear any such comparison.

The third period may be said to begin with *Time's Laughing-stocks* in 1909, and is wholly devoted to lyrical poetry. It is not often that an artist's life can be divided so definitely into separate stages, each stage characterized by the use of a different form; and, next to its length and plenty, and consistently noble idiosyncrasy, this tripartite division is, perhaps, the most remarkable feature of Hardy's career as a whole. The lyrical period, however, does not give us an entirely new development of his genius. While he was writing novels, he had occasionally experimented with poetry, and some of the results were published in *Wessex Poems* (1898) and *Poems of the Past and the Present* (1901), between *Jude the Obscure* and *The Dynasts*. The volumes published since *The Dynasts* also contain a good many more of these earlier poems. But from 1909 onwards Hardy wrote nothing but lyrical poetry, and this may therefore be truly called his lyrical period. (*A Changed Man*, in 1913, merely rescued from the periodicals of former years several stray pieces of minor fiction.) It represents a new concentration of his power, but certainly no diminution of it. Devotion to lyrical expression has produced a mastery almost as signal in its kind as his command of the art of fiction; and his 70th year saw him beginning, with *Time's Laughing-stocks*, the series of volumes—*Satires of Circumstance* (1914), *Moments of Vision* (1917), *Late Lyrics and Earlier* (1922), *Human Shows, Far Phantasies* (1925), and the posthumous volume *Winter Words* (1928), which has shown him to be the most original, the most poignant, and also the most copious of contemporary lyrical poets.

Poetry.—The originality of the technique in these volumes does not by any means consist in a mere breach with the accepted conventions, but rather in its highly individual—to some, perhaps, rather disconcerting—compound of the conventional and the unconventional. Most of these lyrics maintain an exact and even rigid formality of stanza, in which a scheme of rhymes is imposed, as it seems, arbitrarily and at all costs. The effect is sometimes justified by its music; but more often by the compact force its pressure gives to language almost conversational in its idiom and choice of words. Yet the diction which defies poetic tradition and seems to despise the magic of elaborated verbal suggestion, is oddly blended with stiff literary phrases and even with words one might expect only lexicographers to think of. The truth seems to be that, in lyrical technique, Hardy had no prejudices either for or against the conventions. He is simply concerned with the matter which intense feeling and profound understanding have enabled him to imagine in a way peculiarly his own, and to express this faithfully he has forged a technique peculiarly his own, out of whatever the language of literature or of speech could offer him. Readers who are willing to allow him this liberty can hardly fail to be impressed, as perhaps nowhere else in recent poetry, by the subtlety, depth and variety of his versions of the experiences common to humanity; the commonplace becomes in his hands something rich and strange. Naturally, the habits of thought and outlook on the world, which we find progressively insistent in the series of the Wessex novels, and which inspire the turbulent matter and monumental structure of *The Dynasts*, are very evident also in the lyrics; which, indeed, are often in the nature of marginal comments on themes previously used.

But something like the quintessence of his tragic power may be found in such ballads as "A Trampwoman's Tragedy," or such keen discrimination of pathos as "Near Lanivet," and something too like the quintessence of his irony to be altogether comfortable in *Satires of Circumstance* or "Ah, are you Digging on My Grave?" Nor is the rustic humour of his beloved Dorset villagers wanting, nor the vivid delight in nature, in the extraordinary range of his lyrical art. It is, in fact, the same Hardy in the lyrics as in the novels and *The Dynasts;* but a Hardy who, if his lyrics were all we had of him, would surely, by virtue of them alone, hold a secure, indeed a unique, position in modern English literature.

Thomas Hardy died on Jan. 12, 1928, and while, in deference to the feeling of the whole English-speaking world, his ashes were buried in Westminster Abbey, in consideration of his deep affection for his native Wessex and the peculiar inspiration it gave him, his heart was buried in his parish churchyard.

The position which he occupied in English literature on account both of his literary merits and of his great age, was an unique one. Known generally as "the last of the great Victorians," his death seemed to snap the last link connecting with the famous nineteenth century litterateurs.

See Annie Macdonell, *Thomas Hardy* (1894); Lionel P. Johnson, *The Art of Thomas Hardy* (1894); F. A. Hedgcock, *Thomas Hardy penseur et artiste* (Paris, 1911); L. Abercrombie, *Thomas Hardy, a critical study* (1912). In 1928 appeared his *Memoirs*, written in the third person, but obviously autobiographical, which will always be indispensable for the proper understanding of his genius and its early development. (L. A.)

HARDY, SIR THOMAS DUFFUS (1804–1878), English antiquary, belonged to a family famous in the annals of the British navy. Born at Port Royal in Jamaica on May 22, 1804, he crossed over to England and in 1819 entered the Record Office in the Tower of London. Trained under Henry Petrie (1768–1842) he gained a sound knowledge of palaeography, and soon began to edit selections of the public records. From 1861 until his death on June 15, 1878, he was deputy-keeper of the Record Office, which just before his appointment had been transferred to its new London headquarters in Chancery Lane. Hardy, who was knighted in 1873, had much to do with the appointment of the Historical Manuscripts Commission in 1869. Sir T. Hardy edited the Close Rolls, *Rotuli litterarum clausarum, 1204–1227* (2 vols.,

1833–44), and the Patent Rolls, *Rotuli litterarum patentium, 1201–1216* (1835) with introduction, "A Description of the Patent Rolls, to which is added an Itinerary of King John." He also edited the *Rotuli de oblatis et finibus* (1835), which deal also with the time of King John. He edited many other important series of documents. His best known work is the invaluable *Descriptive Catalogue of Materials relating to the History of Great Britain and Ireland* (3 vols., 1862–71).

HARDY, SIR THOMAS MASTERMAN, Bart. (1769–1839), British vice-admiral, of the Portisham (Dorsetshire) family of Hardy, was born on April 5, 1769, and in 1781 began his career as a sailor. He became lieutenant in 1793, and in 1796, being then attached to the "Minerve" frigate, attracted the attention of Nelson by his gallant conduct. He continued to serve with distinction, and in 1798 was promoted to be captain of the "Vanguard," Nelson's flagship In the "St. George" he did valuable work before the battle of Copenhagen in 1801. He was Nelson's flag-captain on the "Victory" at the battle of Trafalgar in 1805, witnessed Nelson's will, and was in close attendance on him at his death. Hardy was created a baronet in 1806 He was then employed on the North American station, and later (1819), was made commodore and-commander-in-chief on the South American station In 1825 he became rear-admiral, and in December 1826 escorted the expeditionary force to Lisbon. In 1830 he was made first sea lord of the admiralty, being created G.C.B in 1831. In 1834 he was appointed governor of Greenwich hospital, where he died on Sept. 20, 1839.

See Broadley and Bartelot, *The Three Dorset Captains at Trafalgar* (1906), and *Nelson's Hardy, his Life, Letters and Friends* (1909).

HARDYNG or **HARDING, JOHN** (1378–1465), English chronicler, was born in the north, and as a boy entered the service of Sir Henry Percy (Hotspur), with whom he was present at the battle of Shrewsbury (1403). He then passed into the service of Sir Robert Umfraville, under whom he was constable of Warkworth Castle, and served in the campaign of Agincourt in 1415 and in the sea-fight before Harfleur in 1416. In 1424 he was on a diplomatic mission at Rome, where at the instance of Cardinal Beaufort he consulted the chronicle of Trogus Pompeius. Umfraville, who died in 1436, had made Hardyng constable at Kyme in Lincolnshire, where he probably lived till his death about 1465. Under Henry V. Hardyng was employed to investigate the feudal relations of Scotland to the English Crown. For this purpose he visited Scotland, at much expense and hardship. For his services he says that Henry V. promised him the manor of Geddington in Northamptonshire. Many years after, in 1439, he had a grant of £10 a year for similar services. In 1457 there is a record of the delivery of documents relating to Scotland by Hardyng to the earl of Shrewsbury, and his reward by a further pension of £20. It is clear that Hardyng was well acquainted with Scotland, and James I. of Scotland is said to have offered him a bribe to surrender his papers. But the documents, which are still preserved in the Record Office, have been shown to be forgeries and were probably manufactured by Hardyng himself. Hardyng spent many years on the composition of a rhyming chronicle of England. The original edition ending in 1436 had a Lancastrian bias and was dedicated to Henry VI. Afterwards he prepared a version for Richard, duke of York (d. 1460), and the chronicle in its final form was presented to Edward IV. after his marriage to Elizabeth Woodville in 1464.

The version of 1436 is preserved in Lansdowne ms. 204, and the best of the later versions in Harley ms. 661, both in the British Museum. Richard Grafton printed two editions in Jan. 1543, which differ much from one another and from the now extant manuscripts. Sir Henry Ellis published the longer version of Grafton with some additions from the Harley ms. in 1812.

See Ellis's preface to Hardyng's *Chronicle*, and Sir F. Palgrave's *Documents illustrating the History of Scotland* (for an account of Hardyng's forgeries).

HARE, AUGUSTUS JOHN CUTHBERT (1834–1903), English writer and traveller. He wrote guide-books to the principal countries and towns of Europe. He also wrote *Memorials of a Quiet Life* (1872), and a long autobiography, *The Story of My Life* (6 vols., 1896–1900).

HARE, SIR JOHN (1844–1921), English actor and manager, was born in Yorkshire on May 16, 1844, and was educated at Giggleswick school, Yorkshire. He made his first appearance on the stage at Liverpool in 1864, coming to London in 1865, and acting for ten years with the Bancrofts. He made his mark in T. W. Robertson's comedies, and in 1875 became manager of the Court theatre. In association with Mr. and Mrs. Kendal at the St. James's theatre from 1879 to 1888 he established his popularity in London, in important "character" and "men of the world" parts, the joint management of Hare and Kendal making this theatre one of the chief centres of the dramatic world for a decade. In 1889 he became lessee and manager of the Garrick theatre, where (though he was often out of the cast) he produced several important plays, such as Pinero's *The Profligate* and *The Notorious Mrs. Ebbsmith*, and had a remarkable personal success in the chief part in Sydney Grundy's *A Pair of Spectacles*. In 1897 he took the Globe theatre, where his acting in Pinero's *Gay Lord Quex* was another personal triumph He became almost as well known in the United States as in England, his last tour in America being in 1900 and 1901. He was knighted in 1907. His last appearances were in 1917 in *A Pair of Spectacles* (July and Sept.). He died in London on Dec. 28, 1921.

HARE, JULIUS CHARLES (1795–1855), English theological writer, was born at Valdagno, near Vicenza, Italy, on Sept. 13, 1795. He was educated at Charterhouse and Trinity college, Cambridge, where he became fellow in 1818. He was ordained in 1826, and in 1832 succeeded his uncle in the rich family living of Hurstmonceaux, Sussex, where he accumulated a library of some 12,000 volumes, especially rich in German literature. In 1840 Hare, who belonged to the "Broad Church" party, was appointed archdeacon of Lewes. He married in 1844 Esther, a sister of his friend Frederick Maurice. In 1851 he was collated to a prebend in Chichester; and in 1853 he became one of Queen Victoria's chaplains. He died on Jan. 23, 1855.

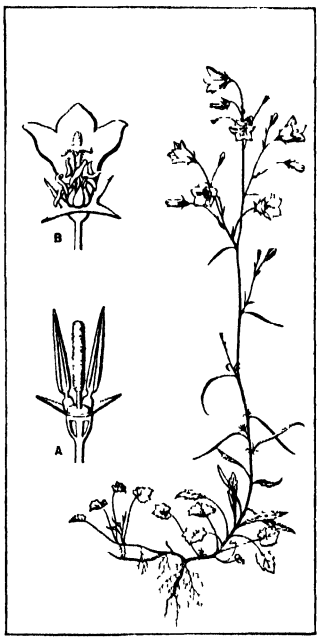
In 1827 *Guesses at Truth by Two Brothers* written in collaboration with his brother Augustus William Hare was published. His numerous other works include a *Vindication of Luther* (1854), and an edition, with a life, of the *Remains of John Sterling* (1848), who had formerly been his curate Carlyle's *Life of John Sterling* was written through dissatisfaction with Hare's "Life" A. J. C. Hare's *Memorials of a Quiet Life* (1872) contains accounts of the Hare family.

HARE, the name of the well-known English rodent now designated *Lepus europaeus*. The name includes all the numerous allied species which do not come under the designation of rabbits. (*See* RABBIT.) In parts of Europe, where the ordinary species does not occur, its place is taken by the closely allied blue, or mountain hare, the true *L. timidus* of Linnaeus, and the type of the genus *Lepus* and the family *Leporidae*. (*See* RODENTIA.) The blue hare is a smaller animal with a more rounded and relatively smaller head, and the ears, hind-legs and tail shorter. In southern Sweden it is permanently of a light fulvous grey, with black tips to the ears, but in more northerly districts the fur—except the black ear-tips—changes to white in winter, and still farther north the animal appears to be white at all seasons. In Ireland there is an allied species, *L. hibernicus*, distinguished by its more russet colouring, and the partial or complete absence of the white winter coat. The range of the common hare extends from England across southern and central Europe to the Caucasus; while that of the blue or mountain species reaches from Scotland and Scandinavia through northern Europe and Asia to Japan and Kamchatka, and thence to Alaska.

The hare takes readily to the water, where it swims well; an instance having been recorded in which one was observed crossing an arm of the sea about a mile in width. Hares are remarkably prolific, pairing when scarcely a year old, and the female bringing forth several broods in the year. The young are born covered with hair and with the eyes open, and after being suckled for a month are able to look after themselves. In Europe this species has seldom bred in confinement, although an instance has recently been recorded. It will interbreed with the blue hare.

Hares (and rabbits) have a cosmopolitan distribution with the exception of Madagascar and Australasia; and are now divided into numerous genera mentioned in the article RODENTIA. The most important of these groups is the typical genus which contains over 80 different species distributed over Europe, Asia, N. America and Africa. Some hares look more like rabbits than hares and are frequently referred to as such; for instance, the American "cotton-tails" (*Sylvilagus*) and "jack-rabbits" (*Macrotolagus*). The more northern N American hares, like the Polar hare (*L. arcticus*) and the Greenland hare (*L. groenlandicus*), turn white in winter. Southern forms, like the wood-hare, gray rabbit, or cotton-tail (*S. floridanus*), do not change colour The Brazilian hare (*S. brasiliensis*) is nearly allied to the wood-hare.

HAREBELL, known also as the blue-bell of Scotland, and witches' thimbles, a well-known perennial wild flower, *Campanula rotundifolia*, a member of the bell-flower family (*Campanulaceae*). The harebell has a very slender slightly creeping root-stock, and a wiry, erect stem The leaves at the base of the stem, to which the specific name *rotundifolia* refers, have long stalks, and are roundish or heart-shaped with a wavy or toothed margin; the lower stem leaves are ovate or lance-shaped, and the upper ones linear, almost stalkless, acute and entire. The flowers are slightly drooping, arranged in a panicle, or in small specimens single, having a smooth calyx, with narrow pointed erect segments, the corolla bell-shaped, with slightly recurved segments, and the capsule nodding, and opening by pores at the base. The plant is found on heaths and pastures throughout Great Britain and flowers in late summer and in autumn; it is widely spread in the north temperate zone. In North America it occurs in meadows and on moist rocks from Labrador to Alaska and southward to Pennsylvania, Illinois and Nebraska and in the Rocky Mountains to Arizona and in the Cascades and the Sierra Nevada to northern California. (*See* CAMPANULA)



HAREBELL (CAMPANULA ROTUNDIFOLIA), SHOWING DEVELOPMENT
A, flower bud with corolla, 2 sepals, and 3 stamens removed to show that stamens ripen before pistil matures
B, Later stage, when stamens are withering and trifid stigma is open and ready to receive pollen

HAREM (hah'rĕm or hah'rēm) (Arabic *ḥarīm*, "forbidden"), a name applied to that part of a house in Muslim countries set apart for the women; it is also used collectively for the women themselves. Zenana (strictly *zanāna*, from Persian *zan*, woman) is the term used in India; andarūn (Persian "inner part") (*sc.* of a house) in Persia. The Indian harem system is also known as *pardah* or *purdah*, literally the name of the curtain used to separate the women's quarters from the rest of the house. In Muhammadan countries theoretically a woman must veil her face to all men except her father, her brother and her husband; but among certain Muslim communities (*e.g.*, in parts of Albania) women of the poorer classes may appear in public unveiled.

Turkish Harems.—The Turkish Republic in 1926 made polygamy illegal; but even before that date it was not common, for, though the Qur'ān permits four wives, the man of average possessions was perforce content with one, and a small number of female servants.

The imperial seraglio was a unique institution, an elaborately organized community with a complete system of officers, disciplinary and administrative, and strict distinctions of status. The real ruler of this society was the sultan's mother, the *Sultana Validé*, who exercised her authority through a female superintendent, the *Kyahya Khatun*. She had also a large retinue of subordinate officials (*Kalfas*) ranging downwards from the *Hasnadar ousta* ("Lady of the Treasury") to the "Mistress of the Sherbets" and the "Chief Coffee Server." Each of these officials had under her a number of pupil-slaves (*alaiks*), whom she trained to succeed her if need be, and from whom the service was recruited. After the sultana validé ranked the mother of the heir-apparent, called the *Bash Kadın Effendi* ("Her excellency the Chief Lady"). Next came the ladies who had borne the younger children of the sultan, the *Hanum Effendis*, and after them the so-called Odalisks or Odalisques (a perversion of *odalık*, from *odah*, chamber). Every odalisk who had been promoted to the royal couch received a *dara*, consisting of an allowance of money, a suite of apartments, and a retinue, in proportion to her status. Since all the harem women were slaves, the sultans, with practically no exceptions, never entered into legal marriage contracts

The security of the harem was in the hands of a body of eunuchs both black and white. The chief of the white eunuchs, the *kapu aghasi* ("master of the gates") had part control over the ecclesiastical possessions, and even the vizier could not enter the royal apartments without his permission The chief of the black eunuchs, usually called the *kislar aghasi* ("master of the maidens"), though his true title was *darus se'ādet aga* ("chief of the abode of felicity"), was an official of high importance His secretary kept count of the revenues of the mosques built by the sultans The number of eunuchs was always a large one. The sultana validé and the bash kadin effendi each had fifty at their service, and others were assigned to the favourite odalisks.

The ordinary middle-class household was naturally on a very different scale. The *selamlik* (or men's quarters) was on the ground floor with a separate entrance, and there the master of the house received his male guests; the rest of the ground floor was occupied by the kitchen and perhaps the stables. The *haremlik* (or women's quarters) was generally (in towns at least) on the upper floor fronting on and slightly overhanging the street; it had a separate entrance, courtyard and garden. Communication with the *haremlik* was effected by a locked door, of which the Effendi kept the key and also by a sort of revolving cupboard (*dutap*) for the conveyance of meals.

The presence of a second wife was the exception, and was generally attributable to the absence of children by the first wife. The expense of marrying a free woman led many Turks to prefer a slave woman who was much more likely to be an amenable partner. If a slave woman bore a child she was often set free and then the marriage ceremony was gone through.

The harem ladies frequently drove into the country and visited the shops and public baths. Their seclusion had very considerable compensations, and from the moment when a woman, free or slave, entered into any kind of wifely relation with a man, she had a legally enforceable right against him both for her own and for her children's maintenance. She had absolute control over her personal property whether in money, slaves or goods; and, if divorce was far easier in Islam than in Christendom, still the marriage settlement had to be of such amount as would provide suitable maintenance in that event

On the other hand, of course, the system was open to the gravest abuse, and in countries like Persia, Morocco and India, the life of Muslim women and slaves was often far different from that of middle class women of European Turkey, where law was strict and culture advanced

Since the middle of the 19th century familiarity with European customs and the direct influence of European administrators has brought about a certain change in the attitude of Orientals to the harem system, and in educated circles those who have more than one wife are spoken ill of; but Turkey is the only Muhammadan country that has abolished polygamy altogether.

In India various attempts have been made by societies, missionary and other, as well as by private individuals, to improve the lot of the zenana women. Zenana schools and hospitals have been founded, and a few women have been trained as doctors and lawyers for the special purposes of protecting the women against their own ignorance and inertia. Similarly, trained medical women are introduced into zenanas by the Lady Dufferin Associa-

tion for medical aid to Indian women. In India, as in Turkey, the introduction of Western dress and education has begun to create new ideas and ambitions, and not a few Eastern women have induced English women to enter the harems as companions, nurses and governesses

Among the principal societies which have been formed to better the condition of Indian and Chinese women in general with special reference to the zenana system are the Church of England Zenana Missionary Society and the Zenana Bible and Medical Mission. Much information as to the medical, industrial and educational work done by these societies will be found in their annual reports and other publications.

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HARFLEUR, a port of France in the department of Seine-Inférieure, about 6 m E of Havre by rail. Pop. (1926) 4,534 It lies in the valley of the Lézarde, near the estuary of the Seine Harfleur is identified with *Caracotinum*, the principal port of the ancient Calates. In the middle ages, when its name, Herosfloth, Harofluet or Hareflot, still indicated its Norman derivation, it was the principal seaport of north-western France. In 1415 it was captured by Henry V of England, but in 1435 the people of the district of Caux rose against the English, and got rid of the foreign yoke. Between 1445 and 1449 the English were again in possession; but the town was recovered for the French by Dunois In the 16th century the port began to dwindle in importance owing to the silting up of the Seine estuary and the rise of Havre. In 1562 the Huguenots put Harfleur to pillage, and its registers and charters were destroyed; but its privileges were restored by Charles IX. in 1568, and it was not till 1710 that it was subjected to the "taille." The port was improved on the opening of the Tancarville canal (1887) connecting it with the port of Havre and with the Seine. Vessels drawing 18 ft. can moor alongside the quays of the new port, which is on a branch of the canal, has some trade in coal, timber and grain, and carries on fishing. The church of St. Martin with its lofty stone steeple forms a landmark for the pilots of the river. It dates from the 15th and 16th centuries Of the old castle there are only insignificant ruins. The industries include distilling, metal founding, flour milling and the manufacture of oil and grease.

HARGREAVES, JAMES (1834–1915), English industrial chemist, was born at Hoarstones, Pendle Forest. He received his early instruction in chemistry from his father who was a chemist and druggist Hargreaves's ability in devising new chemical processes may be gathered from the fact that he obtained more than 200 British and foreign patents to protect his inventions In 1856 he tried to devise a method of recovering sulphur from alkali waste; this brought him in contact with Gossage, the soap manufacturer. Hargreaves was employed by Gossage until 1865; during this period he discovered a method of bleaching the brown soap in common use, he invented blue mottled soap, and devised a method of recovering chromates from the fats and oils used in soap manufacture. Hargreaves also worked out a process for the recovery of phosphates from the slag of blast furnaces, he obtained chlorine and peroxide of iron as by-products of this process Soon after he left Gossage he tried to use sodium nitrate in place of air in the Bessemer steel process. A factory was erected but the method proved too costly and had to be abandoned. In 1873 he erected works for the manufacture of hydrochloric acid by the action of the gases from pyrites burners on common salt; these works were eventually acquired by the United Alkali company. In conjunction with one of his employees, Bird, he invented the Hargreaves-Bird process for the manufacture of soda by the electrolytic decomposition of salt. This method has been extensively adopted in Europe and America. In addition to his chemical investigations Hargreaves invented an engine which ran on gas-tar and was called the Hargreaves Thermo motor; this was the forerunner of the Diesel engine. Hargreaves died at Widnes on April 4, 1915

HARIANA, a tract of country in the Punjab, India; a level upland plain, interspersed with patches of sandy soil, and largely overgrown with brushwood. Since the 14th century Hissar has been the local capital During the troubles which followed the Mogul decline, Hariana was the battlefield of Mahrattas, Bhattis and Sikhs. In 1797–1798 Hariana was overrun by the famous Irish adventurer George Thomas, and in 1803 it passed under British rule. On the conquest of the Punjab Hariana was broken up into the districts of Hissar, Rohtak and Sirsa.

HARINGTON, SIR CHARLES HARINGTON (1872–), British soldier, was born at Chichester on May 31, 1872, and commissioned in the King's (Liverpool) Regiment in 1892 After service in the South African War, he held a series of staff appointments, and on the outbreak of the World War went to France as general staff officer, 2nd grade, of the III. Corps. His ability brought him rapid promotion, and in June 1916 he became major-general, general staff of the II. Army. He remained chief of staff to Gen. Plumer in France for nearly two years, with the exception of a short interval in Italy. The combined talents of the two men were such that the II. Army became proverbial for its excellent staff work and for carrying out any operation with the maximum economy of life. Messines 1917 was perhaps their most brilliant feat. In April 1918 Harington was recalled to the War Office to become deputy chief of the Imperial General Staff. In Sept. 1920 he succeeded General Milne as commander-in-chief of the British forces, and subsequently of the Allied forces at Constantinople and in the Black sea His tact and diplomacy in a difficult situation, especially during the Chanaq incident, helped to avert serious complications, and was fittingly acknowledged in parliament. In Oct 1923 he was appointed to the Northern Command, and in 1927 to the Western Command in India. Harington received many honours, including the K.C.B. (1900) and the G.B.E. (1922). He was gazetted full general in 1927.

HARINGTON, SIR JOHN (1561–1612), English writer, Elizabeth's godson, was born at Kelston, near Bath. He studied at Eton and at Christ's college, Cambridge, and *c.* 1583 was entered at Lincoln's Inn, London Tradition relates that he translated the story of Giocondo from Ariosto and was reproved by the queen for acquainting her ladies with so indiscreet a selection. He was ordered to retire to his seat at Kelston to complete the translation of the entire work. *Orlando Furioso* in English heroical verse was published in 1591 (reprinted 1607 and 1634)

Harington was high sheriff of Somerset in 1592. In 1596 *The Metamorphosis of Ajax* (reprinted 1927), *An Anatomie of the Metamorphosed Ajax*, and *Ulysses upon Ajax*, were published in succession, the three forming collectively a very absurd and indecorous work of a Pantagruelistic kind. An allusion to Leicester in this book threw the writer into temporary disgrace, but in 1598 he received a commission to serve in Ireland under Essex. He was knighted on the field, to the annoyance of Elizabeth. Harington saved himself from being involved in Essex's disgrace by writing an account of the Irish campaign (printed as *Nugae Antiquae*, volume 1, *see* below) which increased Elizabeth's anger against the unfortunate earl. Among some papers found in the chapter library at York was a *Tract on the Succession to the Crown* (1602), written by Harington to secure the favour of the new king. In 1605 he even asked for the office of chancellor of Ireland and proposed himself as archbishop in a document known as *A Short View of the State of Ireland written in 1605* (pr. 1879), advocating a policy of generosity and conciliation.

Harington died at Kelston on Nov. 20, 1612. His *Epigrams* were printed in a collection entitled *Alcilia* in 1613, and separately in 1615. His works include *The Englishman's Doctor, Or the School of Salerne* (1608, reprinted 1922), and *Nugae Antiquae* miscellaneous papers collected in 1779.

A biographical account of Harington is prefixed to the Roxburghe Club edition by C. Markham (1880) of his tract on the succession mentioned above.

HARÎRÎ (Abû Maḥommed ul-Qâsim ibn 'Ali ibn Maḥommed al-Ḥarîrî, *i.e*, "the manufacturer or seller of silk") (1054–1122), Arabian writer, was born at Baṣra. He is said to have occupied a government position, but devoted his life to the study of the niceties of the Arabic language. On this subject he wrote a grammatical poem the *Mulḥat ul-'Irâb* (French trans by L. Pinto, 1885–89; extracts in S. de Sacy's *Anthologie arabe*, 1829); a work on the faults of the educated called *Durrat ul-Ghawwâs* (ed. H. Thorbecke, Leipzig, 1871), and some smaller treatises (ed. in Arnold's *Chrestomathy*, pp 202–9) But his fame rests chiefly on his fifty *maqâmas*. (*See* ARABIA: *Literature*, section "Belles Lettres.") These were written in rhymed prose like those of Hamadhânî, and are full of allusions to Arabian history, poetry and tradition, and discussions of difficult points of Arabic grammar and rhetoric.

The Maqâmas have been edited with Arabic commentary by S. de Sacy (Paris, 1822, 2nd ed 1853); with English notes by F. Steingass (1896), English trans. by T. Preston (1850), and another by T. Chenery and F. Steingass (London, 1867 and 1898) Many editions have been published in the East with commentaries, especially with that of Sharîshî (d. 1222).

HARI-RUD, the ancient Arius river of Afghanistan It rises in the northern slopes of the Koh-i-Baba to the west of Kabul, and finally loses itself in the Tejend oasis north of the Trans-Caspian railway and west of Merv. It runs a remarkably straight course westward through a narrow trough from Daolatyar to Obeh, amidst the bleak wind-swept uplands of the highest central elevations in Afghanistan From Obeh to Kuhsan, 50 m. W. of Herat, it forms a valley of great fertility, densely populated and highly cultivated; practically all its waters being drawn off for purposes of irrigation It is the contrast between the cultivated aspect of the valley of Herat and the surrounding desert that has given Herat its great reputation for fertility. It turns due north and breaks through the Paropamisan hills Below Kuhsan it receives fresh tributaries from the west. Between Kuhsan and Zulfikar it forms the boundary between Afghanistan and Persia, and from Zulfikar to Sarakhs between Russia and Persia North of Sarakhs it diminishes rapidly till it is lost in the sands of the Turkman desert. The Hari-Rud marks the only important break existing in the continuity of the central water-parting of Asia.

HARISCHANDRA, in Epic Hindu mythology the 28th king of the Solar dynasty. In his eagerness to have a son he rashly vowed to Varuna that if his prayer were granted he would sacrifice the child to him The son was born, but Harischandra evaded fulfilment of his vow by vicariously immolating a child purchased by him.

ḤÂRITH IBN HILLIZA UL-YASHKURÎ, pre-Islamic Arabian poet of the tribe of Bakr, famous as the author of one of the poems generally received among the *Mo'allakât* (*q.v.*). Nothing is known of the details of his life.

HARIZI, JUDAH BEN SOLOMON (13th cent.), a Spanish Hebrew poet and traveller. He translated from the Arabic to Hebrew some of the works of Maimonides (*q v*) and also of the Arab poet Ḥariri. His own most considerable work was the *Taḥkemoni*, composed between 1218 and 1220.

See on the *Taḥkemoni*, Kaempf, *Nicht-andalusische Poesie andalusischer Dichter* (Prague, 1858). In that work a considerable section of the *Taḥkemoni* is translated into German.

HARKNESS, ALBERT (1822–1907), American classical scholar, was born at Mendon (Mass.) on Oct. 6, 1822. He graduated at Brown university in 1842, taught for ten years in the Providence high school, studied in Berlin, Bonn (where in 1854 he was the first American to receive the degree of Ph.D.), and Göttingen, and was professor of Greek language and literature in Brown university from 1855 to 1892, when he became professor emeritus. He was one of the founders in 1869 of the American Philological Association, of which he was president in 1875–76, and was a member of the Archaeological Institute's committee on founding the American School of Classical Studies at Athens, of which he served as the second director.

He introduced a new scholarly spirit into American teaching of Latin in secondary schools with a series of Latin text-books. His *Latin Grammar* (1864) and *Complete Latin Grammar* (1898) are his best-known books. He died in Providence (R.I.) on May 27, 1907.

HARLAN, JOHN MARSHALL (1833–1911), American jurist, was born in Boyle county (Ky.), on June 1, 1833. He graduated from Centre college, Danville (Ky.), in 1850, and at the law department of Transylvania university, Lexington, in 1853. He was county judge of Franklin county in 1858–59, was an unsuccessful candidate for Congress on the Whig ticket in 1859, and was elector on the Constitutional Union ticket in 1860.

On the outbreak of the Civil War he recruited and organized the 10th Kentucky U.S Volunteer Infantry, and served with it as colonel Retiring from the army in 1863, he was elected by the Union Party attorney-general of the State, and was re-elected in 1865. In 1867 he removed to Louisville to practise law. He was the Republican candidate for governor in 1871 and in 1875, but was defeated on both occasions He served as a member of the commission which was appointed by President Hayes early in 1877 to accomplish the recognition of one of the two existing State governments of Louisiana (*q v*); and he was a member of the Bering Sea tribunal which met in Paris in 1893.

On Nov. 29, 1877, he became an associate justice of the U.S. Supreme Court, a position which he filled with ability for the remainder of his life. He showed himself a liberal constructionist in opinions on the Civil Rights cases and in the interpretation of the 13th, 14th and 15th Amendments to the Constitution by advocating increasing the power of the Federal Government. He supported the constitutionality of the income-tax clause in the Wilson tariff bill of 1894, and he drafted the decision of the court in the Northern Securities Company case which applied to railways the provisions of the Sherman anti-trust law. In 1889 he became a professor in the Law School of the Columbian university (afterwards George Washington university). He died in Washington (D C.), on Oct. 14, 1911.

HARLAND AND WOLFF, LIMITED. This shipbuilding and engineering firm was established in 1858, when the shipbuilding works of Robert Hickson and Co. on Queen's Island, Belfast, were acquired by E J. Harland (afterwards Sir Edward J Harland, Bart), who had been Messrs. Hickson's manager, and in 1861 G. W. Wolff became a partner, the firm since then being known as Harland and Wolff. W. H. Wilson and W. J. Pirrie (afterwards Viscount Pirrie), pupils of the original firm, became partners in 1874, and on the death of Sir Edward Harland in 1895 Lord Pirrie became chairman, a position which he occupied until his death in 1924. Viscountess Pirrie was in (1928) president of the company When Sir Edward Harland started on his own account in 1858 the yard at the Queen's Island covered an area of 3½ac. and undertook the building of hulls only. Later on the manufacture of machinery was begun, and the firm progressed and extended until (1928) the shipyards and engine works at Belfast covered an area of 220ac.; in busy times they have given employment to more than 20,000 men

While the firm's main interests are centred in the establishment at Belfast, they have great shipyards at Govan and Greenock, engineering works and foundries at Glasgow, and ship repairing and engineering works at London, Liverpool and Southampton. The British Admiralty have had a large number of ships built by Harland and Wolff, including cruisers, monitors and destroyers as well as engines for battleships and submarines. The nominal share capital of the company is £12,100,000; the issued capital amounts to £10,340,394. In addition to the many establishments owned directly by the company, they have also controlling interests in steel manufacturing, coal mining and other concerns connected with the supplying of the various materials used in their main business.

HARLAY DE CHAMPVALLON, FRANÇOIS DE (1625–1695), 5th archbishop of Paris, was born in that city on Aug. 14, 1625. Nephew of François de Harlay, archbishop of Rouen, he was presented to the abbey of Jumièges immediately on leaving the Collège de Navarre, and he was only twenty-six

when he succeeded his uncle in the archiepiscopal see. He was transferred to the see of Paris in 1671, he was nominated by the king for the cardinalate in 1690, and the domain of St. Cloud was erected into a duchy in his favour. At first a firm adherent of Mazarin, he is said to have helped to procure his return from exile. He definitely secured the favour of Louis XIV. by his support of the claims of the Gallican Church formulated by the declaration made by the clergy in assembly on March 19, 1682, when Bossuet accused him of truckling to the court like a valet. One of the three witnesses of the king's marriage with Madame de Maintenon, he was hated by her for using his influence with the king to keep the matter secret. He had a weekly audience of Louis XIV. in company with Père la Chaise on the affairs of the Church in Paris, but his influence gradually declined. He urged the revocation of the edict of Nantes, and showed great severity to the Huguenots at Dieppe, of which he was temporal and spiritual lord. He died on Aug. 6, 1695.

See Abbé Legendre, *Vita Francisci de Harlay* (Paris, 1720) and *Eloge de Harlay* (1695); Saint-Simon, *Mémoires* (vol. ii., ed. A. de Boislisle, 1879), and numerous references in the *Lettres* of Mme. de Sévigné.

HARLECH, ancient capital of Merionethshire, Wales, 38 m. from Aberystwyth by G.W.R. Pop. (1921) 1,096 (Parish of Llandanwg). Ruins of a fortress crown the rock of Harlech, about half a mile from the sea. Roman coins have been discovered in the neighbourhood and there are associations with Bronwen, daughter of Bran Fendigaid, and the Mabinogion generally. In the 10th century, Harlech castle was, apparently, repaired by Colwyn, lord of Ardudwy, and thence called Caer Colwyn. The present structure dates from 1285 and is a good example of an Edwardian concentric castle. Edward made Harlech a free borough. Owain Glyn Dwr held it for four years. Dafydd ap Ieuan ap Einion held it for the Lancastrians, until famine made him surrender to Edward IV. From this time is said to date the air *Rhyfelgyrch gwyr Harlech*. The castle was the last to be held for the king in the civil war. The town is a tourist centre. In 1927 Coleg Harlech was established, for adult education on a residential basis.

HARLEQUIN, in modern comedy and pantomime, the posturing and acrobatic character with masked face, shaven head, and attired in parti-coloured and spangled tights; he is provided with a sword like a bat, or lath, with which he works wonders. The term is not now used in the special sense that characterized the original harlequin; it is used in a more or less general way to signify a person who makes funny moves and cuts amusing capers —not unlike those of the clown (*q.v.*)

HARLEQUIN CABBAGE BUG (*Murgantia histrionica*), an American heteropterous insect of tropical or subtropical origin, belonging to the family Pentatomidae. This insect is a native of Mexico and Central America. It made its appearance in Texas in 1864, and in a way repeated the history of the Colorado potato beetle; it found an abundance of cultivated cabbages, multiplied rapidly, and quickly spread. It appeared in North Carolina in 1867; in 1870 it was found in Missouri and Tennessee; in 1876 it reached Delaware; in 1892 it was injurious in New Jersey, and in 1894 it was found on Long Island. At present it is destructive throughout the entire South as far north as tide-water Virginia. North of this point it is only occasionally injurious, apparently being killed by severe winters, reinvading the territory later. It is a brilliantly coloured red-and-black plant-bug, about half an inch in length, and is known by several common names, such as calico-back, fire-bug and terrapin-bug. It sucks the sap from the leaves and leaf-veins of cabbage and other cruciferous crops, causing the plants to wilt and die. A small plant will be killed in a day or so, and as many as 50 or 60 mature bugs are often found on a large plant. It is supposed to hibernate in the adult condition. The barrel-shaped eggs, white-and-black in colour, are laid in double rows on the leaves. The young are active and resemble the adults except that they are wingless. They moult five times before reaching full growth. In the South there may be several generations annually, probably four or five. It is a difficult insect to fight, since insecticide applications that will kill it also injure the plants. Clean-cultural methods, especially a thorough cleaning-up of the fields during the winter time; the use of trap crops of mustard or other cruciferous plants in the spring, on which the insects may be killed by oil applications, the trap-crops themselves being of no value; and hand-picking, are the methods recommended. On trap-crops in the spring, they may be destroyed by hand-torches. (L. O. H.)

HARLEQUIN-FLY, the popular name of small flies of the genus *Chironomus*. The larvae, known as bloodworms, are aquatic and live in foul or very deep water where there is little oxygen. To enable them to utilize fully the scant supply of oxygen, these larvae possess in their blood the same red pigment, haemoglobin, that is found in vertebrates (*See* DIPTERA; COLOUR OF ANIMALS; DISTRIBUTION OF ANIMALS.)

HARLESS (originally HARLES), **GOTTLIEB CHRISTOPH** (1738–1815), German classical scholar and bibliographer, was born at Culmbach in Bavaria on June 21, 1738, and died at Erlangen on Nov. 2, 1815, where he had been professor for 45 years. His numerous classical editions are now superseded, but he will be remembered for his chief work, the new edition of Fabricius' *Bibliotheca Graeca* (12 vols., 1790–1809).

His life was written by his son, Johann Christian Friedrich Harless (1818).

HARLINGEN, a seaport in the province of Friesland, Holland, on the Zuider Zee, and the terminus of the railway and canal from Leeuwarden (15½ m. E.). Pop. (1926) 10,071. Harlingen has become the most considerable seaport of Friesland since the construction of the outer harbour in 1870–77, and in addition to railway and steamship connection with Bremen, Amsterdam, and the southern provinces there are sailings to Hull and London. Sluices protect the inner harbour from the high tides. The only noteworthy buildings are the town hall (1730–33) and the West church, which consists of a part of the former castle of Harlingen. The chief trade of Harlingen is the exportation of Frisian produce, namely, butter and cheese, meat, flax, fish, potatoes, etc. There is also a considerable import trade in timber, coal, manufactured cotton, hemp and jute for the Twente factories.

HARLINGEN, a rapidly growing city of Cameron county, Texas, U.S.A., 28m. N.W. of Brownsville, on Federal highway 96, and served by the Missouri Pacific and the Southern Pacific railways. The population in 1920 was 1,784, and in 1928 was estimated locally at 13,500. It is an important distributing centre for the irrigated lands of the Lower Rio Grande valley, and there are cotton gins and compresses and other industries. Harlingen was settled about 1904 and incorporated in 1910.

HARMATTAN (har-mat-tăn′), a hot, dry desert wind between November and March on the coast of Upper Guinea, often bringing clouds of red dust which form a dense haze and impede river navigation. Locally, the wind is termed "the Doctor" for, notwithstanding its disadvantages, it forms a welcome relief from the damp heat of the previous season.

HARMINE, an alkaloid of the formula $C_{13}H_{12}ON_2$ (*see* CHEMISTRY: *Organic, Heterocyclic Division*).

HARMODIUS (Gr. har-mŏd-ĭ-ŏs), a handsome Athenian youth, friend of Aristogeiton. Hipparchus, the younger brother of the tyrant Hippias, endeavoured to supplant Aristogeiton in the good graces of Harmodius, but, failing in the attempt, revenged himself by putting a public affront on Harmodius's sister at a solemn festival. Thereupon the two friends conspired with a few others to murder both the tyrants during the armed procession at the Panathenaic festival (514 B.C.). Seeing one of their accomplices speaking to Hippias, and imagining that they were being betrayed, they prematurely attacked and slew Hipparchus alone. Harmodius was cut down on the spot by the guards, and Aristogeiton was soon captured and tortured to death. When Hippias was expelled (510), Harmodius and Aristogeiton became the most popular of Athenian heroes; their descendants were exempted from public burdens, and had the right of public entertainment in the Prytaneum, and their names were celebrated in popular songs and scolia (after-dinner songs) as the deliverers of Athens. One of these songs, attributed to a certain Callistratus, is preserved in Athenaeus (p. 695). Their statues by Antenor in the agora were carried off by Xerxes and replaced by new ones by Critius and

Nesiotes. Alexander the Great afterwards sent back the originals to Athens. It is not agreed which of these was the original of the marble tyrannicide group in the museum at Naples.

HARMONIA, in Greek mythology, according to one account the daughter of Ares and Aphrodite, and wife of Cadmus When the government of Thebes was bestowed upon Cadmus by Athena, Zeus gave him Harmonia to wife All the gods honoured the wedding with their presence. Cadmus (or one of the gods) presented the bride with a robe and necklace, the work of Hephaestus. This necklace brought misfortune to all who possessed it; it led to the death of Amphiaraus, of Eriphyle, of Alcmaeon, of Phegeus and his sons Even in historic times its baleful influence continued. Phayllus, one of the Phocian leaders in the Sacred War (352 B.C.) carried it off and gave it to his mistress. After she had worn it for a time her son was seized with madness and set fire to the house, and she perished in the flames. Both Harmonia and Cadmus were ultimately turned into snakes after a life of misfortunes Other accounts make Harmonia daughter of Zeus and Electra (the Pleiad), or allegorize her as a personification of concord

See Preller-Robert (index, s.v.) and the classical dictionaries.

HARMONIC. In acoustics, a harmonic is a secondary tone which accompanies the fundamental or primary tone of a vibrating string, reed, etc., the more important are the 3rd, 5th, 7th, and octave (*see* SOUND, HARMONY)

For Harmonics in mathematics *see* SPHERICAL HARMONICS

HARMONICA, a generic term applied to musical instruments in which sound is produced by friction upon glass bells. The word is also used to designate instruments of percussion of the Glockenspiel type, made of steel and struck by hammers (Ger. *Stahlharmonika*).

The origin of the glass-harmonica tribe is to be found in the fashionable 18th century instrument known as musical glasses (Fr. *verrillon*), the principle of which was known already in the 17th century The *verrillon* or *Glasspiel* consisted of 18 beer glasses arranged on a board covered with cloth, water being poured in whenever it was found necessary in order to alter the pitch, and the sound being produced by passing the moistened finger round the rims. (Or sometimes the sides of the glasses were struck instead by wooden sticks.) Gluck gave a concert at the "little theatre in the Haymarket" (London) in April 1746, at which he performed on musical glasses a concerto of his composition with full orchestral accompaniment

When Benjamin Franklin visited London, in 1757, he was so much struck by the possibilities of the glasses as musical instruments that he set to work on a mechanical application of the principle involved, the result being the glass harmonica finished in 1762. The instrument was for many years in great vogue Mozart, Beethoven, Naumann and Hasse composed music for it, while it had its celebrated virtuosi, such as Marianne Davies and Marianna Kirchgessner.

The curious vogue of the instrument, as sudden as it was ephemeral, produced emulation in a generation unsurpassed for zeal in the invention of musical instruments The most notable of its offspring were Carl Leopold Röllig's improved harmonica with a keyboard in 1780, Chladni's euphon in 1701 and clavicylinder in 1790, Ruffelsen's melodicon in 1800 and 1803, Franz Leppich's panmelodicon in 1810, and Buschmann's uranion in the same year. Most of these have long since completely disappeared, but many specimens of the Franklin type are still preserved, one being in the Victoria and Albert Museum, London. It may be added, moreover, that instruments of the latter type are still in use in humble circles, being played by itinerant performers in the streets and elsewhere

For the steel harmonica *see* GLOCKENSPIEL.

HARMONIC ANALYSIS. Many physical phenomena, such as sound waves, alternating electric currents, tides, machine motions, etc., may be periodic in character. Such motions can be measured at a number of successive values of the independent variable, usually the time; and these data, or a curve plotted from these data, will represent a function of that independent variable. Thus the ordinate of the curve at any point is

$$y=f(x).$$

Generally the mathematical expression for $f(x)$ will be unknown. However, with the periodic functions to be found in nature, $f(x)$ can be expressed as the sum of a number of sine and cosine terms. Such a sum is known as a Fourier series (*q.v.*) and the determination of the coefficients of these terms is called *harmonic analysis* The term harmonic analysis can also be used in the broader sense of the analysis into any kind of periodic components, such as spherical harmonics, cylindrical harmonics, tesseral harmonics, etc However, in this treatment we shall confine ourselves to the development into Fourier series, which development has found more extensive practical application than any of the others One of the terms of such a series has a period equal to that of $f(x)$ and is called the *fundamental* Other terms have shorter periods, which are aliquot parts of the fundamental These are called *harmonics*

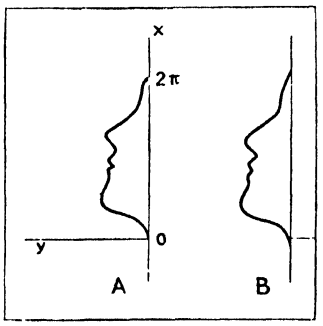

FIG. 1

Applications.—Harmonic analysis is of great value in mathematics, in physics, and in engineering A sound wave, for instance, can cause the vibration of a thin diaphragm, whose motion is photographed in the form of a continuous curve by the use of the Phonodeik of D. C. Miller, or by other methods The shape of the resulting curve will depend on the quality of the sound and will generally be quite complicated However, it can be analysed into its fundamental and harmonics or overtones by use of Fourier series It is the number and magnitude of these harmonics which determine the quality of the sound, and therefore such investigations are of great value in the scientific study of music and speech Similar methods are used extensively by the electrical engineer in the study of alternating currents In mechanical engineering they can be used in the investigation of valve motion and other mechanical movements Harmonic analysis is also used in the study of tidal records; and, by the use of such information as it affords, the prediction of tides is possible. (*See* TIDES)

All the above applications have been for cases where the movements are truly periodic In a large class of other phenomena, such as the weather, sun spots, magnetic deviations, river flow, atmospheric strays in radio reception, etc., the fundamental period is usually not evident and the periods of the harmonics are not aliquot parts of the fundamental Even in such cases, however, modified methods are being used to some extent, the analysis still being made into a series of sine or cosine terms

Any ordinary non-periodic curve of finite length can also be analysed by the harmonic method, the scale being changed in the x-direction so that the length is 2π units An example taken from D. C. Miller's excellent book, *The Science of Musical Sounds*, is shown in fig. 1a, where a profile is analyzed and found to have the equation

$$\begin{aligned} y = {} & 40.6\sin(\theta+302^\circ)+17.4\sin(2\theta+208^\circ) \\ & +13.8\sin(3\theta+105^\circ)+7.1\sin(4\theta+215^\circ) \\ & +4.5\sin(5\theta+80^\circ)+0.6\sin(6\theta+171^\circ) \\ & +2.7\sin(7\theta+34^\circ)+0.6\sin(8\theta+242^\circ) \\ & +1.6\sin(9\theta+331^\circ)+1.3\sin(10\theta+208^\circ) \\ & +0.3\sin(11\theta+80^\circ)+0.5\sin(12\theta+220^\circ) \\ & +0.7\sin(13\theta+103^\circ)+0.3\sin(14\theta+305^\circ) \\ & +0.4\sin(15\theta+160^\circ)+0.5\sin(16\theta+230^\circ) \\ & +0.5\sin(17\theta+207^\circ)+0.4\sin(18\theta+64^\circ). \end{aligned}$$

These harmonics were then combined, giving the result shown in fig. 1b.

Numerical Methods.—In 1822 Fourier showed that a function $y=f(x)$ could be expressed between the limits of $x=0$ and $x=2\pi$ by the series:

Measured ordinates	Sums	Diffs.		Sine terms: 1st and 5th	Sine terms: 3rd	Cosine terms: 1st and 5th	Cosine terms: 3rd
y_0		d_0					
y_1 y_5	S_1	d_1	$\sin 30^\circ$	S_1		d_2	
y_2 y_4	S_2	d_2	$\sin 60^\circ$		S		d_1
y_3	S_3		$\sin 90^\circ$	S_3	S_1-S_3	d_0	d_0-d_2
				S_0 S_2	S	D_0 D_2	D
				$a_1=\frac{S_0+S_2}{3}$	$a_3=\frac{S}{3}$	$b_1=\frac{D_0+D_2}{3}$	$b_3=\frac{D}{3}$
				$a_5=\frac{S_0-S_2}{3}$		$b_5=\frac{D_0-D_2}{3}$	

$$y = a_1 \sin x + a_2 \sin 2x + a_3 \sin 3x + \cdots + b_0 + b_1 \cos x + b_2 \cos 2x + \cdots \quad (1)$$

provided the function is single-valued, finite, and continuous, or at least with a finite number of discontinuities. The coefficients are

$$\left.\begin{aligned} b_0 &= \frac{1}{2\pi}\int_0^{2\pi} y\,dx \\ b_k &= \frac{1}{\pi}\int_0^{2\pi} y\cos kx\,dx \\ a_k &= \frac{1}{\pi}\int_0^{2\pi} y\sin kx\,dx \end{aligned}\right\} \quad (2)$$

where $k = 1, 2, 3, \cdots$

Equation (1) can be written in the alternate form:

$$y = c_1\sin(x+\phi_1) + c_2\sin 2(x+\phi_2) + c_3\sin 3(x+\phi_3) + \cdots, \quad (3)$$

where

$$c_k = \sqrt{(a_k^2 + b_k^2)}, \qquad \phi_k = \tan^{-1}\frac{b_k}{a_k} \quad (4)$$

Assume that a record has been obtained of some periodic phenomenon expressed as a curve or as a set of data which can be plotted and called $f(x)$. Even although $f(x)$ cannot be expressed as a simple function, equation (1) can be used to represent it, and the coefficients a_k and b_k can be determined. It will be necesary first to find the period of the function; that is, the distance between corresponding points on successive waves. This distance will be called 2π radians or 360°, and can then be divided into any convenient number of parts, say n The first n ordinates are measured and their values substituted in equation (1), giving n equations in the n undetermined coefficients. These equations can be solved to obtain a_k and b_k. The n equations have the form:

$$y_k = b_0 + b_1\cos x_k + b_2\cos 2x_k + \cdots + a_1\sin x_k + a_2\sin 2x_k + \cdots,$$

where $k = 0, 1, 2, 3, \ldots (n-1)$ successively; y_k is the *kth* ordinate of the curve, and x_k is the corresponding abscissa expressed in degrees From these it can be shown that

$$\left.\begin{aligned} b_0 &= \frac{1}{n}(y_0 + y_1 + y_2 + \cdots + y_{n-1}), \\ b_k &= \frac{2}{n}(y_0\cos k x_0 + y_1\cos k x_1 + \cdots + y_{n-1}\cos k x_{n-1}), \\ a_k &= \frac{2}{n}(y_0\sin k x_0 + y_1\sin k x_1 + \cdots + y_{n-1}\sin k x_{n-1}). \end{aligned}\right\} \quad (5)$$

A curve plotted from (1) using the coefficients (5) will pass through all the values y_k exactly, but probably will not coincide with the experimental curve at other points Obviously, the use of a larger number of terms will increase the accuracy. In some applications the function can be very closely approximated by a few terms. In other cases, particularly if the wave has sharp corners, a large number of terms is necessary to get a sufficiently accurate expression It is often possible to tell something about the coefficients by inspection, thus simplifying the mathematical work of analysis. If positive and negative loops of the curve are the same, then even harmonics are absent This is practically always the case with alternating currents Also, if the curve for $x < 0$ is the reflection in the y-axis of the curve for $x > 0$, there will be no sine terms; while if the curve is symmetric about the origin, there are no cosine terms

Schedule Methods.—The use of equation (5) is the basis of numerous so-called *schedule methods* of analysis. These are merely short cuts for solving the equations (5), many of the routine multiplications being combined and tabulated in a schedule Of these, the best-known is probably that of Runge. It can best be explained by an example For this a six-point schedule has been selected Only odd harmonics are considered, and the zero is taken where the curve crosses the x-axis Then the six equations are:

$$\begin{aligned}
3b_1 &= y_1\cos 30^\circ + y_2\cos 60^\circ + y_3\cos 90^\circ + y_4\cos 120^\circ + y_5\cos 150^\circ, \\
3b_3 &= y_1\cos 90^\circ + y_2\cos 180^\circ + y_3\cos 270^\circ + y_4\cos 360^\circ + y_5\cos 450^\circ, \\
3b_5 &= y_1\cos 150^\circ + y_2\cos 300^\circ + y_3\cos 450^\circ + y_4\cos 600^\circ + y_5\cos 750^\circ, \\
3a_1 &= y_1\sin 30^\circ + y_2\sin 60^\circ + y_3\sin 90^\circ + y_4\sin 120^\circ + y_5\sin 150^\circ, \\
3a_3 &= y_1\sin 90^\circ + y_2\sin 180^\circ + y_3\sin 270^\circ + y_4\sin 360^\circ + y_5\sin 450^\circ, \\
3a_5 &= y_1\sin 150^\circ + y_2\sin 300^\circ + y_3\sin 450^\circ + y_4\sin 600^\circ + y_5\sin 750^\circ.
\end{aligned}$$

All can be expressed as functions of 30, 60, and 90 degrees:

$$\begin{aligned}
3b_1 &= (y_2 - y_4)\sin 30^\circ + (y_1 - y_5)\sin 60^\circ, \\
3b_3 &= -(y_2 - y_4)\sin 90^\circ, \\
3b_5 &= (y_2 - y_4)\sin 30^\circ - (y_1 - y_5)\sin 60^\circ, \\
3a_1 &= (y_1 + y_5)\sin 30^\circ + (y_2 + y_4)\sin 60^\circ + y_3\sin 90^\circ, \\
3a_3 &= (y_1 - y_3 + y_5)\sin 90^\circ, \\
3a_5 &= (y_1 + y_5)\sin 30^\circ - (y_2 + y_4)\sin 60^\circ + y_3\sin 90^\circ.
\end{aligned}$$

It will be noticed that, except for y_3, all the coefficients occur as sums or differences. In the schedule given above, y_0 has been added so that the curve does not have to cross the x-axis at $x = 0$. If $f(x) = 0$ when $x = 0$, as in the previous equations, then of course y_0 disappears. The work can be tabulated as shown above. A numerical example given by Grover is as follows:

	Ordinates	Sums	Diffs.		Sine terms: 1st and 5th		Sine terms: 3rd	Cosine terms: 1st and 5th		Cosine terms: 3rd
0	−1·3		−1·3							
1	15·1 17·3	32·4	−2·2	0·50	+16·200			−0·425		
2	28·0 28·85	56·85	−0·85	0·86		−40·233	32·400		−1·905	−1·300
3	32·35	32·35		1·00	32·350		32·350	−1·300		0·850
			Sums		48·550	40·233	0·050	1·725	1·905	−0·450
			S_e		40·233	−0·683		1·905	0·180	
					97·783			−3·630		
			$a_1=$		32·594			$b_1=-1·210$		$b_3=-0·150$
					$a_5=-0·228$		$a_3=0·017$	$b_5=0·060$		

This has been plotted in fig. 2. The heavy curve is the one to be analyzed. The six points used in the above schedule are enclosed by circles. Since the wave is nearly sinusoidal, the analysis results in a large fundamental sine curve and very small higher harmonics. Synthesis gives the light curve of fig. 2. It will be noted that this passes through all six points, but obviously it cannot be expected to coincide with the original curve throughout. By

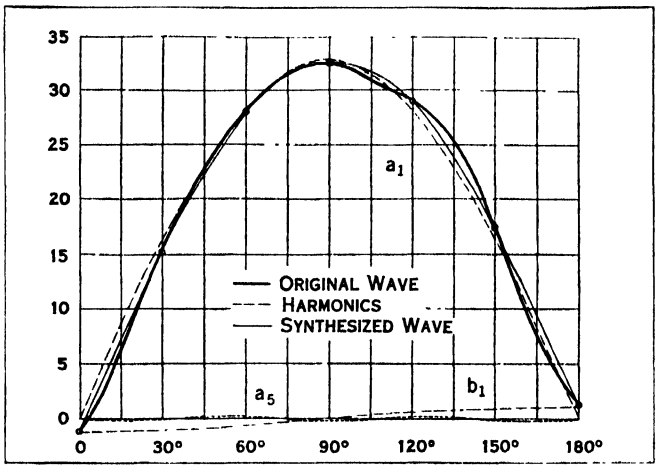

FIG. 2

taking a larger number of points and, therefore, a different schedule, a much closer approximation would be obtained.

A method of selected ordinates has been devised by Fischer-Hinnen. This appears to require slightly less computation than the Runge method, but has the disadvantage that a new set of equally-spaced ordinates must be measured for each pair of coefficients. Other methods of computation of the coefficients have been worked out by Steinmetz, S. P. Thompson and others. Various graphical methods have also been devised. C. S. Slichter, for instance, uses a special graph paper which introduces the sine or cosine factor without computation. The area under the curve is measured with an ordinary planimeter. It requires the replotting of the curve for each coefficient, and it is doubtful if any time is saved over the schedule method. Other graphical methods have been used by Clifford, Perry, Harrison, Ashworth, Beattie and Rottenburg.

Mechanical Methods.—The above methods all require a large amount of labour, especially if many coefficients are to be determined. If much of the work is to be done, therefore, some machine method is advisable. Equation (2) is used in most of the mechanical analyzers.

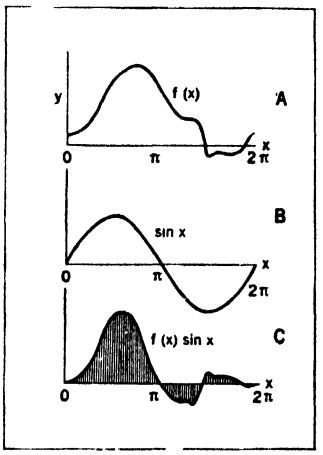

FIG. 3

If the curve $y=f(x)$ of fig. 3a is to be analyzed, it is merely necessary to multiply the ordinates by sin x (fig. 3b) and obtain the area under the resulting curve (fig. 3c). This gives $f(x)$ sin $x\,dx$, which is proportional to a_1. The other coefficients are obtained similarly. Most of the machines, therefore, consist of some means of multiplying the ordinates of the curve by sin kx or cos kx and integrating the product. (*See* MATHEMATICAL INSTRUMENTS.)

The first mechanical harmonic analyzer was proposed by Lord Kelvin, who made use of an integrator invented by his brother, J. Thomson. The integrator consists of a disc D, a sphere S, and a cylinder C, as shown in fig. 4. The sphere rolls along a diameter of the disc so that when it is in the centre of D it will be unaffected by the rotation of D. At any other point it will turn an amount proportional to its distance from the centre of D. This motion is communicated to the cylinder. Pure rolling motion is used throughout, a principle which Kelvin considered very important.

In the Kelvin harmonic analyser the sphere S is rolled back and forth along the disc by an amount equal to the ordinates of the curve being traced. Therefore, if the sphere is a distance r

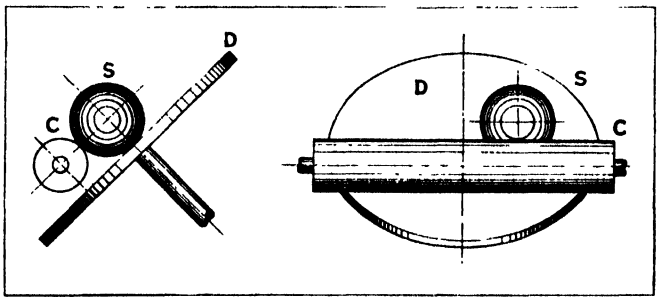

FIG. 4

from the centre of D, $r=f(x)$. At the same time the disc is given a sinusoidal motion. Thus, if the curve moves a distance dx, the disc will turn through an angle $C\begin{Bmatrix}\cos kx\\ \sin kx\end{Bmatrix}dx$ where C is a constant dependent on the construction of the apparatus. The distance moved by a point on the surface of the cylinder is

$$rC\begin{Bmatrix}\cos kx\\ \sin kx\end{Bmatrix}dx = Cf(x)\begin{Bmatrix}\cos kx\\ \sin kx\end{Bmatrix}dx.$$

If the curve is traced for a complete period, the total displacement of a point on the surface of the cylinder is

$$C\int_0^{2\pi} f(x)\begin{Bmatrix}\cos kx\\ \sin kx\end{Bmatrix}dx$$

which, by (2), is proportional to the kth sine or cosine coefficient. By having a number of such units side by side several coefficients can be obtained at once. The spheres are all moved together an amount equal to the ordinates of the curve, while the discs are turned through angles which are exact multiples of each other.

Another machine working on a similar principle is that invented by Henrici and developed by Coradi. This very beautiful instrument makes use of a number of glass spheres which are moved an amount equal to the ordinate of the curve. The readings are obtained by two Amsler integrating wheels bearing on each sphere, one reading sine components, and the other, cosine components. A five-sphere machine will thus give ten coefficients for one trace of the curve. The machine is speedy and accurate, but its expense and delicacy have limited its use to some extent. The Michelson and Stratton analyzer will handle up to eighty coefficients at once. It works equally well as a synthesizer and has been extensively used in tide prediction. The Chubb analyzer differs from all others in that it uses a polar graph instead of a rectangular one. The curve, in the form of a cardboard template, is fastened to the table of the machine. The table moves back and forth with a sinusoidal motion as it turns, and the result is integrated by an ordinary planimeter. The machine can evaluate only one coefficient at a time and is therefore slow. It is very rugged, and finds considerable use in connection with polar oscillograms.

A product integraph, recently developed at the Massachusetts Institute of Technology, obtains the integral of the product of any two curves. Its primary use is in the mechanical solution of differential equations, but obviously it can be used for harmonic analysis. In fact, it will develop curves in terms of various other series as well as the harmonic series of Fourier. Many other machines have been proposed, notably by Mader, Rowe, Wiechert and Sommerfeld, Bashforth, Yule, Le Conte, Terada, Dellenbaugh and Woodbury. Most of these machines work on the principle previously mentioned, though the Dellenbaugh uses the schedule method, while the Woodbury is based on the Fischer-Hinnen method.

Direct Analysis.—All the above methods make use of an experimentally-determined curve or set of data In the case of electric currents or voltages, an entirely different method is possible. This direct method was suggested by Pupin in 1894, and has been developed recently by the Bell System laboratories Instead of first getting an oscillographic record of the voltage or current and then analyzing it mathematically, the analysis is performed directly on the electric quantity by making a record of the response when the natural frequency of a tuned circuit is varied through a wide range

A large number of methods are available for the harmonic analysis of complex waves The direct mathematical method is unnecessarily long and arduous This has been simplified by schedules which are fairly quick and are the methods generally used if only a small amount of such work is to be done If much harmonic analysis is required, it is advisable to use a machine analyzer, such as the Henrici-Coradi, the Michelson and Stratton, or the Chubb. Of these the first appears to offer advantages, if five or ten coefficients are sufficient If a very large number of terms is required, the Michelson and Stratton is advisable

The reverse process of *synthesis* is also used to a considerable extent, particularly in tide prediction Various machines have been built for this purpose, the first being designed by Kelvin An extremely compact form of Kelvin synthesizer was built by D. C Miller for use in his work on the theory of musical sounds The Michelson and Stratton machine is also very good for synthesis In fact, any of the analyzers can be used for this purpose, though some are much more convenient than others

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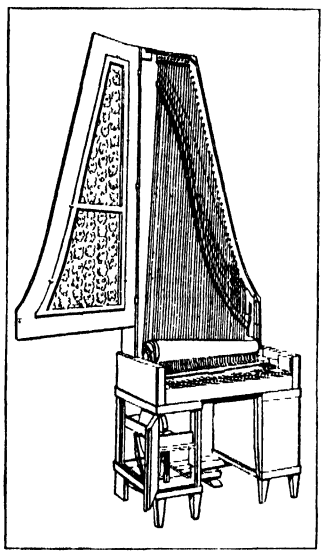
HARMONICHORD, an ingenious kind of upright piano, in which the strings were set in vibration not by the blow of a hammer but by friction. One of the many attempts to fuse piano and violin, the harmonichord was invented by Johann Gottfried and Johann Friedrich Kaufmann (father and son) in Saxony at the beginning of the 19th century. The space under the keyboard was enclosed, a knee-hole being left in which were two pedals used to set in rotation a large wooden cylinder fixed just behind the keyboard over the levers The cylinder (in some specimens covered with chamois leather) tapered towards the treble-end When a key was depressed, a little tongue of wood, one end of which stopped the string, was pressed against the revolving cylinder, and the vibrations produced by friction were transmitted to the string and reinforced as in piano and violin by the soundboard. Carl Maria von Weber must have had some opinion of the possibilities of the harmonichord, since he composed for it a concerto with orchestral accompaniment.

HARMONIUM, a wind, keyboard instrument, otherwise a small organ without pipes, furnished with free reeds. Both the harmonium and its later development, the American organ, are known as free-reed instruments, the musical tones being produced by tongues of brass, technically termed "vibrators" The vibrator is fixed over an oblong, rectangular frame, through which it swings freely backwards and forwards like a pendulum while vibrating, whereas the beating reeds (similar to those of the clarinet family), used in church organs, cover the entire orifice, beating against the sides at each vibration. A reed or vibrator, set in periodic motion by impact of a current of air, produces a corresponding succession of air puffs, the rapidity of which determines the pitch of the musical note. There is an essential difference between the harmonium and the American organ in the direction of this current; in the former the wind apparatus forces the current upwards, and in the latter sucks it downwards, whence it becomes desirable to separate in description these varieties of free-reed instruments

Harmonium.—This has a keyboard of five octaves compass when complete, and a simple action controlling the valves, etc. The necessary pressure of wind is generated by bellows worked by the feet of the performer upon foot-boards or treadles. The air is thus forced up the wind-trunks into an air-chamber called the wind-chest, the pressure of it being equalized by a reservoir, which receives the excess of wind through an aperture, and permits escape, when above a certain pressure, by a discharge valve or pallet The aperture admitting air to the reservoir may be closed by a drawstop named "expression" The air being thus cut off, the performer depends for his supply entirely upon the management of the bellows worked by the treadles, whereby he regulates the compression of the wind. The character of the resulting tone is then entirely changed from a mechanical response to the player's touch to an expressive one, varying in correspondence with the increase or diminution of sound through the greater or less pressure of wind to which the reeds may be submitted. The drawstops bearing the names of the different registers in imitation of the organ, admit, when drawn, the wind from the wind-chest to the corresponding reed compartments, shutting them off when closed

American Organ.—This acts by wind exhaustion A vacuum is practically created in the air-chamber by the exhausting power of the footboards, and a current of air thus drawn downwards passes through any reeds that are left open, setting them in vibration. Valves in the board above the air-chamber give communication to reeds made more slender than those of the harmonium and more or less bent, while the frames in which they are fixed are also differently shaped, being hollowed rather in spoon fashion The channels, the resonators above the reeds, are not varied in size or shape as in the harmonium; they exactly correspond with the reeds, and are collectively known as the "tuneboard." The American organ has a softer tone than the harmonium. The "automatic swell" in the instruments of Mason and Hamlin (of Boston, U S.A), is a contrivance which assists expression. Another very clever improvement introduced by these makers, who were the originators of the instrument itself, is the "vox humana," effected by a fan, made to revolve rapidly by a wind pressure; its rotation, disturbing the air near the reeds, causes interferences of vibration that produce a tremulous effect, not unlike the beatings heard from combined voices, whence the name.



FROM G KINSKY, "CATALOGUE OF THE HEYER MUSIKHISTORISCHES MUSEUM"

THE HARMONICHORD, A KIND OF PIANOFORTE IN WHICH SOUND WAS OBTAINED BY THE FRICTION OF A CYLINDER TURNED BY PEDALS

History.—The start in the instrument's invention was due to Prof. Christian Gottlieb Kratzenstein of Copenhagen, who having had the opportunity of examining a Chinese cheng sent to his native city, invented about 1779, a small pneumatic organ fitted with free reeds which appears to have been the first instrument of its kind

During the first half of the 19th century numerous efforts in

France and Germany, and subsequently in England, were made to produce new keyboard instruments with free reeds, the most notable of these being the physharmonica of Anton Häckel, invented in Vienna in 1818, which, improved and enlarged, has retained its hold on the German people. The modern physharmonica is a harmonium without stops or percussion action; it does not therefore speak readily or clearly. It has a range of five or six octaves Other instruments of similar type are the French melophone and the English seraphine, a keyboard harmonica with bellows but no channels for the tongues, for which a patent was granted to Myers and Storer in 1830; the aeoline or aelodicon of Eschenbach; the melodicon of Dietz; the melodica of Rieffelson; the apollonicon; the new cheng of Reichstein; the terpodion of Buschmann, etc But none of these has survived.

HARMONY. In its earliest English sense the term harmony, in music, is applied to any pleasing arrangement of musical sounds; but technically it is confined to the science of the simultaneous combination of sounds of different pitch, without regard to their quality of tone or *timbre*, a matter which belongs to the province of instrumentation (*q.v.*). The sense of the word harmony is further restricted to the study of combinations rather as blocks of sound than as textures The fundamental aesthetic texture of harmony is counterpoint (*q.v.*).

But while the abstraction of harmony from instrumentation is as legitimate and necessary as the abstraction of draughtmanship from colour, the abstraction of harmony from counterpoint cuts music adrift from its foundations and leads to no better results than the abstraction of sound from sense. Harmony is to classical music what perspective is to pictorial art But visual perspective is a science, whereas this musical perspective is wholly an art The present article aims at showing that its laws are true to the nature of art and are no mere rules of a game. But we must not impute the meaning of its laws to any music earlier than the 14th century, and even in the spacious days of Elizabeth and Palestrina there are many things in harmony which do not mean what we would mean by them to-day

I. ORIGINS OF CONCORD AND DISCORD

The diatonic major scale (or something very like it) may be found by playing eight successive white notes from C to C on the pianoforte. It would be better to accept this as a scientific definition than to begin the study of harmony with questions like that as to whether the first hen preceded or followed the first egg. The interesting fact is that the ancient Greeks showed a latent harmonic sense by developing the diatonic scale that has proved itself capable of bearing our classical system of harmony. In the article Music the origin of scales is touched upon; in the meantime we may assume that eggs are eggs without waiting for the latest researches of bio-chemistry.

The one ostensible effort the Greeks made at organizing simultaneous notes of different pitch was the practice of *magadizing*. The magadis was a stringed instrument with a bridge that divided the strings at two-thirds of their length. The shorter portion of the string then sounded an octave higher than the longer. To magadize, therefore, was to get the voices of children or women to sing in octaves above the voices of men.

Now we may begin our survey of harmonic combinations with two propositions. First, any two notes an octave apart are harmonically identical. From this we may draw two useful inferences —first, that doubling in octaves never was and never will be a process of harmonization; and, secondly, that a combination does not change its meaning by the addition or subtraction of an octave.

The second fundamental proposition is that harmonies are built upwards from the bass. This will be denied by some theorists; but the present line of thought is not an *a priori* theory, but the observation of facts. By "low" notes we mean sounds produced by slow vibrations, and by "high" notes sounds produced by rapid vibrations.

The harmonic identity of notes an octave apart was a matter of physical sensation before the dawn of history. In 1862 Helmholtz explained it and a great many other facts in musical aesthetics. He solemnly warned musical theorists against hastily applying his scientific results to the art of music, and warned them in vain. But we may safely draw some inferences from his discovery that the *timbre* of a note depends upon the selection and proportion of a series of overtones in the vibration-ratios of aliquot parts of the fundamental note. Thus, a note adds nothing to a lower note if it is at the distance of an overtone; except in that if the distance is not exactly one or more octaves the combination will assume the harmonic sense of its difference from an octave; thus, a 12th is equivalent to a 5th

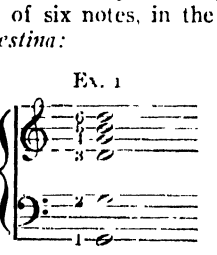
Distances of pitch, it may here be explained, are called intervals. They are reckoned (numerically and inclusive of both notes) up a diatonic scale. From the fundamental (or tonic) note of a major scale (as from C on the white notes of the pianoforte) all intervals within that scale are *major*, and the 4th, 5th and octave are called *perfect* Intervals a semitone less than major are called *minor*, except in the case of perfect intervals, which become *imperfect* or *diminished* when reduced by a semitone. Otherwise a diminished interval is a semitone less than minor. An augmented interval is a semitone greater than major The terms "augmented" and "diminished" should be applied only to *chromatic* intervals, that is to say, to intervals of which one note is foreign to the scale of reference. There is in every scale one 4th that is greater than perfect (F to B in the scale of C) and one imperfect 5th (B to F). This diatonic enlarged 4th is called the *tritone* Intervals are "inverted" by raising the lower note to a higher octave; thus the imperfect 5th is the inversion of the tritone 4th

Helmholtz's discovery of the nature of timbre proves that certain aspects of harmony are latent in nature. Conversely, the art of harmony constantly produces effects of timbre apart from those of the particular instruments in use. But musical elements interact in ways that quickly carry musical aesthetics into regions far removed from any simple relation between harmony and timbre. What acoustics can tell us of concord and discord is not only inadequate for our musical experience, but contrary to it. Acoustics tell us that the rapid "beats" that distress the ear in harsh combinations are due to the periodic reinforcements and weaknesses that occur as the waves get in and out of phase with each other. When these beats are so rapid as to produce a note of their own, this resultant tone may or may not be pleasant; the painful stage of beats is that in which they are noticeable, as a flickering light is noticeable. Combinations that are out of beating distance may set up beats between the upper note and the octave harmonic of the other. On this criterion, 3rds and 6ths, especially the minor 6th, are rougher than many combinations that rank as discords, or than some that have never been digested in classical harmony, such as the 7th overtone.

The art of music had not attained to the simplest scheme for dealing with discords before it traversed the acoustic criterion in every direction. It became a language in which sense dictated what should be accepted in sound. The minor 6th, as the inversion of the major 3rd, occurs in many positions of what has come to be the most fixed chord in music, the major triad. On the other hand, a discord beyond beating-distance will have no beats if it is produced in a timbre that has no octave overtones; but if its sense has come to be that of a discord, its timbre will not make it a concord.

The theorists of the 16th century shrewdly regarded the major triad as really a chord of six notes, in the ratios of 1,2,3,4,5,6, which they called the *Sestina:*

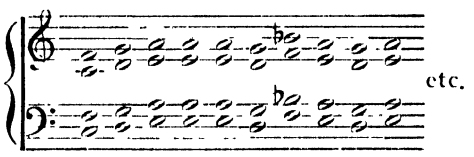
Ex. 1



Long before this natural phenomenon had been recognized music had organized many other elements into its language, and harmony had become (what it has ever since remained, apart from experiments) counterpoint. This arose, slowly and painfully, out of devices diametrically opposed to it. The organum or diaphonia

of the 10th century amounted to a magadizing in all the perfect concords, *i.e.*, in 4ths or 5ths doubled by octaves, thus:

Ex. 2



Its intention was that of a glorified unison and it survives, unheard except as artificial timbre, in the guise of a shrill aura above the notes of the full organ when that instrument is using the most ancient of its registers, the mixture stops. (Some observers have reported the present practice of something like diaphonia in remote parts of Japan.)

The problem of counterpoint was attacked in two ways. First there was a slow evolution through experiments in ornamenting one or more voices of an organum. This gradually took shape as the art of discant, and was slow to move far from the foundation of parallel perfect concords. On the other hand, a violent frontal attack was made by the "motets" of the 13th and 14th centuries, which had no connection with the sublime motet-form of 16th century church music, but consisted in the simultaneous singing of several melodies, independent and perhaps pre-existing; the combination being rough-hewn into a harmony justified by the rule of *marche, ou je t'assomme*. The rough-hewing consisted in contriving that the perfect concords should be conspicuous at the strong accents, on which condition the rest of the harmony could take care of itself. We are apt to misread our documents by forgetting that the note which is now double the length of the longest note in normal use originally deserved its name of "breve." A Hungarian band produces a general harmonic effect more like that of Brahms's Hungarian dances than like any less classical music; but if the details of the Hungarian ornamentation and part-writing were written in breves, semibreves and minims we should find them remarkably like mediaeval counterpoint.

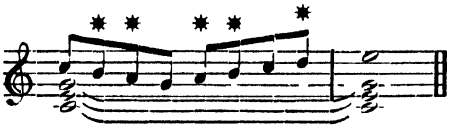
II. PURE POLYPHONY

The first matter of principle that emerged from the chaos was that if the parallel movement of perfect concords was right, everything else was wrong. A few compositions show an evenly-balanced conflict of opposing principles. Our wonderful English rota "Sumer is icumen in" sounds to us like a tuneful six-part double cannon spoilt (or rendered quaint) by numerous consecutive 5ths. Its contemporaries were more likely to have regarded it as a beautiful scheme of perfect concords spoilt or illuminated by dangerous licences. There was no room for prolonged doubt as to where the path of progress and freedom lay. And if the basis of harmony was to be independent melody, then one of the main cares of the composer was to prevent his independent melodies from lapsing into duplications. Fifths and octaves will still form (as they do at the present day) cardinal points in every chord that is dwelt upon; but no two voices can double each other for two consecutive octaves or 5ths without dissolving their integrity in a false resonance.

As to discords the criterion ceased to be acoustical. After centuries of trial and error, musicians accepted 3rds and 6ths as concords; and all discords became equal to one another in mildness when they occurred as unaccented passing-notes proceeding by diatonic conjunct notes between one concord and the next. Polyphony made musical accents far stronger than those of speech; and so the behaviour of accented discords was more restricted. The accented discord must be "prepared" by first appearing as a concord. It then becomes a discord by being held or "suspended" while the other voices move against it; after which it must "resolve" by a step downwards. Upward resolutions are harsh and of complex import, intelligible only in a later system, and so are discords that skip.

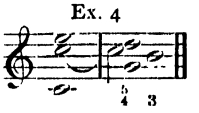
Ex. 3 shows passing-notes (marked*) moving up and down between concords:

Ex. 3



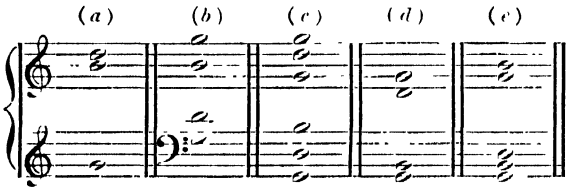
In Ex. 4 the tied C is a suspension, prepared by having begun as an octave, becoming a discord by colliding as a 4th against a 5th, and resolving by stepping down to a 3rd.

Ex. 4



Four three-note chords attained the rank of concords. (Two of them were only inversions of the other two.) First, of course, there was the major triad, the upper three notes (4, 5, 6) of the sestina (Ex. 1). All doublings and differences of octave are negligible in the distribution of a chord so long as they do not bring its middle or upper notes into the bass. All the following examples are concords identical with the sestina and with each other, though the positions that leave two parts low at a distance from the upper parts, or that double the 3rd, are acoustically as rough as many a discord. Positions (*d*) and (*e*) could be justified only in circumstances of great polyphonic or instrumental interest.

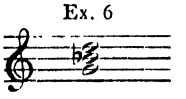
Ex. 5



The essential intervals are those of position (*a*) and comprise a perfect 5th (G–D), a major 3rd from the bass (G–B) and a minor 3rd above (B–D).

Now in listening to polyphony the mind can appreciate the parts two at a time; and the 16th century theorists avoid reasoning as if the mind could do more. They were probably right as well as cautious; nor is it necessary that the mind should attempt more. For any fault in the aggregate of the richest polyphony must be a fault between two parts. If it concerns more, then it is more than a single fault; and if there are no faults, the ear enjoys the faultless aggregate whether it can distinguish the parts or not. Accordingly the question arises: Will the ear resent an aggregate which corresponds as such to nothing in nature, but which contains no intervals that have not already been accepted in the sestina? In other words, can we treat as a concord a triad which puts the minor 3rd below the major?

Ex. 6

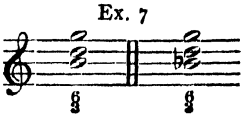


The history of harmony not only answers this in the affirmative, but shows that the contrast between this artificial concord and the major triad is essential to the formation of a flexible musical language. Some theorists, fascinated by the ways in which minor harmonies behave like major harmonies reversed, have invented schemes according to which the "roots" of minor chords are their top notes. The way in which minor chords happen in music does not support any theory which makes Ex. 6 anything other than an artificial alteration of Ex. 5, with the same entirely fundamental behaviour of the same bass-note in every relevant musical context. The artificiality of the chord is not arbitrary or conventional; it is of the very nature of art and is far more self-explanatory than most of the phenomena of spoken language.

Both the major and the minor triad are found in "inverted" positions. An inversion is not a reversal, but a position in which

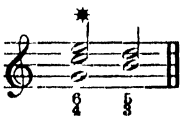
one of the upper notes of the normal chord has become the bass-note. When the 3rd of a triad is in the bass we have the chord of the 6th, thus:

Ex. 7



And now arises a phenomenon wholly unintelligible to acoustics and unpredictable by theory. The once perfect concord of the 4th becomes a discord when taken from the bass. Between any higher parts it is a concord; but from the bass it will never do except as a passing-note or a properly prepared and duly resolved suspension. The reason for this is purely contingent. It so happens that practically every context in which an accented 4th occurs from the bass implies a 5th above it, as in Ex. 4. If instead of the 5th you substitute a 6th you will obtain a chord which is theoretically a second inversion of a triad.

Ex. 8



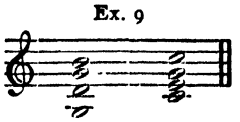
But no amount of logic will persuade the ear that this 6th is more than another *appoggiatura* or "leaning-note" demanding as urgently to resolve on the 5th as the 4th demands to resolve on the 3rd The fact is an accident of far-reaching importance, but as unamenable to grammatical logic as the reason why a modern English poet should not apply the epithet "blooming" to his lady's cheek. Find a context for a 4th from the bass which does not imply the $\frac{6}{4}$ $_3$ of Ex 4, and that 4th will cease to be a discord. But it will be some strange and pregnant language, not to be taken in vain; like the cry at the beginning and end of the Allegretto of Beethoven's seventh symphony. And even there the ear is, at the outset, expecting the true bass and remembering it at the end.

The harmonic materials of 16th century polyphony are, then, the major and minor triads, their inversions as chords of $\frac{6}{3}$, and the discords of the 2nd and 7th and (from the bass) the 4th, treated either as suspensions or as passing-notes. The scale in which the flux of polyphony moved through transient discord from concord to concord was the diatonic scale preserved from ancient Greece and handed down directly from the Greco-Roman or Ptolemaic system to the church-music of the middle ages, doubtless with conflation from Jewish sources.

III. MODAL TONALITY

Tonality is the element which groups a succession of musical sounds intelligibly round some centre. With the development of polyphony, tonality becomes as important as the concord-discord system itself; and, indeed, that system could not have existed without tonal guidance at every point. Discord is transition; concord is finality. The task of tonality is to organize various degrees of finality among concords The first decision made by pure polyphony (but revoked in a later age) was that the minor triad, though it might be a concord, could never be final. A bare 5th or even a bare octave would be more acceptable, as being a potential major triad. The final chord, whether complete or not, requires to be approached by chords in a well-defined relation to it. Two types of full close, or cadence, thus came into existence —the authentic, in which the final chord is preceded by a major chord whose bass is a 4th below or a 5th above the final bass—

Ex. 9



and the plagal, in which the penultimate chord is based a 4th above or a 5th below the final, and is major or minor according to the mode:

Ex. 10



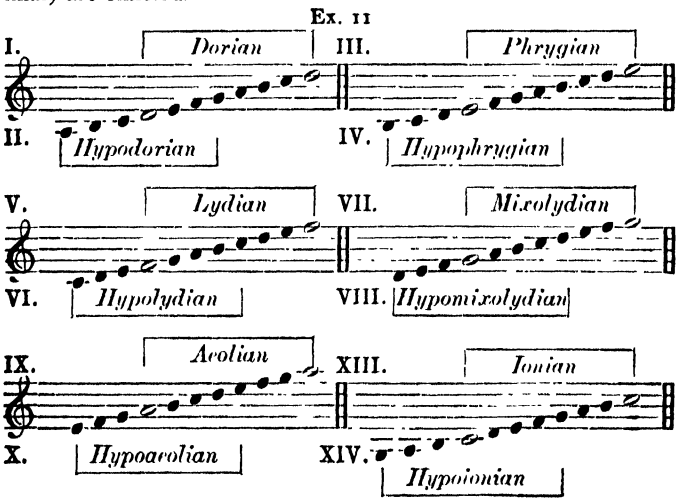
The modes were named after those of ancient Greece, wrongly identified in particular; and theory clung to terms derived from non-harmonic notions long after the practice of composers had become inveterately harmonic An aesthetically-correct account of Palestrina's tonality is much more easily achieved by a description in terms of Beethoven's key-system than by any attempt to refer it to the orthodox modal theory.

According to the finally-prevalent statement of that theory there were ideally 14 modes, two based on each degree of the diatonic scale Practically the modes based on B were impossible, as the diatonic 5th from B is imperfect. The numbers of these imaginary modes, XI. and XII., were piously retained for them, together with the name of Locrian. The "authentic" modes ran from the "final" or fundamental note to its octave Each authentic mode was allied to a "plagal" mode, having the same final, but lying a fourth lower. This is an important distinction in purely melodic music and can be clearly recognized in folk-songs. Thus, *The Bluebells of Scotland* is authentic, while *Auld Lang Syne* is, except for an isolated top note, typically plagal. In polyphonic music the difference between an authentic mode and its plagal companion is a vague matter settled by the position of the tenor voice.

The word "modulation" was used in the theory of modal music to denote the formation of full closes on other notes than the final. The 16th century composer developed a perfect sense of key around his cadences, and he knew very well what he was doing when he avoided stimulating that sense elsewhere. He selected his subordinate cadences on no more cogent principle than the avoidance of monotony He was like a painter whose draughtsmanship is faultless in faces and figures, but who sees no objection to implying a different horizon for each detail in his picture. And harmony has no such relation to external nature as can justify critics in calling modal tonality archaic Palestrina's tonality is one of the most mature and subtle things in music, and later developments cannot lessen its truth to the nature of art.

Here are the 12 modes which theoretically underlie the tonality of the 16th century. Every composition was written in one of these modes, and its incidental modulations were not regarded as visits to another mode, though that is aesthetically what they really were. The diagram gives the name of the authentic position above each scale, and the plagal name and position below. The white note is the final. The imaginary Locrian modes (with B as final) are omitted.

Ex. 11



In practice these modes are not always easy to ascertain. The B natural in Lydian tonality is so difficult to handle that the

great masters almost always flattened it permanently and put the flat as a key-signature, thus producing an Ionian mode transposed, or plain modern F major. (All modes could be thus written a 4th higher; and apart from this, the actual pitch of performance was determined by convenience and was bound by no fixed standard.) The Phrygian mode cannot form an authentic cadence, and its plagal cadence (shown in Ex. 10b) sounds to our ears like a half-close on the dominant of A minor. This is quite final enough for modal harmony; but a very slight impulse may make Palestrina reverse the cadence and so end with a chord of A. This does not make the mode Aeolian, and, though the Aeolian mode looks as if it was the origin of our minor scale, true Aeolian polyphony is of all harmonic styles the most remote from modern music. The Dorian and Phrygian modes are much nearer to our notions of a well-grounded minor key. The Ionian mode is identical with our major key; and Mixolydian tonality is like a major key with either an excessive emphasis on the subdominant or a top-heavy and finally prevalent dominant.

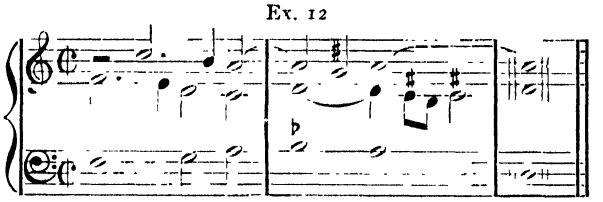
Extraneous sharps constantly come into modal music through the necessity of providing major penultimate chords in authentic cadences, as well as final major 3rds for minor modes. Flats were no less often necessary to correct the tritone 4th between F and B (hence the shape of the flat, and Morley's naming of it as the B clef). The rules governing these accidentals were so well known that singers resented the providing of the signs where the need of such *musica ficta* was self-evident. On the other hand, many of the most mystical harmonies, such as the opening of Palestrina's *Stabat Mater*, were the gifts of creative imagination equally remote from modal theory and modern tonality. Brahms understood modal harmony much better than the critics who blame him for violating the modes of folk-songs by not setting them in a kind of musical Wardour street. If you want to set old tunes without using leading-notes and changes of key you must not harmonize them at all.

IV. ESSENTIAL DISCORDS AND RIGID TONALITY

The strict theory of suspensions and passing-notes was diversified by many idioms which grew up charmingly and illogically. Logic itself admitted harshnesses which the pure taste of Victoria and Palestrina rejected without waiting for the judgment of theorists. For instance, our glorious Tudor masters shared with many other composers outside the Hispano-Roman orbit a keen intellectual pleasure in violent collisions between a major and a minor 3rd over the same bass; *some* 3rd being essential to the harmony and each of the conflicting voices having unanswerable reasons for its own version. But these "false relations," as we now call them, are both archaic and provincial, for all their logic. The overlapping of harmonic ideas produced many results both more pleasant and more fruitful.

Here is an extreme case in which the ordinary rules of *musica ficta* give results which strain the 19th century theorist and compel him to discover "double roots" and other cabalistic secrets.

Ex. 12



The bass singer, knowing his rules of *musica ficta*, would be insulted at such a "donkey's mark" as a flat to the B for the purpose of correcting the inadmissible tritone, comprised between F and B. The treble singer would automatically sharpen his G, under the impression that he was making a close on A; and so the augmented 6th, one of the most complex discords known to Bach and Mozart, did frequently occur in 16th century performances and was not always regarded as a blunder. In Ex. 12 the treble singer would happen to be mistaken in sharpening the G, for it is not really part of a close on to A. The close is on to D, and the middle singer would recognize its leading-note without the aid of "donkey's marks." For our Boeotian age we require a flat to the B in the bass and sharps for the penultimate Cs in the middle part. If the 16th century composer intended to produce an augmented 6th, he would provide the soprano with a sharp to the G in order to reassure the singer.

But the beginning of the 17th century saw a musical revolution far beyond the scope of any accumulation of licences on the polyphonic basis. The feeble efforts of the first Monodists, Jacopo Peri, Emilio Cavalieri and other pioneers of opera and solo vocal declamation with lute or keyboard accompaniment, had already drawn attention to the value of any and every chord as a thing in itself, apart from its position in a polyphonic flux, when the masterful spirit of Monteverdi gave to the new movement all the power of his intellect and rhetorical instinct. Only a polyphonist can appreciate the real aesthetic values of monody, and Monteverdi was a vigorous, though decadent polyphonist, both before and after he took up monody. But not even his mastery could organize the chaos that overwhelmed the art of music when the limitations of the golden age had been broken down. For one thing, pure polyphony dealt only with unaccompanied voices. When instruments were treated as important elements in serious music the polyphonic hypothesis became inadequate and several new sets of laws had to be found by experiment. A century was no long time for such a task.

Monteverdi's chief innovation is popularly said to be the "invention" of the dominant 7th and of other so-called "essential" discords. An essential discord is merely a discord which through custom has ceased to require preparation, and to attribute its invention to any particular author is like naming the first writer who used a metaphor instead of a full-blown simile. Most, if not all, of the discords that have become essential are based on that part of the key which we call the dominant; for the reason that all harmonic phenomena gravitate towards the full close as inevitably as all verbal statements gravitate round the subject-predicate-copula group. The dominant of a key is the bass of the penultimate chord of an authentic cadence. Opposed to the dominant there is another centre, the subdominant, which supports the penultimate chord of a plagal cadence. A key has, then, three cardinal points, the key-note, or tonic; the dominant, the chief means of orientation in modulations; and the subdominant, whose function we should understand much more readily if we called it the anti-dominant.

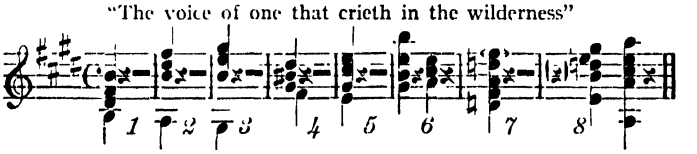
The chief and not wholly unconscious aim of the successors of Monteverdi (that is to say, of the composers of the mid-17th century) was to establish the tonic-dominant-subdominant orientation of major and minor keys in a system which could digest essential discords. A modal composition visited other modes than its own whenever it made a cadence other than on its own final; but it did not establish itself in the visited modes; and still less did it go into regions that produced its own mode at a different pitch.

Throughout the 17th century the various streams of music were trickling gently towards a mighty lake, from which all later music takes its origin. Alessandro Scarlatti (*q.v.*) is now less known to us than his wayward son, Domenico, whose harpsichord music is in a *genre* by itself. But Alessandro, more than any other composer in history, deserves to be considered the founder of a great classical tradition. He is called the founder of the Neapolitan school. And classical tonality is primarily Neapolitan. It recognizes only two modes—the major and the minor. The loss of modal subtleties is more than compensated by the powerful dramatic and architectonic values of clearly-established keys with a capacity for modulation to similar keys in relations of clear harmonic significance.

The following eight bars from the end of the first recitative in Handel's *Messiah*, epitomize several normal features of the system:

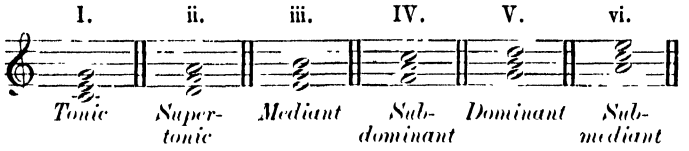
Ex. 13

"The voice of one that crieth in the wilderness"



Before discussing this example, we must further explain the system of major and minor keys. Here are the first six degrees of the scale of C major (which, being without sharps and flats, is taken as the standard key) with a triad, or common chord, on each. The notes of these triads are all within the key The functional names of each degree are given below, and the number above in Roman figures. Large figures indicate major chords and small figures minor.

Ex. 14

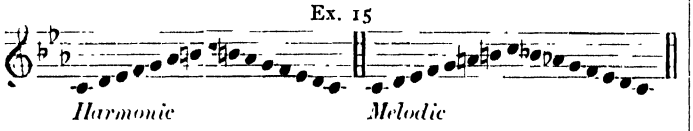


The 7th degree, or leading-note, bears no common chord within the key, for its triad has an imperfect 5th. The submediant is so called because the subdominant is not conceived as the note below the dominant, but as an anti-dominant, a fifth below the tonic, so that there is a submediant as a 3rd between it and the tonic, just as there is a mediant as a 3rd between the tonic and dominant.

Another most important gain of the new tonality as against the modal system is that the minor mode can now so firmly support its tonic by its other chords that a minor tonic chord becomes convincing as a final The contrast between major and minor keys acquires a high emotional value We must clearly understand that the minor mode, like the minor triad, is identified with the major mode on the same tonic The so-called "relative major" is one of five equally direct relations to a minor tonic and the "relative minor" is one of five to a major tonic. The minor mode of C is not (as the Tonic Sol-fa system will have it) A minor, but C minor

In the minor mode a strict confinement to cardinal harmonies produces a melodically awkward augmented 2nd between the flat 6th and the necessarily sharp leading-note Accordingly the external form of the scale varies and the variations have harmonic results Ex 15 shows the so-called harmonic and melodic minor scales.

Ex. 15



The melodic form avoids the augmented 2nd by sharpening the 6th in ascent and flattening both 6th and 7th in descent.

V. CLASSICAL KEY-RELATIONSHIPS

A fundamental proposition in the aesthetics of tonality is that key-relationship subsists between two tonics only and has nothing to do with the intervention of a third tonic. Observe the word tonic; the proposition commits us to no specified mode on either side of the relation.

Direct relationship exists between two keys when the tonic chord of one is among the common chords of the other. If our first key is major, we simply identify its related keys with its common-chords other than its tonic; thus Ex. 14 shows that C major is directly related to five keys, D minor the supertonic, E minor the mediant, F major the subdominant, G major the dominant, and A minor the submediant

The relatives of a minor tonic have to be discovered by a converse process, for the minor scale is so unstable that the evidence of its common chords is conflicting and misleading For instance, the dominant chord of a minor key is major. But you will receive a shock if you try answering the subject of Bach's G minor Fugue, Bk. I., No. 16, of *Das Wohltemperirte Klavier* in D major instead of D minor! Evidently the only directly related dominant *key* to a minor tonic is also minor. This being so, the subdominant must be minor also, for it is the converse of the dominant, the key to which the tonic is dominant. In order to reach it the tonic chord must become major, a pathetic effect constantly to be found near the end of classical slow movements in minor keys.

The other relations of a minor tonic are converse to the relations of a major tonic. Thus, if D minor be the supertonic of C major, we must find a name for the relation of C major to D minor We run up the scale of D minor and find that C is its flat 7th Similarly, if E minor is the mediant of C major, then C major is the flat 6th or submediant of E minor; and, lastly, if A minor is the submediant or relative minor of C major, then C major is the mediant or relative major of A minor. And so the relations of a minor tonic may be obtained by reading Ex 14 backwards, with A minor as the key of reference Transposing Ex. 14 so that vi. becomes C minor, we obtain the following five relations: B flat major the flat 7th, A flat major the submediant, G minor the dominant, F minor the subdominant, E flat the mediant (or relative major).

It is now easy to describe the drift of the Handelian chords of Ex. 13. The key-signature is that of E major, a key that differs only in pitch and in minute instrumental technicalities from all other major keys. (Ideas as to the characters of keys in themselves are entirely subjective, and no agreement is to be expected about them) The first chord is a common-chord of B major, the dominant of E. In its present context it represents not only the dominant chord, but the dominant key, for it happens to be the close of a passage in B major The next chord is still a dominant chord, but effects a return to E, being the last inversion of the dominant 7th thereof The 7th is in the bass, and duly resolves on G sharp in the next chord, a first inversion of E (bar 3). Handel would have had less scruple than many later writers in letting the bass skip down to E, so long as the G sharp was somewhere in the chord, but here he is making his bass regularly descend the scale. The next step, F sharp, supports another dominant chord, that of C sharp minor (vi from our tonic) in its last inversion, like that in bar 2 It also resolves in bar 5 Bar 6 passes to the subdominant (A major) and bar 7 establishes that key in a manner to remove all doubt by striking its subdominant chord, which is wholly outside the range of E major. The natural result is the full close in A major in bar 8 Such is the normal way of using key-relations in the essentially Neapolitan art of Handel; and all the intensity of Bach's thought adds nothing to its essential elements. When Bach modulates more widely his purpose is, like that of Handel in "Thy rebuke hath broken his heart," not to explain, but to astound.

Another great change had to enlarge the art of music before key-relationships could attain their full meaning; but this time the change was accomplished without a period of chaos It was like Kant's "Copernican revolution" in philosophy; and its more general aspects are discussed in the articles INSTRUMENTATION, MUSIC, OPERA and SONATA FORMS

Its first effect on harmony was shown in a drastic simplification of style; for music had now become dramatic, and there was no musical resource of more cardinal dramatic importance than changes of key. Consequently the baldest facts of key-relation became dramatically significant, out of all proportion to their direct intellectual import. A musical historian can make no graver blunder than to mistake Mozart's and Haydn's harmonic simplicity for an intellectual simplicity. To prolong a preparatory harping on the dominant of a new key is equivalent to working up the entry of an important person in a drama.

A hundred years before the problem which Alessandro Scarlatti solved in his youth might be described as that of finding the dominant The simple-seeming Mozart is, as often as not, mocking us with the riddle "When is a dominant not a dominant?" Musical perspective has gained another new depth in its command of planes. A modulation may establish a new key firmly enough for an incident in the course of a melody, but not nearly firmly enough for a new stage in the whole scheme. Conversely, a passage which at first sounded like vehement emphasis on the local dominant may, long afterwards, when the dominant key has been firmly established, be given note for note at the same pitch with a triumphantly tonic effect. And the dimensions over which Mozart's tonality maintains its coherence are enormous;

sometimes almost on Beethoven's largest scale.

Music, which in Palestrina's age was "a linked sweetness long-drawn out," with the links extending only from one accent to the next, had by the beginning of the 18th century trained the mind to measure harmonic relations over melodic periods of eight or more bars; and the mighty polyphony of Bach and Handel broke down the melodic regularity, but did not greatly enlarge the range over which the listener must depend on his memory. These masters can visit the same key several times in a composition without inciting the listener to notice the fact either as a purpose or as a tautology. But Mozart, Haydn and Beethoven build confidently on a knowledge of the exact effect that a modulation in one passage will have on a passage five or even ten minutes later. Beethoven's enormous architectural and dramatic power enabled him to discover and command the whole range of key-relationship theoretically possible within any definite meaning of the term. There is no limit to the possible range of modulation, as Bach took pains to show; but "the unity of the chromatic scale" is a feeble dogma on which to base the notion that Beethoven ought to have treated all keys as equally related, instead of drawing the line where he did. Great artists discover facts and resources, not licences and vagaries.

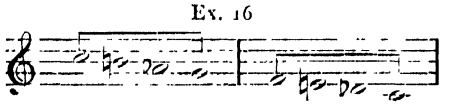
Haydn, Mozart, Beethoven, Schubert, Brahms and Wagner all agree in one simple and cogent method of extending the direct or natural series of key-relations. They merely changed the modes of either or both numbers of a directly related pair. Certain reservations were necessary; the supertonic of a major key which is quite happy as a minor neighbour completely fails to sound like a major key in its own right and behaves merely like "dominant preparation" for the ordinary dominant. An analyst who imputes the key of A major to bars 19–24 of the first movement of Beethoven's G major sonata op. 14, No. 2, *when he hears them in their context*, should not attempt to discuss key-relationship until he can discriminate between a passage *on* the dominant and a passage *in* the dominant.

What is true of one key-relationship will be true of its converse: the key of the flat 7th refuses to assert itself as a real key in relation to a major tonic. A dozen accessory chords in D major would not make the 7th bar of Ex. 13 amount to more than the subdominant chord in A major until they included a chord of G. The testimony of such openings as those of Beethoven's sonatas opp. 31 (No. 1) and 53 is emphatic.

In the rare cases where such keys do not thus explain themselves away, their effect is startling. (Ineptitudes may be neglected.) The passage that follows the return of the main theme in the first movement of Beethoven's Eroica symphony is one of the supreme dramatic strokes in music. The hard-won tonic of E flat gives way first to F major and then to the opposite extreme, a 3rd lower, D flat. Another third down brings us safely to our own dominant chord.

One other type of key-relation is derived from a special form of the minor scale, in which the lower tetrachord is made to correspond with the upper—

Ex. 16



The first inversion of its flat supertonic chord is known as the Neapolitan 6th; and the Neapolitan key-relations are the flat supertonic major, equally related (as the E natural in Ex. 16 shows) to a major and a minor tonic, and the converse relation of the sharp 7th. A minor tonic has no direct converse relation, for the Neapolitan chord is major. But, as Schubert shows at the end of the first movement of his D minor quartet and in the slow movement of his string quintet in C, an indirect relation may be established by making the Neapolitan chord minor.

We must beware of imputing relationship to keys separated by discursive modulation unless we have strong collateral evidence from the key-functions of a musical design. Tonality and form are inseparable; and great composers do not even expect the tonic to be recognized after long wanderings without some such conclusive evidence as the return of the opening theme.

Here are two tables, indicating by Roman figures the whole scheme of key-relationships, first from a major tonic, secondly from a minor tonic. Flats indicate degrees flattened in comparison with those of the major scale of reference; and in Table B sharps are used to distinguish cases where the key is a semitone above the corresponding degree of a minor scale. Thus, if C be the tonic, E major will be represented by III in Table A, and by III♯ in Table B. In either table the figure iii♭ would, reckoned from C, be E flat minor.

TABLES OF KEY-RELATIONSHIPS

A. From Major Tonic.

	I Direct Relationships	ii	iii	IV	V	vi
	Indirect through both i and the second key			iv	V	
Indirect through i III♭ VI♭	Indirect through the second key		III			VI
Doubly indirect through the former indirect keys iii♭ vi♭						
Neapolitan, direct	II♭		VII and vii			
Neapolitan, indirect	ii♭					
Unconnected	IV♯ and iv♯ = V♭ and v♭ and all enharmonic synonyms of other keys					
Ambiguous		II	VII♭ and vii♭			

B. From Minor Tonic

	i Direct Relationships	III♭	iv	v	VI♭	VII♭
	Indirect through both I and the second key		IV	V		
Indirect through i iii♯ vi♯	Indirect through the second key	III♭			VI♭	
Doubly indirect through the former indirect keys III♯ – VI♯						
Neapolitan, direct	II♭					
Neapolitan, indirect	ii♭				VII♯ and vii♯	
Unconnected	IV♯ and iv♯ = V♭ and v♭ and all enharmonic synonyms of other keys					
Ambiguous	ii II vi♭					

The characters of key-relationships are solid facts, and they probably have some bearing on the various subjective ideas which many music-lovers entertain as to the character of keys in themselves; for nobody can name a key without being aware of its distance from C major. Be this as it may, it is an undisputed fact that modulations in a dominant direction have an effect of action, while modulations towards the subdominant have an effect of retirement. With a major tonic the three remaining directly-related keys are minor, a contrast which outweighs their other distinctive characters. To move from a major tonic to the relations of its tonic minor, such as III♭ and VI♭, is to pass into deep and warm shadow. Such modulations form characteris-

tic purple patches in the course of Mozart's "second subjects."

Changes from a major tonic to the major mode of its mediant or submediant are extremely bright. Haydn, who explored all the range of tonality in contrasts between whole movements, or between a minuet and its trio, is very fond of using them in this way in his later works. Beethoven incorporates them in the most highly-organized functions of his sonata-movements. The Neapolitan relations appearing once as a paradox in Haydn's last pianoforte sonata, are completely rationalized by Beethoven, Schubert and Brahms. The flat supertonic casts a deep warm shadow over the tonal scheme, and becomes sheer blackness in the rare cases where it is changed to minor. Conversely, the move a semitone downwards from the tonic (to VII♯ or vii♯) is a move into mysterious brightness. Other extreme depths are sounded in the double changes from a major tonic to iii♭ or vi♭; which (with convenient change of notation) may be found in Beethoven's sonata op 106 and Schubert's last pianoforte sonata The converse relations III♯ and VI♯ from a minor tonic are very bright; the only really bright contrasts that the minor key-relations possess. Beethoven's C minor concerto shows III♯, and his F minor quartet shows VI♯.

VI. THOROUGH-BASS

The great classical tradition cares little for the study of chords as things in themselves; and the art of harmony perishes under a discipline that separates its details from counterpoint and its larger issues from form An excellent means of mastering a good harmonic vocabulary is to practise the filling-out of classical figured basses at the keyboard; in other words, to exercise the function of the continuo-player who, from the time of Monteverdi to that of Beethoven's organ-teachers, used to supply accompaniments from a bass with figures indicating the gist of the chords required Fluency in such a practice does not of itself confer the ability to produce original harmony, but it means that music can be read with understanding It is an empiric craft But it had the misfortune to become a science, when, early in the 18th century, Rameau discovered the theory of the fundamental bass This is an imaginary bass (best when most imaginary) that gives "roots" to all the essential chords of the music above it The conception is true only of the most obvious harmonic facts, beyond them it is as vain as the attempt to ascertain your neighbour's dinner from a spectrograph of the smoke from his chimney The augmented 6th which arose so innocently in Ex 12 requires a double root The first chord of Beethoven's sonata in E flat, Op. 31 No 3, is an "eleventh" with its root on the dominant in flat defiance that the dominant is the most inconceivable bass-note in the whole passage until it arrives as a climax in the sixth bar But musical fundamentalists refuse to look six bars ahead

Philipp Emanuel Bach, in conversation with Dr. Burney (*The Present State of Music in Germany, etc*), said that Rameau's theory was "childish, for it reduces all music to full closes." This is perfectly true, and the theory did no harm to 18th century French music, which eschewed long sentences and seldom strayed far from the regions of the full close But in England Rameau's doctrine raged unchecked by taste or common sense, and culminated in Dr Day's famous application of homoeopathy to the art of music. This would have mattered less if Dr. Day had not gained the ear of the greatest English academic musicians of Mid-Victorian times. As Sir Charles Stanford aptly says (*Musical Composition*), Day's theory "irrigated a wide area of low-lying ground, and we are still suffering from the effects of its miasma." The remedy lies in cultivating vivid impressions of the actual relations between counterpoint and harmony in detail, between tonality and form in general, and between key-relations and chromatic chords. To this end, thorough-bass should be cultivated not on paper but at the keyboard, with passages (graded according to difficulty) from the continuos of Bach's cantatas and Mozart's church music

VII. TEMPERAMENT AND JUST INTONATION

Even in pure 16th century polyphony the ideal diatonic scale implies distinctions of intonation beyond the capacity of any mechanical instrument with a limited number of notes In the Ionian mode or major scale of C the interval C–D is not the same kind of whole tone as the interval D–E, but differs as 8 9 from 9.10

The normal position for the supertonic is a "major tone" (8.9) above the tonic; but even so common a discord as the dominant 7th will set up a conflict, the dominant requiring its 5th to be as 9 8 above the tonic, while the 7th will want to make a true minor 3rd from a supertonic in the position of 10 9 Such conflicts are about very minute distinctions, but every discord produces them if it is dwelt upon Nevertheless, the 12 notes that human hands can negotiate within a span-stretched octave suffice to express the most chromatic harmony with less average inaccuracy than is cheerfully permitted in human singing and violin playing. Singers and violinists can and do constantly achieve a purer intonation than that of keyed instruments; but the only aesthetic issue between free voices and tempered instruments is the difference between a human intonation liable to human error and an instrumental intonation with an inherent systematic error The human error is often not only accidentally, but deliberately in excess of the systematic error, for the slightest *vibrato* is larger than the quantities involved

The subject of just intonation is fatally fascinating to people whose mathematical insight has not attained to the notion of approximation In art, as in mathematics, accuracy lies in estimating the relevant degree of approximation rather than in unrolling interminable decimals Music is no more to be heard through Helmholtz resonators than pictures are to be enjoyed through microscopes. The true musical ear will recognize the real meaning of harmonies though the practical intonation confounds them with homonyms Bach introduced no new musical thought when he arranged *Das Wohltemperirte Klavier* to stimulate the adoption of equal temperament by providing music in every major and minor key for which the keyboard had notes Systems of unequal temperament tuned the commoner keys as well as possible, in the hope that remoter keys would never be visited Bach decided that it was better to have all keys equally out of tune than to have some keys intolerable. The miraculous modulations of his *Chromatic Fantasia* deliberately emphasize all the chords that were "wolves" in unequal temperament, and thus Bach devoted his highest efforts of imagination to a humble practical purpose. But Marenzio had modulated as far in madrigals written in the purest golden-age polyphony No true harmonic ideas are based on equal temperament, any more than a true geometry is based on exclusively rational quantities.

VIII. METHODS OF MODULATION

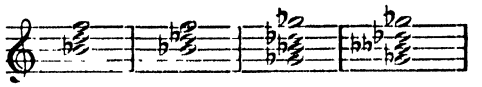
The commonest way of establishing a change of key is, as we have seen, to emphasize the dominant chord of the new key until only the new tonic can be expected This we will call dominant modulation; leaving out of consideration how the new dominant is reached (It was probably surrounded by its own dominant-of-dominant which could be reached from various other directions.)

A more interesting type of modulation begins with Beethoven, arising out of hints given by Haydn and Mozart It may be called functional modulation, and consists in placing indirectly-related keys into positions which make their exact relation appear vividly. If the first chord of the second key is a dominant, the relation will still appear in high relief; but any further decoration of that dominant will reduce the result to an ordinary modulation. (Compare bars 22–23 of the first movement of Beethoven's *Waldstein* sonata with the drastic process of bars 37–38 in the first movement of op 106)

Functional modulation might well be called "natural" if that term had not been commonly assigned to modulation within the five directly-related keys, irrespective of method

Mere juxtaposition of tonics will suffice for the purposes of a functional modulation. If Beethoven had wished to explain the presence of F sharp minor (vi♭) in the scheme of op 106, the natural (or functional) process would consist of the following four chords:

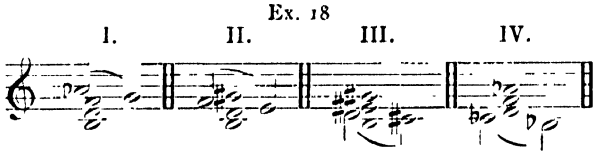
Ex. 17



Closely akin to this method is Beethoven's dramatic way of reducing a chord to a single note, and then building up therefrom a quite remote chord. (*See* opp. 90 and 81a.)

All such devices show the listener what is really happening. The object of *enharmonic* modulation is frankly to mystify. It is popularly supposed to belong specially to tempered scales; but it really presupposes just intonation. All discords, as we have seen, set up a conflict in their intonation; and an enharmonic modulation is merely a conflict so coarse-grained that it appears in the notation by some such mark as a change from G♯ to A♭. An ill-motived enharmonic modulation is like a bad pun; a great enharmonic modulation is a sublime mystery. Here is the commonest pivot of enharmonic changes, the diminished 7th, with its four vastly different resolutions·

Ex. 18



Of course, these are really four different chords If the true theory of just intonation demanded that the minor scale should be rigid, a chord of the diminished 7th would be much harsher than the tempered scale makes it. But what really happens in just intonation is that two notes of the minor scale become so unstable in the stress of discord that it becomes a small matter to shift the strains to whatever notes you please. Even with a limited keyboard the ear imagines a change of intonation when the unexpected resolution appears. This is why chromatic intervals are difficult to sing; the singer loses confidence when he has to aim at a note which will not stand still.

Not every change of notation represents a genuine enharmonic modulation. Modulate diatonically from A to F: and transpose your modulation down a semitone. You will start in A flat, but if you have much to say in the second key you will probably prefer to write it as E, instead of F flat. Sad nonsense has been written by many commentators on the most ordinary harmonies disguised by convenience of notation.

Nevertheless, a merely notational change may eventually have an enharmonic result, for it may be part of an enharmonic circle. If the harmonic world is round, why should just intonation be plane? Adjustments infinitely smaller than those of temperament will suffice to make the ends of an enharmonic circle meet in the course of a long composition. The first movement of Brahms's F major symphony, played with its repeat, goes four times round an enharmonic circle of major 3rds (F, D♭, B♭♭=A, F). Every time the key written as F returns it identifies itself by the opening theme. If the pitch rose to G♭♭ we would scarcely notice the fact after the intervening passages, and when the pitch had risen noticeably we should complain. Temperament keeps the pitch; but just intonation could do so by an even distribution of infinitely smaller adjustments.

It now becomes clear why keys a tritone 4th apart cannot become related. That interval (which modal musicians identified with the devil) constitutes the kink in musical space. It sets up an enharmonic short-circuit; a modulation from C to F sharp is exactly the same as one from G flat back to C; and whichever key you start from, the other will sound like the dominant of a Neapolitan key instead of asserting its own rights. No sensible person forbids the modulation; its effect may be excellent, but it is not the effect of a key-relation

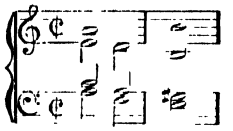
IX. WAGNERIAN HARMONY

Wagner's sense of key is exactly the same as Beethoven's; but it has hours in which to exercise itself, whereas Beethoven's designs seldom stretch without break over 15 minutes, and always show their purport within five. But take, for example, the conflict between two major keys a tone apart. The jealous Fricka *did* hope (in F major) that the domestic comforts of Walhalla would induce Wotan to settle down. Wotan, gently taking up her theme in E flat, dashes her hopes by this modulation more effectively than by any use of his artillery of tubas and trombones.

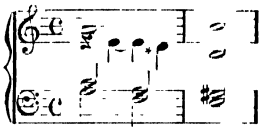
But the most distinctive feature of Wagner's harmony is his use of long auxiliary notes in such a way as to suggest immensely remote keys, which vanish with the resolution. (Chopin anticipates Wagner in what Sir Henry Hadow finely describes as "chromatic iridescence.")

Here is the evolution of the wonderful opening of *Tristan und Isolde:*

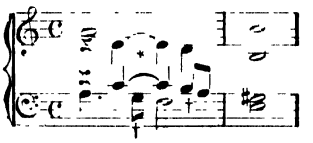
Ex. 19.—Three concords (tonic, first inversion of subdominant, and dominant of A minor, a possible 16th-century cadence in the Phrygian mode).



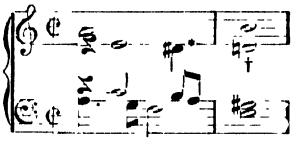
Ex. 20.—The same chords varied by a suspension (*).



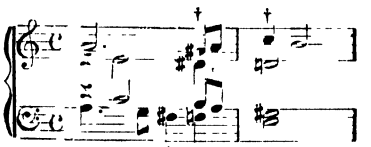
Ex. 21.—Ditto, with the further addition of a double suspension (*) and two passing notes (††).



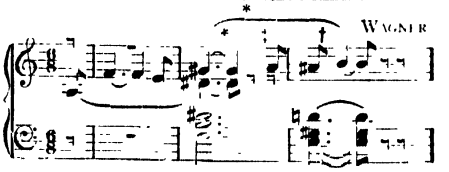
Ex. 22.—Ditto, with a chromatic alteration of the second chord (*) and an "essential" discord (dominant 7th) at (†).



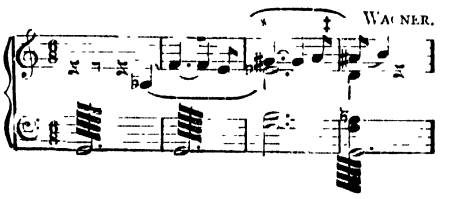
Ex. 23.—Ditto, with chromatic passing notes (**) and appoggiaturas (††).



Ex. 24.—The last two chords of Ex 16 attacked unexpectedly, the first appoggiatura (*) prolonged till it seems to make a strange foreign chord before it resolves on the short note at ‡, while the second appoggiatura (†) is chromatic.



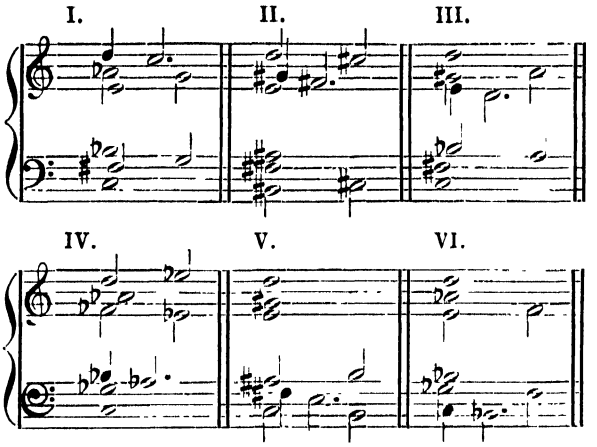
Ex. 25.—The same enharmonically transformed so as to become a variation of the "dominant ninth" of C minor. The G♯ at * is really A♭, and ‡ is no longer a note of resolution, but a chromatic passing-note.



X. POST-WAGNERIAN HARMONY

The line of evolution traced thus far has, evidently, no *a priori* limits, though it has principles. Any new system is destined either to starve for lack of nourishment from the main sources of music or become absorbed in them. Systems derived from equal temperament are crude fallacies. The whole-tone scale which readily arises on the pianoforte, *e.g.*, C,D,E,F,♯ · (=G♭, A♭, B♭, C), amused Debussy during a few dozen songs and short pieces, and played a much less predominant part in his *Pelléas et Mélisande* than is generally supposed. It is really no more a whole-tone scale than the diminished 7th is a major 6th bounding a series of minor 3rds. Sir Walford Davies points out that this scale is a six-note chord projected into a single octave and capable, like the diminished 7th, of an enharmonic turn to each of its notes. Here is one of several possible ways of showing the six resolutions of this scale:

Ex. 26



Enthusiasts for new systems are naturally infuriated when the systems thus fade into the light of common or Wagnerian day. Nevertheless, the pleasure given by every effort at revolutionary harmony results from the fact that the new chords enter our consciousness with the meaning they would bear in a classical scheme. Not only Wagner, but Bach and Palestrina lurk behind every new harmonic sensation and cannot long be prevented from making sense of it After sense has been made, the fundamental theorists will return and prove to us that many quite commonplace chromatic progressions contain the triskaidekahyperhendekaenneaheptachord of Ex. 26 with the omission of not more than four of its notes

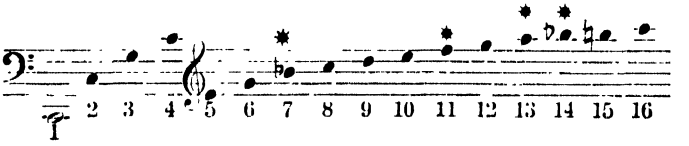
Other new theories are not less quickly worn out, even when invented by gifted composers. Scriabin, each of whose last five sonatas is built round its own new chord, complained shortly before his untimely death that he had, after all, not succeeded in getting away from a sophisticated dominant 7th. This complaint recalls Philipp Emanuel Bach's criticism of Rameau's theory, and its cause lies deep in the very nature of articulate thought. If you wish to compose freely, do not fix your mind on new harmonic propositions. Language is not extended by declining to use what is known of it.

Arnold Schonberg's harmonic theory is often masterly in its analysis of classical music; but it is extremely disappointing in its constructive aspect. Not only does Schonberg think the absurd old theory of "added 3rds" worth refuting, but he invents a new theory of added 4ths which has even less foundation The theory of "added 3rds" was no more scientific than a classification of birds by the colour of their feathers. But birds do have feathers of various colours, and classical music does build up chords by sequences of thirds. Schonberg's theory rests on no observation at all, for the piling up of 4ths has no origin in classical harmony and only a quickly exhausted melodic value. However, it can be carried right round the tempered scale in 12 steps and *ad infinitum* in just intonation. To find the composer of the *Gurrelieder* fathering such theories is as disconcerting as to discover Einstein telling fortunes in Bond street.

THEORETIC POSSIBILITIES OF THE FUTURE

Harmony has not yet found a place for so simple a natural phenomenon as the 7th note of the harmonic series Here are the first 16 notes from bass C as the fundamental. Many a "clang" contains them all in appreciable strength, yet no fewer than three (besides the octave of No 7) are outside our system, Nos 7 and 13 being much flatter than the notes here written, and No. 11 much sharper.

Ex. 27



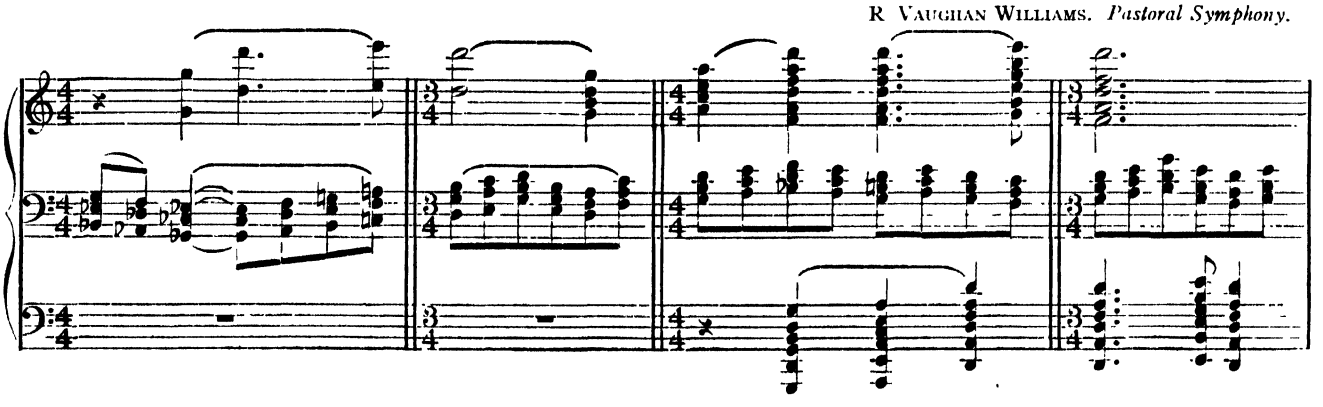
Again, though resultant tones are audible enough to save organ-builders from the expense of 32 ft. pipes by means of devices which reinforce the resultant tone and obliterate its generators, they have played no acknowledged part in musical aesthetics. A theory which builds upon them must abandon the hypothesis that all harmony grows upwards from the bass Abandon it by all means if your musical intuitions inspire you with ideas based on resultant tones—by which, however, you must mean something different from harmony whose ideal bass lies in its resultant tones —for that will merely be another notion of fundamental bass, differing from Rameau's, but again forcing you to regard harmony as rising from the bass And, after all, the hypothesis is not a theory, but an experience The language of music has, in fact, taken shape without guidance from resultant tones, just as the art of painting has, until recent epochs, made no conscious use of complementary colours, except by instinctively avoiding ugly or unintelligible effects.

Schonberg rightly says that *das Einfall*, the inspiration that comes without theorizing, is the sole criterion of musical truth; and perhaps some composers may have *Einfalle* so convincing in their use of Nos. 7, 11 and 13, as to compel us to build new instruments for them And so with the use of a resultant-tone or inverted harmonic system. The string-quartets of Haba have not as yet made quarter-tones sound convincingly unlike faulty intonation We must not blame our ears, which often appreciate much smaller measurements The just intonation of a Wagner opera would comprise some thousand notes to the octave The question is not how many notes we use in the long run, but how small a direct measurement is of interest to us. The carpenter deals faithfully with the incommensurable when he so much as fits a cross-bar to a square gate.

Many other modern harmonic tendencies are essentially matters of instrumentation. If, abandoning the polyphonic hypothesis, we use chords, simple or complex, as mere unanalysed tone-colours, we can start a new polyphony with moving chords instead

Ex 28 Triplanar harmony and doubling of melodies in whole chords

R VAUGHAN WILLIAMS. *Pastoral Symphony.*



of moving single parts. Our problem, then, will be to keep the planes of tone distinct. Organ-mixtures, if not properly drowned by the fundamental tones, would shock the boldest multi-planar harmonist by the mess they would make of classical harmony.

Extremes meet, and we are recovering a sense of the values of unharmonized melody, not melody which wants to be harmonized, nor melody which achieves harmonic sense by draughtmanship, but the austere achievement, far more difficult than any "atonality," of a melody that neither needs nor implies harmony. And so we return to nature. (D. F. T.)

HARMOTOME, a mineral of the zeolite group, consisting of hydrous barium and aluminium silicate, $H_2BaAl_2(SiO_4)_3+5H_2O$ Usually a small amount of potassium is present replacing part of the barium. The system of crystallization is monoclinic; only complex twinned crystals are known. A common and characteristic form of twinned crystal consists of four intercrossing individuals twinned together according to two twin-laws; the compound group resembles a tetragonal crystal with prism and pyramid, but may be distinguished from this by the grooves along the edges of the pseudo-prism Crystals are usually white and translucent, with a vitreous lustre. The hardness is 4½, and the specific gravity 2·5.

Like other zeolites, harmotome occurs with calcite in the amygdaloidal cavities of volcanic rocks, for example, in the dolerites of Dumbartonshire, and as fine crystals in the agate-lined cavities in the melaphyre of Oberstein in Germany. It also occurs in gneiss, and sometimes in metalliferous veins.

HARMS, KLAUS (1778–1855), German divine, was born at Fahrstedt, Holstein, on May 25, 1778 He became a fervent Evangelical preacher, first at Lunden (1806), and then at Kiel (1816) His best book was *Pastoraltheologie* (1830–34, 3 vols.; new ed. 1891–93, 2 vols.) He died on Feb. 1, 1855

See his autobiography, *Harms' Lebenbeschreibung* (1851, new ed., 1888).

HARNACK, ADOLF VON (1851–), German theologian, was born on May 7, 1851 at Dorpat, Estonia, where his father, Theodosius Harnack (1817–99), author of a well-known work—*Luther's Theologie* (1862–68; new ed., 1926)—was professor of pastoral theology Adolf studied at Dorpat and at Leipzig, where he became privatdozent (1874) and professor extraordinarius (1876) He occupied chairs at Giessen (1879), Marburg (1886–89) and Berlin (1889–1924) He was also director of the Prussian National Library (1905–21) and president of the Evangelical Congress (1902–12) He was ennobled in 1914.

Harnack's chief work, *Lehrbuch der Dogmengeschichte* (4 vols., 1886–90; 6th ed 1922, in *Grundriss der theol Wiss ;* Eng trans 7 vols, 1894–99), strongly affected Protestant thought both in Germany and in other countries He traces the rise of dogma, by which he understands the authoritative doctrinal system of the 4th century, and its development down to the Reformation His general thesis is that in its origins the Christian faith was so strongly influenced by the contemporary developments of Greek thought that much that was inessential to Christianity found its way into the beliefs and practice of the Church. Therefore, Protestant Christians were free, even bound, to criticize dogma (in the sense understood by Harnack). In fact, he tried to reconcile Lutheran doctrine with modern tendencies of thought, finding his justification by reference to early church history, of which he was an acknowledged master He was violently attacked for unorthodoxy, and his appointment to Berlin in 1888 was opposed by conservative Lutheran authorities There he was drawn into controversy over the Apostles' Creed, which, he maintained, in his *Das Apostolische Glaubensbekenntnis* (1892), contained both too much and too little to be a satisfactory test for candidates for ordination. At Berlin he held a *seminar*, in which he trained a body of students to distrust speculative theology, and to demand absolute freedom and an open mind in the study of Church history and of the Bible

Harnack's other works include: *Das Monckthum, seine Ideale und seine Geschichte* (1881, 10th ed., 1921); *Geschichte der altchristlichen Literatur bis Eusebius* (3 vols. 1893–1904), incomplete; *Das Wesen des Christentums* (1900 and many later ed.; Eng trans. *What is Christianity,* 1901); *Die Mission und Ausbreitung des Christentums in den ersten drei Jahrhunderten* (1902; 4th ed. 1914; Eng. trans. 2 vols., 1904–05); a collection of papers, *Beiträge zur Emleitung in das Neue Testament* (4 parts 1906–11; Eng trans of some of these: *Luke the Physician,* 1907, and others); *Entstehung und Entwicklung der Kirchenverfassung und des Kirchewrechts in den drei ersten Jahrhunderten* (1910); *Marcion* (Leipzig, 1921); *Briefsammlung des Apostel Paulus* (1926). With O. L. von Gebhardt and T. Zahn he published *Patrum apostolicorum opera* (1876); with Gebhardt and K. Schmidt, the periodical, *Texte und Untersuchungen z. Gesch. der altchristl. Lit.* (Giessen, 1882, *seq.*).

A complete bibliography is given in a special Harnack number of *Naturenssenschaft* (vol. xix., 1926). *See* his own *Erforschtes und Erlebtes* (1922).

HARNESS, gear, tackle, equipment in general (from O. Fr. *harneis* or *harnois*); early applied to the body armour of a soldier, and the trappings of the horse; now the general term for the gear of an animal used for draft purposes, traces, collar, bridle, girth, breeching, etc (*See* SADDLERY AND HARNESS.)

HARO, CLAMEUR DE, the ancient Norman custom of "crying for justice," still surviving in the Channel islands. The wronged party must on his knees and before witnesses cry: "Haro! Haro! Haro! à l'aide, mon prince, on me fait tort." This appeal has to be respected, and the alleged trespass or tort must cease till the matter has been thrashed out in the courts. The "cry" thus acts as an interim injunction, and no inhabitant of the Channel islands would think of resisting it. This method of appeal is said to be identical with the "Legatro of the Bavarians and the Thuringians," and the first mention of it in France is to be found in the "Grand coutumier de Normandie." A similar custom, only observed in criminal charges, was recognized by the Saxon laws under the name of "Clamor Violentiae." Thus there is reason to think that William the Conqueror on his arrival in England found the "cry" fully established as far as criminal matters were concerned Later the "cry" was made applicable to civil wrongs; and, when the administration of justice became systematized, disappeared altogether in criminal cases It was long retained in north-western France in cases of disputed possession, and was not actually repealed until the close of the 18th century. (*See* HUE AND CRY.)

HARO, LUIS DE (1599–1661), Spanish diplomat, son of the marquis of Caspio and nephew of the duke of Olivares, whom he succeeded as prime minister in 1643. The disastrous war with France and her allies continued until 1659, when Haro concluded with Mazarin the treaty of the Pyrenees. The terms were hard, and Haro was diplomatically no match for Mazarin, but he brought much-needed peace to Spain, and was rewarded by the elevation of the marquesate of Caspio into a dukedom and the title of "prince of the peace." He died at Madrid on Nov. 26, 1661.

HAROLD I. (d. 1040), surnamed Harefoot, the illegitimate son of Canute, king of England, and Aelfgifu of Northampton. On the death of his father in 1035, he claimed the crown of England in opposition to Canute's legitimate son, Hardicanute. His claims were supported by Leofric, earl of Mercia, and the north. Eventually Harold was temporarily elected regent, pending a final settlement on Hardicanute's return from Denmark. In 1037 he was definitely elected king, and banished Emma mother of Hardicanute. The only events of his reign are ineffectual inroads of the Welsh and Scots. Harold died at Oxford on March 10, 1040.

HAROLD II. (1022?–1066), king of the English, the second son of Earl Godwine, was born about 1022. While still very young (before 1045) he was appointed, through his father's influence with Edward the Confessor, to the earldom of the East Angles He shared his father's outlawry and banishment in 1051, but while Godwine went to Flanders, Harold with his brother Leofwine took refuge in Ireland. In 1052 the uneasiness felt at the visit to England of William, Duke of Normandy, who was known to covet the English throne, caused a reaction in favour of Godwine, who returned to England with his sons, under arms. The witan finally decreed that their lands should be restored. Harold

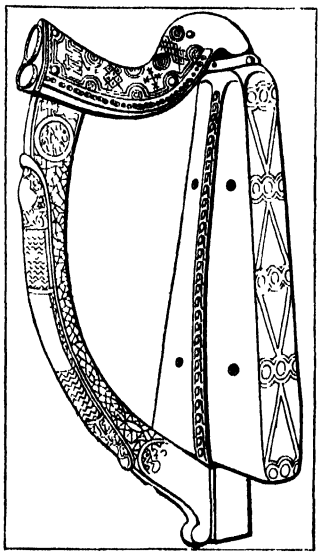
therefore received his earldom of the East Angles, and on his father's death in 1053 succeeded him in the greater earldom of the West Saxons, Sweyn having died while on a pilgrimage to Jerusalem. Harold was now the chief man in the kingdom, and the latter part of Edward's reign was virtually the reign of Harold. On the death (1055) of Siward, earl of Northumbria, Edward, at the instigation of Harold, appointed his brother Tostig earl of Northumbria; Earl Aelfgar looked upon this appointment as a menace to the Mercian house, and his opposition led Harold to procure his outlawry by the witan. Aelfgar then joined Gruffydd, Prince of North Wales in an attack on Hereford, as the result of which Aelfgar regained his position as earl of East Anglia. In 1057, with the exception of Mercia, Harold and his brothers held all the earldoms throughout England. Aelfgar, in order to secure a useful ally, married his daughter Ealdgyth to Gruffyd. Aelfgar died in 1062, and was succeeded by his son Edwin. In spite of the alliance between the Mercians and the Welsh, Harold and Tostig raided Wales in 1063, and forced Gruffyd, who was eventually killed by his own men, to flee. In 1063 Harold was shipwrecked on the French coast, and captured by the Normans, who only released him on his oath on sacred relics (though at the time he was unaware of their nature) to support William in any claim for the English throne. Probably on his return to England, though the date is uncertain, Harold married Ealdgyth (Edith), sister of Edwin, and widow of Gruffyd, thus conciliating the powerful earl of Mercia. His mistress, Eadgyth of the Swan-neck, the mother of his children, was still living. In 1065 the Northumbrians revolted against Tostig's rule, choosing Morkere, brother of Edwin of Mercia, in his place. Harold acted as mediator, but was compelled to agree to the banishment of Tostig, who was thenceforth his bitterest enemy.

On Jan. 6, 1066 Edward died, recommending Harold as his successor. He was accordingly elected at once and crowned. He won over the men of Northumbria, and prepared against the attacks which threatened on both sides. William challenged the crown, alleging both a bequest of Edward in his favour and Harold's oath, and prepared to invade England. From May to September, Harold kept men and ships in readiness on the south coast, but at last provisions failed and he returned to London. At this time Harald Hardrada of Norway, supported by Tostig in the north, invaded England. Together they sailed up the Humber, defeated Edwin and Morkere, and received the submission of York. Harold hurried northwards, and on Sept. 25 won a complete victory over the Northmen at Stamford Bridge, in which Tostig and Harald Hardrada were slain. Two days later Harold received news that William had landed at Pevensey, and he marched southward as fast as possible. He gathered his army in London from all southern and eastern England, while Edwin and Morkere held the north. The king then marched into Sussex, and engaged the Normans (Oct. 14, 1066) on the hill of Senlac near Battle (*see* HASTINGS, BATTLE OF). After a fight lasting all day the Normans had the victory; Harold, wounded by an arrow in the eye, and his two brothers Gyrth and Leofwine, lay dead on the field. Harold had three sons, Godwine, Edmund and Magnus, and two daughters, probably the children of Edith of the Swan-neck. Another son was named Ulf. By his wife Ealdgyth, who was sent for safety to Chester in 1066, he had a posthumous son, Harold, who took part in the expedition of Magnus Barefoot to the Scottish Isles in 1098. Harold's body is said to have been taken from the cairn of stones on the sea shore where it was originally buried to Waltham.

See E. A. Freeman, *History of the Norman Conquest of England* (6 vols., Oxford, 1871–79) in which the existing sources are fully utilised; Lytton's *Harold* is a brilliant historical novel, though not an impartial record.

HARP, the largest of the class of stringed instruments of which the strings are twanged or vibrated by the fingers. The harp is an instrument of beautiful proportions, approximating to a triangular form, the strings diminishing in length as they ascend in pitch. The mechanism is concealed within the different parts of which the instrument is composed: (1) the pedestal, or pedal-box, on which rest (2) the vertical pillar and (3) the inclined convex body in which the sound-board is fixed (4) the curved neck, with (5) the comb concealing the mechanism for stopping the strings, supported by the pillar and the body.

The harp usually has 40 strings, of gut in the middle and upper registers, and of covered steel wire in the bass. The compass thus has a range of 6½ octaves and in respect of notation the double stave is used as for the pianoforte. The modern harp with double action is the only instrument with fixed tones, not determined by the ear or touch of the performer, which has separate notes for naturals, sharps, and flats, giving it an enharmonic compass. On the harp the appreciable interval between D♯ and E♭ can be played.



BY COURTESY OF THE LIBRARIAN, TRINITY COLLEGE, DUBLIN

AN IRISH HARP OF THE MIDDLE AGES, WHICH IS TRADITIONALLY STATED TO HAVE BELONGED TO KING BRIAN BOIROIMHE

The harp in its normal condition is tuned to C♭ major; it rests with the performer to transpose it at will in a few seconds into any other key by means of the pedals, each of the pedals influencing one note of the scale throughout the compass. The harp is the instrument upon which transposition presents the least difficulty, for the fingering is the same for all keys. The quality of tone does not vary much in the different registers, but it has the greatest brilliancy in keys with many flats, for the strings are then open and not shortened by the mechanism.

It is possible to play on the ordinary harp all kinds of diatonic and arpeggio passages, but not chromatic, except in very slow tempo, on account of the time required by the mechanism of the pedals. Hence the invention of Pleyel's chromatic harp, patented in 1894 and improved in 1903 by Gustave Lyon, manager of the firm of Pleyel, Wolff & Co. This is an instrument practically without internal mechanism, constructed on the familiar lines of the pianoforte. There is a string for every chromatic semitone of the scale of C major, the white strings representing the white keys of the piano keyboard, and the black strings corresponding to the black keys. The strings cross halfway between neck and sound-board, this being the point where they are plucked, the left hand finds the black notes above, and the right hand below the crossing. The chromatic harp has many useful features, but it has shown no signs so far of displacing the ordinary double-action instrument.

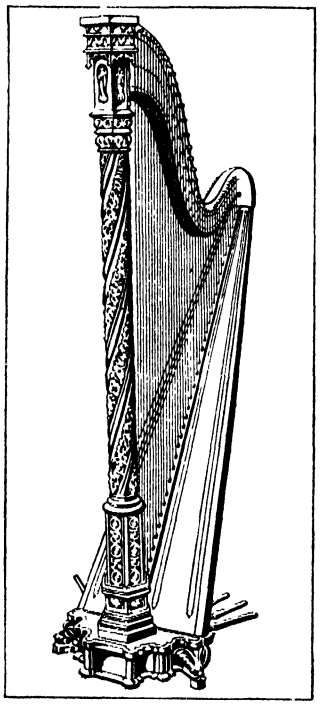
History.—While the instrument is of great antiquity it is yet from northern Europe that the modern harp and its name are derived. The Greeks and Romans preferred to it the lyre in its different varieties, and a Latin writer, Venantius Fortunatus, described it in the 7th century A.D. as an instrument of the barbarians—"Romanusque lyra, plaudat tibi barbarus harpa." This is believed to be the earliest mention of the name, which is clearly Teutonic—O.H.G. *harapha*, A.S. *hearpe*, O. Norse, *harpa*.

The earliest delineations of the harp in Egypt point to its having had its origin in nothing more elaborate than the tense string of the warrior's or hunter's bow. Such an early instrument is the nanga, between which and the grand vertical harps in the frescoes of the time of Rameses III., more than 3,000 years old, there are varieties that permit one to bind the whole, from the simplest bow-form to the almost triangular harp, into one family.

The earliest records that we possess of the Celtic race, whether Gaelic or Cymric, give the harp a prominent place and harpists peculiar veneration and distinction. Upon a cross belonging to the ancient church of Ullard near Kilkenny, the date of which cannot be later than 830, a harp is plainly indicated; the sculpture is rude, but the instrument is clearly shown to have no front pillar. This remarkable structural likeness to the old harps of

Egypt and Assyria may be accidental, but permits the plausible hypothesis of Eastern descent.

As regards Wales, an old Welsh harp, not triple strung, exists, which bears a great resemblance to the Irish harp in neck, sound-board and sound-holes. But this does not imply derivation of the harp of Wales from that of Ireland or the reverse. There is no really good historical evidence, and there may have been a common or distinct origin on which ethnology only can throw light. The Welsh like the Irish harp was often an hereditary instrument, to be preserved with great care and veneration and used by the bards of the family, who were alike the poet-musicians and historians. A slave was not allowed to touch a harp, and it was exempted by the Welsh laws from seizure for debt.



BY COURTESY OF S. AND P. ERARD

LARGE DOUBLE-ACTION MODERN HARP, MADE BY S. & P. ERARD, WHOSE FOUNDER, SEBASTIAN ERARD, WAS THE INVENTOR OF THE DOUBLE-ACTION PRINCIPLE

The first pattern of the modern harp is discovered in German and Anglo-Saxon illuminated mss. as far back as the 9th century. No accidental semitones were possible with this instrument, unless the strings were shortened by the player's fingers. Then, in the 17th century, a Tirolese maker adapted hooks that, screwed into the neck, could be turned downwards to fix the desired semitone at pleasure. Later, somewhere about 1720, Hochbrucker, a Bavarian, invented pedals that, acting through the pedestal of the instrument, governed by mechanism the stopping, and thus left the player's hands free, a great advance. By a sequence of subsequent improvements, in which two Frenchmen named Cousineau took an important part, the pedal system was still further developed, to be brought finally to something like perfection in 1810 by the invention of the wonderfully ingenious double-action mechanism associated with the name of Sebastian Erard.

Notwithstanding these improvements, however, and the great beauty of tone the harp possesses, the domestic use of it in modern times has almost disappeared. But it still constitutes an indispensable feature of the orchestra and in this capacity has been employed with great effect by all the great masters, while during recent years its resources have been utilized to an ever-increasing extent in chamber music compositions.

HARPENDEN, an urban district of Hertfordshire, England, 25 m. N.W. by N. from London by rail. Pop. (1921) 6,738. It is an outlying residential district of London. The church of St. Nicholas is modern except the Perpendicular tower. In the Lawes testimonial laboratory there is a vast collection of samples of experimentally grown produce, annual products, ashes and soils. Sir John Bennet Lawes (d. 1900) provided an endowment of £100,000 for the perpetuation of the agricultural experiments which he inaugurated here at his seat of Rothamsted park, and the Rothamsted Experimental Station (*q.v.*) plays a foremost part in modern agricultural and botanical research. There are some rubber and hat manufactures.

HARPER, WILLIAM RAINEY (1856–1906), American Hebraist and educator, was born on July 26, 1856, at New Concord, O. His interest in Hebraic studies began in Muskingum college, at which he graduated in 1870. In 1875, when but 19 years of age, he received his Ph.D. at Yale for studies in the Indo-Iranian and Semitic languages. In 1880, after several years of academy teaching, he was given a professorship in Hebrew at the Baptist Union Theological seminary in Chicago. Here he founded *The Hebrew Student* and *Hebraica* and organized the American Institute of Hebrew. He published a number of text-books and study helps for the teaching of Hebrew which found wide use. In 1886 he accepted a professorship in Semitic languages at Yale, and in 1889 was appointed also Woolsey professor of biblical literature, filling both positions simultaneously. He gave up his work at Yale, however, to accept in 1891, the presidency of the newly established University of Chicago. His liberal aims and comprehensive plans for the new university attracted wide attention and the president was able to raise sufficient funds to build adequate buildings and gather a notable faculty at the start. The university as a result was an immediate success. Harper remained its president and head of the department of Semitic languages until his death on Jan. 10, 1906.

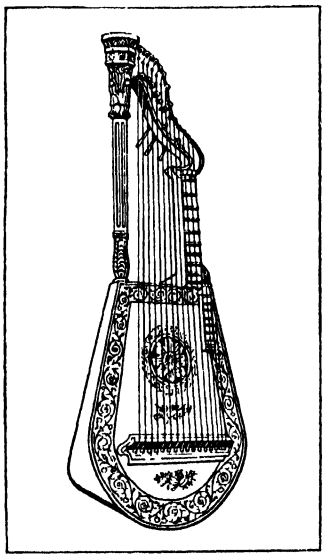
Among his more important books are *Religion and the Higher Life* (1904); *A Critical and Exegetical Commentary on Amos and Hosea* (1905); *The Prophetic Element in the Old Testament* (1905); *The Trend in Higher Education* (1905).

See T. W. Goodspeed, *William Rainey Harper* (1928).

HARPER'S FERRY, a town of Jefferson county, W.Va., U.S.A., finely situated at the confluence of the Potomac and Shenandoah rivers (which here pass through a beautiful gorge in the Blue Ridge), 55 m. N.W. of Washington, D.C. Pop. (1920) 713. It is served by the Baltimore and Ohio railway, which crosses the Potomac here, and the Winchester and Potomac railway (Baltimore and Ohio) of which it is a terminus. Across the Potomac, on the north, rise the Maryland Heights; across the Shenandoah, on the West Virginia side, the Virginia or Loudoun Heights; and behind the town to the west the Bolivar Heights. A U.S. arsenal and armoury were established at Harper's Ferry in 1796, the site being chosen because of the good water-power; these were seized on Oct. 16, 1859, by John Brown (*q.v.*), the abolitionist, and some 21 of his followers. The engine-house in which Brown was captured was exhibited at the Columbian Exposition at Chicago and was later rebuilt on Bolivar Heights; a marble pillar, marked "John Brown's Fort," has been erected on its original site.

The first settlement here was made about 1747 by Robert Harper, who ran a ferry across the Potomac. The position of Harper's Ferry at the lower end of the Shenandoah Valley rendered it a place of strategic importance during the Civil War. On April 18, 1861, the day after Virginia passed her ordinance of secession, when a considerable force of Virginia militia under Gen. Kenton Harper approached the town—an attack having been planned in Richmond two days before—the Federal garrison of 45 men under Lieut. Roger Jones set fire to the arsenal and fled. Within the next few days large numbers of Confederate volunteers assembled here; and Harper was succeeded in command April 27 by "Stonewall" Jackson, who was in turn succeeded by Brig.-Gen. Joseph E. Johnston on May 23. Johnston thought that the place was unimportant, and withdrew when (June 15) the Federal forces under Gen. Robert Patterson and Col. Lew Wallace approached, and Harper's Ferry was again occupied by a Federal garrison. In Sept. 1862, during Gen. Lee's first invasion of the North, Gen. McClellan advised that the place be abandoned in order that the 10,000 men defending it might be added to his fighting force, but Gen. Halleck would not consent, so that when Lee needed supplies from the Shenandoah Valley he was blocked by the garrison, then under the command of Col. Dixon S. Miles. On Jackson's approach they were distributed as follows: about 7,000 men on Bolivar Heights, about 2,000 on Maryland Heights, and about 1,800 on the lower ground. On Sept. 13 Gen. Lafayette McLaws carried Maryland Heights and Gen. John G. Walker planted a battery on Loudoun Heights. On the 14th there was some fighting, but early on the 15th, as Jackson was about to make an assault on Bolivar Heights, the garrison, surrounded by a superior force, surrendered. The total Federal loss (including the garrisons at Winchester and Martinsburg) amounted to 44 killed (the commander was mortally wounded), 12,520 prisoners, and 13,000 small arms. For this terrible loss to the Union army the responsibility seems to have been Gen. Halleck's, though the blame was officially put on Col. Miles, who died immediately after the surrender. Jackson rejoined Lee on the following day in time to take part

in the battle of Antietam, and after the battle Gen. McClellan placed a strong garrison (the 12th Corps) at Harper's Ferry. In June 1863 the place was again abandoned to the Confederates on their march to Pennsylvania. After their defeat at Gettysburg, the town again fell into the hands of the Federal troops, and it remained in their possession until the end of the war. On July 4, 1864 Gen Franz Sigel, who was then in command here, withdrew his troops to Maryland Heights, and from there resisted Early's attempt to enter the town and to drive the Federal garrison from Maryland Heights Harper's Ferry was seriously damaged by a flood in the Shenandoah in Oct 1878.



FROM HENRY BODDINGTON, "CATALOGUE OF MUSICAL INSTRUMENTS"

THE HARP-LUTE, A HYBRID INSTRUMENT, ONE OF SEVERAL INVENTED IN THE EARLY YEARS OF THE 19TH CENTURY, COMBINING FEATURES OF THE HARP, THE LUTE AND THE GUITAR

HARPIES (Gr. ἅρπυιαι the "snatchers"), fabulous creatures, probably wind-spirits although their presence as tomb-figures (*e.g.*, on the famous Harpy Tomb of Xanthus in Lydia) makes it not impossible that they were ghosts; the two ideas are not wholly contradictory. In Homer they are plainly winds (*Odyssey*, xx 66) which carried people away; as also *Odyssey*, i 241 (the *harpyiai* have carried off Odysseus; *i.e.*, he has been lost at sea). They are sometimes connected with the powers of the under-world; thus they carried off the daughters of Pandareus and gave them to the Erinyes as servants Homer names one, Podarge (Swiftfoot), who seemed to be of equine nature, for she became by the West Wind the dam of Achilles' horses (Iliad, XVI., 150) Hesiod (Theog., 265) mentions two, Aello, and Okypete (Stormwind and Swiftwing), daughters of Thaumas, and Electra the daughter of Oceanus

These Harpies were in no way disgusting; later, especially in the Argonautic saga, they were represented as birds with the faces of women, horribly foul and loathsome They are sent to punish Phineus for his ill-treatment of his children, or some other offence, and nearly starve him to death by carrying off most of his food and befouling the rest Calais and Zetes (q.v.) deliver him and chase the Harpies away (Apollodorus, I., 120–123). Virgil imitates the episode in *Aen.*, III., 210 et seq.; he calls the chief Harpy Celaeno (Dark; *cf.* Hyginus, Fab 14).

HARPIGNIES, HENRI (1819–1916), French landscape painter and engraver, born at Valenciennes on June 28, 1819. He took to painting comparatively late in life entering Achard's atelier in Paris at the age of 27 He went to Rome in 1850 returning to Paris in 1852 During the next few years he devoted himself to the painting of children in landscape setting. In 1863 he returned to Italy for two years working mainly in Rome, Naples and Capri. He came more and more under the influence of Corot and the water-colours executed during this period are among his finest work. He scored his first great success at the Salon, in 1861, with his "Lisière de bois sur les bords de l'Allier" After that year he was a regular exhibitor at the old Salon; in 1886 he received his first medal for "Le Soir dans la campagne de Rome," which was acquired for the Luxembourg Gallery. Many of his best works were painted at Hérisson in the Bourbonnais, as well as in the Nivernais and the Auvergne He died on Aug 28, 1916 at Saint Privé (Yonne) where he had settled in 1878. His landscapes are distinguished for constructive drawing and breadth of treatment; a silvery tone pervades them.

See Léonce Bénédite, *Notre Art, Nos Maitres* (1923).

HARP-LUTE, or DITAL HARP, one of the many attempts to improve the guitar and to increase its compass, invented in 1798 by Edward Light, and taking the form of a kind of combined guitar and harp There are 12 catgut strings A further improvement was patented in 1810 as the British harp-lute Other attempts were the lyra-guitarre, which appeared in Germany at the beginning of the 19th century; the accord-guitarre, towards the middle of the same century; and the keyed guitar

HARPOCRATES, originally an Egyptian deity, adopted by the Greeks, and worshipped in later times both by Greeks and Romans In Egypt, Harpa-khruti, Horus the child, was one of the forms of Horus, the sun-god, the child of Osiris He was supposed to carry on war against the powers of darkness, and hence Herodotus (ii. 144) considers him the same as the Greek Apollo He was represented in statues with his finger on his mouth, a symbol of childhood The Greeks and Romans, not understanding the meaning of this attitude, made him the god of silence (Ovid. *Metam.*, ix 691), and as such he became a favourite deity with the later mystic schools of philosophy

See articles by G. Lafaye in Daremberg and Saglio's *Dictionnaire des antiquités*, and by E. Meyer (*s.v.* "Horos") in Roscher's *Lexikon der Mythologie*.

HARPOCRATION, VALERIUS, Greek grammarian of Alexandria He is possibly the Harpocration mentioned by Iulius Capitolinus (*Life of Verus*, 2) as the tutor of Antonius Verus (2nd century A.D.); some authorities place him much later, on the ground that he borrowed from Athenaeus He is the author of Λεξικὸν (or Περ τῶν λέξεων) τῶν δέκα ῥητόρων, a *Lexicon* or notes on well-known events and persons mentioned by the ten most famous orators, and explanations of legal and commercial expressions. As nearly all the lexicons to the Greek orators have been lost, Harpocration's work, of which part is extant, is especially valuable. Amongst his authorities were the writers of Atthides (histories of Attica), the grammarian Didymus, Dionysius of Halicarnassus, and the lexicographer Dionysius, son of Tryphon. Nothing is known of an Ἀνθηρῶν συναγωγή a sort of anthology attributed to him by Suidas A series of articles in the margin of a Cambridge ms of the lexicon forms the basis of the *Lexicon rhetoricum Cantabrigiense* (*see* DOBREE, P P.)

The best edition is by W. Dindorf (1853), *see* also J E Sandys, *History of Classical Scholarship*, i. (1906), p. 325, C Boysen, *De Harpocrationis fontibus* (Kiel, 1870).

HARPOON, a barbed spear, particularly one used for spearing whales or other large fish, and either thrown by hand or fired from a gun (*see* WHALE-FISHERIES)

HARPSICHORD, a large keyboard instrument, belonging to the same family as the virginal and spinet, but having two, three or even four strings to each note, and a case of the harp or wing shape, afterwards adopted for the grand pianoforte J S Bach's harpsichord, preserved in the museum of the *Hochschule fur Musik* at Charlottenburg, has two manuals and four strings to each note, one 16ft., two 8ft and one 4ft By means of stops the performer has within his power a number of combinations for varying the tone and dynamic power In all instruments of the harpsichord family the strings, instead of being struck by tangents as in the clavichord, or by hammers as in the pianoforte, are plucked by means of a quill firmly embedded in the centred tongue of a jack or upright placed on the back end of the key-lever. This plucking of the string produces the incisive tone peculiar to the harpsichord family What these instruments gain in brilliancy of tone, however, they lose in power of expression and of accent. For fuller discussion of the harpsichord and its congeners *see* PIANOFORTE

HARPY or HARPY-EAGLE, a large diurnal bird of prey, so named after the mythological monsters (*see* HARPIES) This bird, *Thrasaetus harpyia*, inhabits America from south Mexico to Brazil Its flight is slow and heavy, but it possesses an enormous bill and powerful talons. Except for a pectoral band, the head and lower parts are white; the upper parts are dark grey, banded with black, the wings dusky, the tail barred On the head is an erectile crest Its nearest allies are the eagles

HARQUEBUS: *see* ARQUEBUS

HARRAN, an ancient site of considerable strategic value on the River Belikh, in 37° N 39° E It lay on the old road from Nineveh westwards to the river crossing at Carchemish, in the

river valley, but close to the foothills and just north of the modern Syrian boundary. It is worthy of note that the modern caravan route goes north by Urfah, while the line chosen for the Baghdad railway skirted the hills, where the boundary runs and did not penetrate into the valley in which Harran stands. Its chief cult in Assyrian times was the moon god. The city was accepted as of considerable importance by the Assyrian kings. Crassus was here defeated and killed by the Parthians, and the Emperor Caracalla was murdered here. It appears to have remained of some importance down to the time of the Caliphate, but from that time onwards gradually fell into ruins. Its Roman name was Carrhae.



THE HARPY (THRASAETUS HARPYIA). A LARGE BIRD OF PREY ALLIED TO THE EAGLE: IT IS A NATIVE OF CENTRAL AMERICA AND, ALTHOUGH SLOW OF FLIGHT, IS POWERFULLY ARMED WITH GREAT BILL AND TALONS

HARRATIN, black Berbers, dwelling in Tidikelt and other Saharan oases. Many, though blacker than the average negro, are of the Berber type, with European features and well-proportioned bodies. They are the result of an early crossing with the Sudanese negro. To-day they have all the pride of the Berbers (*q.v.*) and do not live with or intermarry among negroes.

HARRIER, the name of birds of prey forming the genus *Circus*. Harriers affect open country, feeding on snakes, frogs and other small vertebrates. The long wings and legs and the frill surrounding the lower part of the head serve to distinguish them. The group is almost world-wide in distribution.

The commonest species is the hen-harrier (*C. cyaneus*), ranging over N. Europe and Asia and showing great sexual dimorphism. Montague's harrier (*C. cineraceus*), with a more southerly range, shows the same phenomenon, but is distinguished by its longer wings. The American marsh-hawk (*C. hudsonius*) is very similar to the hen-harrier, but the male has rufous markings below. Other species occur in Europe, Africa, Asia, S. America, Australia and New Zealand.

Harriers build large nests on or near the ground, in marshes or similar situations. When the male brings food for the female during incubation, she leaves the nest, he drops the prey and she catches it in mid-air. In Great Britain, three species are found (the first two mentioned above and *C. aeruginosus*, the marsh-harrier), but all are now very rare. Harriers are extremely light (Montague, *Ornithological Dictionary*, 1802, gives the weight of the male as 13oz.), but have a wing-spread of as much as 3ft.

HARRIMAN, EDWARD HENRY (1848–1909), American financier and railroad magnate, son of the Rev. Orlando Harriman, rector of St. George's Episcopal church, Hempstead (L.I.), was born at Hempstead, on Feb. 25, 1848. He became a broker's clerk in New York at an early age, and in 1870 was able to buy a seat on the New York Stock Exchange on his own account. He carefully mastered the situation affecting American railways. In this respect he was assisted by his friendship with Stuyvesant Fish, who, on becoming vice-president of the Illinois Central in 1883, brought Harriman upon the directorate, and in 1887, being then president, made Harriman vice-president; 20 years later it was Harriman who dominated the finance of the Illinois Central, and Fish, having become his opponent, was dropped from the board.

It was not till 1898, however, that his career as a great railway organizer began with his formation, by the aid of the bankers, Kuhn, Loeb & Co., of a syndicate to acquire the Union Pacific line, which was then in the hands of a receiver and was generally regarded as a hopeless failure.

Having brought the Union Pacific out of bankruptcy into prosperity, he utilized his position to draw other lines within his control, notably the Southern Pacific in 1901. His abortive contest in 1901 with James J. Hill for the control of the Northern Pacific led to one of the most serious financial crises ever known on Wall Street. At his death, on Sept. 9, 1909, his influence was estimated to extend over 60,000m. of track. Harriman's methods excited the bitterest criticism, culminating in a stern denunciation from President Roosevelt himself in 1907.

HARRIMAN, a city of Roane county, Tenn., U.S.A., on the Emory river, 35m. W. by S. of Knoxville. It is served by the Louisville and Nashville, the Southern and the Tennessee Central railways. The population was 4,019 in 1920 (88% native white) and was estimated locally at 5,500 in 1928. The region abounds in coal, iron and timber, and peaches are extensively grown. The city has various manufacturing industries. Harriman was founded by a land company in 1890, and was chartered as a city in 1891.

HARRINGTON, EARLS OF. The first earl of Harrington (cr. 1742) was the diplomatist and politician, William Stanhope (*c.* 1690–1756), a younger son of John Stanhope of Elvaston, Derbyshire. Educated at Eton, William Stanhope was British ambassador in Spain from 1720 to 1729, and was created Baron Harrington in Jan. 1730. He was secretary of State for the northern department from 1730 to 1746 except for a short interval (1742–44), when he was president of the council. He was lord lieutenant of Ireland from 1747 to 1751, and he died in London on Dec. 8, 1756.

Leicester Fitzgerald Charles (1784–1862), 5th earl, was a soldier and a politician of advanced views, who worked with Lord Byron in the cause of Greek independence. He wrote *A Sketch of the History and Influence of the Press in British India* (1823); and *Greece in 1823 and 1824* (English ed. 1824, American ed., 1825).

HARRINGTON or **HARINGTON, JAMES** (1611–77), English political philosopher, was born in January 1611, the son of Sir Sapcotes Harrington of Rand, Lincolnshire, and great-nephew of the first Lord Harington of Exton (d. 1615). In 1629 he entered Trinity college, Oxford, as a gentleman commoner. One of his tutors was the famous Chillingworth. After several years spent in travel, and as a soldier in the Dutch army, he returned to England and lived in retirement till 1646, when he was appointed to the suite of Charles I., at that time being conveyed from Newcastle as prisoner. Though republican in his ideas, Harrington won the king's regard and esteem, and accompanied him to the Isle of Wight. He roused, however, the suspicion of the parliamentarians and was dismissed. After Charles's death Harrington wrote his *Oceana*, a work which pleased neither party. By order of Cromwell it was seized when passing through the press. But, by the favour of the Protector's favourite daughter, Mrs. Claypole, the work was restored to him, and appeared in 1656, dedicated to Cromwell. The views embodied in *Oceana*, particularly that bearing on vote by ballot and rotation of magistrates and legislators, Harrington and others (who in 1659 formed a club called the "Rota") endeavoured to push practically, but with no success. In November 1661, by order of Charles II., Harrington was arrested on a charge of conspiracy, and was thrown into the Tower. No public trial could be obtained, and when at length his sisters obtained a writ of *habeas corpus* he was secretly removed to St. Nicholas island off Plymouth. He died on Sept. 11, 1677, and was buried next to Sir Walter Raleigh in St. Margaret's, Westminster.

The *Oceana* is the exposition of an ideal constitution, "Oceana" being England, and the lawgiver Olphaus Megaletor, Oliver Cromwell. The main ideas are: that the determining element of power in a state is property generally, property in land in particular; and that the executive power ought not to be vested for any considerable time in the same men or class of men. Harrington recommends an agrarian law, limiting the portion of land held to that yielding a revenue of £3,000, and consequently insisting on particular modes of distributing landed property. As a means to the second object he lays down the rule of rotation by ballot.

His *Works* were edited with biography by John Toland in 1700;

Toland's edition, with additions by Birch, appeared in 1747, and again in 1771. *Oceana* was reprinted by Henry Morley in 1887. *See* H. F. Russell-Smith, *Harrington and his Oceana* (1914). Harrington has often been confused with his cousin Sir James Harrington, a member of the commission which tried Charles I., and afterwards excluded from the acts of pardon.

HARRIOT or **HARRIOTT, THOMAS** (1560–1621), English mathematician and astronomer, was born at Oxford in 1560. After studying at St. Mary hall, Oxford, he became tutor to Sir Walter Raleigh, who appointed him in 1585 to the office of geographer to the second expedition to Virginia. Harriot published an account of this expedition in 1588, which was afterwards reprinted in Hakluyt's *Voyages*. On his return to England (1587) he resumed his mathematical studies. He materially assisted the development of algebra, and introduced symbols and notation still used, e.g., x^3 for *xxx* A manuscript of Harriot's entitled *Ephemeris chrysometria* is preserved in Sion college, near London, and his *Artis analyticae praxis ad aequationes algebraicas resolvendas* was published at London in 1631. He died in London on July 2, 1621.

See Charles Hutton, *Mathematical and Philosophical Dictionary* (1815); J. E. Montucla, *Histoire des mathématiques* (1758), and Wallis, *History of Algebra* (1685).

HARRIS, GEORGE, 1ST BARON, cr. 1815 (1746–1829), British general, was the son of the Rev. George Harris, curate of Brasted, Kent, and was born on March 18, 1746 Educated at Westminster school and at the Royal Military Academy, Woolwich, he was commissioned to the Royal Artillery in 1760, transferring to an ensigncy in the 5th foot (Northumberland Fusiliers) in 1762 His first active service was in the American War of Independence, his next under Major-General Medows at Santa Lucia in 1778–1779, after which his regiment served as marines in Rodney's fleet. After commanding the 5th in Ireland for some years, he exchanged and went with General Medows to Bombay, and served in India until 1792. In 1794 he was again in India, and in 1796 became local lieutenant-general in Madras Up to 1800 he commanded the troops in the presidency, and for a short time he exercised the civil government as well In December 1798 he was appointed by Lord Wellesley, the governor-general, to command the field army against Tippoo Sahib (*q.v.*), and in a few months Harris reduced the Mysore country and stormed the great stronghold of Seringapatam. He returned home in 1800, and attained the rank of full general in 1812. Lord Harris died at Belmont in May 1829.

See Rt. Hon. S. Lushington, *Life of Lord Harris* (London, 1840).

HARRIS, JAMES RENDEL (1852–), English scholar, born at Plymouth, studied at Close college, Cambridge, of which he became a fellow. He held professorships at Johns Hopkins university and at Haverford college, U.S.A., from 1882 to 1892, was then professor of palaeography (1893–1903) at Cambridge, spent a year at Leyden as professor of theology, and was director of studies at the Friends' Settlement at Woodbrooke, near Birmingham, from 1903 to 1918. In 1918 he became curator of mss. at the Ryland library, Manchester. Rendel Harris travelled extensively in the Near East in search of mss. He is the author of a long series of works dealing with textual criticism of the biblical books, and of sacred books outside the canon of scripture, and of works on various Mediterranean cults. His works include: *Biblical Fragments from Mount Sinai* (1890); *The Diatessaron* (1890); *Lectures on the Western Text of the New Testament* (1894); *Origin of the Cult of Dionysus* (1915); *Further Traces of Hittite Migration* (1927).

HARRIS, JOEL CHANDLER (1848–1908), American author, was born in the vicinity of Eatonton, Putnam county (Ga.), Dec. 9, 1848. As apprentice on a weekly plantation paper near his home, he obtained the real basis for his later work Later he continued his newspaper work at Macon, New Orleans, Forsyth (Ga) and Savannah, finally spending 24 years on the staff of the Atlanta *Constitution*. Although he had earlier established a reputation as a capable newspaper man and brilliant paragrapher, it was through his negro sketches contributed to this paper that he first became known throughout the nation. *Uncle Remus: His Songs and Sayings* was published in book form in 1880 and was followed by *Nights with Uncle Remus* (1883), *Daddy Jake, the Runaway, and Short Stories Told after Dark* (1889), *Uncle Remus and His Friends* (1892) and later volumes of like nature, books which endeared the picturesque old storyteller and his animal characters to young and old. A series of children's books began with *Little Mr. Thimblefinger and His Queer Country* (1894). *Mingo, and other Sketches in Black and White* (1884), *Free Joe, and Other Georgian Sketches* (1887), *Sister Jane, Her Friends and Acquaintances* (1896) and *Gabriel Tolliver* (1902) reveal Harris' ability to vitalize other southern types *On the Plantation* (1892, published in London as *A Plantation Printer*) is one of the most interesting of his books because of its autobiographic nature Harris often spoke of himself as simply a mouthpiece and a "cornfield" writer As a man who has done much, however, to immortalize the faithfulness, the humour, the kindliness and quaint philosophy of the negro, in short, as the creator of Uncle Remus, he has won for himself a secure place in American literature. He died in Atlanta, July 3, 1908

See Julia Collier Harris, *The Life and Letters of Joel Chandler Harris* (1918), which contains a bibliography.

HARRIS, JOHN (*c.* 1666–1719), English writer. He is best known as the editor of the *Lexicon technicum*, or *Dictionary of the Arts and Sciences* (1704), which ranks as the earliest of the long line of English encyclopaedias, and as the compiler of the *Collection of Voyages and Travels* which passes under his name He was born about 1666, probably in Shropshire, and was a scholar of Trinity college, Oxford, from 1684 to 1688 He held the vicarage of Icklesham in Sussex, and subsequently the rectory of St. Thomas, Winchelsea. In 1698 he delivered the seventh series of the Boyle lectures—*Atheistical Objections against the Being of God and His Attributes fairly considered and fully refuted* Between 1702 and 1704 he gave at the Marine coffee house, Birchin lane, London, the mathematical lectures founded by Sir Charles Cox. The friendship of Sir William Cowper, afterwards lord chancellor, secured for him a series of church preferments He showed himself an ardent supporter of the Government, and engaged in a bitter quarrel with the Rev. Charles Humphreys, afterwards chaplain to Dr Sacheverel who held him up to ridicule in *The Picture of a High-flying Clergyman* (1710) Harris was one of the early members of the Royal Society, and for a time acted as vice-president. He died on Sept. 7, 1719.

HARRIS, SIR WILLIAM SNOW (1791–1867), English electrician, was born at Plymouth on April 1, 1791 He set up as a medical practitioner in Plymouth but gave this up to study electricity. In 1820 he invented a new method of arranging the lightning conductors of ships, but the method was not adopted by the Government for the Royal navy until 1847 He was then knighted and later received a grant of £5,000 Harris published a number of papers on general electricity and was the author of manuals on *Electricity, Galvanism* and *Magnetism* published between 1848 and 1856. He died at Plymouth on Jan 22, 1867

Harris' *Treatise on Frictional Electricity* was published posthumously in 1867, with a memoir of the author by Charles Tomlinson.

HARRIS, WILLIAM TORREY (1835–1909), American educationalist, was born in North Killingly, Conn., on Sept 10, 1835. He studied at Phillips academy, Andover, Mass., and entered Yale, but left in his junior year to teach in St. Louis, Mo., being city superintendent of schools from 1867 until 1880 There he grew interested in modern German philosophy; he founded in 1867 *The Journal of Speculative Philosophy;* and later became a lecturer at the Concord School of Philosophy. In 1873, with Miss Susan E. Blow, he established in St. Louis the first permanent public school kindergarten in America From 1889 to 1906 he was U.S. commissioner of education Besides being a contributor to the magazines and encyclopaedias on educational and philosophical subjects, he wrote *An Introduction to the Study of Philosophy* (1889); *The Spiritual Sense of Dante's Divina Commedia* (1889); and *Psychologic Foundations of Education* (1898); he interpreted Hegel to American readers; he edited Appleton's *International Education Series* and Webster's *New International Dictionary*. He died in Providence, R.I., on Nov 5, 1909.

See Henry R. Evans, "A List of the Writings of William Torrey

Harris" in the *Report of the Commissioner of Education for 1907* (vol. i, 1908) and J. S Roberts, *William T. Harris, a Critical Study of His Educational and Related Philosophical Views* (1924).

HARRISBURG, a city in the rich agricultural and coal-mining region of southern Illinois, U.S.A ; the county seat of Saline county. It is on Federal highway 45, and is served by the Big Four and the Southern Illinois Railway and Power company railways. The population was 7,125 in 1920 (90% native white), and was estimated locally at over 12,000 in 1928. The city has flour mills, brick and tile works, saw and planing mills. It was settled about 1840 and incorporated in 1876.

HARRISBURG, the capital city of Pennsylvania, U.S.A, and the county seat of Dauphin county, on the E. bank of the Susquehanna river, 105m. W. by N. of Philadelphia. It is at the intersection of Federal highways 11, 15, 22, 209 and 230, and of many State roads, and is served by the Pennsylvania and the Reading railways The population was 75,917 in 1920 (87·6% native white), and was estimated at 85,700 in 1928. Including contiguous boroughs, the population of the metropolitan area in 1928 was over 125,000.

The river here is 1m wide Ordinarily it is shallow, and dotted with islets, but after a moderate rain it rises 4 to 6 feet. The area of the city is 9 square miles. Along the river bank for 5m. extends a parkway (Front street), bordered by fine residences, including the governor's mansion. Below the parkway, at the edge of the river, is a concrete promenade, on the top of a large intercepting sewer, with steps leading down into the water. On a large island is the municipal bathing beach, and during the summer huge flat-bottomed dance-boats ply up and down the river at night. A park system embracing 1,100ac. almost encircles the city. There are public golf links and tennis courts, and 17 supervised playgrounds for children. At right angles to Front street is State street, 120ft. wide, running east to Capitol park (16ac.) in the heart of the city. The present capitol, dedicated in 1906, was erected at a cost of $13,000,000 to replace one burned in 1897 It is a fine building, with a dome modelled after that of St. Peter's at Rome. At the main entrance are groups of statuary by George Grey Barnard. The bronze doors are decorated in relief with scenes from the State's history. The rotunda is paved with tiles made at Doylestown in the style of the pottery of the early Moravian settlers There are stained-glass windows by W. B. van Ingen; and mural decorations by him and by Edwin A. Abbey, John W. Alexander and Violet Oakley. Adjoining is the State library and museum, containing 150,000 volumes, the State records and thousands of historic exhibits and relics. A large tract behind the capitol has been transformed into a park, as a site for four State office buildings, two of which had been erected by 1928. A viaduct across the Pennsylvania railroad tracks is under construction by the State as a memorial to the Pennsylvania men who served in the World War. A comprehensive city plan is in process of development. The assessed valuation of property subject to taxation was $86,918,210 in 1928.

For several years before 1902 Harrisburg suffered from impure water, a bad sewerage system and poorly paved and dirty streets. In 1902 a non-partisan mayor was elected, and a vigorous programme of improvement undertaken. Since then the city has spent over $14,000,000 in major civic improvements, including streets, schools, sewers, bridges, parks, fire apparatus, filtration and incineration plants, elimination of grade crossings and development of civic centres The private charitable agencies are associated, for joint raising of funds and other purposes, in a welfare federation which has 25,000 contributors. A State hospital for the insane, established in 1845 through the efforts of Dorothea Lynde Dix, is situated here.

Harrisburg is a concentration point for the Pennsylvania railroad, and both the Pennsylvania and the Reading have large freight-classification yards here. Coal and iron abound in the vicinity, and immense quantities of coal for power plants are salvaged from the bed of the river. The city has numerous manufacturing establishments (204 in 1925, according to a State census), with an annual output valued at $46,000,000. The most important products are steel and iron, knit goods, tobacco and cigars, confectionery and ice-cream, food products, printing, boilers and engines, and book-keeping and book-binding machinery. The railroads employ about 10,000 persons; the factories about 9,000; and 4,400 State employees live in the city. Its immediate trading area has a population of 250,000. Bank clearings in 1927 amounted to $247,870,414.

The first settler here was John Harris, about 1726, a trader attracted to the site because it was an easy place to ford the Susquehanna. In 1753 his son began to operate a ferry, and the settlement was known as Harris's Ferry until 1785, when the younger Harris laid out a town and named it Harrisburg. In the same year it was made the seat of the new county of Dauphin, and its name was changed to Louisburg; but in 1791, when it was incorporated as a borough, the old name was resumed. As the result of efforts extending over 25 years, it was made the capital of the State in 1812. In 1860, when the population was 13,405, it was chartered as a city. A commission form of government was adopted in 1913. A convention held here in 1827, in the interest of securing legislative aid for the woollen manufactures of New England, framed a programme which did much to bring about the passage by Congress of the famous high tariff act of 1828.

HARRISMITH, a town in the Orange Free State, South Africa, situated in 28° 15′ S , 29° 9′ E , 261 m. from Durban; altitude, 5,321 feet. Pop. (1921), 2 546 Europeans, 3,654 non-Europeans. It is situated near the Wilge river, and is an important trading centre. It was formerly a military centre. The town is laid out in wide, straight streets, many of which are lined with trees. The houses are built of local sandstone. A good water supply is led in pipes from the Platberg, a mountain about 8,000 ft high, which rises immediately to the north of the town The surrounding district is well watered, the annual rainfall being about 27 inches. Owing to the dry atmosphere, the strong sunlight and the comparative freedom from dust, the climate is beneficial to those suffering from chest troubles. In winter the nights may be very cool, and even in daytime the weather may be very bracing when the wind is blowing from the south or off the snows on the Drakensberg and Malutis. The town is named after its founder, Sir Harry Smith. Wool and hides are the principal productions. (R U. S)

HARRISON, BENJAMIN (1833–1901), the 23rd president of the United States, was born at North Bend, near Cincinnati, O., on Aug. 20, 1833. His great-grandfather, Benjamin Harrison of Virginia (*c.* 1740–91), was a signer of the Declaration of Independence. His grandfather, William Henry Harrison (1773–1841), was 9th president of the United States. His father, John Scott Harrison (1804–78), represented his district in the National House of Representatives in 1853–57. Benjamin's youth was passed upon the ancestral farm, and as opportunity afforded he attended school in the log school-house near his home. He was prepared for college by a private tutor, studied for two years at the Farmers college, near Cincinnati, and in 1852 graduated from Miami university. From his youth he was diligent in his studies and a great reader, and during his college life showed a marked talent for extemporaneous speaking. He pursued the study of law, partly in the office of Bellamy Storer (1798–1875), a leading lawyer and judge of Cincinnati, and in 1853 he was admitted to the bar. At the age of 21 he removed to Indianapolis, Indiana. He had but one acquaintance in the place, the clerk of the Federal court, who permitted him to occupy a desk in his office and place at the door his sign as a lawyer. Within a few years he took rank among the leading members of the profession at a bar which included some of the ablest lawyers of the country.

His legal career was early interrupted by the Civil War. His whole heart was enlisted in the anti-slavery cause, and during the second year of the war he accepted a commission from the governor of the State as second-lieutenant and speedily raised a regiment. He became its colonel, and as such continued in the Union army until the close of the war, and on Jan. 23, 1865, was breveted a brigadier-general of volunteers for "ability and manifest energy and gallantry in command of brigade." He participated with his regiment in various engagements during Gen. Don Carlos Buell's campaigns in Kentucky and Tennessee in 1862 and 1863; took

part in Gen. W. T. Sherman's march on Atlanta in 1864 and in the Nashville campaign of the same year; and was transferred early in 1865 to Sherman's army in its march through the Carolinas. As the commander of a brigade he served with particular distinction in the battles of Kenesaw Mountain (June 29–July 3, 1864), Peach Tree Creek (July 20, 1864) and Nashville (Dec. 15–16, 1864).

Allowing for this interval of military service, he applied himself exclusively for 24 years to his legal work. He was a devoted member of the Republican Party, but not a politician in the strict sense. He took a deep interest in the campaign which resulted in the election of James A. Garfield as president, and was offered by him a place in his cabinet; but this he declined, having been elected a member of the U.S. Senate, in which he took his seat on March 4, 1881. He was chairman of the committee on territories, and took an active part in urging the admission as States of North Dakota, South Dakota, Washington, Idaho and Montana, which finally came into the Union during his presidency. He served also on the committee on military and Indian affairs, the committee on foreign relations and others, was prominent in the discussion of matters brought before the Senate from these committees, advocated the enlargement of the navy and the reform of the civil service, and opposed the pension veto messages of President Cleveland. Having failed to secure a re-election to the Senate in 1887, Harrison was nominated by the Republican Party for the presidency in 1888, and defeated Grover Cleveland, the candidate of the Democratic Party, receiving 233 electoral votes to Cleveland's 168 Among the measures and events distinguishing his term as president were the following: the meeting of the Pan American Congress at Washington; the passage of the McKinley tariff bill and of the Sherman silver bill of 1890; the suppressing of the Louisiana lottery; the enlargement of the navy; further advance in civil service reform; the convocation by the United States of an international monetary conference; the establishment of commercial reciprocity with many countries of America and Europe, the peaceful settlement of a controversy with Chile; the settlement of difficulties with Germany concerning the Samoan islands, and the adjustment by arbitration with Great Britain of the Bering sea fur-seal question. His administration was marked by a revival of American industries and a reduction of the public debt He was nominated by his party in 1892 for re-election, but was defeated by Cleveland, this result being due, at least in part, to the strikes which occurred during the presidential campaign and arrayed the labour unions against the tariff party.

After leaving public life he resumed the practice of the law, and in 1898 was retained by the Government of Venezuela as its leading counsel in the arbitration of its boundary dispute with Great Britain. In this capacity he appeared before the international tribunal of arbitration at Paris in 1899. He wrote *This Country of Ours* (1897), treating of the organization and administration of the Government of the United States, and a collection of essays by him was published posthumously, in 1901, under the title *Views of an Ex-President*. He died at Indianapolis on March 13, 1901. Harrison's distinguishing trait of character, to which his success is to be most largely attributed, was his thoroughness He was somewhat reserved in manner, and this led to the charge in political circles that he was cold and unsympathetic; but no one gathered around him more devoted and loyal friends, and his dignified bearing in and out of office commanded the hearty respect of his countrymen.

President Harrison was twice married; in 1853 to Miss Caroline Lavinia Scott, by whom he had a son and a daughter, and in 1896 to Mrs. Mary Scott Lord Dimmock, by whom he had a daughter.

A "campaign" biography was published by Lew Wallace (Philadelphia, 1888), and a sketch of his life may be found in *Presidents of the United States* (1894), edited by James Grant Wilson. *See* also U.S. Government Printing Office, *Public Papers and Addresses of Benjamin Harrison* (1893); and W. W. Thorton, "Benjamin Harrison a Lawyer and an Orator," in *Green Bag*, vol. xiv., pp. 49–57 (1902). (J. W. F.)

HARRISON, FREDERIC (1831–1923), English jurist and man of letters, was born in London on Oct. 18, 1831. Members of his family (originally Leicestershire yeomen) had been lessees of Sutton Place, Guildford, of which he wrote an interesting account (*Annals of an Old Manor House*, 1893). He was educated at King's College school and at Wadham college, Oxford, where, after taking a first-class in *Literae Humaniores* in 1853, he became fellow and tutor. He was called to the bar in 1858, and practised in equity cases. He worked at the codification of the law with Lord Westbury. His special interest in legislation for the working classes led to his appointment on the Trades Union Commission of 1867–69; he was secretary to the commission for the digest of the law, 1869–70; and was from 1877 to 1889 professor of jurisprudence and international law under the council of legal education Of his separate publications at this time the most important are his lives of Cromwell (1888), William the Silent (1897), Ruskin (1902) and Chatham (1905); his *Meaning of History* (1862; enlarged 1894) and *Byzantine History in the Early Middle Ages* (1900); and his essays on *Early Victorian Literature* (1896) and *The Choice of Books* (1886) are remarkable alike for generous admiration and good sense. In 1889 he was elected an alderman of the London County Council, but resigned in 1893. In 1870 he married Ethel Berta, daughter of Mr. William Harrison, by whom he had four sons.

Harrison was president of the English Positivist Committee from 1880 to 1905 In his last book *De Senectute* (1923), which he did not live to see published, he re-affirmed his life-long principle and attachment to the religion of Auguste Comte, and no estimate can do him justice which does not take into account the essentially religious character of his life, of which all his written works may be said to be a contributory expression. Though Frederic Harrison originally came into prominence in the days (1850–80) of fighting agnosticism, he was never himself an "agnostic," and in fact was severely criticised by the leading agnostics, notably by Huxley and Herbert Spencer, etc.; moreover, as Positivist, he was a republican in spirit and, what was new at that period, a sociologist. It was this positivist sociology which caused him as a young man to espouse the cause of trade unionism, which he did with such energy and legal skill as adviser to the Royal Commission on Trade Unions in 1867, that he was really the inspirer and founder of the trade union law as it existed from 1868 to 1906. None the less, his religion did not permit him to embark upon a public career He virtually retired from politics (in the party sense) and from legal practice in mid-life, this latter very largely as the enforced consequence of his pioneer fight on behalf of trade unionism, and took to letters.

At the age of 80 he published his *Autobiographic Memoirs* (2 vols., 1911). Among the books that flowed almost annually from his pen may be mentioned: *Memories and Thoughts* (1906); *National and Social Problems* (1908); *Tennyson, Ruskin, Mill and other Literary Estimates* (1899); *George Washington, etc.* (1901); *Theophano* (1904), a "romantic monograph" of the 10th century; *Nicephorus* (1906), a verse tragedy; *The Creed of a Layman* (1907); *Realities and Ideals* (1908); *Novissima Verba* (1920); *De Senectute* (1923). As an historian Frederic Harrison did not belong to the modern school of specialization, and ranks as a "literary-historian"; as essayist, he excelled, occupying a distinguished place both for the soundness of his judgment and for the vigour and clarity of his style. Politically, he stood in the position of an unofficial pro-consul, and for some years before the World War he repeatedly warned his countrymen of the impending crisis arising out of the armed system of Europe, and of the necessity of British preparation to meet it. An article he wrote in *The English Review* in 1913 proved to be only too prophetic. During the War he stood unfalteringly for victory and for the cause of France. His son, René, was killed in Flanders in 1915.

Frederic Harrison's life may be described as an attempt to introduce Comte's Humanist sociology into England, to which end he devoted all his energies. For 20 years he was the leader of English Positivism and regularly lectured at Newton Hall, being also a co-founder of and contributor to *The Positivist Review*. His political views were zealously put forward in that organ He was not a Radical in the party sense though always a Liberal

in spirit. Internationally he was a life-long supporter of France, and in 1870 vehemently urged British support of Gambetta as against Bismarckianism. If he was a "Little Englander," it was because of his championship of the "Little Peoples," and during the Boer War his pronounced anti-jingoism led him into acute controversy. Publicly, his attitude was often misunderstood for that reason. He may be said to have been a republican in spirit, a humanist by conviction and a "meliorist" as politician.

Frederic Harrison had not originally wished to found a Positivist centre or sect, but after the secession of Dr. Congreve on the crucial issue of allegiance to French Comtists, he virtually had no alternative, and it was thus that Newton Hall came into being. As head of that body, Frederic Harrison found copious use for his scholastic knowledge and energies as lecturer and teacher, and though in that position he was "labelled," the sincerity and disinterestedness of his opinions were so universally recognized that his public moral authority did not lose through isolation. In this way he occupied a kind of "chair" of public morals, such as is hardly conceivable in any other country, hence his unflinching war determinism in 1914 caused him to be more popularly known and appreciated in extreme old age than had been the case during the Victorian epoch when, as a humanist, he found himself neither on the one side nor the other of the great Victorian struggle for "liberty of thought," the foundation of which intellectually had been laid by Auguste Comte and Charles Darwin.

In this great battle of "reason," which started at Oxford, Harrison played a conspicuous part, though never as an iconoclast and in interest, spiritually; *i.e.*, outside the intellectual ethicism arising out of the new criticism, for he neither adhered to the utilitarianism of Mill nor to the "dry light" of the debaters in the famous Metaphysical Society of which he was a member. Positivism was at that time regarded as a "heresy" both by orthodoxy and by the agnostics, and in the controversies that ensued Harrison drifted somewhat out of the movements of his time. He was perhaps the last survivor of the "great" Victorians. He will be remembered as a supreme individualist, a slashing controversialist, as a practical idealist and citizen. Thus he consistently advocated the return of the "Elgin Marbles" to Greece on the ground that the statuary belonged to the historical religion of the Greeks. He was a friend of President Roosevelt and twice lectured in the United States. He was at his best as critic of life and art in relation of the past to the present, which was Comte's "law" of continuity, but Harrison was alive to the academic weaknesses in Comte's *Polity* and rejected any dogma. In his latter years he resided at Bath, of which city he was given the freedom. He died there on Jan. 14, 1923. He had refused all titles or "honours." His ashes, mingled with those of his wife, repose in an urn placed in the chapel of Wadham college, Oxford, according to his last wishes.

See Austin Harrison, *Frederic Harrison: Thoughts and Memories* (1925). (A. Har.)

His son Austin Harrison (1873–1928) was joint editor of the *Observer* (1905–08) and as editor of the *English Review* (1910–23), was instrumental in making known to the public a number of writers who have since become famous. His works include *The Kaiser's War* (1914) and *Pandora's Hope* (1925).

HARRISON, JANE ELLEN (1850–1928), English scholar, was born at Cottenham, Yorkshire, on Sept. 9, 1850, and was educated at Cheltenham college and Newnham college, Cambridge. She took a place in the moral sciences tripos equivalent to the second place. Her life-work was done in art and archaeology. She brought to the study of Greek art and of Greek religion great enthusiasm, a generous spirit and considerable learning. A humanist in the best sense she was all her life susceptible to new ideas and never allowed her mind to go stale. Thus in her old age she began the study of Persian. Jane Harrison returned to Newnham as fellow and lecturer in classical archaeology in 1900, and gave a great impetus to classical study there. Her most important work was *Prolegomena to the Study of Greek Religion* (1903). Others were: *Myths of the Odyssey in Art and Literature* (1882); *Introductory Studies in Greek Art* (1885); *Themis* (1912); *Ancient Art and Ritual* (1913); and *Epilegomena to the Study of Greek Religion* (1921). She died in London on April 16, 1928.

HARRISON, JOHN (1693–1776), English horologist, was the son of a carpenter, and was born at Faulby, near Pontefract. In 1715 he made a clock with wooden wheels, which is in the patent museum at South Kensington, and in 1726 he devised his ingenious "gridiron pendulum," which maintains its length unaltered in spite of variations of temperature. Another invention of his was a recoil clock escapement in which friction was reduced to a minimum, and he was the first to employ the commonly used and effective form of "going ratchet," which is a spring arrangement for keeping the timepiece going at its usual rate during the interval of being wound up.

In 1713 the British government offered rewards of £10,000, £15,000 and £20,000 to any who should construct chronometers that would determine the longitude within 60, 40 and 30 m. respectively. Harrison, after making several watches, went up to London in 1761 with one which he considered almost perfect. His son William was sent on a voyage to Jamaica to test it; and on his return to Portsmouth in 1762, it was found to have lost only 1 minute 54½ seconds. This was surprisingly accurate, as it determined the longitude within 18 m., and Harrison claimed the full reward of £20,000; but though from time to time he received sums on account, it was not till 1773 that he was paid in full. In these watches compensation for changes of temperature was applied for the first time by means of a "compensation-curb," designed to alter the effective length of the balance-spring in proportion to the expansion or contraction caused by variations of temperature. Harrison died in London on March 24, 1776.

See his *The Principles of Mr Harrison's Timekeeper*, published by order of the Commissioners of Longitude (1767).

HARRISON, THOMAS (1606–1660), English parliamentarian, a native of Newcastle-under-Lyme, Staffordshire, the son of a butcher and mayor of that town, enlisted in 1642 in Essex's lifeguards, became major in Fleetwood's regiment of horse under the earl of Manchester, was present at Marston Moor, at Naseby, Langport and at the taking of Winchester and Basing, as well as at the siege of Oxford. In 1646 he was returned to parliament for Wendover, and served in Ireland in 1647 under Lord Lisle, returning to England in May, when he took the side of the army in the dispute with the parliament and obtained from Fairfax a regiment of horse. In November he opposed the negotiations with the king, whom he styled "a man of blood" to be called to account, and he declaimed against the House of Lords. At the surprise of Lambert's quarters at Appleby on July 18, 1648, in the second civil war, he was severely wounded. He showed a special zeal in bringing about the trial of the king. Charles was entrusted to his care on being brought up from Hurst Castle to London. Harrison was assiduous in his attendance at the trial, and signed the death-warrant. He took part in suppressing the royalist rising in the midlands in May 1649, and in July was appointed to the chief command in South Wales, where he is said to have exercised his powers with exceptional severity. On Feb. 20, 1651, he became a member of the council of state, and during Cromwell's absence in Scotland held the supreme military command in England. He failed to stop the march of the royalists into England at Knutsford on Aug. 16, 1651, but after the battle of Worcester he pursued the fugitives. Later he pressed on Cromwell the necessity of dismissing the Long Parliament, and it was he who at Cromwell's bidding, on April 20, 1653, laid hands on Speaker Lenthall and compelled him to vacate the chair. He was president of the council of thirteen which now exercised authority. Harrison belonged to the faction of Fifth Monarchy men, whose political ideals were entirely destroyed by Cromwell's assumption of the protectorate. He was deprived of his commission on Dec. 22, 1653, and on Feb. 3, 1654, was ordered to confine himself to his father's house in Staffordshire. He was imprisoned for a short time in September, and on Feb. 15, 1655, he was imprisoned in Carisbrooke Castle, being liberated in March 1656. At the Restoration, Harrison, who was excepted from the Act of Indemnity, refused to take any steps to save his life, to give any undertaking not to conspire against the government or to flee. He was arrested in Stafford-

shire in May 1660, and executed at Charing Cross on Oct. 13, 1660.

Richard Baxter, who was acquainted with him, describes Harrison as "a man of excellent natural parts for affection and oratory, but not well seen in the principles of his religion; of a sanguine complexion, naturally of such a vivacity, hilarity and alacrity as another man hath when he hath drunken a cup too much, but naturally also so far from humble thoughts of himself that it was his ruin." Cromwell also complained of his excessive eagerness. "Harrison is an honest man and aims at good things, yet from the impatience of his spirit will not wait the Lord's leisure but hurries me on to that which he and all honest men will have cause to repent."

See C. H. Simpkinson, *Life of Harrison* (1905).

HARRISON, THOMAS ALEXANDER (1853–), American painter, was born in Philadelphia, Jan. 17, 1853. He was a pupil of the Pennsylvania Academy of Fine Arts and of the Ecole des Beaux-Arts, Paris, whither he went in 1878, having previously been with a U S Government survey expedition on the Pacific coast. Chafing under the restraints of the schools, he went into Brittany, and at Pont Aven and Concarneau turned his attention to marine painting and landscape. In 1882 he sent a figure-piece to the Salon, a fisher boy on the beach, which he called, "Châteaux en Espagne." This piece attracted attention, and in 1885 he received an honourable mention, the first of many awards conferred upon him, including the Temple gold medal (Pennsylvania Academy of Fine Arts, Philadelphia, 1887), first medal, Paris Exhibition (1889), and medals in Munich, Brussels, Ghent, Vienna and elsewhere.

HARRISON, WILLIAM (1534–1593), English topographer and antiquary, was born in London on April 8, 1534. He was inducted early in 1559 to the rectory of Radwinter, Essex, on the presentation of Sir William Brooke, Lord Cobham, to whom he had formerly acted as chaplain; and from 1571 to 1581 he held from another patron, Francis de la Wood, the living of Wimbish in the same county. He became canon of Windsor in 1586, and his death and burial are noted in the chapter book of St. George's chapel on April 24, 1593

His famous and amusing *Description of England* was undertaken for the queen's printer, Reginald Wolfe, who designed the publication of "an universall cosmographie of the whole world . . . with particular histories of every knowne nation" After Wolfe's death in 1576 this comprehensive plan was reduced to descriptions and histories of England, Scotland and Ireland. The historical section was to be supplied by Raphael Holinshed, the topographical by Harrison. The work was eventually published as *The Chronicles of England, Scotland and Ireland* . . . by Raphael Holinshed and others, and was printed in two black-letter folio volumes in 1577. Harrison's *Description of England*, humbly described as his "foule frizeled treatise," and dedicated to his patron Cobham, is an invaluable survey of the condition of England under Elizabeth, in all its political, religious and social aspects He is properly contemptuous of the snobbery that was even then characteristic of English society; but his account of "how gentlemen are made in England" must be read in full to be appreciated. He is especially instructive on the condition and services of the church immediately after the Reformation; notably in the fact that, though an ardent Protestant, he is quite unconscious of any breach of continuity in the life and organization of the Church of England. Harrison also contributed the translation from Scots into English of Bellenden's version of Hector Boëce's Latin *Description* of Scotland.

For the later editions of the *Chronicles of England* . . . *see* HOLINSHED. The second and third books of Harrison's *Description* were edited by Dr. F. J. Furnivall for the New Shakspere Society, with extracts from his "Chronologie" and from other contemporary writers, as *Shakspere's England* (2 vols., 1877–78).

HARRISON, WILLIAM HENRY (1773–1841), ninth president of the United States, was born at Berkeley, Charles City county, Va., on Feb. 9, 1773, the third son of Benjamin Harrison (*c.* 1740–1791). His father was long prominent in Virginia politics and became a member of the Virginia house of burgesses in 1764; he was a member of the Continental Congress in 1774–77, signing the Declaration of Independence and serving for a time as president of the board of war; speaker of the Virginia house of delegates in 1777–82; and governor of Virginia in 1781–84. William Henry Harrison received a classical education at Hampden-Sidney college, where he was a student in 1787–1790, and began a medical course in Philadelphia, but the death of his father caused him to discontinue his studies, and in Nov. 1791, he entered the army as ensign in the 10th Regiment at Fort Washington, Cincinnati. In the following year he became a lieutenant, and subsequently acted as aide-de-camp to Gen. Anthony Wayne in the campaign which ended in the battle of Fallen Timbers on Aug. 10, 1794 He was promoted to a captaincy in 1797 and for a brief period served as commander of Fort Washington, but resigned from the army in June 1798. Soon afterwards he was made secretary of the North-west Territory. In 1799 he was chosen by the Jeffersonian party of this territory as the delegate of the territory in Congress. While serving in this capacity he devised a plan for disposing of the public lands upon favourable terms to actual settlers, and also assisted in the division of the North-west Territory.

In Jan. 1800, President John Adams appointed him governor of the newly created Indiana Territory, which comprised until 1809 a much larger area than the present State of the same name. He was sworn into office on Jan 10, 1801, and was governor until Sept. 1812. Among the legislative measures of his administration may be mentioned the attempted modification of the slavery clause of the ordinance of 1787 by means of an indenture law; more effective land laws; and legislation for the more equitable treatment of the Indians and for preventing the sale of liquor to them In 1803 Harrison also became a special commissioner to treat with the Indians "on the subject of boundary or lands," and as such negotiated various treaties—at Fort Wayne (1803 and 1809), Vincennes (1804 and 1809) and Grouseland (1805)—by which the southern part of the present State of Indiana and portions of the present States of Illinois, Wisconsin and Missouri were opened to settlement For a few months after the division in 1804 of the Louisiana Purchase into the Orleans Territory and the Louisiana Territory he also acted as governor of the Louisiana Territory.

The Indian cessions of 1809, along the Wabash river, aroused the hostility of Tecumseh (*q.v.*) and his brother, familiarly known as "The Prophet," who were attempting to combine the tribes between the Ohio and the Great Lakes in opposition to the encroachment of the whites. Several fruitless conferences between the governor and the Indian chiefs, who were believed to be encouraged by the British, resulted in Harrison's advance with a force of militia and regulars to the Tippecanoe river, where (near the present Lafayette, Ind.) on Nov 7, 1811, he won over the Indians, a victory which established his military reputation and was largely responsible for his subsequent election to the presidency of the United States. From one point of view the battle of Tippecanoe may be regarded as the opening skirmish of the war of 1812. When in the summer of 1812 open hostilities with Great Britain began, Harrison was appointed major-general in the Kentucky militia A few weeks later (Aug 22, 1812) he was made brigadier-general in the regular U S army, and soon afterwards was put in command of all the troops in the north-west, and on March 2, 1813 he was promoted to the rank of major-general. General James Winchester, whom Harrison had ordered to prepare to cross Lake Erie on the ice and surprise Fort Malden, turned back to rescue the threatened American settlement at Frenchtown (now Monroe), on the Raisin river, and there on Jan 22, 1813 was forced to surrender to Col. Henry A Proctor Harrison accomplished nothing that summer except to hold in check Proctor, who (May 1–5) besieged him at Fort Meigs, the American advanced post after the disaster of the river Raisin After Lieut. O. H. Perry's naval victory, Sept 10, 1813, Harrison no longer had to remain on the defensive; he advanced to Detroit, re-occupied the territory surrendered by Gen William Hull, and on Oct. 5 administered a crushing defeat to Proctor at the battle of the Thames.

In 1814 Harrison resigned his commission President Madison then utilized Harrison in negotiating with the north-western

Indians a second treaty of Greenville (July 22, 1814), by which they were to become active allies of the United States, should hostilities with Great Britain continue. This treaty publicly marked an American policy of alliance with these Indians. From 1816 to 1819 Harrison was a representative in Congress, and as such worked in behalf of more liberal pension laws and a better militia organization, including a system of general military education, of improvements in the navigation of the Ohio, and of relief for purchasers of public lands, and for the strict construction of the power of Congress over the Territories, particularly in regard to slavery. Harrison was a member of the Ohio senate in 1819–21, and was an unsuccessful candidate for the national House of Representatives in 1822, when his Missouri vote helped to cause his defeat, he was a presidential elector in 1824, supporting Henry Clay, and from 1825 to 1828 was a member of the U S. Senate. In 1828 Harrison was appointed as the first minister of the United States to Colombia. He became, however, an early sacrifice to Jackson's spoils system, being recalled within less than a year. For some years after his return from Colombia he lived in retirement at North Bend, Ohio

Early in 1835 Harrison began to be mentioned as a suitable presidential candidate, and later in the year he was nominated for the presidency at large public meetings in Pennsylvania, New York and Maryland In the election of the following year he attracted a large part of the Whig and anti-Masonic vote of the middle and western states and led among the candidates opposing Van Buren, but received only 73 electoral votes while Van Buren received 170. His unexpected strength, due largely to his clear, if non-committal, political record, rendered him the most "available" candidate for the Whig party for the campaign of 1840, and he was nominated by the Whig convention at Harrisburg, Pa., in Dec., 1839, his most formidable opponent being Henry Clay. The convention adjourned without adopting any "platform" of principles, the party shrewdly deciding to make its campaign merely on the issue of whether the Van Buren administration should be continued in power and thus to take full advantage of the popular discontent with the administration, to which was attributed the responsibility for the panic of 1837 and the subsequent business depression. Largely to attract the votes of democratic malcontents the Whig convention nominated for the vice-presidency John Tyler, who had previously been identified with the Democratic party. The campaign was marked by the extraordinary enthusiasm exhibited by the Whigs Because of his fame as a frontier hero, of the circumstance that a part of his home at North Bend, Ohio, had formerly been a log cabin and of the story that cider, not wine, was served on his table, Harrison was derisively called by his opponents the "log cabin and hard cider" candidate; the term was eagerly accepted by the Whigs in whose processions miniature log cabins were carried and at whose meetings hard cider was served, and the campaign itself has become known in history as the "log cabin and hard cider campaign." Harrison's canvass was conspicuous for the immense Whig processions and mass meetings, the numerous "stump" speeches (Harrison himself addressing many meetings), and the use of campaign songs of party insignia, and of campaign cries (such as "Tippecanoe and Tyler too"); and in the election he won by an overwhelming majority of 234 electoral votes to 60 cast for Van Buren.

President Harrison was inaugurated on March 4, 1841. He chose for his cabinet Daniel Webster as secretary of state, Thomas Ewing as secretary of the treasury, John Bell as secretary of war, George E Badger as secretary of the navy, Francis Granger as postmaster-general, and John J. Crittenden as attorney-general. He survived his inauguration only one month, dying on April 4, 1841, and being succeeded by the vice-president, John Tyler The immediate cause of his death was an attack of pneumonia, but the malady was aggravated by the excitement attending his sudden change in circumstances and the incessant demands of office seekers. After temporary interment at Washington, his body was removed to the tomb at North Bend, Ohio, where it now lies. A few of Harrison's public addresses survive, the most notable being *A Discourse on the Aborigines of the Ohio*. It has been said of him: "He was not a great man, but he had lived in a great time, and he had been a leader in great things." He was the first territorial delegate in the Congress of the United States and was the author of the first step in the development of the country's later homestead policy; the first presidential candidate to be selected upon the ground of "expediency" alone; and the first president to die in office. In 1795 he married Anna Symmes (1775–1864), daughter of John Cleves Symmes. Their grandson, Benjamin Harrison, was the 23rd president of the United States.

BIBLIOGRAPHY.—In 1824 Moses Dawson published at Cincinnati the *Historical Narrative of the Civil and Military Services of Major-General William H. Harrison*. This is the source of all the subsequent "lives" that have appeared. There are several "campaign" biographies, including one by Richard Hildreth (1839) and one by Caleb Cushing (1840); and there is a good sketch in *Presidents of the United States* (1894), ed. J G. Wilson. An excellent study of Harrison's career in Indiana appears in vol. 4 of the *Indiana Historical Society Publications*. See for a recent study Dorothy Burne Goebel, "William Henry Harrison," in *Indiana Historical Collections*, vol. xiv.; Biographical Series, vol. ii. (1926); also Beverly W. Bond; "William Henry Harrison in the War of 1812," in *Mississippi Valley Historical Review*, vol. xiii, p. 499–516 (1926–27).

HARRISON, a town of Hudson county, N J., U S A., on the Passaic river, opposite Newark. It is served by the Erie, the Lackawanna and the Pennsylvania railways The population was 15,721 in 1920 (33·7% foreign-born white) and was estimated locally at nearly 17,000 in 1928. Harrison is an integral part of the Newark industrial district. It has several miles of river-front, lined with factories, and the aggregate output of its manufacturing industries was valued at $45,738,000 in 1928. The principal products are steel, roller bearings, elevators, wires, leather, pumps, metal toys, electric lamps, gas and cutlery. The town was settled before the end of the 17th century. In 1840 it was set off from Lodi and named after President William Henry Harrison; in 1873 it was incorporated Harrison originally included what is now the town of Kearney

HARRISONBURG, a city of north-western Virginia, U.S.A., in the beautiful Shenandoah valley, at an altitude of 1,300ft.; the county seat of Rockingham county. It is on the Lee highway, and is served by the Baltimore and Ohio, the Chesapeake Western and the Southern railways, and by motor-coach lines in every direction. The population was 5,875 in 1920 (86% native white) and was estimated locally at over 7,000 in 1928 It is the seat of a State teachers' college for women and in the centre of a rich farming region. Its manufactures are chiefly such as use agricultural products or contribute to their production, and include the largest poultry-fattening houses in the East and several hatcheries and incubators Harrisonburg was established by an act of the legislature in 1780, and at first was called Rocktown, from the large out-crop of limestone It was incorporated as a town in 1849 and became a city in 1916.

HARRIS TWEED, the description applied to all-wool tweed fabrics of coarse and open texture, but having a soft feel. They are produced in Lewis and other islands of the Outer Hebrides, off the north-west coast of Scotland. The true Harris tweeds are made by the cottars and crofters who employ the best grades of native blackface or Cheviot wool in the natural colours, and also dyed with the natural vegetable dyes. The fleece wool is scoured, combed and spun into worsted threads by the primitive distaff method of hand-spinning, and then woven on primitive hand-looms, in the crofters' homes Hence, the term "homespun tweed," said to be a corruption of the Scottish word "tweel," and English "twill."

Harris homespun tweeds are distinguished for their great durability and a peculiar peaty odour, which is actually simulated in the many imitations of Harris tweeds produced by modern spinning and weaving machinery. The superiority of the home-made over the machine-made tweeds is said to be due to the use of long stapled wool in the homespun yarn, in addition to this being spun with a little more twist; whereas the machine-made Harris tweeds are sometimes produced from a mixture of wool and shoddy, which is spun with less twist in order to make a cheaper fabric. Very cheap and inferior imitations of Harris and Scotch tweeds are also produced from yarn spun from a mixture of both cotton and shoddy. (*See* TWEEDS.) (H N.)

HARRODSBURG, a city of Kentucky, U.S.A., 74m. S.E of Louisville, on the Southern railway; the county seat of Mercer county. The population was 3,765 in 1920 (26% negroes). There are sulphur springs here, and the city has been a health and summer resort since early in the 19th century. It is the trade centre for a rich region, producing especially fine trotting horses, white burley tobacco and poultry. Electric power is supplied from the Dix Dam hydro-electric plant. Harrodsburg is the oldest permanent settlement in the State, founded on June 16, 1774, by James Harrod. Daniel Boone helped in laying out the site, and from Ft. Harrod George Rogers Clark planned the conquest of the north-west. The city was chartered in 1875

HARROGATE, a municipal borough of the West Riding of Yorkshire, England, 18 m. N of Leeds, 19 m. W. of York, 203 m. N. by W. from London, on the L N E railway Pop (1891), 16,316, (1901) 28,423, (1911) 33,703, (1921) 38,885 It stands about 400 ft above sea-level, on the Pennine foothills, with Blubberhouses moor lying to the west, and the Vale of York to the east. It is thus an excellent tourist centre for the high moorland district and the dales of Yorkshire and is not far from the beauty spots of Fountains abbey, Bolton abbey, etc. Harrogate is the principal inland watering place in the north of England, containing upwards of 80 mineral springs for bathing and drinking purposes It owes its rise and importance to the presence of these springs

The town consists of two scattered townships—Low Harrogate, sheltered and warm in winter, and High Harrogate, with a more bracing climate These have gradually been connected by the growth of villas extending from both the high and the low town A common, called the Stray, secured by act of parliament from ever being built upon, stretches for 200 ac in front of the main lines of houses, and so, notwithstanding its rapid growth, Harrogate has retained much of its rural charm

The principal chalybeate springs are the Tewitt well, discovered towards the close of the 16th century by Captain William Slingsby, of Bilton Hall, and called "The English Spa" by Dr. Bright, who wrote the first account of it, the Royal Chalybeate Spa, more commonly known as John's Well, discovered by Dr. Stanhope, of York, in 1631; Muspratt's chalybeate or chloride of iron spring, discovered in 1819, but first properly analysed by Dr. Sheridan Muspratt in 1865; and the Starbeck springs, midway between High Harrogate and Knaresborough The chief sulphur springs are the old sulphur well in the centre of Low Harrogate, discovered about the year 1656; the Montpellier springs, the principal well of which was discovered in 1822, situated in the grounds of the Crown hotel, and the Harlow Car springs, in a wooded glen about 1 m W from Low Harrogate A saline spring was discovered in Low Harrogate in 1783. The principal bath establishments are the Victoria Baths (1871) and the Royal Baths (1897), both of which are owned by the corporation Harrogate also contains a handsome Kursaal, opened in 1903, a grand opera house, numerous modern churches, and several hospitals, including the Royal Bath hospital. Harlow Hill observatory, a square tower 100 ft. in height, stands on elevated ground about 1 m W of Low Harrogate, and commands a very extensive view. The town was incorporated in 1884, the corporation consisting of a mayor, eight aldermen and 24 councillors.

HARROW: *see* CULTIVATING MACHINERY.

HARROWBY, DUDLEY RYDER, 1ST EARL OF (1762–1847), the eldest son of Nathaniel Ryder, 1st Baron Harrowby (1735–1803), was born in London on Dec 22, 1762, and educated at St John's college, Cambridge. He entered parliament in 1784, and held various offices in administrations from 1789 onwards In 1804 he was secretary of State for foreign affairs and in 1805 chancellor of the duchy of Lancaster under his intimate friend William Pitt; in 1805 he was sent on a mission to the emperors of Austria and Russia and the king of Prussia, and for the long period between 1812 and 1827 he was lord president of the council. After Canning's death in 1827 he refused the premiership, and never held office again He died at Sandon Hall, Staffs, on Dec. 26, 1847, being, as Charles Greville says, "the last of his generation and of the colleagues of Mr. Pitt, the sole survivor of those stirring times and mighty contests"

HARROW FOOTBALL: *see* FOOTBALL, *the Harrow Game.*

HARROWING OF HELL, an English poem in dialogue, dating from the end of the 13th century. It is written in the East Midland dialect, and is generally cited as the earliest dramatic work in the language, though it was probably intended for recitation rather than performance. The opening words—"Alle herkneth to me nou A strif wille I tellen ou Of Jesu and of Satan"—seem to indicate that the piece was delivered by a single performer The subject—the descent of Christ into Hades to succour the souls of the just, as related in the apocryphal gospel of Nicodemus,—is introduced in a kind of prologue; then follows the dispute between "Dominus" and "Satan" at the gate of Hell; the gatekeeper runs away, and the just are set free, while Adam, Eve, Habraham, David, Johannes and Moyses do homage to the deliverer The poem ends with a short prayer: "God, for his moder loue Let ous never thider come" Metrically, the poem is characterized by frequent alliteration imposed upon the rhymed octosyllabic couplet.—

> Welcome, louerd, god of londe
> Godes sone and godes sonde (ll 149-150)

The piece is obviously connected with the Easter cycle of liturgical drama, and the subject is treated in the York and Townley plays

Mss are: Brit. Mus., Harl. ms. 2,253; Edinburgh, Auchinleck ms., W 41; Oxford, Bodleian, Digby 86 It was privately printed by J. P. Collier and by J. O Halliwell, but is available in Appendix iii of A W. Pollard's *English Miracle Plays . . .* (4th ed., 1904); K Boddeker, *Altengl Dichtungen des MS Harl 2,253* (1878); and E Mall, *The Harrowing of Hell* (Breslau, 1871). *See* also Sir E K Chambers, *The Mediaeval Stage* (1903).

HARROW-ON-THE-HILL, urban district, Middlesex, England, 12 m. W N W. of St. Paul's cathedral, London, served by the L M S., Metropolitan and District railways Pop (1921) 19,469. It takes its name from its position on an isolated hill rising to a height of 345 ft On the summit is the church of St Mary, said to have been founded by Lanfranc, archbishop of Canterbury, and Norman work appears at the base of the tower

Harrow school was founded in 1571 by John Lyon, whose brass is in the church, a yeoman of the neighbouring village of Preston who had yearly during his life set aside 20 marks for the education of poor children of Harrow, though a school existed before his time. Though the charter was granted by Queen Elizabeth in 1571, and the statutes drawn up by the founder in 1590 two years before his death, it was not till 1611 that the first building was opened for scholars. Lyon settled about two-thirds of his property on the school About 1660 the headmaster, taking advantage of a concession in Lyon's statutes, began to receive "foreigners," *i.e.*, boys from other parishes, who were to pay for their education From this time the prosperity of the school may be dated In 1809 the parishioners of Harrow appealed to the court of chancery against the manner in which the school was conducted, but the decision, while it recognized their privileges, confirmed the right of admission to foreigners Control was originally vested in six persons of standing in the parish who had the power of filling vacancies in their number by election among themselves; but under the Public Schools act of 1868 the governing body consists of six members who are elected respectively by the lord chancellor, the universities of Oxford, Cambridge and London, the Royal Society and the assistant masters of the school. Harrow was originally an exclusively classical school, but is such no longer The principal buildings are modern The fourth form room, however, dates from 1611, and on its panels are cut the names of many eminent *alumni*, such as Byron, Robert Peel, R. B. Sheridan and Temple (Lord Palmerston).

A considerable extension of Harrow as an outer residential suburb of London has taken place north of the hill, where is the urban district of Wealdstone (pop. [1925] 13,433), and there are also important printing and photographic works

HARRY THE MINSTREL or **BLIND HARRY** (*fl* 1470–1492), author of the Scots historical poem *The Actis and Deidis of the Illustre and Vailzeand Campioun Schir William*

Wallace, Knicht of Ellerslie, flourished in the latter half of the 15th century. He appears to have been a blind Lothian man, in humble circumstances, who had some reputation as a story-teller; he received, on five occasions, in 1490 and 1491, gifts from James IV. He is alluded to by Dunbar (*q.v.*) in the fragmentary *Interlude of the Droichis Part o' the Play*, where a "droich," or dwarf, personates

"the nakit blynd Harry
That lang has bene in the fary
Farleis to find";

and again in Dunbar's *Lament for the Makaris*. John Major (*q.v.*) in his Latin *History* says that Henry used to recite his tales before nobles, and thus received food and clothing as his reward (Bk. iv., ch. xv.).

The poem (preserved in a unique ms., dated 1488, in the Advocates' library, Edinburgh) is divided into 11 books and runs to 11,853 lines. It is one of the earliest, certainly one of the most extensive, verse-documents in Scots written in five-accent, or heroic, couplets. It is also the earliest outstanding work which discloses that habit of Scotticism which took such strong hold of the popular Northern literature during the coming years of conflict with England. But there are elements in the poem which show that it is not entirely the work of a poor crowder; and these (notably references to historical and literary authorities, and occasional reminiscences of the literary tricks of the Scots Chaucerian school) have inclined some to the view that the text, as we have it, is an edited version of the minstrel's rough song-story. It has been argued, though by no means conclusively, that the "editor" was John Ramsay, the scribe of the Edinburgh ms. and of the companion Edinburgh ms. of the *Brus* by John Barbour (*q.v.*).

The poem appears, on the authority of Laing, to have been printed at the press of Chepman and Myllar about 1508, but the fragments which Laing saw are not extant. The first complete edition, now available, was printed by Lekprevik for Henry Charteris in 1570 (Brit. Museum). There are many reprints, including some of William Hamilton of Gilbertfield's modern Scots version of 1722. The first critical edition was prepared by Dr. Jamieson and published in 1820. In 1889 the Scottish Text Society completed their edition of the text, with prolegomena and notes by James Moir.

HARSDÖRFFER, GEORG PHILIPP (1607–1658), German poet, was born at Nuremberg on Nov 1, 1607. Jointly with Johann Klaj he founded in 1644 at Nuremberg the literary society of the Pegnitzschäfer, for the purification of the German language. He died at Nuremberg on Sept. 22, 1658. His writings in German and Latin fill 50 volumes, and a selection of his poems, interesting mostly for their form, is to be found in Müller's *Bibliothek deutscher Dichter des 17ten Jahrhunderts*, vol. ix. (Leipzig, 1826).

His life was written by Widmann (Altdorf, 1707). *See* also Tittmann, *Die Nurnberger Dichterschule* (Gottingen, 1847), and Krapp, *Die asthetischen Tendenzen Harsdorffers* (1904).

HARSHA or **HARSHAVARDHANA** (*fl* A.D. 606–648), an Indian king who ruled northern India as paramount monarch for over forty years. The events of his reign are related by Hsüan Tsang, the Chinese pilgrim, and by Bana, a Brahman author. He was the son of a raja of Thanesar, who waged successful wars against the Huns and came to the throne in A.D. 606, though he was only crowned in 612. He devoted himself to a scheme of conquering the whole of India, and carried on wars for thirty years with success, until (A.D. 620) he came in contact with Pulakesin II., the greatest of the Chalukya dynasty, who made himself lord of the south, as Harsha was lord of the north. The Nerbudda river formed the boundary between the two empires. In the latter years of his reign Harsha's sway over the whole basin of the Ganges from the Himalayas to the Nerbudda was undisputed. After thirty-seven years of war he set himself to emulate Asoka and became a patron of art and literature. He was the last native monarch who held paramount power in the north prior to the Mohammedan conquest; and was succeeded by an era of petty states.

See Bana, *Sri-harsha-charita*, trans. Cowell and Thomas (1897); Ettinghausen, *Harsha Vardhana* (Louvain, 1906).

HART, ALBERT BUSHNELL (1854–), American historian, was born at Clarksville (Penn.), on July 1, 1854. He graduated from Harvard College in 1880, and studied at Paris, Berlin and Freiburg. He was instructor in history at Harvard in 1883–87, assistant professor in 1887–97, and professor in 1897–1910, and thereafter was professor of government. Among his writings are. *Practical Essays on American Government* (1893); *Studies in American Education* (1895); *Guide to the Study of American History* (with Edward Channing, 1897, and with Edward Channing and F. J. Turner, 1912); *Salmon Portland Chase* (1899); *Foundations of American Foreign Policy* (1901); *Actual Government* (1903); *Slavery and Abolition* (1906) and *National Ideals Historically Traced* (1907), both in the "American Nation" series, which he edited (1904 to 1918); *Monroe Doctrine* (1916); *We and Our History* (1923); and many historical pamphlets and articles.

In addition he edited *American History told by Contemporaries* (1898–1901), *Source Readers in American History* (1901–03), and other series; and was editor of the *American Year Book*. He served as president of the American Historical Association in 1909 and of the American Political Science Association in 1912.

HART, CHARLES (d. 1683), English actor, grandson of Shakespeare's sister Joan, is first heard of as playing women's parts at Blackfriar's theatre as an apprentice of Richard Robinson. In the Civil War he was a lieutenant of horse in Prince Rupert's regiment, and after the king's defeat he played surreptitiously at the Cockpit and at Holland House and other noblemen's residences. After the Restoration he is known to have been in 1660 the original Dorante in *The Mistaken Beauty*, adapted from Corneille's *Le Menteur*. In 1663 he went to the Theatre Royal in Killigrew's company, with which he remained until 1682, taking leading parts in Dryden's, Jonson's and Beaumont and Fletcher's plays. He is highly spoken of by contemporaries in such Shakespearian parts as Othello and Brutus. He is often mentioned by Pepys. Betterton praised him, and would not himself play the part of Hotspur until after Hart's retirement. Hart is said to have been the first lover of Nell Gwyn, and to have trained her for the stage.

HART, ERNEST ABRAHAM (1835–1898), English medical journalist, was born in London on June 20, 1835, the son of a Jewish dentist. Beginning on the *Lancet* in 1857, he was made editor of the *British Medical Journal* in 1866. He took a leading part in the exposures which led to the reform of the treatment of sick poor throughout England, and the Infant Life Protection act of 1872, aimed at the evils of baby-farming, was largely due to his efforts. The record of his public work covers nearly the whole field of sanitary legislation during the last 30 years of his life, the amendments of the Public Health and of the Medical acts, the measures relating to notification of infectious disease and to vaccination, and the improvement of factory legislation, etc. From 1872 to 1897 he was chairman of the parliamentary bill committee of the British Medical Association. He died on Jan. 7, 1898.

HART, SIR ROBERT, 1st Bart., cr. 1893 (1835–1911), Irish-Chinese statesman, was born at Milltown, Co. Armagh, on Feb. 20, 1835. He was educated at Taunton, Dublin and Belfast, and graduated at Queen's College, Belfast, in 1853. In the following year he received an appointment as student-interpreter in the China consular service, and after serving for a short time at the Ningpo vice-consulate, he was transferred to Canton, where after acting as secretary to the allied commissioners governing the city, he was appointed the local inspector of customs. There he first gained an insight into custom-house work. One effect of the Taiping rebellion was to close the native custom-house at Shanghai; and it was arranged by Sir Rutherford Alcock, the British consul, with his French and American colleagues, that they should undertake to collect the duties on goods owned by foreigners entering and leaving the port. Sir T. Wade was appointed to the post of collector in the first instance, and after a short tenure of office was succeeded by Mr. H. N. Lay, who held the post until 1863. The

system adopted at Shanghai was applied to the other treaty ports, so that when on Lay's resignation Hart was appointed inspector-general of foreign customs, the organization collected a revenue of upwards of eight million taels per annum at fourteen treaty ports During Hart's tenure of the office the revenue of the department grew from upwards of eight million taels to nearly twenty-seven million, collected at the thirty-two treaty ports, and the customs staff, which in 1864 numbered 200, reached in 1901 a total of 5,704. From the first Hart gained the entire confidence of the Chinese government; of all their numerous sources of revenue, the money furnished by Hart was the only certain asset which could be offered as security for Chinese loans. The British minister, as well as the ministers of other powers, constantly consulted him, and in 1885 Granville nominated him British minister plenipotentiary at Peking. Hart, however, declined the honour. His confidence in the Chinese made him turn a deaf ear to the warnings which he received of the threatening Boxer movement in 1900. To the last he believed that the attacking force would at least have spared his house, which contained official records of priceless value, but he was mistaken. The building was burnt to the ground with all that it contained, including his private diary for forty years. When the stress came, and he retreated to the British legation, he took an active part in the defence Hart had established a postal service in the provinces, and after the signing of the protocol of 1901 he organized a native customs service at the treaty ports.

The appointment of Sir Robert Hart as inspector-general of the imperial maritime customs secured the interests of European investors in Chinese securities, and helped to place Chinese finance generally on a solid footing. When, therefore, in May 1906 the Chinese government appointed a Chinese administrator and assistant administrator of the entire customs of China, who would control Sir Robert Hart and his staff, great anxiety was aroused. The Chinese government had bound itself in 1896 and 1898 that the imperial maritime customs services should remain as then constituted during the currency of the loan. Hart, finding himself placed in a subordinate position after his long service, retired in July 1907. He obtained formal leave of absence in January 1908, when he received the title of president of the board of customs. Sir Robert, who married in 1886 Hester, daughter of Alexander Bredon, of Portadown, died at Great Marlow, Bucks, on Sept 20, 1911.

See Julia Bredon, *Sir Robert Hart* (1909).

HARTE, FRANCIS BRET (1839–1902), American author, was born in Albany, N Y., on Aug 25, 1836, of English and Dutch parentage His grandfather on his father's side was a Jew. His father, a school teacher, and his mother gave him a rich intellectual and literary background, and their library gave him every opportunity to read widely and well. Ill health from six to ten kept the young lad from engaging in games with other children and he spent those years reading Shakespeare, Froissart, Dickens, Fielding, Washington Irving and others At the age of 11 he wrote a poem, "Autumnal Musings," which was published in the *New York Sunday Atlas*. His family discouraged further poems, and while he continued to write them he made no attempt to have them published at the time. Later he was amply repaid for his patience.

Owing to family financial straits, Bret Harte left school when only 13, spent about a year in a lawyer's office and then went to the counting room of a merchant. He was supporting himself by the time he was 16. Three years later he joined his mother who had gone to California. For a time he taught in a school, clerked for an apothecary, tutored and was an express messenger on a California stage, but was also writing stories and poems for magazines. Later he became a printer for the *Humboldt Times* (Calif.), and then assistant editor of the *Northern California*, the latter work being cut short by a scathing editorial, written in his chief's absence on the massacre of Indians by Americans, which aroused the antagonism of the community. But his varied experiences and continued journeyings furnished inspiration and material for his frontier tales.

In 1857 Bret Harte became a typesetter for the *Golden Era* in San Francisco. Here he so interested the editor that he was given an opportunity to contribute some short sketches and later worked in the editorial room. In 1864 he procured a position as secretary of the California Mint which gave him more time for his writing. He wrote a series of *Condensed Novels*, parodies of well known fiction, for *The Californian*, to which Mark Twain was also contributing. A year later his book of poems, *The Lost Galleon*, appeared. In 1868 he was made editor of the *Overland Monthly*. *The Luck of Roaring Camp*, which he wrote for this magazine, attracted the attention of editors in the East and brought requests for his vivid western tales. He was also made a professor of recent literature at the University of California, which work he continued for two years with his editorship of *The Overland* and his work at the Mint. Then his verses, "The Heathen Chinee," brought such urgent demands from the East to return that he went to New York in 1871.

Bret Harte was lionized by the whole country and "hailed as a new prophet in American letters." His trip East, so like a triumphal march, caught the attention of foreign papers and his stories were reprinted and translated abroad For a time he was in great demand as a lecturer on his Californian experiences and he continued writing his stories of pioneer life. Unfortunately, however, his income did not provide for the extravagant living he insisted on and he became involved in financial difficulties. His friends were instrumental in having him appointed as U.S. commercial agent at Crefeld in Germany. Reluctantly and yet with mingled relief and hope of re-establishing himself he left America, never to return.

He was most cordially welcomed in literary circles in London where he spent much of his time, writing and lecturing. He was never happy about his work in Crefeld, and in 1880 was appointed consul to Glasgow. During the five years in this office he wrote a large number of stories for American magazines and attempted several plays which, however, proved unsuccessful From 1885 until his death on May 5, 1902, in Camberley, England, Bret Harte lived in London.

It is doubtful if Bret Harte ever surpassed the work of his early stories *The Luck of Roaring Camp*, *The Outcasts of Poker Flat* and *Tennessee's Partner*, yet he did reach the high level of these masterpieces in *The Twins of Table Mountain*, *The Ancestors of Peter Atherley* and *Left Out on Lone Star Mountain*. His outstanding poem was "The Heathen Chinee."

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HARTEBEEST (hahr'tā-bāst), a large South African antelope, *Bubalis cama*, characterized by its red colour, long face with naked muzzle, and sharply angulated lyrate horns, present in both sexes. This graceful animal, one of the swiftest of African antelopes, easily outdistancing greyhounds, formerly occurred in great herds from Cape Colony to Rhodesia, but is now comparatively rare and restricted to remote districts It stands about 4 ft. high at the withers, with heavy forequarters, which are much higher than the narrow and drooping hindquarters The name is sometimes extended to include all members of the genus. (*See* ANTELOPE.)

HARTFORD, capital of Connecticut, U.S.A., at the head of navigation on the Connecticut river, 38 m. from Long Island sound and 100 m. N.E. of New York city; a port of entry and the county seat of Hartford county It is served by the New York, New Haven and Hartford railroad, by steamers to New York and by numerous motor bus and freight truck lines operating over the federal and state highways which radiate in every direction; and is a station on the air-mail route from Boston to New York and the west and south The population in 1920 was 138,036, of whom 40,667 were foreign-born white (over half from Russia, Poland, Italy and Ireland); and was estimated locally at 178,000 in 1928. The city covers 18 sq.m. of undulating ground on the west bank of the river, surrounded by the beautiful valley and gently rolling hills. From the north-west and the south-west corners enter the two branches of the little Park river, which unite about the middle of the city, after many twists and turns, and meander on to the

Connecticut. A fine stone bridge of nine arches, dedicated in 1908, spans the Connecticut, commanding a panorama of city and river. The city is well laid out and compactly built, with many distinctive features. Since 1907 development has been guided by a city-plan commission. The State capitol stands on a hill in Bushnell park, in the heart of the city. It is a handsome building of white marble, designed by Richard M. Upjohn, and was completed (1878) at a cost ($2,642,524) within the original appropriations. It contains many objects of historic interest, including the tombstone of Israel Putnam and a carved chair made for the senate chamber from the wood of the charter oak (*see* below). In the park is the Corning memorial fountain (1899), designed by J Massey Rhind, and the memorial arch and bridge (across the Park river) erected by the city in 1884 in tribute to the soldiers and sailors of the Civil War. Facing the capitol on the south is the supreme court and State library building (1910), and across the west lawn is the State armory and arsenal, one of the largest in the country. Between the capitol and the Connecticut river stands the old three-story brick State house (1796), a gem of colonial architecture, designed by Charles Bulfinch. When the new capitol was occupied it was turned over to the city, and for a generation was used as a city hall, but since 1915 it has been restored as an historic shrine. Near by is the First Church of Christ (Congregational), known as the Center church, which was organized in Cambridge, Massachusetts, in 1632, and moved to Hartford in 1636 under the leadership of Thomas Hooker and Samuel Stone. The present building (1807) stands near the site of the original meeting-house, and adjoins the graveyard where Hooker, William Leete, John Haynes and their contemporaries were buried. Across the street, a little to the south, is a group of museum and library buildings: the Wadsworth atheneum (built in 1844 by popular subscription, and more recently enlarged and heavily endowed), containing historical treasures; the Colt memorial (1908) housing the collection of fire-arms gathered by Col. Samuel Colt, the Hartford armourer; and the Junius Spencer Morgan memorial, an art gallery built (1908) by J Pierpont Morgan in memory of his father, a native of Hartford

There are 25 parks and public squares, covering 1,340 ac. (11.6% of the city's area) and containing golf links, tennis courts, 65 baseball diamonds and one of the finest rose gardens in the country Two miles south of the centre of the city is the municipal airport (Brainard field), 165 ac of grass-covered river silt. A bond issue of $1,000,000 was approved by the voters in 1928 for a dike and other flood-control works to protect the landing field and the rest of the south meadows. Among the business buildings the homes of the insurance companies, many of them architecturally beautiful, are as conspicuous as their business is important in the economic life of the city. The tower of the Travellers companies (527 ft. high, the highest building in New England) is a landmark for aviators and others, visible for many miles, by day and by night.

Hartford is the seat of Trinity college (chartered as Washington college in 1823); the Hartford Theological seminary (Congregational), founded at East Windsor Hill in 1834 and moved to Hartford in 1865, and associated with it the School of Religious education and the Kennedy school of missions; St. Thomas's seminary (Roman Catholic) and a Roman Catholic cathedral; the Hartford retreat for the insane (opened 1824); and the State school for the blind. The American School for the Deaf, founded in Hartford by Thomas W. Gallaudet in 1816, the first in America, is now in the adjoining town of West Hartford. The public-school system includes 25 elementary, 3 high, and one trade school, and the city's appropriations for education, including the public library, was $3,320,531 for the fiscal year 1928–29. The Hartford *Times* (est. 1817) has a beautiful building and notable mechanical equipment; and the *Courant* (est. 1764) is the oldest newspaper in America.

Insurance is Hartford's outstanding business, employing 16,000 men and women in the local offices. The 43 companies (fire, life and casualty) which have their home offices here had a total premium income in 1927 of $569,712,171, and have paid to policyholders and beneficiaries since their organization $3,766,571,483. Manufacturing also is important. The 337 industrial establishments in 1927 had an output valued at $113,674,982, and their annual payroll approximates $32,000,000. Among the widely distributed articles made in Hartford are small fire-arms, typewriters, brushes, precision machines and small tools. Other important manufactures are silver plate, hardware, rubber tires, electric equipment and aeroplanes. Hartford is a trading centre for a population of 450,000, and the market for the agricultural products of the county, including tobacco to the value of $15,000,000 annually. Bank debits in 1927 amounted to $2,237,553,092.

History.—The first settlement here was made by Dutch from New Amsterdam, who in 1633 built a fort at the mouth of Park river, which they held until 1654. In 1635, 60 English settlers came from New Town (now Cambridge), Massachusetts, and in 1636 practically all the rest of the New Town congregation joined them, led by Thomas Hooker and Samuel Stone. Their settlement was at first called Newtown, but in 1637 the present name was adopted, from Hertford, the birthplace of Stone. The first general court of the Connecticut colony was held here in 1636, and its first written constitution (the Fundamental Orders) was adopted here in 1639. When the colonies of New Haven and Connecticut were united (1662) Hartford became the capital, but shared the honour with New Haven from 1701 to 1873. In 1687 Governor Andros came to Hartford to take away the royal charter of 1662, under which the colonists practically had local sovereignty. At his meeting with the officials of the colony, when the document was on the table, suddenly the candles were blown out, and when they were re-lighted the charter had disappeared It was hidden by Capt Joseph Wadsworth in a hollow tree ("the Charter Oak") the site of which is now marked by a granite monument. The city was chartered in 1784, and in 1881 was made co-extensive with the town of Hartford.

In the latter part of the 18th century Hartford was the home of a group of Federalist authors known as "the Hartford Wits," including Lemuel Hopkins, John Trumbull, Joel Barlow and David Humphreys; and in 1814–15 it was the meeting-place of the Hartford Convention, an event of great importance in the history of the Federalist party. Delegates from Massachusetts, Connecticut, Rhode Island, New Hampshire and Vermont met in secret session from Dec 15, 1814, to Jan. 5, 1815, to consider the grievances of New England against the national (Democratic) government in its conduct of the war with Great Britain. The convention recommended a greater measure of military control for the several States, and proposed (for consideration by the State legislatures) a number of amendments to the federal constitution, limiting the power of Congress and of the executive. The legislatures of Massachusetts and Connecticut were the only ones which approved the proposed amendments. They sent commissioners to Washington to urge their adoption, but before they arrived the war had come to an end. Nine state legislatures expressed positive disapproval of the convention, some charging it with sowing "seeds of dissension and disunion," and in general it was vigorously criticized throughout the country.

During the 18th century Hartford had a large and lucrative commerce, but with the development of railways in the 19th century it suffered from the competition of Boston and New York. The first woollen mill in New England was established here in 1788, and here about 1846 the Rogers process of electro-silver plating was invented. As early as 1794 policies were issued by the Hartford Fire Insurance company (chartered in 1810). In the San Francisco disaster of 1906 the fire insurance companies of Hartford paid more than $15,000,000 in losses. Hartford was the birthplace of Noah Webster, who published here (1783–85) his *Grammatical Institute of the English Language*, and of Henry Barnard, John Fiske and Frederick Law Olmsted. It was the home of Samuel P. Goodrich (Peter Parley), George D. Prentice, Harriet Beecher Stowe, Charles Dudley Warner, Horace Bushnell and Samuel L. Clemens (Mark Twain). More than 100 periodicals have been established in Hartford. The *Congregationalist* (now published in Boston) and the *Churchman* (now published in New York) were founded in Hartford in 1816 and 1805 respectively. The Hartford *Courant* was very influential in shaping public opin-

ion in the years preceding the Revolution, and the *Times* (edited by Gideon Wells 1826–36) was one of the most powerful Democratic organs in the second quarter of the 19th century.

See *Scaeva, Hartford in the Olden Times: Its First Thirty Years* (1853); J. H. Trumbull, *Memorial History of Hartford County* (1886); *History of the Hartford Convention* (1833); H. C. Lodge, *Life and Letters of George Cabot* (1877); Henry Adams, *Documents Relating to New England Federalism* (1877).

HARTFORD, a city of Washington county, Wisconsin, U.S.A., 37m. N.W. of Milwaukee, on the Chicago, Milwaukee, St. Paul and Pacific railroad. The population was 4,515 in 1920. It has large automobile works and various other manufacturing industries. It was founded *c* 1850 and incorporated in 1884.

HARTFORD CITY, the county seat of Blackford county, Ind., U.S.A., 62m. N.E. of Indianapolis. It is served by the Nickel Plate and the Pennsylvania railways and inter-urban electric lines. The population was 6,183 in 1920 (97% native white) and estimated locally at 7,500 in 1928. The city has important window-glass and chipped-glass factories, paper-pulp mills and other industries. It was settled in 1832, laid out in 1839, incorporated as a town in 1867 and as a city in 1894.

HARTIG, GEORG LUDWIG (1764–1837), German agriculturist and writer on forestry, was born at Gladenbach, near Marburg, on Sept. 2, 1764. After obtaining a practical knowledge of forestry at Harzburg, he studied from 1781 to 1783 at the University of Giessen. He held forestry appointments under various German princes, and established a school of forestry which he removed to Berlin in 1811 He secured its affiliation with the university. He died in Berlin on Feb. 2, 1837.

G. L. Hartig's works include *Lehrbuch für Forster* (3 vols., Stuttgart, 1808); *Lehrbuch fur Jager* (Stuttgart, 1810); *Kubiktabellen fur geschnittene, beschlagene, und runde Holzer* (1815, 10th ed. Berlin, 1871); and *Lexikon fur Jäger und Jagdfreunde* (1836, 2nd ed. Berlin, 1859–61).

HARTLEPOOL, a parliamentary borough of Durham, England, embracing the municipal borough of Hartlepool or East Hartlepool and the municipal and county borough of West Hartlepool. Pop. (1921) of Hartlepool, 20,997; of West Hartlepool, 68,641. The towns are on the coast of the North sea separated by Hartlepool bay, with a harbour, and both have stations on the L.N.E. railway, 247 m. N from London. The surrounding country is bleak, and the coast is low The ancient market town of Hartlepool lies on a peninsula which at the end of a sweep of the coast, embraces the bay. Its naturally strong position was formerly fortified, and part of the walls, serving as a promenade, remain. The parish church of St. Hilda, is late Norman and Early English, with a massive tower, heavily buttressed. There is a borough hall in Italian style. The municipal area embraces the three townships of Seaton Carew, a seaside resort; Stranton, with its church of All Saints, of the 14th century, on a very early site; and Throston.

The two Hartlepools are officially considered as one port. The harbour, which embraces two tidal basins and six docks aggregating 200 acres, included in which are timber docks (57 acres), with excellent facilities for storing timber. There are five graving docks, admitting vessels of 550 ft. length and 10 to 21 ft. draught. The depth of water on the dock sills varies from 16½ ft. at neap tides to 25 ft. at spring tides. A breakwater three-quarters of a mile long protects the entrance to the harbour. An important trade is carried on in the export of coal, ships, machinery, iron and other metallic ores, woollens and cottons, and in the import of timber, sugar, iron and copper ores, and eggs. The principal industries are shipbuilding (iron), boiler and engineering works, iron and brass foundries, steam saw and planing mills, flour-mills, paper and paint factories, and soapworks. The parliamentary borough returns one member.

Hartlepool (Hertepull, Hertipol) grew up round the monastery (founded 640), was destroyed by the Danes (800) and rebuilt by Ecgred, bishop of Lindisfarne. Bishop Hugh de Puiset (1173) allowed French and Flemish troops to land at Hartlepool to aid the Scots. It became the property of the see of Durham in 1189, and in 1201 received a charter from the bishop. Other charters were granted in 1230, in 1328 by Edward III., in 1397 by Richard II., and minor ones followed until Elizabeth incorporated the borough in 1593 During the civil wars Hartlepool was taken by the Scots and garrisoned by them until 1647. As a borough of the Palatinate, Hartlepool did not receive parliamentary representation until the 19th century. In 1216 John confirmed the market on Wednesday and the fair on the feast of St. Lawrence; this fair was extended to fifteen days by the grant of 1230, while the charter of 1595 also granted a fair and market. During the 14th century trade was carried on with Germany, Spain and Holland, and in 1346 Hartlepool provided five ships for the French war. The markets were still considerable in Camden's day, but declined during the 18th century, when Hartlepool became fashionable as a watering-place

HARTLEY, SIR CHARLES AUGUSTUS (1825–1915), English engineer, was born in 1825 at Heworth, Durham. From 1856 to 1872 he was engineer-in-chief for the works carried out by the European Commission of the Danube for improving the navigation at the mouths of that river, and from 1872 onwards he was consulting engineer to the Commission (*see* DANUBE). In 1875 he was a member of the committee appointed by Congress to report on the works necessary to form and maintain a deep channel through the south pass of the Mississippi delta; and in 1884 the British Government nominated him a member of the international technical commission for widening the Suez Canal. He was consulted by the British and other Governments in connection with many other river and harbour works, including the improvement of the navigation of the Scheldt, Hugli, Don and Dnieper, and of the ports of Odessa, Trieste, Kustendjie, Burgas, Varna and Durban. He was knighted in 1862, and became K C M.G. in 1884. He died in London on Feb. 20, 1915.

HARTLEY, DAVID (1705–1757), English philosopher, and founder of the Associationist school of psychologists, was born on Aug. 30, 1705 He was educated at Bradford grammar school and Jesus College, Cambridge, later practising as a physician at Newark, Bury St. Edmunds, London, and lastly at Bath, where he died on Aug. 28, 1757.

Hartley's *Observations on Man* was the first systematic attempt to interpret the phenomena of mind by the theory of association; its two main theories are the doctrine of vibrations and the doctrine of associations. His physical theory, he tells us, was drawn from Newton's *Principia* His psychological theory was suggested by the Rev. John Gray's *Dissertation concerning the Fundamental Principles of Virtue or Morality,* which was prefixed to Bishop Law's translation of Archbishop King's *Origin of Evil.*

With Locke, Hartley asserted that, prior to sensation, the mind is a blank. From simple sensations, however, originate all states of consciousness, the law of growth being the law of contiguity, synchronous and successive. By this law he explained not only memory, as others had done, but also emotion (which he analyses with skill), reasoning, and voluntary and involuntary action (*see* ASSOCIATION OF IDEAS). He held that sensation is the result of a vibration of the minute particles of the medullary substance of the nerves made possible by Newton's subtle elastic ether.

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HARTLEY, DAVID, the younger (1731–1813), parliamentarian, pamphleteer and inventor, the son of the above, was a fellow of Merton college, Oxford, and member of Parliament for Hull (Kingston-upon-Hull) from 1774–80 and from 1782–84. He gained fame about 1776 by a discovery intended to protect buildings against fire, and attracted important gatherings to his experiment-house on Putney Common, where an obelisk stands in his honour. He was the friend and correspondent of Benjamin Franklin, with whom he had many interests; and he gave up the greater part of his political career to opposing the American War, speaking frequently and at length in the Commons, and publishing in 1778 his vigorous *Letters on the American War.* He was appointed by the Fox-North ministry as a plenipotentiary to treat with the Americans in 1783, and signed the definitive treaty in

Paris.

See G. H. Guttridge, *David Hartley, M.P.* (Univ. of California Press, 1926. *With bibliography.*)

HARTLEY, JONATHAN SCOTT (1845–1912), American sculptor, was born at Albany, N.Y., on Sept. 23, 1845. He was a pupil of E. D. Palmer, New York, and of the schools of the Royal Academy, London; he later studied for a year in Berlin and for a year in Paris. He devoted himself particularly to the making of portrait busts, in which he attained high rank. Among his works are a statue of Miles Morgan, the Puritan, for Springfield (Mass.); the Daguerre monument in Washington; "Thomas K. Beecher," Elmira (N.Y.); "Alfred, the Great," Appellate Court-house, New York; "Young Hopi Stick Thrower" (1911); and "The Cradle of Pan" (1912). He died in New York city on Dec. 6, 1912.

HARTLIB, SAMUEL (*c.* 1599–*c.* 1670), English writer on education and agriculturist, was born towards the close of the 16th century at Elbing in Prussia, his father being a refugee merchant from Poland. His mother was the daughter of a rich English merchant of Danzig. About 1628 Hartlib went to England, where he carried on a mercantile agency. An enthusiastic admirer of Comenius, he published in 1637 his *Conatuum Comenianorum praeludia*, and in 1639 *Comenii pansophiae prodromus et didactica dissertatio*. In 1641 appeared his *Relation of that which hath been lately attempted to procure Ecclesiastical Peace among Protestants*, and *A Description of Macaria*, containing his ideas of what a model State should be. During the Civil War Hartlib devoted himself to agriculture, publishing various works by himself, and printing at his own expense several treatises by others on the subject. In 1652 he issued a second edition of the *Discourse of Flanders Husbandry* by Sir Richard Weston (1645); and in 1651 *Samuel Hartlib, his Legacy, or an Enlargement of the Discourse of Husbandry used in Brabant and Flanders*, by Robert Child. For his various labours Hartlib received a pension from Cromwell, as he had spent all his fortune on his experiments. He planned a school for the sons of gentlemen, to be conducted on new principles, and this probably was the occasion of his friend Milton's *Tractate on Education*, addressed to him in 1644, and of Sir William Petty's *Two Letters* on the same subject, in 1647 and 1648. At the Restoration Hartlib lost his pension. Apparently he is referred to by Andrew Marvell as alive in 1670 and fleeing to Holland from his creditors.

See H. Dircks, *A Biographical Memoir of Samuel Hartlib* (1865).

HARTMANN, JOHANNES FRANZ (1865–), German astronomer, was born at Erfurt on Jan. 11, 1865. From 1886–91 he studied mathematics in Tübingen, Berlin and Leipzig. In 1891 he was appointed assistant in Leipzig observatory. In 1909 he became professor of astronomy and director of the observatory in Göttingen, and in 1921 director of the university observatory at La Plata, Argentine. He has worked on spectrographs and dispersion-curves and has written numerous papers on his spectral observations. He edited the volume on astronomy in the series *Die Kultur der Gegenwart* (1921). Hartmann invented the microphotometer (1899), and the spectrocomparator (1904). With Plaskett and Otto Struve, he discovered and investigated the calcium clouds in space.

HARTMANN, KARL ROBERT EDUARD VON (1842–1906), German philosopher, was born in Berlin on Feb. 23, 1842. He was educated for the army, but turned to philosophy, and in 1867 the university of Rostock conferred on him the degree of D. Phil. He subsequently returned to Berlin, and died at Grosslichterfelde on June 5, 1906. Von Hartmann's reputation was established by his first book, *The Philosophy of the Unconscious* (1869; 11th ed. 1904). Its success was due to the diversity of its contents (von Hartmann professing to obtain his speculative results by the methods of inductive science, and using many concrete illustrations), the fashionableness of its pessimism and the vigour and lucidity of its style. The Unconscious appears as a combination of the metaphysic of Hegel with that of Schopenhauer. It is both Reason and Will and the absolute all-embracing ground of all existence, the spiritual principle required by nature. Von Hartmann thus combines "pantheism" with "panlogism" in a manner adumbrated by Schelling in his "positive philosophy." At the Fall, Will and Reason were separated, and the former, as blind impulse, determines the melancholy career of the Unconscious in the world process. Reason is in constant strife against Will and only when it is emancipated from this strife in the conscious reason of the enlightened pessimist can the world be redeemed. When the greater part of the Will in existence is so far enlightened by reason as to perceive the inevitable misery of existence, a collective effort to will non-existence will be made, and the world will relapse into nothingness, the Unconscious into quiescence. Civilization, like the happiness of the individual, means the annullment of the will-to-live and the gradual releasing of the Unconscious from its sufferings. Meanwhile we must provisionally affirm life and devote ourselves to social evolution, instead of striving after a happiness which is impossible; in so doing we shall find that morality renders life less unhappy. Suicide, and all other forms of selfishness, are highly reprehensible.

Von Hartmann's works number about thirty of which the chief are: *Kategorienlehre* (1896); *Das sittliche Bewusstsein* (1879); *Die Philosophie des Schonen* (1887); *Die Philosophie des Unbewussten* (1869) (3 vols., which now include his, originally anonymous, self-criticism, *Das Unbewusste vom Standpunkte der Physiologie und Descendenztheorie*, (and its refutation, Eng. trs. by E. C. Coupland, 1884), *Grundriss der Erkenntnislehre* (1907); *Das Problem des Lebens Biologische Studien* (1908); *Das religiose Bewusstsein der Menschheit* (1881); *Geschichte der Metaphysik* (2 vols., 1899); *Kant's Erkenntnistheorie;* studies of Schelling, Lotze, von Kirchmann; *Zur Geschichte des Pessimismus* (1880); *Neukantianismus, Schopenhauerismus, Hegelianismus* (1877); *Moderne Psychologie* (1901); *Das Christentum des neuen Testaments* (1905); *Soziale Kernfragen* (1894); *Moderne Probleme* (1886); *Zwei Jahrzehnte deutscher Politik* (1888). His select works have been published in 10 volumes (2nd ed., 1885–96). *See* R. Kober, *Das philosophische System E. von Hartmanns* (1884); O. Plümacher, *Der Kampf ums Unbewusste* (2nd ed., 1890); A. Drews, *E. von Hartmanns Philosophie und der Materialismus in der modernen Kultur* (1890) and *E. von Hartmanns philosophisches System* (1906); O. Braun, *E. von Hartmann* (1909); N. F. Pohorilles, *Entwicklung und Kritik der Erkenntnislehre E. v. Hartmanns* (Vienna, 1911); G. S. Hall, *Founders of Modern Psychology* (1912); J. P. Steffs, *E. von Hartmanns Religions philosophie* (1921); C. O. Petraschek, *Die Logik des Unbewussten* (Munich, 1926). Full bibliography in Uberweg, *Grund. der Gesch. der Phil.* pt. 4 (1923).

HARTMANN, MORITZ (1821–1872), German poet and patriot, of Jewish origin, was born at Duschnik, Bohemia, on Oct. 15, 1821. For two volumes of patriotic poems, *Kelch und Schwert* (1845) and *Neuere Gedichte* (1846), published at Leipzig, he was imprisoned by the Austrian authorities, but was released at the revolution in March 1848, and sat in the Frankfurt parliament. He took part in the revolution in Vienna, and after its suppression escaped to London and Paris. In 1849 he published *Reimchronik des Pfaffen Mauritius*, a satirical political poem in the style of Heine. During the Crimean War (1854–56) Hartmann was correspondent of the *Kölnische Zeitung*, settled in 1860 in Geneva as a teacher of German literature and history, became in 1865 editor of the *Freya* in Stuttgart and in 1868 a member of the staff of the *Neue Freie Presse* in Vienna. He died at Oberdöbling near Vienna on May 13, 1872.

Among Hartmann's works may be especially mentioned *Der Krieg um den Wald* (1850), a novel, the scene of which is laid in Bohemia; *Erzählungen eines Unsteten* (1858); and *Die Letzten Tage eines Königs* (1867); an idyll, *Adam und Eva* (1851), and a collection of poetical tales, *Schatten* (1851).

See O. Wittner, *Moritz Hartmann's Leben und Werke* (2 vols., 1907).

HARTMANN VON AUE (1170?–1210?), Middle High German poet, belonged to the lower nobility of Swabia. He became retainer of a nobleman whose domain, Aue, has been identified with Obernau on the Neckar, and took part in the Crusade of 1196–97. He is mentioned by Gottfried von Strassburg (*c.* 1210) as still alive, and in the *Krone* of Heinrich von dem Türlin, written *c.* 1220, he is mourned for as dead. Hartmann was the author of four narrative poems. The oldest of these, *Erec*, which may have been written as early as 1191, and the latest and ripest, *Iwein*, belong to the Arthurian cycle and are based on epics by Chrétien de Troyes (*q.v.*); between them lie the romance, *Gregorius*, also an adaptation of a French epic, and *Der arme Heinrich*, a charming specimen of mediaeval German poetry. The theme of the

latter is the cure of the leper, Heinrich, by a young girl who is willing to sacrifice her life for him. Hartmann's language is carefully chosen, his narrative lucid, flowing and characterized by a sense of balance and proportion which is rarely to be found in German mediaeval poetry. His lyrics, which are all fervidly religious, relate in some cases to the crusade

Erec has been edited by M. Haupt (2nd ed., Leipzig, 1871); *Gregorius*, by H. Paul (2nd ed., Halle, 1900); *Der arme Heinrich*, by W. Wackernagel and W. Toischer (Basel, 1885) and by H. Paul (2nd ed., Halle, 1893); by J. G. Robertson (London, 1895), with English notes; *Iwein*, by G. F. Benecke and K. Lachmann (4th ed., Berlin, 1877) and E. Henrici (Halle, 1891–93). A convenient edition of all Hartmann's poems by F. Bech, 3 vols. (3rd ed., Leipzig, 1891–93, vol. 3 in 4th ed., 1902).

The literature on Hartmann is extensive. *See* L. Schmid, *Des Minnesingers Hartmann von Aue Stand, Heimat und Geschlecht* (Tübingen, 1874); H. Rötteken, *Die epische Kunst Heinrichs von Veldeke und Hartmanns von Aue* (Halle, 1887); F. Saran, *Hartmann von Aue als Lyriker* (Halle, 1889); A. E. Schönbach, *Über Hartmann von Aue* (Graz, 1894); F. Piquet, *Étude sur Hartmann d'Aue* (Paris, 1898). Translations have been made into modern German of all Hartmann's poems, while *Der arme Heinrich* has repeatedly attracted the attention of modern poets, both English (Longfellow, Rossetti) and German (notably, Gerhart Hauptmann). *See* H. Tardel, *Der arme Heinrich in der neueren Dichtung* (Berlin, 1905).

HARTSHORN, SPIRITS OF, a name signifying originally the ammoniacal liquor obtained by the distillation of horn shavings, afterwards applied to the partially purified similar products of the action of heat on nitrogenous animal matter generally, and now popularly used to designate the aqueous solution of ammonia (*q.v.*)

HART'S-TONGUE (*Phyllitis*), the name given to a genus of ferns, formerly known as *Scolopendrium*, meaning "like a centipede," from the numerous lines of fructification on the leaves. *P. Scolopendrium* (*S. vulgare*) is common in Europe, including Great Britain, and extends into Asia and North America, but is very rare in the latter continent, occurring only locally in central New York, Tennessee, Ontario and New Brunswick. The thick, leathery, glossy fronds reach a length of 18 in. There are ten species of *Phyllitis*, mainly tropical and subtropical. (*See* FERN; PTERIDOPHYTES.)

HARTY, SIR HERBERT HAMILTON (1879–), Irish conductor and composer, was born at Hillsborough, Co. Down, Ireland, on Dec. 4, 1879. He was an organist in Belfast and in Dublin before he came to London in 1900. As an accompanist he was soon in great demand and his compositions also received recognition. His *Comedy Overture* was played at a promenade concert at Queen's Hall in 1907 and in the same year his *Ode to a Nightingale* was produced at the Cardiff festival with Madame Agnes Nicholls, his wife, in the solo part. In 1920, after gaining considerable experience by conducting the London Symphony orchestra, he was appointed permanent conductor of the Halle orchestra in Manchester. In 1925 he was knighted, and also received the degree of Mus.D. from Dublin university. In January 1927 he visited London with the Halle orchestra and chorus and gave a notable performance of Berlioz's *Requiem* at a British Broadcasting Corporation's Albert Hall concert. His compositions include a violin concerto; *With the Wild Geese*, tone poem for orchestra; *The Mystic Trumpeter* for voices and orchestra; an "Irish" symphony; a transcription of Handel's *Water-Music* for modern orchestra; songs and settings of folk-songs.

HĀRŪN AL-RASHĪD (hă-rōōn' ar rah' shēd) (763–809), fifth of the 'Abbasids of Baghdad, and second son of the third caliph Mahdi, was born at Rai (Rhagae), and at the age of 22 ascended the throne. For the campaigns in which he took part prior to his accession *see* CALIPHATE: *The Abbasids*. He owed his succession to the prudence of Yahyā b. Khālid the Barmecide, his secretary, whom on his accession he appointed his lieutenant and grand vizier (*see* BARMECIDES). Under his guidance the empire flourished in spite of revolts in the provinces by the old Alid family. Successful wars were waged with the rulers of Byzantium and the Khazars. In 803, however, Hārūn became suspicious of the Barmecides, whom with a single exception he caused to be executed. Henceforward the chief power was exercised by Fadl b. Rabi', who had been chamberlain under Hārūn himself and under his predecessors, Mansūr, Madhi and Hādī. Later troubles in the eastern parts of the empire, led Hārūn to go to Khorasan, but he died at Tus in March 809.

The reign of Hārūn (*see* CALIPHATE) was one of the most brilliant in the annals of the caliphate, in spite of losses in northwest Africa and Transoxiana. His fame spread to the West, and Charlemagne and he exchanged gifts and compliments as masters respectively of the West and the East. Himself a scholar and poet, Hārūn patronized poets, jurists, grammarians, cadis, scribes and musicians. The excellent administration of the empire during his life was in reality due to his viziers Yahyā and Fadl. Hārūn is known to Western readers as the hero of stories in the *Arabian Nights;* and in Arabic literature he is the figure of numberless anecdotes.

See the Arabic histories of Ibn al-Athir and Ibn Khaldūn; W. Muir, *The Caliphate* (1891); R. D. Osborn, *Islam under the Khalifs of Bagdad* (1878); G. Weil, *Geschichte der Chalifen* (Mannheim and Stuttgart, 1846–62); G. le Strange, *Baghdad during the Abbasid Caliphate* (Oxford, 1900), A. Muller, *Der Islam*, vol. i. (1885); E. H. Palmer, *The Caliph Haroun Alraschid* (1880); J. B. Bury's edition of Gibbon's *Decline and Fall* (1898), vol. vi.

HARUSPICES, Etruscan diviners, "entrail observers" (*cf.* Skt. *hira*, Gr. χορδή). Their art (*disciplina*) consisted especially in deducing the will of the gods from the appearance presented by the entrails of the slain victim. They also interpreted all portents or unusual phenomena of nature, especially thunder and lightning, and prescribed the expiatory ceremonies after such events. This formed a most complicated pseudo-science, in sharp contrast to native Italian divination, which consisted of asking the approval of the gods for a proposed action and deducing a "yes" or "no" from such omens as the flight of birds (*see* AUGURS, OMEN), and in simple inspection of the entrails of a victim to see if the beast were normal and therefore acceptable. The Etruscans were said to have learned it from a being named Tages (*q.v.*). Instructions were contained in certain books called *libri haruspicini fulgurales, rituales*. The art was practised in Rome chiefly by Etruscans, occasionally by native-born Romans who had studied in the priestly schools of Etruria. Though of great importance under the early republic, it never became a part of the state religion. In this respect the haruspices contrast with the augurs, who were an ancient and purely Roman institution, and were a most important element in the political organization of the city. In later times the art fell into disrepute (Cic. *de div.* ii. 24). Under the empire, however, we hear of a collegium of sixty haruspices; but this was never a state priesthood but a body of salaried expert advisers.

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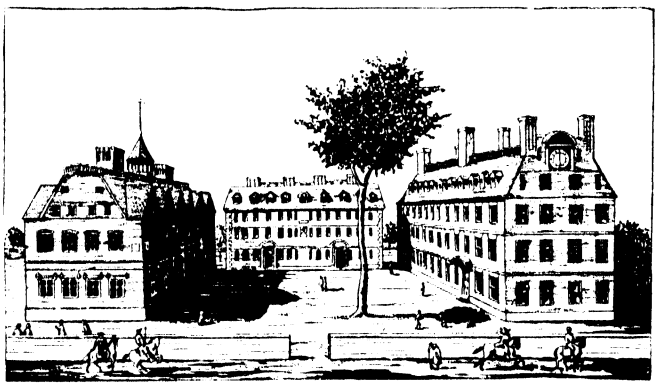
HARVARD UNIVERSITY, the oldest and one of the foremost of American educational institutions, situated chiefly in Cambridge, Mass., but also in Boston and other places. In 1636 the general court of the Colony voted £400 towards "a schoale or colledge," which in the next year was ordered to be at "Newetowne." In memory of the English university where many (probably some 70) of the leading men of the Colony had been educated, the township was named Cambridge in 1638. In the same year John Harvard (1607–38), an immigrant Puritan minister to America, a bachelor and master of arts of Emmanuel college, Cambridge, dying in Charlestown, Mass., bequeathed to the wilderness seminary £780 (half his estate) and 260 books; and the college, until then unorganized, was named Harvard college (1639) in his honour.

The history of Harvard is unbroken from 1640, and its first commencement was held in 1642. The spirit of the founders is beautifully expressed in the words taken from *New England's First Fruits* (1643) and carved on the college gates: "After God had carried us safe to *New-England*, and wee had builded our houses, provided necessaries for our liveli-hood, rear'd convenient places for Gods worship and settled the Civill Government; One of the next things we longed for, and looked after was to advance *Learning* and perpetuate it to Posterity; dreading to leave an

illiterate Ministry to the Churches, when our present Ministers shall lie in the Dust." The charter of 1650 dedicated the college to "the advancement of all good literature, arts, and sciences," and "the education of the English and Indian youth . . . in knowledge and godlynes." The second building (1654) on the college grounds was called the "Indian College." In it was set up the college press, which since 1638 had been in the president's



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HARVARD COLLEGE IN 1726, AFTER A CONTEMPORARY ENGRAVING
On the right is Massachusetts Hall, added in 1720 to the group of three buildings then composing the college, and the only one of them which remains to the present date. It is now used as a dormitory

house, and here, it is believed, was printed the translation of the Bible (1661–63) by John Eliot into the language of the natives, with his primer, catechisms, grammars, tracts, etc. A fair number of Indians were students, but only one, Caleb Cheeshahteaumuck, took a bachelor's degree (1665). By generous aid received from abroad for this special object, the college was greatly helped in its infancy.

The charter of 1650 has been in the main, and uninterruptedly since 1707, the fundamental source of authority in administration. It created a self-perpetuating corporation consisting of the president, the treasurer and five fellows, who formally initiate administrative measures, control the college funds, and appoint officers of instruction and government, subject, however, to confirmation by the board of overseers (established in 1642), which has a revisory power over all acts of the corporation. Circumstances gradually necessitated ordinary government by the resident teachers; and to-day the various faculties, elaborately organized, exercise immediate government and discipline over all the students. The board of overseers was at first jointly representative of State and Church. The former, as founder and patron, long regarded Harvard as a State institution; but the controversies and embarrassments incident to legislative action proved prejudicial to the best interests of the college, and an act of 1865 severed the connection with the State. Financial aid and practical dependence had ceased some time earlier; indeed, from the very beginning, and with steadily increasing preponderance, Harvard has been sustained and fostered by private munificence. The last direct subsidy from the State terminated in 1824, although State aid was afterwards given to the Agassiz museum, later united with the university.

The church was naturally sponsor for the early college. The changing composition of its board of overseers marked its liberation first from clerical and later from political control; since 1865 the board has been chosen by the alumni who therefore really control the university. When in the first half of the 17th century the unity of Puritanism, in religion and in politics, gave way to a variety of intense sectarianisms, this, as also the incoming of Anglican churchmen, made the old faith of the college insecure. The conservatives, who clung to pristine and undiluted Calvinism, sought to entrench themselves in the board of overseers. The history of the college from about 1673 to 1725 was exceedingly troubled. One episode in the struggle was the foundation of Yale college by the conservatives of New England as a truer "school of the prophets" after they had failed to secure control of the government of Harvard. In 1792 the first layman was chosen to the corporation; in 1805 a Unitarian became professor of theology; in 1843 the board of overseers was opened to clergymen of all denominations; in 1886 attendance on prayers ceased to be compulsory. Thus Harvard, in response to changing conditions, grew away from the ideas of its founders.

Harvard, her alumni and her faculty had been very closely connected with American letters, not only in the colonial period, when the Mathers, Samuel Sewall and Thomas Prince were important names, and in the revolutionary and early national epoch with the Adamses, Fisher Ames and Robert Treat Paine, but especially in the second third of the 19th century, when the great New England movements of Unitarianism and Transcendentalism were led by Harvard graduates. In 1805 Henry Ware was elected the first anti-Trinitarian to be Hollis professor of divinity, and this marked Harvard's close connection with Unitarianism, in the later history of which nearly all the leaders were Harvard graduates. Of the "Transcendentalists," Emerson, Francis Henry Hedge, Clarke, Convers Francis, Parker, Thoreau and Christopher Pearse Cranch were Harvard graduates. Longfellow's professorship at Harvard in 1836–54 identified him with it; Oliver Wendell Holmes was professor of anatomy and physiology at Harvard in 1847–82; and Lowell, a Harvard alumnus, was Longfellow's successor in 1855–86 as professor of the French and Spanish languages and literatures. Ticknor and Charles Eliot Norton, in literary criticism, are other important names. The historians Sparks, Bancroft, Hildreth, Palfrey, Prescott, Motley, Parkman and Fiske were graduates of Harvard, as were the orators Edward Everett, Charles Sumner and Wendell Phillips.

In organization and scope of effort Harvard became, especially after 1869, under the direction of President Charles W. Eliot, in the highest sense a university; but the "college" proper, whose end is the liberal culture of undergraduates, continues to be the centre of university life, as it is the embodiment of university traditions. The medical school (in Boston) dates from 1782, the law school from 1817, the divinity school (though instruction in theology was of course given from the foundation of the college) from 1819, and the dental school (in Boston) from 1867. The Bussey institution (at Jamaica Plain) was established in 1871 as an undergraduate school of agriculture, and reorganized in 1908 for advanced instruction and research in subjects relating to agriculture and horticulture. The Graduate School of Arts and Sciences dates from 1872, and the Graduate School of Business Administration from 1908. The latter is situated just across the Charles river from the college and is housed in a series of suitable buildings erected in 1926–27 through the generous gift of $6,000,000.00 from Mr. George F. Baker of New York. The Lawrence scientific school, established in 1847, was practically abolished in 1907–08 but was re-established later as the Harvard engineering school, and comprises departments of study in mechanical, electrical, civil, sanitary, municipal and mining engineering, in sanitary and industrial chemistry and in metallurgy. There are also schools of public health, of architecture, of landscape architecture, and the Graduate School of Education to which alone of the various departments women are admitted. The university institutions include the botanic garden (1807) and the (Asa) Gray herbarium (1864); the Arnold arboretum (1872) at Jamaica Plain for the study of arboriculture, forestry and dendrology; the university museum, founded in 1859 by Louis Agassiz as a museum of comparative zoology, greatly developed by his son, Alexander Agassiz, and transferred to the university in 1876, though under an independent faculty; the Peabody museum of American archaeology and ethnology, founded in 1866 by George Peabody; the Fogg art museum (1895); the Semitic museum (1889); the Germanic museum (1902), containing rich gifts from Kaiser Wilhelm II., the Swiss Government and individuals and societies of Germanic lands; the astronomical observatory (1843, location 42° 22′ 48″ N. lat., 71° 8′ W. long.), which long maintained a station near Arequipa, Peru, but removed in 1927 to a point near Bloemfontain, South Africa; besides a number of other museums and laboratories. A permanent summer engineering camp is maintained at Squam lake, New Hampshire. In Petersham, Mass., is the Harvard Forest, about 2,000ac. of hilly wooded country; this

forest was given to the university in 1907, and is an important part of the equipment of the division of forestry.

The Harvard library is the largest university library in the country, and is of exceptional value. In 1928 it numbered, including the various special and departmental libraries, 2,785,000 books and pamphlets. Some of its collections are of great value from associations or special richness. There are department libraries connected with the law school, the Arnold arboretum, the Gray herbarium, the Bussey institution, the astronomical observatory, the meteorological observatory, the Peabody museum, the museum of comparative zoology and the schools of theology, medicine, dentistry, engineering, business administration, architecture, landscape architecture and education. In 1878 the library published the first of a valuable series of *Bibliographical Contributions*. Other publications of the university include, for example, the *Harvard Oriental Series* (started 1891), *Harvard Studies in Classical Philology* (1890), *Harvard Theological Review* (1907), *Harvard Law Review* (1889), *Harvard Historical Studies* (1897), *Harvard Economic Studies* (1906), *Harvard Psychological Studies* (1903), *Harvard Engineering Journal* (1902), the *Bulletin* (1874) of the Bussey institution, the *Archaeological and Ethnological Papers* (1888) of the Peabody museum, and the *Bulletin* (1863), *Contributions and Memoirs* (1865) of the museum of comparative zoology. The *Harvard Alumni Bulletin*, a weekly, and the *Harvard Graduates' Magazine* (1892), a quarterly, are published chiefly for the alumni

In 1927-28 there were 1,311 officers of instruction and 10,748 students (1,059 in 1869), the latter including 3,250 in the college, 4,775 in the graduate and professional schools, 415 in graduate medical courses and 2,844 in the summer school, but with 536 deducted from the total "for names counted more than once." The whole number of degrees conferred in 1928 was 2,126. The average age of the students at entrance, only 14 years so late as 1820, had risen in 1890 to 19 years, making possible the transition to a régime of great liberty of life and studies with positive improvement to the morals of the student body A strong development toward the university ideal marked the last half of the 19th century, especially in the widening of courses, the betterment of instruction and the progress in university freedom. The elimination of the last vestiges of sectarianism and churchly discipline, a lessening of oversight of conduct, a lopping off of various outgrown colonial customs, a complete reconstruction of professional standards and methods, the development of a great graduate school in arts and sciences based on and organically connected with the undergraduate college, a marked improvement in the college standard of scholarship, the allowance of great freedom to students in the shaping of their college course (the "elective" system), and very remarkable material prosperity marked the administration (1869–1909) of President Eliot.

In the co-ordination in the curricula of American colleges of the elements of professional training and liberal culture Harvard has been bold in experiment and innovation. She took a leading part in the movement that transformed university education, and her influence upon secondary education in America has been great. Her entrance requirements to the college and to the schools of medicine, law, dentistry and divinity have been higher than those of other American universities. A bachelor's degree is requisite for entrance to the professional schools (except that of dentistry), and the master's degree (since 1872) is given to students only for graduate work in residence, and rarely to other persons as an honorary degree. In scholarship and in the growth of academic freedom Germany gave the quickening impulse. This influence began with George Ticknor and Edward Everett, who were trained in Germany, and was continued by several eminent German scholars, some driven into exile for their liberalism, who became professors in the second half of the 19th century, and above all by the many members of the faculty later trained in German universities.

The ideas of recognizing special students and introducing the elective system were suggested in 1824, attaining establishment even for freshmen by 1885, the movement characterizing particularly the years 1865–85. The basis of the elective system is freedom in choice of studies within liberal limits. This freedom was modified in 1910 by requiring each student to choose enough courses in one field to enable him to gain considerable knowledge of that subject, and by distributing a certain number of courses among other fundamental subjects so as to secure a more well-rounded education At the same time the "degree with distinction" was established for high attainment in general, coupled with distinguished success in the subject to which the student had given most attention. Beginning with 1916, general final examinations on the student's field of concentration were introduced for all students in the departments of history, government and economics; the plan was later extended to almost all departments

In the years following 1916 a system of tutors was developed to direct the private reading of the students The tutor meets his men individually each week and advises as to their private study; he is in no sense a coach The results thus far show that the tutorial system is of great educational value, it encourages the student to think of his chief subject as a whole, and to read independently in his field, while the general final examination gives an opportunity to test his capacity at the end of his course The two have resulted in increased interest on the part of the students and in higher scholarship among students of varying abilities

The material equipment of Harvard is very rich. The total investments were valued June 30, 1928, at $94,372,702 22. For the fiscal year ended on that day, the total income of the university, excluding gifts to capital account and gifts for immediate use given in that year, was $10,489,889 40. Gifts in the year were, for capital account, $4,462,349 11; for immediate use, $1,809,906 67. In the year (1927–28) the amount distributed in scholarships, fellowships, prizes and other aids to students was $461,723 02 Among the university buildings are residence halls, dining halls, libraries, laboratories, museums, a theatre for public ceremonies, a chapel, a home for religious societies, a club-home (the Harvard Union) for graduates and undergraduates, an infirmary, a gymnasium, boat-houses and a concrete stadium capable of seating 54,000 spectators

RADCLIFFE COLLEGE, an institution of higher education for women, dates from the beginning of instruction of women by members of the Harvard faculty in 1879, the Society for the Collegiate Instruction of Women being formally organised in 1882. The present name was adopted in 1894, in honour of Ann Radcliffe, Lady Mowlson (*ob. c.* 1661), widow of Sir Thomas Mowlson, alderman and (1634) lord mayor of London; she was the founder (1643) of the first scholarship in Harvard college. From 1894 also dates the present official connection of Radcliffe with Harvard. The requirements for admission and for degrees are the same as in Harvard, and all diplomas are countersigned by an authorized official of Harvard and bear the university seal. Instruction is given by members of the university teaching force, who repeat in Radcliffe many Harvard courses. Many advanced courses in Harvard, and to a certain extent laboratory facilities, are directly accessible to Radcliffe students, and they have unrestricted access to the library.

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HARVEST, the season of the ingathering of crops (A.S. *haerfest* "autumn," O.H. Ger. *herbist*). Harvest has been a season of rejoicing from the remotest ages The Romans had their Cerealia or feasts in honour of Ceres. The Druids celebrated their harvest on Nov. 1. In pre-Reformation England Lammas Day (Aug. 1, O.S.) was observed as the beginning of the harvest festival. Throughout the world harvest has always been the occasion for many queer customs which all have their origin in the animistic belief in the corn-spirit or corn-mother. This per-

sonification of the crops has left its impress upon the harvest customs of modern Europe In West Russia, for example, the figure made out of the last sheaf of corn is called the bastard, and a boy is wrapped up in it. The woman who binds this sheaf represents the "corn-mother," and an elaborate simulation of childbirth takes place, the boy in the sheaf squalling like a new-born child, and being, on his liberation, wrapped in swaddling bands. Even in England vestiges of sympathetic magic can be detected. In Northumberland, an image formed of a wheatsheaf, and dressed in a white frock and coloured ribbons, is hoisted on a pole. This is the "kern-baby" or harvest-queen, and is set up in a prominent place during the harvest supper. In Scotland, the last sheaf, if cut before Hallowmas, is called the "maiden," and the youngest girl in the harvest-field is given the privilege of cutting it.

Throughout the world, as Sir J. G. Frazer shows, the semi-worship of the last sheaf is or has been the great feature of the harvest-home. Among harvest customs none is more interesting than harvest cries; the Devonshire reapers go through a ceremony which in its main features is a counterpart of pagan worship. "After the wheat is cut they . . . pick out a bundle of the best ears . . . ; this bundle is called 'the neck'; the harvest hands then stand round in a ring, an old man holding 'the neck' in the centre. At a signal from him they take off their hats, then all together they utter in a prolonged cry 'the neck!' three times, raising themselves upright with their hats held above their heads. Then they change their cry to 'Wee yen! way yen!' or, as some report, 'we haven!' " On a fine, still autumn evening "crying the neck" has a wonderful effect at a distance

For a very full discussion of harvest customs *see* Sir J. G. Frazer, *The Golden Bough*

HARVEST-BUG, the familiar name for mites of the family *Trombidiidae*, belonging to the order Acari of the class Arachnida. Harvest-bugs are the six-legged larval forms of several British species of *Trombidium* They are minute, rusty-brown organisms, barely visible to the naked eye, which swarm in grass and low herbage in the summer and early autumn, and cause considerable irritation by piercing the skin, often lodging themselves in some part where the clothing is tight. They may be destroyed, and the irritation allayed, by rubbing the affected area with some insecticide like turpentine or benzine They are not permanently parasitic, and if left alone will leave their temporary host to assume the active life characteristic of the adult mite, which preys upon minute animal organisms

HARVESTER, HARVESTER-SPIDER or HARVEST-MAN, names given to Arachnids of the order Opiliones, referable to various species of the family Phalangiidae. Harvest-spiders or harvest-men, so-called on account of their abundance in the late summer and early autumn, may be distinguished from all true spiders by the extreme length and thinness of their legs, and by the small size and spherical or oval shape of the body, which is not divided into two regions by a constriction They may be met with in a great variety of situations. They are predacious, feeding upon small insects, mites, and spiders. The males are smaller than the females, and often differ markedly from them. The male is furnished with a long protrusible penis. The sexes pair in the autumn, and the female, by means of her long, protrusible ovipositor, lays her eggs in some cleft or hole in the soil. After breeding, the parents die. The eggs hatch with the warmth of spring. The adults are provided with a pair of glands, situated one on each side of the carapace, which secrete an evil-smelling fluid believed to be protective. Harvest-men are very widely distributed and are abundant in temperate countries of the northern hemisphere. They are also common in India. The long legs of harvest-men serve them not only as organs of rapid locomotion, but also as props to raise the body well off the ground, thus enabling the animals to stalk unmolested from the midst of an army of raiding ants. Harvester is sometimes, but erroneously, used as a synonym for harvest-bug (*q.v.*). (*See* ARACHNIDA.)

HARVESTING MACHINERY. The three principal types of crop for the harvesting of which machinery is employed are (a) grass, (b) cereals and (c) roots Mechanical methods are to some extent applied in the harvesting of other crops, *e.g.*, flax: but the principal food crops are those which chiefly lend themselves to mechanical treatment. In many parts of the world primitive methods are still, however, employed, and a very substantial part of the world's harvest is cut with the sickle and threshed out with a flail or by means of a sledge drawn round and round by oxen on a circular threshing floor. Whether machinery is to be employed or not depends chiefly upon land tenure: in a country of peasant holdings, few individuals can employ machinery economically and the common organization of labour which might permit the introduction of a machine is difficult. Weather, too, plays a large part in determining to what extent machinery may be used. The scythe, for example, is still employed habitually in certain hilly districts even in Great Britain, for mowing grass and the hand rake for turning it. Again, crops of cereals may be so badly laid that they cannot be cut mechanically and resort must be had to the scythe. Increasing attention is being paid to methods of drying crops artificially, and these are described elsewhere (*see* CROP-DRYING).

Haymaking Machinery.—Haymaking includes the cutting, drying and storage of grasses and leguminous crops. The mower or grass cutter consists of a light two-wheeled frame carrying the cutting mechanism (which is driven by gearing from the wheels), a seat for the driver, and a pole or shafts by which the machine is hauled. Mowers are usually drawn by two horses, though tractors also are employed small one-horse machines are used in hilly districts and on small holdings. The cutting mechanism consists of the cutter bar (a long flat steel bar to which slotted fingers are bolted), and the knife (a long bar of smaller section than the cutter bar to which triangular steel blades are riveted). The cutter bar is carried on shoes or runners and follows, within limits, the irregularities of the land and can be lifted by the driver to clear obstructions The grass is cut by the movement of the knife to and fro between the fingers in the cutter bar. The cut grass is left behind on the ground in a continuous "swath": this is pushed on one side by means of a hinged board attached to the end of the cutter bar in order to clear a path for the mower on its next round. The usual width of cut of a mower is 4 ft. 6 in. but both smaller and larger sizes are made. Special cutter bars are also made for attachment to tractors; these have a universal joint for actuating the knife from the engine.

Various machines are available for turning the grass in order to assist natural drying. The hay-turner or tedder which was one of the first machines used for this purpose has a series of tines or teeth attached to a skeleton cylinder fixed on the axle of the machine and driven by gearing from the wheels. A metal shield is placed over the forward and upper part of the cylinder while the back is uncovered. When the tines rotate in a forward direction they pick up the grass and carry it round in the machine and throw it out backwards, spreading it evenly over the ground. When the tines rotate in the reverse direction the grass is merely knocked out backwards and stands exposed to the air. Modern practice favours the use of combined swath-turners, side-delivery-rakes and tedders which may be quickly adapted for each operation. Swath-turners are used for turning over the swaths without dispersing the grass. This operation is performed by means of spring tines which revolve across the swath as the machine proceeds. When the machine is used as a tedder, the tines revolve at double the speed in the reverse direction. It should be noted that swath-turners must follow in the track of the mower, while the hay-turner can be used across the field. Side-delivery-rakes are employed for raking the partially made hay into windrows. The machine is carried on two main wheels and a small trailing wheel. The commonest type has four horizontal rake bars fitted with spring-mounted, vertical steel tines. These bars are mounted at each end on revolving disks set at an angle to the frame behind the driver's seat, and are driven by gearing from the main shaft. The tines are mounted on each rake bar in three sections, the middle one of which is readily detachable. If the middle section is removed the swaths are merely turned over. If all three sections are used the hay is swept to one side and left in a windrow. The horse rake is being displaced by the side-delivery-rake for gathering purposes

but is still used for cleaning fields afterwards. It consists of a number of curved steel tines, extending the whole width of the machine, carried on a light frame with two wheels. The teeth are often adjustable, both for pressure and pitch, so that the ground may be either closely or lightly raked. A ratchet-gear fitted to the wheels provides the means for depositing the load which the rake has collected. The use of hay sweeps or hay loaders is steadily displacing hand forking. Which method is adopted depends largely on the farm and the prevailing weather. In large fields and where the ricks are built in the fields, hay sweeps are usually employed. In smaller fields and where it is necessary to cart the hay some distance to the homestead, loaders are more useful The hay sweep consists of a frame carried on two widely-spaced travelling wheels, and a large number of long wooden teeth or a wooden platform projecting forward from the frame. The hay is swept up as the implement moves forward, drawn, as a rule, by two horses hitched to each side of the sweep. When the sweep is full the teeth or platform is raised slightly from the ground and the machine is driven to the rick and unloaded. Hay loaders are of two distinct types: the apron and the reciprocating fork. The former consists of a gathering drum fitted with spring teeth mounted on a main axle and an endless apron or web. The hay is picked up by the gathering drum and delivered to the travelling web, which elevates it to the waggon or cart. In the reciprocating-fork machine, hay is worked up the loader by means of shaker rods and tines operated by crank shafts, driven by chains from the travelling wheels. Loaders usually pick up hay from the windrows The loader is mounted on a frame carried on four travelling wheels, and is drawn behind a waggon or lorry Where the land is laid in ridge and furrow hay-loaders are at a disadvantage

Silage Cutters and Blowers.—Silage or ensilage is herbage stored in a green moist state Silage possesses certain advantages as a feeding stuff, and the practice of growing succulent fodder crops for making it, particularly in wet districts, is now a common one. Certain crops which are unsuitable for making hay can be turned into silage. Silage may be stored in pits, stacks or in specially constructed tower silos. For making silage the crop is mown green and cut up into short lengths. Portable combined silage cutters and blowers are employed to reduce the mown crop to the required fineness and to convey it into the silo A belt conveyer carries the fodder along the feed trough where it is gripped by a pair of rollers, the upper one of which is floating From these rollers it passes to the knives, which are readily adjustable without altering their set, and are mounted on a fly-wheel together with the fan blades The whole is enclosed in a casing to which is connected a metal duct running up into the silo and as the chopped fodder leaves the knives it is blown into the silo Another type of silage cutter is fitted with spiral knives of the lawn-mower type —the fan being situated at the side of the machine and the fodder conveyed to it by worm or other feeding device

Grain Harvesting and Threshing Machinery.—Although in certain parts of the world cereal crops are harvested only for their grain, both in intensively farmed countries and in primitive countries great importance is attached to the straw In intensively farmed countries straw is used for food and litter for the cattle and is converted into manure: in primitive countries where fodder is scarce the straw is bruised and fed to the farm animals. These several conditions mainly determine the type of machinery required: other factors are land tenure—since a small-holder does not as a rule use an expensive or complicated machine—and climate. Reapers are the simplest machines used for harvesting grain crops. There are two types of reapers, namely, the manual delivery and the self-delivery or sail-reaper. The former type is very similar to the mower (see above) but has a light wooden frame-work attached to the cutter bar for collecting the cut corn which is raked off by hand and dropped in heaps for making sheaves These heaps must be cleared away before the machine can cut another strip and it is usual to cut the crop across the field, the reaper running idle on the return journey. Often combined mowers and reapers are used. The self-delivery or sail-reaper is mounted on one main driving wheel having a fixed cutter-bar carried on travelling wheels at either end which may be adjusted for height of cut. Behind the cutter-bar is a platform on to which the corn falls and from which it is swept to one side by four rakes working on arms attached to a capstan on the main frame and driven from the land-wheel. This machine leaves a clear path for cutting the next strip and the machine is able to travel round and round the field.

Self-binders, which deliver the corn bound in sheaves, often known simply as binders, are really modifications of sail-reapers with the addition of elevating and tying mechanism. Binders are usually hauled by three horses or by tractors. Certain modifications have been introduced to enable higher travelling and cutting speeds to be used when the binders are drawn by tractors, and in some machines the cutting and binding mechanism is driven from the engine of the tractor. The sheaves are either thrown to the ground at the side of the machine or collected by a sheaf carrier and dropped in heaps to facilitate stooking or shocking Combined harvester-threshers were devised for harvesting in the dry climates of North and South America, Australia and South Africa

Threshing machines are sometimes fitted with mechanical or self-feeders and conveyers are used for carrying the sheaves from the rick to the thresher. In America the thresher is usually of larger capacity than the English machine. The straw cavings and chaff are all blown through piping to a distance and deposited in heaps In this way the straw is much broken, contrary to English practice, where straw is expected to be delivered in an unbroken condition.

Corn [Maize] Harvesting and Threshing Machinery.—The extensive cultivation of maize in America and elsewhere has led to the development of special machines for harvesting and threshing this crop, which may be cut and bound into sheaves or merely headed. The corn binder like the grain binder has cutting, elevating and tying devices and is carried on a framework with one large wheel (which drives the mechanism) and two or three smaller wheels The stalks are cut between a fixed knife and movable knives attached to two endless chains which rotate as the machine traverses the row. There is also a device to grip the stalks and to convey them to the binding platform from which they are either dropped on the ground for shocking or elevated to a waggon drawn alongside the binder. The corn header or picker takes the ears or cobs from the standing stalks, removes the husks and then elevates the cleaned ears into a waggon drawn alongside the machine. The stalks are left standing and the husks are dropped on the ground The corn sheller removes the kernels from the ears, cleans the shelled corn and separates it from the cobs and other foreign matter. There is also a device to separate any loose kernels from the shredded material The ears are afterwards put through a sheller for extracting the kernels.

Elevators.—Where large quantities of hay and corn require to be stacked, a great saving in manual labour is effected by the use of elevators. The principal type of elevator consists of a hopper, a long trough and an endless web fitted with forks. The whole is mounted on a frame carried by four wheels and for convenience in transport the machine is made in sections so that it can be folded. The material is fed into the hopper, from which it is picked by the forks and conveyed up the trough to the top of the stack Elevators may be driven by horse gear, internal combustion engine, or, when used for stacking straw, direct from the threshing machine.

Root Harvesting Machinery.—The increased cost of labour and the extension of root crops grown for the market (*e.g.*, sugar-beet) as distinct from those consumed on the farm, have led to the development of mechanical devices for lifting the roots and performing all subsequent operations necessary to produce a marketable product The difficulties are very much greater than in the case of standing crops, and since apart from other factors the soil, in all conditions from clay to sand, requires to be separated from the roots, machines have yet to be designed which will perform efficiently under a wide range of conditions all the requisite operations. Only certain machines of particular importance can be described here The simplest mechanical device for lifting potatoes is the potato plough which has a series of prongs for raising the tubers as the implement is drawn through the ground. More elaborate machines, designed both to raise and

separate the tubers from the soil, are of two distinct types—the spinner and the elevator. Spinners are carried on two land wheels and have a broad scoop share which runs under the ridge and loosens the earth around the tubers. Immediately behind the share is the spinner, consisting of a series of forks rotating at right angles to the track of the machine. The forks are set to work at about the same depth as the share and, as they turn, throw out the potatoes to one side, leaving them in more or less compact rows. Elevators comprise a share and an elevating device actuated by gearing from the two travelling wheels. The machine has a main and a fore carriage, the latter being carried on two small wheels. As it moves forward, the potatoes and a certain amount of earth are raised by the share and carried up by a travelling web, which allows most of the earth to fall through before the potatoes reach the top; the potatoes then either fall to the ground or are delivered to a further cleaning and separating device—usually composed of oscillating forks. The depth of working can be regulated. Both types of machine leave the potatoes on the surface to be picked up and bagged by hand: no satisfactory machine to lift and bag potatoes at one operation has yet been evolved. Potato sorting and grading is effected by a separate machine, consisting of a series of riddles.

The simplest form of beet-lifter consists of a special share attached to an ordinary plough beam. There are many different kinds of digging shares, but only two main types, those which exert a pressure on both sides of the beet, leaving it loose but still standing upright in the ground, and those which exert pressure on one side only and tend to push the beet to one side. With all these machines the beet is afterwards pulled by hand and the tops cut off with a knife, the beet being subsequently loaded by hand into carts. Many machines have been invented for topping beet mechanically, either before or after the roots are lifted. The cutting implement is usually either a revolving disc or a hoe blade generally fixed diagonally across the row. These machines are built either simply as toppers, or in combination with lifters. It cannot, however, be said that an entirely satisfactory topping and lifting machine has yet been produced, though some will do useful work under favourable conditions. *See* also AGRICULTURAL MACHINERY. *See* F. N. G. Kranich, *Farm Equipment for Mechanical Power.* (B J O; H. G. R)

THE UNITED STATES

Among the many devices invented for large-scale farming in the United States a few are of sufficient importance to call for full description here.

The Harvester-thresher or Combine was originally developed for harvesting the small grains in the semi-arid regions of the western United States; it is, however, no longer limited to this area nor merely to the harvesting of small grain. It is now being employed in increasing numbers in the Central States, the East and in the South. Its introduction into these regions of small farms and varying climatic conditions is the result of several innovations, chief among which are the development of a small-type machine that can be operated by one man if necessary. Not only is the smaller machine more suitable to the small acreages in these regions, it is less costly and requires a much smaller investment than the larger machines used in the West. Certain other improvements in the combine have also been influential in extending its use, particularly those making it adapted for harvesting such crops as soy beans, cowpeas, grain sorghums, flax, buckwheat, rice, and clover, alfalfa and timothy seed.

Previously the combine could be used successfully only where the grain ripened evenly and was free from weeds and other green material. Now with the development of a new machine, the windrow harvester, the farmer can begin cutting his grain at the same time he would go into his field with an ordinary binder, which is usually a week to ten days earlier than the combine can be started. The windrow machine, or windrow-harvester, as it is called, is virtually a right-hand header with facilities for delivering the cut grain in a windrow on the stubble. It is important that the stubble be cut high enough so that it will hold the cut grain and allow air to circulate underneath and cure it quickly. The grain is laid in the windrow with the heads overlapping the butts similar to that in which shingles are laid on a roof. After two or three days of good drying weather, a harvester-thresher equipped with a pick-up device is brought into the field and run in the same direction as the windrow harvester; the grain is picked up just as a man would raise shingles from a roof and goes into the combine to be threshed and handled from there on just as if it were being cut from the stubble in the usual manner. The windrow method has been developed to supplement the combine method of harvesting; its use is especially advantageous where grain is weedy or ripens unevenly or weather hazards are prevalent at the time of harvesting. Frequently a farmer begins his harvest by windrowing his grain and later when conditions are right he removes the pick-up device from the harvester-thresher and finishes the harvest by the straight combine method.

There are several types of combines now in use. The large machine developed for use in the Great Plains is now equipped with an auxiliary engine and may be pulled by horses or tractor. It is made in sizes that cut from 9 to 24 ft. swaths. Machines of this type cutting from 9 to 12 ft. swaths are used somewhat in the Corn Belt and require from 6 to 8 horses, or tractors of 12 to 15 drawbar horse-power. On the hilly farms in the Pacific North-west as many as 30 horses are sometimes used.

Another type of combine introduced in 1926 cuts a 9 or 10 ft. swath and is drawn by a tractor with a direct power drive from the tractor to operate the cutting and threshing machinery. This type can be operated by one man and has the further advantage of being less expensive than the large combines with auxiliary motors.

The smallest type of combine now on the market, also introduced in 1926, is one mounted on the tractor from which it obtains its power. It cuts an 8-ft. swath, the cutter bar being directly in front of the tractor. It also differs radically from all others in that an auger is used instead of canvases on the cutting platform. This small power machine is used mostly on farms which have small acreages of grain.

Combines can be equipped with grain tanks to store the grain until it can be run into a motor truck for hauling to the farm or market. Where wagons are used for hauling the grain away from the combine the grain is usually run directly into a trailing wagon When one wagon is full, another is substituted to catch the grain while the loaded one is hauled away. The straw is spread behind the machine uniformly over the land by means of special equipment for the purpose. It can then be plowed under without difficulty. Without the straw-spreader equipment the straw is left in a narrow strip and must be raked into piles for burning or hauling.

Mechanical Cotton-harvesters.—Until recent years the world's cotton crop was harvested entirely by hand. The first application of mechanical principles in harvesting the crop in the United States was in connection with the sled or stripper devised for pulling or snapping cotton. This rather primitive, or home-made, affair was an outgrowth of the practice of farmers in certain parts of Texas and Oklahoma who began along about 1900 to pull or snap their cotton by hand. In those regions early frosts made it difficult to pick the cotton in the usual manner as the plants become too brittle for picking the bolls without pulling the entire burr. Adverse weather conditions at cotton picking time, low prices for cotton, and scarcity of labour also were factors making it necessary to adopt rapid and more economical methods of harvesting. The sled method based on the hand method of pulling or snapping was developed under these conditions along about 1918 and used successfully for several seasons but did not come into prominence until the fall of 1926 when Western farmers again suffered from adverse economic conditions.

Two main types of sleds, the finger type and the slot type, are now in general use. The sleds are commonly drawn by two horses and operated by one or two men. The finger type is adapted to small cotton of the kind grown in the Staked Plains area, and the slot type for use in the bottom lands of the plains area where cotton grows more vigorously and taller. The finger type is characterized by toothed arrangements, not unlike mower guards,

attached to the front of the sled where they strip all bolls from the stalks as one strips leaves from a tree branch by drawing it through the fingers of the hand. The harvested cotton falls or is raked back into a box for holding until the end of the row is reached.

The slot type differs from the finger type in that the stripping action is done by narrow slots running through the centre of the sled from front to rear. The slots become narrow and slope upward toward the rear of the sled so that the cotton is stripped from the stalks as they pass into the slots. Well-constructed sleds often gather as much as 95% of the cotton from the plants.

Recently manufacturers of farm machinery have made marked progress in developing an improved harvester of the sled type. The slot idea is retained but the cotton is stripped from the plants by revolving rollers, or by lugs attached to endless chains. The snapping rolls are either twisted, perforated, or spiked to provide a rough surface for removing the cotton from the plants The stripped cotton is either raked or conveyed from beneath the snapping rolls to a box in the rear, provision being made in some cases to screen out some of the dirt and trash. The endless chain type, however, has no separate conveyor as the stripper fingers convey the cotton to the box

The newest mechanical cotton pickers are known as the spindle type and have been built to operate with horses or tractor While these machines are still regarded as in the experimental stage, they have made satisfactory field tests during the past season. The cotton row passes between two revolving cylinders set upright. The cylinders are filled with numerous spindles covered with barbs that catch the cotton and wind it around the spindles. A sleeve arrangement over each spindle automatically slips the cotton off and it is blown into sacks at the rear of the machine. With the development of these machines, as well as improved sled harvesters, a good start has been made toward placing the harvesting of the cotton crop on a mechanical basis

Hay Stacking Machinery.—In western United States where hay is largely stacked in the field instead of being stored in the barn, stacking machinery is used to eliminate much of the hand labour. Stackers can be used to advantage on many farms in other parts of the country as well as in the West, especially when farm labour is scarce. They enable the farmer to handle hay more rapidly than by other methods and usually a smaller number of men will be required. Boys often replace men in some operations when stackers are employed. Loading the hay on wagons by hand and unloading it with a stacker eliminates half of the hand labour. If push rakes or hay loaders are used to move the hay to the stack, pitching by hand is avoided entirely.

There are two principal types of stackers in common use. One type handles the hay by means of the single or double harpoon fork, grapple fork, or sling, and the other type has long wooden teeth similar to those of the push rake on which the hay is placed for elevating to the top of the stack.

Stackers of the first type are usually home-made affairs and are represented by the cable stacker, the pole or derrick stacker, and the tripod stacker. With the cable stacker hay is brought to the stack on wagons or by push rakes. The load is elevated by forks or slings to a carrier which runs on the cable and deposits the load at any desired point on the top of the stack between the poles. The height and length of the stack is limited only by the height of the poles and the length of the cable used. The pole or derrick stacker consists of a single pole set upright and of sufficient length to make a stack of the desired height. A shorter pole (or boom) is fastened at right angles near the top of the upright pole. By means of ropes and pulleys one or two horses elevate the fork or sling load of hay to the outer end of the boom pole which is then swung over the stack where the load is dropped. The upright pole is anchored by means of guy wires. The tripod stacker has 3 poles above 30 ft. long, bolted together at the top and spread out at the bottom far enough to permit a stack to be built under the tripod. The equipment for this outfit consists of three pulleys, a hay rope, a trip rope, and a horse fork.

The second type of stacker is represented by the "overshot," the "swing around," and the "combination." Each of these has long wooden teeth, like those of the push rake, on which hay brought from the windrow by push rakes is deposited for elevation to the top of the stack. The overshot stacker is so called because the hay is carried up and over the stacker frame and dropped on the stack. On some forms the stacker head merely slides up an inclined plane and dumps its load on the stack, while on others the stacker head is attached to a frame-work which vaults it up and over. These stackers are mounted on wheels or sled-like frames to facilitate their movement from place to place in the field. The swing around stacker is similar to the overshot except that the stacker head is attached to an arm balanced like an old-fashioned well sweep over the top of a high upright pole. A weight at the far end of the arm counterbalances the load of hay and helps to lift it This stacker has the advantage of being able to deliver the hay at any desired point on the top of the stack. The combination stacker does the work of both the stacker and the push rake. Stacks a little more than 20 ft high can be made with the combination stacker. It is most commonly used around the stack to pick up the loads brought in by push rakes, depositing them on the stack from either side or end. In all types of stackers one or two horses furnish the power to elevate the loads of hay to the top of the stack (L. S. R)

HARVEY, FREDERICK WILLIAM (1888–), English poet, was born in Gloucestershire. He was educated at Rossall, and studied law, setting up in practice as a solicitor in 1912. He enlisted at the outbreak of the World War, obtaining a commission in 1915, and was captured in 1916. After the war he returned to his solicitor's practice. In addition to four volumes of poetry, he published his experiences as a prisoner in Germany in *Comrades in Captivity* (1920).

His poetry includes: *A Gloucester Lad at Home and Abroad* (1916); *Gloucestershire Friends* (1917); *Ducks* (1919), and *Farewell* (1921).

HARVEY, GABRIEL (*c.* 1545–1630), English writer, eldest son of a ropemaker of Saffron-Walden, Essex, was born about 1545. He matriculated at Christ's college, Cambridge, in 1566, and in 1570 was elected fellow of Pembroke Hall. Here he formed a lasting friendship with Edmund Spenser, and it has been suggested (*Athen. Cantab.* ii 258) that he may have been the poet's tutor. Harvey was a good scholar, who has perhaps been judged too exclusively from the brilliant invectives directed against him by Thomas Nashe (*q.v.*). Harvey desired to be "epitaphed as the Inventour of the English Hexameter," and was the prime mover in the literary clique that desired to impose on English verse the Latin rules of quantity. In a "gallant, familiar letter" to M. Immerito (Edmund Spenser) he says that Sir Edward Dyer and Sir Philip Sidney were helping forward "our new famous enterprise for the exchanging of Barbarous and Balductum Rymes with Artificial Verses." The document includes a tepid appreciation of the *Faerie Queene* which had been sent to him for his opinion, and he gives examples of English hexameters illustrative of the principles enunciated in the correspondence. The opening lines—

"What might I call this Tree? A Laurell? O bonny Laurell
Needes to thy bowes will I bow this knee, and vayle my bonetto"—

are sufficient to show that Harvey's metrical experiments presented a fair mark for Nashe's wit. "He (Harvey) goes twitching and hopping in our language like a man running upon quagmires, up the hill in one syllable, and down the dale in another," says Nashe in *Strange Newes,* and he mimics him in the mocking couplet:

"But eh! what news do you hear of that good Gabriel Huffe-Snuffe,
Known to the world for a foole, and clapt in the Fleete for a Runner?"

Harvey exercised great influence over Spenser for a short time, and the friendship lasted even though Spenser's genius refused to be bound by the laws of the new prosody. Harvey is the Hobbinoll of his friend's *Shepheards Calender,* and into his mouth is put the beautiful song in the fourth eclogue in praise of Eliza. If he was really the author of the verses "To the Learned Shepheard" signed "Hobynoll" and prefixed to the *Faerie Queene,* he was a good poet spoiled. But Harvey's genuine friendship for Spenser shows the best side of a disposition uncompromising and quarrel-

some towards the world in general. In 1573 ill-will against him in his college was so strong that there was a delay of three months before the fellows would agree to grant him the necessary grace for his M.A degree. He became reader in rhetoric about 1576, and in 1578 disputed publicly before Queen Elizabeth on her visit to Sir Thomas Smith at Audley End. In 1585 he was elected master of Trinity Hall, of which he had been a fellow from 1578, but the appointment appears to have been quashed at court. Gabriel's brother, Richard, had taken part in the Marprelate controversy, and had given offence to Robert Greene (*q.v.*) by contemptuous references to him and his fellow wits. Greene retorted in his *Quip for an Upstart Courtier* with some scathing remarks on the Harveys, the worst of which were expunged in later editions, drawing attention among other things to Harvey's modest parentage. After Greene's death Harvey published *Foure Letters and certaine Sonnets* (1592), in which in a spirit of righteous superiority he laid bare with spiteful fulness the miserable details of Greene's later years For the controversy with Nashe which followed *see* NASHE, THOMAS. In 1599 Archbishop Whitgift made a raid on contemporary satire in general, and among other books the tracts of Harvey and Nashe were destroyed, and it was forbidden to reprint them. Harvey spent the last years of his life in retirement at his native place, dying in 1630.

The Letter-Book of Gabriel Harvey, A.D. 1573–80 (1884, ed. E. J. L Scott, Camden Society), contains rough drafts of the correspondence between Spenser and Harvey, letters relative to the disputes at Pembroke Hall, and an extraordinary correspondence dealing with the pursuit of his sister Mercy by a young nobleman.

Harvey's complete works were edited by Dr. A. B. Grosart with a "Memorial Introduction" for the *Huth Library* (1884–85). G C. Stone-Smith edited other fragments as *Marginalia* (Stratford-on-Avon, 1913). *See* also Isaac Disraeli, on "Literary Ridicule," in *Calamities of Authors* (ed., 1840); T Warton, *History of English Poetry* (ed. W. C. Hazlitt, 1871); J. P. Collier, *Bibliographical and Critical Account of the Rarest Books in the English Language* (1865), and the *Works* of Thomas Nashe.

HARVEY, SIR GEORGE (1806–1876), Scottish painter, son of a watchmaker, was born at St Ninians, near Stirling, and died at Edinburgh on Jan. 22, 1876. He became a fellow of the Royal Scottish academy in 1829, and its president in 1864. Harvey painted some pictures on subjects drawn from religious and Scottish history, but his best work is in *genre* pictures of Scottish life.

HARVEY, GEORGE BRINTON McCLELLAN (1864–1928), American editor and diplomat, was born in Peacham (Vt.), Feb. 10, 1864. At eighteen he became a reporter on the *Springfield* (Mass.) *Republican*, and later on the *Chicago News* and the *New York World* He was insurance commissioner of New Jersey in 1890–91 and managing editor of the *New York World*, 1891–93 Then for several years he was engaged in the construction and administration of electric railways, and in 1898 organized a syndicate which secured possession of the lines in Havana, Cuba. The following year he purchased the *North American Review*, which he thereafter edited. During 1900–15 he was president of the publishing house of Harper & Bros., and during 1902–13 was editor of *Harper's Weekly*. In 1903 he purchased the *Metropolitan Magazine*.

Harvey was said to have been the first to suggest (in 1906) Woodrow Wilson, then president of Princeton, as a presidential possibility. In the campaign of 1912 he gave Wilson strong support, but after the latter's nomination an estrangement developed. In 1916 Harvey urged the election of Charles E. Hughes, the Republican candidate for president. He was strongly opposed to the League of Nations on the ground that it involved the yielding of national sovereignty. In 1918 he established the *North American Review's War Weekly*, later called *Harvey's Weekly*, which bitterly denounced the Wilson administration. In 1921 he was appointed ambassador to England by President Harding, a position which he held till Dec. 1923 He was editorial director of the *Washington Post* in 1924–25. He died at Dublin (N.H.) Aug. 20, 1928.

Harvey's books include *Women* (1908), *The Power of Tolerance, and Other Speeches* (1911), and *Henry Clay Frick, the Man* (1928).

HARVEY, WILLIAM (1578–1657), English physician, the discoverer of the circulation of the blood, was born at Folkestone on April 1, 1578. He was educated at Caius college, Cambridge, and then proceeded to Padua to study medicine under H. Fabricius and became doctor of medicine in April 1602. Returning to England, he settled in London. He was admitted (June 1607) fellow of the Royal College of Physicians, and in 1609 obtained the reversion of the post of physician to St. Bartholomew's hospital, and in the course of the same year he succeeded to the post.

In 1616 he began a course of lectures at the College of Physicians in which he first brought forward his views upon the movements of the heart and blood. Meantime his practice increased, and he had the lord chancellor, Francis Bacon, and the earl of Arundel among his patients. He was physician extraordinary to James I., and physician in ordinary to Charles I. In 1628 he published the *Exercitatio anatomica de motu cordis et sanguinis;* between 1629 and 1632 he travelled on the Continent, principally in Italy with James Stuart, afterwards duke of Richmond Four years later he accompanied the earl of Arundel on his embassy to the emperor Ferdinand II. He returned to his practice in London at the close of the year 1636, and accompanied Charles I. in one of his journeys to Scotland (1639 or 1641), and was in attendance on the king at the battle of Edgehill (Oct. 1642), and then followed Charles I to Oxford.

While with the king at Oxford he was made warden of Merton college, but a year later, in 1646, that city surrendered to Fairfax, and Harvey returned to London. He was now 68 years old, and, having resigned his appointments and relinquished the cares of practice, lived in learned retirement with one or other of his brothers. It was in his brother Daniel's house at Combe that Dr. (afterwards Sir George) Ent, a faithful friend and disciple (1604–89), visited him in 1650. The work on which he had been chiefly engaged at Oxford, and indeed since the publication of his treatise on the circulation in 1628, was an investigation into the subject of generation. Charles I. had put the royal deer parks at Windsor and Hampton Court at his disposal, and had watched his demonstration of the growth of the chick with no less interest than the movements of the living heart. Harvey had collected a large number of observations, and Ent succeeded in obtaining the manuscripts, with authority to print them or not. The result was the publication of the *Exercitationes de generatione* (1651).

This was the last of Harvey's labours. He had now reached his 73rd year His theory of the circulation was generally accepted by the most eminent anatomists both in his own country and abroad and he was known and honoured throughout Europe. In 1654 he was elected president of the College of Physicians but declined the honour, though he enriched the college with many gifts.

Harvey died on June 3, 1657, and was buried at Hempstead, Essex; in 1883 his remains were placed in the Harvey chapel in the church there.

John Aubrey says: "In person he was not tall, but of the lowest stature; round faced, olivaster complexion, little eyes, round, very black, full of spirits; his hair black as a raven, but quite white 20 years before he died." The best known portrait of him extant is by Cornelius Jansen in the library of the College of Physicians.

Harvey's Work on the Circulation.—In estimating the character and value of the discovery announced in the *Exercitatio de motu cordis et sanguinis*, it is necessary to bear in mind the previous state of knowledge. Aristotle taught that the blood was elaborated from the food in the liver, thence carried to the heart, and sent through the veins over the body. The Alexandrian physicians, Erasistratus and Herophilus, taught that, while the veins carried blood from the heart to the members, the arteries carried a subtle kind of air or spirit. Galen discovered that the arteries were not, as their name implies, mere air-pipes, but that they contained blood as well as vital air or spirit and he believed that the nerves (νεῦρα) arose from the brain and conveyed "animal spirits" to the body. The views of Galen remained current till the 16th

century. The physicians of that period had developed certain doctrines concerning the vascular system which we may thus summarize: *First*, the blood is not stagnant, but moves in the body. But no one had a conception of a continuous stream returning to its source (a circulation in the true sense of the word) either in the system or in the lungs. If they used the word *circulatio*, as did Caesalpinus, it was as vaguely as the French policeman cries "Circulez." The movements of the blood were in fact thought to be slow and irregular in direction as well as in speed, like the "circulation" of air in a house, or of a crowd in the streets. *Secondly*, they supposed that one kind of blood flowed from the liver to the right ventricle of the heart, and thence to the lungs and the general system by the veins, and that another flowed from the left ventricle to the general system by the arteries. *Thirdly*, they supposed that the septum of the heart was pervious and allowed blood to pass directly from the right to the left side. *Fourthly*, they had no conception of the functions of the heart as the motor power of the movement of the blood. They doubted whether its substance was muscular; they supposed its pulsation, like that of the arteries, to be due to expansion of the contained spirits.

Of the great anatomists of the 16th century, Vesalius (*De humani corporis fabrica*, 1542) ascertained that the septum between the right and left ventricles is complete, though he could not bring himself to deny the invisible pores which Galen's system demanded. Servetus, in his *Christianismi restitutio* (1553), goes somewhat farther, and, from this anatomical fact and the large size of the pulmonary arteries he concludes that there is a communication in the lungs by which blood passes from the pulmonary artery to the pulmonary vein. It seems doubtful whether even Servetus rightly conceived of the entire mass of the blood passing through the pulmonary artery and the lungs. Indeed, a true conception of the lesser circulation as a transference of the whole blood of the right side to the left was impossible until the corresponding transference in the greater or systematic circulation was discovered. Lastly, the system of valves in the veins had been elaborately set forth and illustrated by Harvey's own teacher Fabricius.

The way then to Harvey's great work had been paved by the discovery of the valves in the veins, and by that of the lesser circulation, but the significance of the valves was unsuspected and the fact of even the pulmonary circulation was not generally admitted.

In his treatise Harvey proves (1) that it is the contraction, not the dilatation, of the heart which coincides with the pulse, and that the ventricles, as true muscular sacs, squeeze the blood which they contain into the aorta and pulmonary artery; (2) that the pulse is produced by the arteries being filled with blood; (3) that there are no pores in the septum of the heart, so that the whole blood in the right ventricle is sent to the lungs and round by the pulmonary veins to the left ventricle, and also that the whole blood in the left ventricle is again sent into the arteries, round by the smaller veins into the venae cavae, and by them to the right ventricle again—thus making a complete "circulation"; (4) that the blood in the arteries and that in the veins is the same blood; (5) that the action of the right and left sides of the heart, auricles, ventricles and valves, is the same, the mechanism in both being for reception and propulsion of liquid and not of air; (6) that the blood propelled through the arteries to the tissues is not all used, but that most of it runs through into the veins; (7) that there is no to-and-fro undulation in the veins, but a constant stream from the distant parts towards the heart; (8) that the dynamical starting-point of the blood is the heart and not the liver.

The *method* by which Harvey arrived at his solution of the most fundamental and difficult problem in physiology is well worthy of attention. He had not only furnished himself with all the knowledge that books and the instructions of the best anatomists of Italy could give, but, by a long series of dissections, had gained a far more complete knowledge of the comparative anatomy of the heart and vessels than any contemporary. Thus equipped, he tells us that he began his investigations into the movements of the heart and blood by seeing their action in living animals. He minutely describes what he saw and handled in dogs, pigs, serpents, frogs and fishes, and even in slugs, oysters, lobsters and insects, in the transparent shrimp, and lastly in the chick while still in the shell. He particularly describes his observations and experiments on the ventricles, the auricles, the arteries and the veins. He shows how the arrangement of the vessels in the foetus supports his theory. He adduces facts observed in disease as well as in health to prove the rapidity of the circulation. He explains how the mechanism of the valves in the veins is adapted to favour the flow of the blood to the heart. He estimates the capacity of each ventricle, and reckons the rate at which the whole mass of blood passes through it. He elaborately and clearly demonstrates the effect of obstruction of the bloodstream in arteries or in veins, by the forceps in the case of a snake, by a ligature on the arm of a man, and illustrates his argument by figures. These results can only be explained by the constant circulation of the same blood. Lastly, in the 15th, 16th and 17th chapters, he adds certain confirmatory evidence, as to the effect of position on the circulation, the absorption of animal poisons and of medicines applied externally, the muscular structure of the heart and the necessary working of its valves. The whole treatise, which occupies only 52 pages of print, is a model of accurate observation, patient accumulation of facts, ingenious experimentation, cautious hypothesis and logical deduction.

In one point only was the demonstration of the circulation incomplete. Harvey did not see the capillary channels by which the blood passes from the arteries to the veins. This gap in the circulation was supplied thirty years later by the great anatomist Marcello Malpighi, who described the capillary circulation four years after Harvey's death. But the existence of the channels first seen by Malpighi was already clearly pointed to by Harvey's reasoning.

Harvey's Work on Generation.—The *Exercitationes de generatione* is between five and six times as long as the *Exerc. de motu cord. et sang.*, and is followed by excursus *De partu, De uteri membranis, De conceptione;* but, though the fruit of as patient and extensive observations, its value is far inferior. The subject was more abstruse, and inaccessible to proper investigation without the aid of the microscope. Fabricius, Harvey's master, in his work *De formatione ovi et pulli* (1621) and another pupil of Fabricius, Volcher Coiter (1534–?) of Nuremberg, were among the few who had preceded Harvey in modern times. The 72 chapters which form the book lack the co-ordination so conspicuous in the earlier treatise, and some of them seem almost like detached chapters of a system which was never completed or finally revised.

Aristotle had believed that the male parent determined the form of the future embryo, while the female only nourished and nursed the seed. Galen taught that each parent contributes seeds, the union of which produced the young animal. Harvey, after speaking with due honour of Aristotle and Fabricius, begins "ab ovo," for he says, "almost all animals, even those which bring forth their young alive, and man himself, are produced from eggs." This dictum, usually quoted as *omne vivum ex ovo*, was a prevision of genius, and was not proved until K. E. von Baer discovered the mammalian ovum in 1827. Harvey proceeds with a careful anatomical description of the ovary and oviduct of the hen, describes the new-laid egg, and then gives an account of the appearance seen on the successive days of incubation. Commenting on Aristotle and Fabricius, he declares against spontaneous generation, proves that there is no *semen foemineum*, that the chalazae of the hen's eggs are not the *semen galli*, and that both parents contribute to the formation of the egg. He describes accurately the first appearance of the ovarian ova as mere specks, their assumption of yolk and afterwards of albumen. He describes two methods of production of the embryo from the ovum: one is *metamorphosis*, or the direct transformation of pre-existing material, as a worm from an egg, or a butterfly from an *aurelia* (chrysalis); the other is *epigenesis*, or development with addition of parts, the true generation observed in all higher animals. Chapters xlvi.–l. are devoted to the abstruse question of the

efficient cause of generation, which, after much discussion of the opinions of Aristotle and of Sennertus, Harvey refers to the action of both parents as the efficient instruments of the first great cause. He then goes on to describe the order in which the several parts appear in the chick. He states that the *punctum saliens* or foetal heart is the first organ to be seen, and explains that the nutrition of the chick is not only effected by yelk conveyed directly into the midgut, as Aristotle taught, but also by absorption from yelk and white by the umbilical (omphalomeseraic) veins; on the fourth day of incubation appear two masses (which he oddly names *vermiculus*), one of which develops into three vesicles, to form the cerebrum, cerebellum and eyes, the other into the breastbone and thorax; on the sixth or seventh day come the viscera, and lastly, the feathers and other external parts. Harvey points out how nearly this order of development in the chick agrees with what he had observed in mammalian and particularly in human embryos. He notes the bifid apex of the foetal heart in man and the equal thickness of the ventricles, the soft cartilages which represent the future bones, the large amount of liquor amnii and absence of placenta which characterize the foetus in the third month; in the fourth the position of the testes in the abdomen, and the uterus with its Fallopian tubes resembling the uterus bicornis of the sheep; the large thymus; the caecum, small as in the adult, not forming a second stomach as in the pig, the horse and the hare; the lobulated kidneys, like those of the seal (*"vitulo,"* sc. *marino*) and porpoise, and the large suprarenal veins, not much smaller than those of the kidneys (li.-lvi.). He failed, however, to trace the connection of the urachus with the bladder. In the following chapters (lxiii.-lxxii.) he describes the process of generation in the fallow deer or the roe. Much of Harvey's work on generation was superseded during the next 25 years by that of Malpighi. The remaining writings of Harvey are unimportant.

Of Harvey as a practising physician we know very little. Aubrey tells us that "he paid his visits on horseback with a footcloth, his man following on foot, as the fashion then was." He adds—"Though all of his profession would allow him to be an excellent anatomist, I never heard any that admired his therapeutic way. I knew several practitioners that would not have given threepence for one of his bills" (the apothecaries used to collect physicians' prescriptions and sell or publish them to their own profit), "and that a man could hardly tell by his bill what he did aim at." However this may have been, and rational therapeutics was impossible when the foundation stone of physiology had only just been laid, we know that Harvey was an active practitioner, performing such important surgical operations as the removal of a breast, and he turned his obstetric experience to account in his book on generation. Some good practical precepts as to the conduct of labour are quoted by Percivall Willughby (1596–1685). He also took notes of the anatomy of disease; these unfortunately perished with his other manuscripts. We may regard him as a forerunner of Morgagni, for Harvey saw that pathology is but a branch of physiology, and like it must depend on accurate anatomy. He speaks to this purpose in his first epistle to Riolan. The only specimen we have of his observations in morbid anatomy is his account of the post-mortem examination made by order of the king on the body of the famous Thomas Parr, who died in 1635, at the reputed age of 152. Harvey insists on the value of physiological truths for their own sake, independently of their immediate utility; but he himself gives us an interesting example of the practical application of his theory of the circulation, in the cure of a large tumour by tying the arteries which supplied it with blood (*De generat.* Exerc., xix.).

BIBLIOGRAPHY.—The following is believed to be a complete list of all the known writings of Harvey, published and unpublished:—*Exercitatio anatomica de motu cordis et sanguinis,* (Frankfort-on-Main, 1628); *Exercitationes duae anatomicae de circulatione sanguinis, ad Johannem Riolanum, filium, Parisiensem* (Cambridge, 1649); *Exercitationes de generatione animalium, quibus accedunt quaedam de partu, de membranis ac humoribus uteri, et de conceptione* (1651); *Anatomia Thomae Parr,* first published in the treatise of Dr. John Betts, *De ortu et natura sanguinis* (1669). Letters: To Caspar Hoffmann of Nuremberg, May 1636; to Schlegel of Hamburg, April 1651; three to Giovanni Nardi of Florence, July 1651, Dec. 1653, and Nov. 1655; two to Dr. Morison of Paris, May 1652; two to Dr. Horst of Darmstadt, Feb. 1654–55 and July 1655; to Dr. Vlackveld of Haarlem, May 1657. His letters to Hoffman and Schlegel are on the circulation; those to Morison, Horst and Vlackveld refer to the discovery of the lacteals; the two to Nardi are short letters of friendship. All these letters were published by Sir George Ent in his collected works (Leyden, 1687). Of two ms. letters, one, on official business to the secretary, Dorchester, was printed by Dr. Aveling, with a facsimile of the crabbed handwriting (*Memorials of Harvey,* 1875), and the other, about a patient, appears in Dr. Robert Willis's *Life of Harvey* (1878). *Praelectiones anatomiae universalis per me Gul. Harveium medicum Londinensem, anat. et chir. professorem, an. dom.* (1616), *aetat.* 37,—ms. notes of his Lumleian lectures in Latin—are in the British Museum library; an autotype reproduction was issued by the College of Physicians in 1886. An account of a second ms. in the British Museum, entitled *Gulielmus Harveius de musculis, motu locali,* etc., was published by Sir G. E. Paget (*Notice of an unpublished ms. of Harvey,* 1850). The following treatises, or notes towards them, were lost either in the pillaging of Harvey's house, or perhaps in the Fire of London, which destroyed the old College of Physicians: *A Treatise on Respiration,* promised and probably at least in part completed (pp. 82, 550, ed. 1766); *Observationes de usu Lienis; Observationes de motu locali,* perhaps identical with the above-mentioned manuscript; *Tractatum physiologicum; Anatomia medicalis* (apparently notes of morbid anatomy); *De generatione insectorum.* The fine edition of Harvey's *Works,* published by the Royal College of Physicians in 1766, was superintended by Dr. Mark Akenside; it contains the two treatises, the account of the post-mortem examination of old Parr, and the six letters enumerated above. A translation of this volume by Dr. Willis, with Harvey's will, was published by the Sydenham Society (1847).

A copy of the *De generatione* with numerous notes in Harvey's own hand, referring chiefly to his reading of Aristotelian works, is in private possession.

There is a convenient photographic facsimile of the work on the circulation issued by C. Moreton (1894). The standard translation of his collected works is still that of Thomas Willis (1847). A convenient reprint of the translation by Willis of the work on the circulation is available (1906).

The literature that has arisen on Harvey and his great discovery would fill a library. A bibliography by Geoffrey Keynes has been published (1928), and a further account of the works of Harvey on the occasion of the celebration of the tercentenary of the publication of the work on the circulation by the Royal College of Physicians, London (1928). Of recent writings on Harvey mention may be made of the life by D'Arcy Power (1897); the facsimile of Harvey's Paduan diploma issued by the Royal College of Physicians, with pamphlet by J. F. Payne (1908); the volume of *Portraits of Harvey* published by the Historical Section of the Royal Society of Medicine (1913). The Harveian oration at the Royal College of Physicians is devoted to an annual exposition of some part of his work. Among the recent orations are those by W. Osler, *The Growth of Truth* (1906); H. R. Spencer, *William Harvey, Obstetric Physician and Gynaecologist* (1921); A. Chaplin, *Medicine in the Century before Harvey* (1922); C. Singer, *Discovery of the Circulation of the Blood* (1922) gives an exposition of the history of this event.

(P. H. P.; C. Sl.)

HARVEY, WILLIAM HENRY (1811–1866), Irish botanist, was born on Feb. 5, 1811, at Summerville, near Limerick, and was educated at Kildare. He became an authority on algae and Cape flora, on which he published extensive works. He died at Torquay on May 15, 1866.

HARVEY, a city of Cook county, Ill., U.S.A., 20m. S. of the Chicago "Loop." It is served by the Baltimore and Ohio Chicago Terminal, the Illinois Central, and the Grand Trunk railways and is near the Calumet river. The population was 9,216 in 1920 (22% foreign-born white), and was estimated locally at over 20,000 in 1928. It is a residential suburb, and also has important manufactures, including mine, oil-well, road and ditching machinery, railway cars, foundry equipment, cement, gas stoves, automobiles, electric travellers and aluminium-ware. Harvey was named for a Chicago capitalist. It was founded in 1890, chartered as a city in 1895, and in 1921 adopted a commission form of government.

HARVEY STEEL PROCESS. Named after the inventor, H. A. Harvey, an American metallurgist, this is a process of hardening the surface of steel, used in the production of armour plate. The essence of the process is that the plate is face-hardened by cementation of its surface. The plate is exposed in a furnace to great heat for a considerable period, about a fortnight, and covered with finely pulverized carbon. The surface of the steel is thus penetrated and carburized to a considerable depth, the front of the plate becoming of a different composition from that of the back. After thus being exposed to cementation, the plate

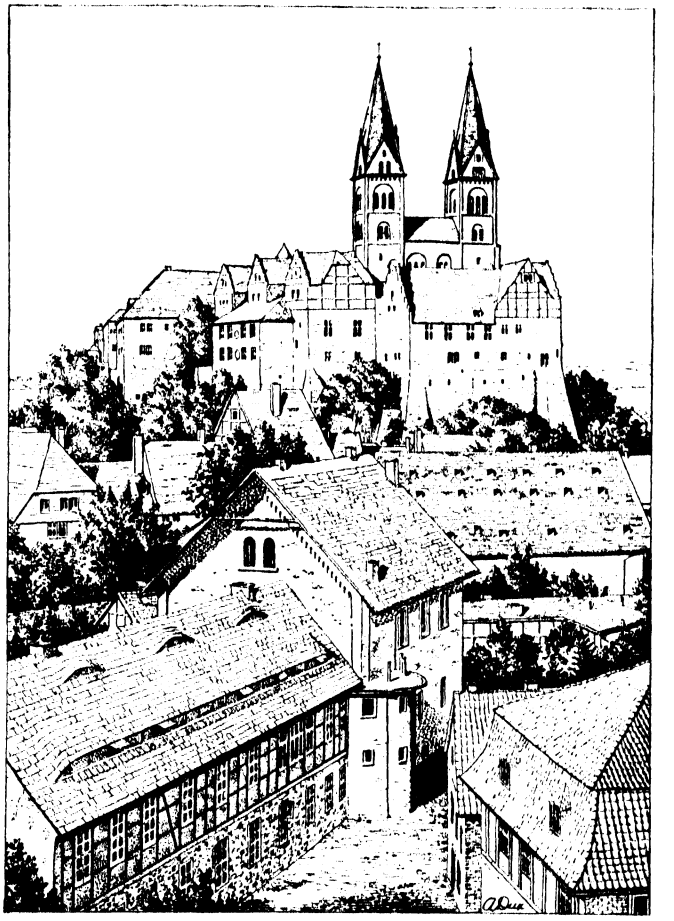
is withdrawn and cooled slowly to a dull red, when it is suddenly chilled by a water spray. (*See* IRON AND STEEL; ARMOUR PLATE; METALLURGY.)

HARWICH, municipal borough and seaport, Harwich parliamentary division, Essex, England, on the extremity of a small peninsula projecting into the estuary of the Stour and Orwell, 70 m. N.E. by E. of London by the L.N.E. railway. Pop. (1921) 13,046, including Halstead, added to the borough in 1917. Harwich (Herewica, Herewyck) formed part of the manor of Dovercourt. It became a borough in 1319 by a charter of Edward II., which was confirmed in 1342 and 1378, and by each of the Lancastrian kings. Harwich received charters in 1547, 1553 and 1560. In 1604 James I. gave it a charter which provided a new constitution, and from this date begins the regular parliamentary representation. Two burgesses had attended parliament in 1343. Until 1867 Harwich returned two members; it then lost one, and in 1885 its representation was merged. In 1252 Henry III. granted to Roger Bigod a market here every Tuesday, and a fair on Ascension day, and eight days after. In 1320 a Tuesday market was granted, but no fair is mentioned. James I. granted a Friday market, and two fairs, at the feast of St. Philip and St. James, and on St. Luke's day. The fair has died out, but markets are still held on Tuesday and Friday. In the 14th century merchants came even from Spain, and there was much trade in wheat and wool with Flanders. But the passenger traffic appears to have been as important at Harwich in the 14th century as it is now. Shipbuilding was a large industry at Harwich in the 17th century.

The town of Harwich occupies an elevated situation, and a wide view is obtained from Beacon hill at the southern end of the esplanade. The harbour is one of the best on the east coast of England, and in stormy weather is largely used for shelter, and ships drawing 17 ft. can enter at low water. A breakwater and seawall prevent the blocking of the harbour entrance and encroachments of the sea; and there is another breakwater at Landguard point on the opposite (Suffolk) shore of the estuary. The principal imports are grain and agricultural produce, timber and coal, fruit, vegetables, cattle and horses and the exports cement, horses and fish. Harwich is one of the principal English ports for continental passenger traffic, steamers regularly serving the Hook of Holland, Amsterdam, Rotterdam, Antwerp, Esbjerg, Zeebrugge, Copenhagen and Hamburg. A train ferry to Zeebrugge was inaugurated in 1924. The continental trains of the L.N.E. railway run to Parkeston quay, 1 m. from Harwich up the Stour, where the passenger steamers start. The fisheries are important, principally those for shrimps and lobsters. There are cement and shipbuilding works. There are several of the Martello towers of the Napoleonic era. Between the Parkeston Quay and Town railway stations is that of Dovercourt, a popular watering-place now united with Harwich. Harwich is the most important naval base on the east coast.

HARZBURG, a town of Germany, in the republic of Brunswick, situated at the northern foot of the Harz mountains, at the terminus of the railway from Brunswick, 5 m. E.S.E. from Goslar and 18 m. S. from Wolfenbüttel. Pop. (1925) 6,198. The town is a spa and possesses brine and carbonated springs. A mile and a half south from the town lies the Burgberg, 1,500 ft. above sea-level, with remains of an old castle and, according to tradition, formerly an altar to the heathen god Krodo, still to be seen in the Ulrich chapel at Goslar.

HARZ MOUNTAINS, the most northerly mountain-system of Germany, situated between the rivers Weser and Elbe, occupy an area of 784 sq.m. Their greatest length extends in a south-east and north-west direction for 57 m. and their maximum breadth is about 20 m. An irregular series of terraced plateaus rises here and there into rounded summits, and is intersected by narrow, deep valleys. The north-western and higher part is Ober or Upper Harz; the south-eastern and more extensive part, Unter or Lower Harz; while the north-west and south-west slopes of the Upper Harz form the Vorharz. The Brocken group, dividing the Upper and Lower Harz, is generally classed with the Upper. The Upper Harz includes the Brocken (3,806 ft.), the Heinrichshöhe (3,425 ft.), the Königsberg (3,376 ft.) and the Wurmberg (3,176 ft.); the Lower Harz, the Josephshöhe in the Auerberg group and the Viktorshöhe in the Ramberg, each 1,887 ft. The Brocken (*q.v.*) is celebrated in legends immortalized in Goethe's *Faust*. While useful in working the numerous mines of the district, at other parts of their course the many streams present most picturesque scenery. The finest valley is the rocky Bodethal, with the Ross-



BY COURTESY OF THE GERMAN RAILROAD INFORMATION BUREAU

QUEDLINBURG CASTLE NEAR THE HARZ MOUNTAINS, FOR MANY CENTURIES THE RESIDENCE OF THE ABBESSES OF QUEDLINBURG

trappe, the Hexentanzplatz, the Baumannshöhle and the Bielshöhle.

The Harz is a mass of Palaeozoic rock rising through the Mesozoic strata of north Germany, and bounded on all sides by faults. Slates, schists, quartzites and limestones form the greater part but the Brocken and Viktorshöhe are intrusive granite, and diabases and diabase tuffs are interstratified with sediments. Silurian, Devonian and Carboniferous are represented—the Silurian and Devonian forming the greater part of the hills south-east of a line drawn from Lauterberg to Wernigerode, while north-west of this line the Lower Carboniferous predominates. A few patches of Upper Carboniferous on the borders of the hills near Ilfeld, Ballenstedt, etc., are unconformable upon the Devonian. The general strike of the folds, especially in Oberharz is about north-east. The mass belongs to the Hercynian chain of Europe (which derives its name from the Harz), and continues north-eastwards the Ardennes and Eifel. The folding took place at the close of the Palaeozoic; but the faulting to which they owe their present position was probably Tertiary. Metalliferous veins are common, amongst the best-known being the silver-bearing lead veins of Klausthal, which occur in the Culm or Lower Carboniferous.

Owing to its position as the first range which the northerly winds strike after crossing the north German plain, the climate on the summit of the Harz is generally raw and damp, even in summer. In 1895 an observatory was opened on the top of the Brocken, and the results of the first five years (1896–1900) showed a July mean of 50° Fahr., a February mean of 24·7°, and a yearly

mean of 36·6°. During the same five years the rainfall averaged 64½ in. annually. But while the hill-top summer is thus ungenial, the summer heat of the lower-lying valleys is greatly tempered and cooled; so that, adding this to the scenery, forests and legendary and romantic associations, the Harz is a favourite summer resort. Among the more popular places of resort are Harzburg, Thale and the Bodethal; Blankenburg, with the Teufelsmauer and the Hermannshohle; Wernigerode, Ilsenburg, Grund, Lauterberg, Hubertusbad, Alexisbad and Suderode. Some places also have mineral springs and baths, pine-needle baths, whey cures, etc. The Harz is penetrated by several railways, among them a rack-railway up the Brocken, opened in 1898.

The northern summits are bare, but the lower slopes of the Upper Harz are rich in pines and firs Between the forests stretch numerous peat-mosses, the spongy reservoirs of which are sources of many small streams. On the Brocken are found one or two arctic and several alpine plants In the Lower Harz the forests contain a great variety of timber. The beech attains unusual size and beauty, and the walnut-tree grows in the eastern districts. The last bear was killed in the Harz in 1705, and the last lynx in 1817, and since then the wolf has become extinct; but deer, foxes, wild cats and badgers are still found.

Mining has been carried on since the middle of the 10th century, especially for rich argentiferous lead, but gold in small quantities, copper, iron, sulphur, alum and arsenic are also found. Klausthal and St. Andreasberg in the Upper Harz are the chief centres. Near the latter the Samson shaft goes down 2,790 ft. or 720 ft. below sea-level. For obviating flooding of deep workings, large drainage works have been built. In 1777–1799 the Georgsstollen was cut through the mountains from the east of Klausthal westward to Grund, a distance of 4 m.; the Ernst-Auguststollen, no less than 14 m. in length, was made from the same neighbourhood to Gittelde, at the west side of the Harz, in 1851–1864. Marble, granite and gypsum are worked; and vitriol is manufactured. Much wood is exported for building and other purposes, and it is used locally as fuel. The sawdust of numerous mills is collected for use in paper-making Turf-cutting, coarse lace-making and the breeding of canaries and native song-birds also occupy many of the people. Agriculture is carried on chiefly on the plateaus of the Lower Harz; but there is excellent pasturage both in the north and in the south. In the Lower Harz, as in Switzerland, the cows, which carry bells are driven up into the heights in early summer, returning to the sheltered regions in late autumn.

Upper and Lower Saxon, Thuringian and Frankish stocks have all contributed to form the present people, and their respective influences are still to be traced in the varieties of dialect. The boundary line between High and Low German passes through the Harz. The Harz was the last stronghold of paganism in Germany, and to that fact are due its legends and fanciful names.

See G. Braun, *Deutschland* (Berlin, 1926).

HASĀ, AL, so-called from the springs of its main oasis, is the easternmost province of the kingdom of Najd or Nejd extending S. along the west coast of the Persian gulf, with an average width of 50 m. from the frontier of the Kuwait enclave to Jabrīn on the north edge of the Great South desert. The coast is low and flat, with a deep barrier of sand-dunes between it and the hard desert. Along it are the three ports of Jubail, Qātīf and 'Uqair (ancient Gerrha), the first and last being fair harbours, which of recent years have attracted an increasing amount of trade, while Qātīf is both a sea-port and extensive oasis with palms and other cultivation irrigated by springs. The fort of Qātīf is a strongly-built structure attributed to the Carmathian prince, Abu Tāhir. Inland the southern oasis of Jabrīn was found by Cheesman, in 1923, to be a miserable settlement of palms, the headquarters of the camel-breeding tribe, Al Murra, of the Rub' Al Khālī.

About 150 m. N lies the main oasis, which gives its name to the province and is famous for its many springs, both hot and cold; its prosperous palm groves producing the excellent Khalās variety of date; its Shiā' population; its peculiar breed of large white donkeys; and its many settlements, of which the chief are Hufūf (30,000) and Mubarraz (20,000). The Kūt or fort of Hufūf is attributed to the Carmathians, and its chief architectural feature is the great mosque of Ibrāhīm Pasha, so named after a Turkish governor of the province (not the famous Ibrāhīm Pasha) during the early 19th century. The great market place, or Sūq al Khamīs, is the scene of great activity every Thursday, when a good business is done in the produce of the oasis and the *'abas* (mantles) and leather-work, which are the main features of local industry. 'Ain al Hārra, near Mubarraz, and Umm al Saba' are the most remarkable of the numerous spring-fed pools, from which perennial streams issue for the irrigation of the oasis.

Before the Wahhābī movement of the 18th century, Hasā was ruled by princes of a dynasty called 'Arair. In due course it was absorbed by the Wahhābī empire and, on the destruction of the latter, it came within the orbit of Turkey. Relapsing again under the Wahhābī rule of Faisal ibn Sa'ūd, it was reoccupied in 1875 by Midhat Pasha and remained part of the Turkish province of Najd until 1914, when Abdul'azīz ibn Sa'ūd captured it by a bold *coup-de-main* and ejected the Turkish garrisons from Hufūf, Qātīf and 'Uqair. Since then the province has enjoyed a period of peace and growing prosperity, as testified by several British visitors, the last of whom, Cheesman, spent a considerable time at Hufūf and completed the rough survey which was made in 1920 by Maj. H. R. P. Dickson. The Hasā tribes—'Ajman, Banī Hājir and Banī Khālid—were formerly conspicuous disturbers of the peace, but have been brought under effective control by the present governor, appointed to the post in 1914. The peninsula of Qatar, closing the Gulf of Bahrain on the south, forms geographically part of Hasā, but is administered semi-independently by its Shaikhly family of Ibn Thānī, which acknowledges Ibn Sa'ūd as its suzerain. Part of the prosperity of the Hasā is due to its share in the pearl fisheries along its coast. (H. St. J. B. P.)

HASAN and **ḤOSAIN** (or Ḥusein), sons of the fourth Mohammedan caliph Ali by his wife Fatima, daughter of Mohammed. On Ali's death Ḥasan was proclaimed caliph, but the strength of Moawiya who had rebelled against Ali was such that he resigned his claim on condition that he should have the disposal of the treasure stored at Kufa, with the revenues of Darabjird. This secret negotiation came to the ears of Ḥasan's supporters, a mutiny broke out and Ḥasan was wounded. He retired to Medina where he died about 669. The story that he was poisoned at Moawiya's instigation is generally discredited (*see* Caliphate). Subsequently his brother Ḥosain revolted against Moawiya's successor Yazid, but was defeated and killed at Kerbela on Oct. 10, 680. Ḥosain is the hero of the passion play performed annually (*e.g.*, at Kerbela) on the anniversary of his death by the Shi'ites of Persia and India, to whom the family of Ali are the only true descendants of Mohammed.

See Sir Wm. Muir, *The Caliphate* (1883); Sir Lewis Pelly, *The Miracle Play of Hasan and Hosein* (1879).

HASAN UL-BASRI (Abū Sa'ūd ul-Ḥasan ibn Abī-l-Ḥasan Yassār ul-Baṣrī) (642–728 or 737), Arabian theologian, was born at Medina, the son of a freedman of Zaid ibn Thābit, one of the *Anṣār* (Helpers of the Prophet). He became a teacher of Baṣra and founded a school there, where among his pupils was Wāṣil ibn 'Atā, the founder of the Mo'tazilites. He himself was a great supporter of orthodoxy and practised ascetism. With him fear is the basis of morality, and sadness the characteristic of his religion. In politics he adhered to the earliest principles of Islam, being strictly opposed to the inherited caliphate of the Omayyads and a believer in the election of the caliph.

His life is given in Nawāwī's *Biographical Dictionary* (ed. F. Wüstenfeld, Göttingen, 1842–47). *Cf.* R. Dozy, *Essai sur l'histoire de l'islamisme* (1879); A. von Kremer, *Culturgeschichtliche Streifzüge* (1873); R. A. Nicholson, *A Literary History of the Arabs* (1907).

HASBEYA, a small Druse town of the Beka', situated at the foot of Mt. Hermon, 36 m. W. of Damascus and set in the midst of olives, vines and other fruit trees. Its castle was held by the Crusaders but recaptured by the Druses (1171).

In the immediate neighbourhood is the chief sanctuary of the Druses and the place where the founder of the sect dwelt. A large

number of Christians were massacred here in 1860. In the course of the punitive expedition the sacred and secret books of the Druses were discovered. The ground around Hasbeya is volcanic and there are bitumen pits in the neighbourhood. An identification of the site with the Baal-Gad or Baal-Hermon of the Bible has been suggested. (E. Ro.)

ḤASDAI IBN SHAPRUT (*c.* 915–970/90), the founder of the new culture of the Jews in Moorish Spain in the 10th century, was born at Jaen and died at Córdoba. He was both physician and minister to Caliph Abd ar-Raḥman III. in Córdoba. A man of wide learning and culture, he encouraged the settlement of Jewish scholars in Andalusia, and promoted the Jewish renaissance in Europe.

See article in *Jewish Encyclopedia.*

HASDEU or **HĂJDEU, BOGDAN PETRICEICU** (1836–1907), Rumanian philologist, was born at Khotin, Bessarabia, and studied at the University of Kharkov. In 1858 he first settled in Jassy as professor of the high school and librarian. He may be considered as the pioneer in many branches of Rumanian philology and history. At Jassy he started his *Archiva historica a Romaniei* (1865–67), in which a large number of old documents in Slavonic and Rumanian were published for the first time. In 1870 he inaugurated *Columna lui Traian*, the best philological review of the time in Rumania. In his *Cuvente den Bătrâni* (2 vols., 1878–81) he was the first to contribute to the history of apocryphal literature in Rumania. His *Historia critica a Romanilor* (1875), though incomplete, marks the beginning of critical investigation into the history of Rumania. Hasdeu edited the ancient Psalter of Coresi of 1577 (*Psaltirea lui Coresi*, 1881). In 1876 he was appointed director of the State archives in Bucharest and in 1878 professor of philology at the University of Bucharest. His works include one drama, *Rasvan şi Vidra*. After the death of his only child Julia in 1888 he became a mystic and a strong believer in spiritualism. He died at Campina on Sept. 7, 1907. (M. G.)

HASDRUBAL, the name of several Carthaginian generals, the most important being:

1. The son-in-law of Hamilcar Barca (*q.v.*), who followed the latter in his campaign against the governing aristocracy at Carthage at the close of the First Punic War, and in his subsequent wars in Spain. After Hamilcar's death (228) Hasdrubal, who succeeded him in the command, extended the newly acquired empire by skilful diplomacy, and consolidated it by the foundation of New Carthage (Cartagena) as the capital of the new province, and by a treaty with Rome which fixed the Ebro as the boundary between the two powers In 221 he was killed by an assassin.

Polybius ii. 1; Livy xxi. 1; Appian, *Hispanica*, 4–8.

2. The second son of Hamilcar Barca, and younger brother of Hannibal. Left in command of Spain when Hannibal departed to Italy (218), he fought for six years against the brothers Gnaeus and Publius Scipio. A defeat in 216 prevented him from joining Hannibal in Italy at a critical moment; but in 212 he completely routed his opponents, both the Scipios being killed. He was subsequently outgeneralled by Publius Scipio the Younger, who in 209 captured New Carthage. Nevertheless, he evaded Scipio and broke into Central Italy (207). He was ultimately defeated on the banks of the Metaurus, his head being thrown into Hannibal's camp by order of the Roman general Nero.

Polybius x. 34–xi. 3; Livy xxvii. 1–51; Appian, *Bellum Hannibalicum*, ch. lii. *sqq.*; R. Oehler, *Der letzte Feldzug des Barkiden Hasdrubals* (1897); C. Lehmann, *Die Angriffe der drei Barkiden auf Italien* (Leipzig, 1905). *See* also PUNIC WARS.

HASE, CARL BENEDICT (1780–1864), French Hellenist, of German extraction, was born at Sulza near Naumburg on May 11, 1780, and died in Paris on March 21, 1864. He made his way to Paris on foot in 1801, and from being employed to edit Johannes Lydus by Choiseul-Gouffier, devoted himself to Byzantine studies. In addition to various professorships, in 1812 he was chosen to supervise the studies of Louis Napoleon and his brother. His most important works are the editions of Leo Diaconus and other Byzantine writers (1819), and of Johannes Lydus, *De ostentis* (1823), a masterpiece of textual restoration, the difficulties of which were aggravated by the fact that the ms. had for a long time been stowed away in a wine-barrel in a monastery.

See J. D. Guigniaut, *Notice historique sur la vie et les travaux de Carl Benedict Hase* (1867); articles in *Nouvelle Biographie générale* and *Allgemeine deutsche Biographie;* and a collection of autobiographical letters, *Briefe von der Wanderung und aus Paris*, edited by O. Heine (1894), containing a vivid account of Hase's journey, his enthusiastic impressions of Paris and the hardships of his early life.

HASE, KARL AUGUST VON (1800–1890), German Protestant theologian and Church historian, was born at Steinbach, Saxony on Aug. 25, 1800 He studied at Leipzig and Erlangen, and was professor of theology at Jena from 1829 to 1883 He died at Jena on Jan. 3, 1890. Hase's aim was to reconcile modern culture with historical Christianity in a scientific way. His views are presented scientifically in his *Evangelisch-protestantische Dogmatik* (1826; 6th ed., 1870), the value of which "lies partly in the full and judiciously chosen historical materials prefixed to each dogma, and partly in the skill, caution and tact with which the permanent religious significance of various dogmas is discussed" (Otto Pfleiderer). More popular in style is his *Gnosis oder prot-evang. Glaubenslehre* (3 vols., 1827–29; 2nd ed., 1869–70). But his reputation rests chiefly on his treatment of Church history in his *Kirchengeschichte, Lehrbuch zunächst für akademische Vorlesungen* (1834, 12th ed.; 1900).

For his life *see* his *Ideale und Irrtümer* (1872; 5th ed., 1894) and *Annalen meines Lebens* (1891); R Bürkner, *Karl von Hase* (1900). *See* also O. Pfleiderer, *Development of Theology* (1890); F. Lichtenberger, *Hist. of German Theology* (1889).

HASHISH or **HASHEESH,** the Arabic name, meaning literally "dried herb," for the various preparations of the Indian hemp plant (*Cannabis indica*), used as a narcotic or intoxicant in the East, and either smoked, chewed, or drunk (*see* HEMP and BHANG). From the Arabic hashīshīn, *i.e.*, "hemp-eaters," comes the English "assassin" (*see* ASSASSIN).

HASKOVO, a town in S. Bulgaria, capital of the department of the same name. Pop (1926) 26,366 It is connected by rail with the main Sofia-Constantinople railway. It is an important centre for the tobacco trade of S. Bulgaria. Near by are a natural mineral bath and a coal mine.

HASLEMERE, a market-town in Surrey, England, 43 m. S W. from London by the S R. It is situated in an elevated valley between the ridges of Hindhead (895 ft.) and Blackdown (918 ft.) Their summits are open heath, but their flanks are wooded and deeply scored by steep valleys, of which the most remarkable is the Devil's Punch Bowl, a hollow on the west flank of Hindhead On Blackdown is Aldworth, built for Alfred, Lord Tennyson, who died here in 1892. George Eliot stayed for a considerable period at Shottermill, a neighbouring village. Pop. of Haslemere (1921) 3,865; of Hindhead, 1,536.

HASLER or **HASSLER, HANS LEO** (?1564–1612), German composer, was born at Nuremberg, probably in 1564. He was taught by his father, Isaac Hasler, a musician of some standing in Nuremberg, and afterwards became a pupil of Andrea Gabrieli in Venice. About 1585 he entered the house of the Fuggers at Augsburg and in 1560 was appointed musical director in that city. He next became organist of the Frauenkirche at Nuremberg (1601) and in 1608 entered the service of Christian II. of Saxony. He died on June 8, 1612, at Frankfurt. Hasler is considered the greatest German representative of the Venetian school. His church music is of great beauty but his fame rests on the charm of his secular "songs," which are essentially German in spirit. One of his melodies in the *Lustgarten deutscher Gesänge: "Mein G'müt ist mir verwirret, das macht ein' Jungfrau zart"* was adapted to the chorales "Herzlich tut mich verlangen," "O Haupt voll Blut und Wunden" and others, and appears no fewer than five times in Bach's Matthew Passion.

Hasler's principal works are: *XXIV. Canzonetti a 4 voci* (Nuremberg 1590); *Cantiones sacrae de festis praecipius totius anni 4, 5, 8, et plurium vocum* (Augsburg, 1591); *Concentus ecclesiastici* (Augsburg 1596); Neue teutsche Gesaeng, Madrigali (1596); *Cantiones novae* (1597); 8 Masses (1599); *Lustgarten deutscher Gesänge* (1601, reprinted in *Ges. d. Musikforschung's* publications) Sacri concentus, 5 to 13 v. (Augsburg 1601) *Psalmen u. Gesänge* (Nuremberg 1607, Breitkopf 1777); German and Latin secular songs. Three masses are included in Proske's *Musica divina*, a *Pater noster* in Rochlitz's *Sammlung* vol.

III. and other pieces in Bodenschatz's *Florilegium* and Schadaeus's *Promptuarium musicum*. *See* Eitner: *Quellenlexikon* and a bibl. in *Monatshefte für Musikgeschichte* (1874).

HASLINGDEN, market town, municipal borough, Rossendale parliamentary borough, Lancashire, England, 19 m. N.W. of Manchester by the L.M.S. railway. Pop. (1921) 17,486. The old town stood on the slope of a hill, on the borders of Rossendale forest, but the modern part has extended about its base. The parish church of St. James (rebuilt 1780), still retains a 16th century tower. Woollen manufactures have given place to the manufacture of cotton goods. Engineering works, coal mining, quarrying and brick making are carried on in the neighbourhood. The borough was incorporated in 1891.

HASPE, a town in the Prussian province of Westphalia, on the Dusseldorf-Dortmund railway 10 m. N.E. of Barmen, was raised to the rank of a town in 1873. Pop. (1925) 25,636. Its industries include iron foundries, rolling mills, puddling furnaces and manufactures of iron, steel, brass, aluminium wares and of machines.

HASSAM, CHILDE (1859–), American figure and landscape painter and etcher, was born in Dorchester, now part of the city of Boston, and studied in Boston and Paris. He soon fell under the influence of the Impressionists, and took to painting in a style of his own, in brilliant colour, with effective touches of pure pigment. He won a bronze medal at the Paris Exhibition of 1889; medals at the World's Fair, Chicago, 1893; Boston Art Club, 1896; Philadelphia Art Club, 1892; Carnegie Institute, Pittsburgh, 1898; Buffalo Pan-American, 1901; Temple gold medal, Pennsylvania Academy of Fine Arts, Philadelphia, 1899; silver medal, Paris Exhibition, 1900; and gold medal of honour, Pennsylvania Academy of Fine Arts, 1920; and a gold medal at the Sesquicentennial Exhibition, Philadelphia, 1926.

HASSAN, a town and district of Mysore, India. The town dates from the 11th century and had in 1921 a population of 8,096. The district naturally divides into the Malnad, or hill country, including some of the highest ranges of the Western Ghats, and the Maidan or plain country, sloping towards the south. The Hemavati, which flows into the Cauvery in the extreme south, is the most important river. The upper slopes of the Western Ghats are clothed with forests, and wild animals abound. Minerals found are gold, magnesite, mica, corundum and asbestos. The soil of the valleys is rich red loam. The area is 2,665 sq.m. Population (1921) 583,960. The district contains remarkable monuments, such as the colossal Jain image at Sravana Belgola (a monolith 57 ft. high on the summit of a hill) and the great temple at Halebid Coffee cultivation is largely carried on. The Madras and Southern Mahratta railway traverses the north-east of the district, and Hassan has a station on the line of the Mysore railway from Arsikere to Mysore.

The history of Hassan begins with the Hoysala dynasty, which lasted from the 11th till the 14th century. Their capital was at Dwarasamundra (Dwaravati-pura), the ruins of which are scattered round the village of Halebid. The earlier kings professed the Jain faith, but the finest temples were erected to Siva by later monarchs. At their zenith all south India owned their sway.

HASSANIA, an African tribe of Arab stock. They inhabit the desert between Merawi and the Nile at the 6th cataract, and the left bank of the Blue Nile immediately south of Khartum. *See* H. A. MacMichael, *History of the Arabs of the Sudan* (1922).

HASSĀN IBN THĀBIT (died 674), Arabian poet, was born in Yathrib (Medina), a member of the tribe Khazraj. In his youth he travelled to Hira and Damascus, then settled in Medina, where, after the advent of Mohammed, he accepted Islam and wrote poems in defence of the prophet. His poetry is regarded as lacking in distinction.

His diwan has been published at Bombay (1864), Tunis (1864) and Lahore (1878). *See* H. Hirschfeld's "Prolegomena to an edition of the Diwan of Hassan" in *Transactions of Oriental Congress* (1892).

(G. W. T.)

HASSE, JOHANN ADOLPH (1699–1783), German musical composer, was born at Bergedorf near Hamburg, on March 25, 1699 After singing in a travelling operatic company and at the court theatre of Brunswick, he made his début as a composer at that theatre with the opera *Antigonus*. Afterwards he went to Italy to complete his studies under Porpora, with whom, however, he seems to have disagreed both as a man and as an artist. But he gained the friendship of Alessandro Scarlatti, to whom he owed his first commission for a serenade for two voices, sung by two of the greatest singers of Italy, Farinelli and Signora Tesi. Subsequently his opera *Sesostrato,* written for the Royal Opera at Naples in 1726, made his name known all over Italy. He then spent some years in Venice, where he married (1730) the soprano singer Faustina Bordogni (1693–1783) with whom he was invited by the splendour-loving elector of Saxony, Augustus II. In 1733 Hasse was invited to London by the aristocratic clique inimical to Handel. But he modestly and wisely declined to become the great master's rival, remaining in London only long enough to superintend the rehearsals for his opera *Artaserse* (first produced at Venice, 1730). Meanwhile Faustina had remained at Dresden, the declared favourite of the public and unfortunately also of the elector; her husband, who remained attached to her was only allowed to see her at long intervals. In 1739, after the death of Augustus II., Hasse settled permanently at Dresden till 1763, when he and his wife retired from court service. Later, however, he went with his family to Vienna, and added several operas to the great number of his works already in existence. His last work for the stage was the opera *Ruggiero* (1771), written for the wedding of Archduke Ferdinand at Milan. On the same occasion a work by Mozart, then fourteen years old, was performed, and Hasse observed "this youngster will surpass us all." Hasse died at Venice on Dec. 23, 1783.

His compositions include 120 operas, besides oratorios, cantatas, masses, and many instrumental works, all now forgotten though the popularity which many of them enjoyed during the composer's life time was enormous. The two airs which Farinelli had to repeat every day for ten years to the melancholy king of Spain, Philip V., were both from Hasse's works.

HASSELT, ANDRE HENRI CONSTANT VAN (1806–1874), Belgian poet, was born at Maastricht, in Limburg, on Jan. 5, 1806. He was educated in his native town, and at the University of Liège. In 1833 he left Maastricht, then blockaded by the Belgian forces, and made his way to Brussels, where he became a naturalized Belgian, and was attached to the Bibliothèque de Bourgogne. In 1843 he entered the education department, and eventually became an inspector of normal schools. His native language was Dutch, and as a French poet André van Hasselt had to overcome the difficulties of writing in a foreign language. His first volume of verse, *Primevères* (1834), shows markedly the influence of Victor Hugo, which had been strengthened by a visit to Paris in 1830. His relations with Hugo became intimate in 1851–52, when the poet was an exile in Brussels. His chief work, the epic of the *Quatre Incarnations du Christ*, was published in 1867. In the same volume were printed his *Etudes rythmiques*, a series of metrical experiments designed to show that the French language could be adapted to every kind of musical rhythm. He died in Dec. 1874.

A selection from his works (10 vols., 1876–77) was edited by Charles Hen and Louis Alvin. He wrote many books for children, chiefly under the pseudonym of Alfred Avelines; and studies on historical and literary subjects. The books written in collaboration with Charles Hen are signed Charles André. A bibliography of his writings is appended to the notice by Louis Alvin in the *Biographie nat. de Belgique,* vol. vii. A series of tributes to his memory are printed in the *Poésies choisies* (1901), edited by Georges Barral for the *Collection des poètes français de l'étranger*. This book contains a biographical and critical study by Jules Guillaume, and some valuable notes on the poet's theories of rhythm.

HASSELT, the capital of the Belgian province of Limburg. Pop. (1925) 21,166. It stands at the junction of several important roads and railways from Maaseyck, Maastricht and Liége. It has many breweries and distilleries, and makes coarse gin called Hasselt spirit. On Aug. 6, 1831 the Dutch troops obtained here their chief success over the Belgian nationalists during the War of Independence. A septennial fete is held on the day of Assumption, Aug. 15, in honour of the Virgin under the name of Virga Jesse. Fir trees and branches are planted in front of the houses. The figure of the giant who is supposed to have once held the

Hazelbosch under his terror is paraded on this occasion as the "lounge man." Originally this celebration was held annually, but in the 18th century it was restricted to once in seven years. Hasselt is beginning to grow quickly as the industrial capital of the new Campinl coalfield.

HASSENPFLUG, HANS DANIEL LUDWIG FRIEDRICH (1794–1862), German statesman, was born at Hanau, Hesse, on Feb. 26, 1794. He studied law at Göttingen, graduated in 1816, and took his seat as *Assessor* in the judicial chamber of the board of government (*Regierungskollegium*) at Cassel, of which his father Johann Hassenpflug was also a member. He rose rapidly, and in May 1832 was appointed successively minister of justice and of the interior. He now became conspicuous in the constitutional struggles of Germany. He deliberately set to work to reverse the Hessian constitution of 1831 The story of the constitutional deadlock that resulted belongs to the history of Hesse-Cassel and Germany; so far as Hassenpflug himself was concerned, it made him, more even than Metternich, the Mephistopheles of the Reaction to the German people. In the summer of 1837 he was suddenly removed from his post as minister of the interior and he thereupon left the elector's service.

In 1838–39 he was head of the administration of the little principality of Hohenzollern-Sigmaringen, and in 1839–40 civil governor of the grand-duchy of Luxemburg. From 1841 to 1850 he was in the Prussian judicial service. In 1850 he was tried for peculation and convicted; and, though this judgment was reversed on appeal, he left the service of Prussia

He was now recalled by the elector of Hesse, and immediately threw himself again with zeal into the struggle against the constitution. Finding the opinion of all classes, including the army, solidly against him, he decided to risk all on an alliance with the reviving fortunes of Austria, which was steadily working for the restoration of the *status quo* overthrown by the revolution of 1848. On his advice the elector seceded from the Northern Union established by Prussia and, on Sept. 13 fled from Hesse with his minister. They went to Frankfort, where the federal diet had been re-established, and on the 21st persuaded the diet to decree armed intervention in Hesse. This decree, carried out by Austrian troops, all but led to war with Prussia, but the unreadiness of the Berlin government led to the triumph of Austria and of Hassenpflug, who at the end of the year was installed at Cassel as minister of finance. He was loathed and despised by all, and disliked even by his master. In November 1853, he was publicly horse-whipped by the count of Isenburg-Wächtersbach, the elector's son-in-law. The count was pronounced insane; but Hassenpflug tendered his resignation. It was not accepted; and it was not till Oct. 16, 1855 that he was finally relieved of his offices. He died at Marburg on Oct. 16, 1862. He lived just long enough to hear of the restoration of the Hesse constitution of 1831 (June 21, 1862), which it had been his life's mission to destroy. Of his publications the most important is *Actenstücke, die landständischen Anklagen wider den Kurfürstlichen hessischen Staatsminister Hassenpflug. Ein Beitrag zur Zeitgeschichte und zum neueren deutschen Staatsrechte*, anonym. (Stuttgart and Tübingen, 1836.) He was twice married, his first wife being the sister of the brothers Grimm.

See the biography by Wippermann in *Allgemeine deutsche Biographie*, with authorities.

HASTINAPUR, an ancient city of British India, in the Meerut district of the United Provinces, lying on the banks of a former bed of the Ganges, 22 m. N.E. of Meerut. It formed the capital of the great Pandava kingdom, celebrated in the *Mahābhārata*, and probably one of the earliest Aryan settlements outside the Punjab. Tradition points to a group of shapeless mounds as the residence of the Lunar princes of the house of Bharata whose deeds are commemorated in the great national epic. The town was finally swept away by a flood of the Ganges, and the capital was transferred to Kausambi.

HASTINGS, a famous English family. Sir Henry de Hastings (d. 1268), was summoned to parliament as a baron by Simon de Montfort in 1264. Having joined Montfort's party Sir Henry led the Londoners at the battle of Lewes and was taken prisoner at Evesham. He was among those who resisted the king at Kenilworth, and after the issue of the *Dictum de Kenilworth* he commanded the remnants of the baronial party when they made their last stand in the isle of Ely, submitting to Henry in July 1267.

His son JOHN, BARON HASTINGS (*c.* 1262–*c.* 1313), married Isabella (*d.* 1305), daughter of William de Valence, earl of Pembroke, a half-brother of Henry III. His paternal grandmother, Ada, was a younger daughter of David, earl of Huntingdon, and a niece of the Scottish king, William the Lion; and in 1290 when Margaret, the maid of Norway, died, Hastings came forward, unsuccessfully, as a claimant for the vacant throne. He fought constantly either in France or in Scotland; he led the bishop of Durham's men at the celebrated siege of Carlaverock castle in 1300; and with his brother Edmund he signed the letter which in 1301 the English barons sent to Pope Boniface VIII. repudiating papal interference in the affairs of Scotland; on two occasions he represented the king in Aquitaine.

LAURENCE HASTINGS (1318?–1348), son of John, 3rd baron, was created earl of Pembroke in 1339. (*See* PEMBROKE.)

HASTINGS, FRANCIS RAWDON-HASTINGS, 1ST MARQUESS OF (1754–1826), British soldier and governor-general of India, born on Dec. 9, 1754, was the son of Sir John Rawdon of Moira, Co. Down, fourth baronet, who was created Baron Rawdon of Moira, and afterwards earl of Moira, in the Irish peerage Lord Rawdon, as he was then called, was educated at Harrow and Oxford, and joined the army in 1771 as ensign in the 15th foot. His life may be divided into four periods: from 1775 to 1782 he was engaged with much distinction in the American war; from 1783 to 1813 he held various high appointments at home, and took an active part in the business of the House of Lords; from 1813 to 1823 was the period of his labours in India; after retiring from which, in the last years of his life (1824–1826), he was governor of Malta. He was created an English peer, Baron Rawdon (1783), and succeeded his father as earl of Moira in 1793.

In 1812 he was appointed governor-general of Bengal and commander-in-chief of the forces in India. He landed at Calcutta, and assumed office in succession to Lord Minto in Oct. 1813. One of the chief questions which awaited him was that of relations with the Gurkha state of Nepal. Lord Moira, after travelling through the northern provinces to study the question, declared war against Nepal (Nov. 1814). The enemy's frontier was 600 m. long, and Lord Moira, who directed the plan of the campaign, resolved to act offensively along the whole line. In 1816 the Gurkhas abandoned the disputed districts, ceded some territory to the British, and agreed to receive a British resident. This affair brought Lord Moira the marquessate of Hastings (1817).

He had now to deal with a combination of Mahratta powers. In 1816 the Pindaris entered British territory in the Northern Circars, where they destroyed 339 villages. Before the end of 1817 the preparations of Lord Hastings were completed, when the peshwa suddenly broke into war, and the British were opposed at once to the Mahratta and Pindari powers, estimated at 200,000 men and 500 guns. Both were utterly shattered in a brief campaign of four months (1817–18). The peshwa's dominions were annexed, and those of Sindhia, Holkar, and the raja of Berar lay at the mercy of the governor-general, and were saved only by his moderation. Thus, after 60 years from the battle of Plassey, the supremacy of British power in India was effectively established.

While Lord Hastings's achievements were appreciated in India, the court of directors of the East India company grumbled at his having extended British territory. They also disliked his measures for introducing education among the natives and his encouraging the freedom of the press. In 1819 he obtained the cession by purchase of the island of Singapore. In finance his administration was very successful, as, in spite of his wars, he showed an annual surplus of two millions sterling. Lord Hastings did not escape unjust detraction. His last years of office were embittered by the discussions on the affairs of the banking-house of W. Palmer and company. Annoyed by the insinuations made against him, he tendered his resignation in 1821, though he did not leave India till the first day of 1823. He was much exhausted by his nine years

of labour in India, and his fortune was gone. In 1824 he received the comparatively small post of governor of Malta. He died on Nov. 28, 1826, leaving a request that his right hand should be cut off and preserved till the death of the marchioness of Hastings, and then be interred in her coffin.

See Ross-of-Bladensburg, *The Marquess of Hastings* ("Rulers of India" series, 1893); and *Private Journal of the Marquess of Hastings*, edited by his daughter, the marchioness of Bute (1858).

HASTINGS, FRANK ÀBNEY (1794–1828), British naval officer and phil-Hellene, was son of Lieut.-gen. Sir Charles Hastings, a natural son of Francis Hastings, tenth earl of Huntingdon. He served in the navy from 1805 to 1820. In 1822 he joined the Greek service. For two years he took part in the naval operations in the Gulf of Smyrna and elsewhere. He saw that the light squadrons of the Greeks must in the end be overpowered by the heavier Turkish navy, clumsy as it was; and in 1823 he drew up and presented to Lord Byron an able memorandum which was laid before the Greek Government in 1824. This paper contains the germs of the great revolution afterwards effected in naval gunnery and tactics. In substance the memorandum advocated the use of steamers in preference to sailing ships, and of direct fire with shells and hot shot, as a more trustworthy means of destroying the Turkish fleet than fire-ships.

The application of Hastings's ideas led necessarily to the disuse of sailing ships, and the introduction of armour. Largely by the use of his own money, of which he is said to have spent £7,000, he was able to some extent to carry out his bold plans. In 1824 he came to England to obtain a steamer, and in 1825 he had fitted out a small steamer named the "Karteria" (Perseverance), manned by Englishmen, Swedes and Greeks, and provided with apparatus for the discharge of shell and hot shot. The effect produced by his shells in an attack on the sea-line of communication of the Turkish army, then besieging Athens at Oropus and Volo in March and April 1827, proved the truth of his contention. After the defeat of the Greeks round Athens, Hastings, in co-operation with General Sir R. Church (*q.v.*), shifted the scene of the attack to western Greece. Here his destruction of a small Turkish squadron at Salona Bay in the Gulf of Corinth (Sept. 29, 1827) provoked Ibrahim Pasha into the aggressive movements which led to the destruction of his fleet by the allies at Navarino (*q.v.*) on Oct. 20, 1827. On May 25, 1828, Hastings was wounded in an attack on Anatolikon, and he died in the harbour of Zante on June 1.

See T. Gordon, *History of the Greek Revolution* (1832); G. Finlay, *History of the Greek Revolution* (Edinburgh, 1861).

HASTINGS, WARREN (1732–1818), the first governor-general of British India, was born on Dec. 6, 1732, in the hamlet of Churchill, near Daylesford, of an old Oxfordshire family which had fallen into poverty. His mother died a few days after giving him birth; his father, Pynaston Hastings, drifted away to perish obscurely in the West Indies. Young Hastings attended a charity school in his native village until, at the age of eight, he was taken in charge by an uncle, Howard Hastings, who held a post in the customs. After two years at a private school at Newington Butts, he was sent to Westminster, where Thurlow, Shelburne, Elijah Impey, and the poets Cowper and Churchill were among his contemporaries. In 1749, his uncle died, leaving him to the care of a distant kinsman, Mr. Creswicke, who sent his ward to seek his fortune as a "writer" in Bengal.

When Hastings landed at Calcutta in October 1750 the affairs of the East India Company were at a low ebb. In southern India French influence was predominant. Bengal, however, was under the able government of Ali Vardi Khan, who peremptorily forbade the foreign settlers at Calcutta and Chandernagore to introduce feuds from Europe. Hastings was placed in charge of an *aurang* or factory in the interior, where his duties would be to superintend the weaving of silk and cotton goods under a system of money advances. In 1753 he was transferred to Cossimbazar, the river-port of the native capital of Murshidabad. In 1756 the old nawab died, and was succeeded by his grandson Suraj-ud-Dowlah, a young madman of 19, whose name is indelibly associated with the tragedy of the Black Hole. When Suraj-ud-Dowlah resolved to drive the English out of Bengal, his first step was to occupy the fortified factory at Cossimbazar, and imprison Hastings and his companions. Hastings was soon released at the intercession of the Dutch resident, and made use of his position at Murshidabad to open negotiations with the English fugitives at Falta, the site of a Dutch factory near the mouth of the Hugli. After a while he fled from the Mohammedan court to join the main body of the English at Falta.

When the relieving force arrived from Madras under Colonel Clive and Admiral Watson, Hastings enrolled himself as a volunteer, and took part in the action which led to the recovery of Calcutta. Clive appointed him in 1758 resident at the court of Murshidabad. There he first came into collision with the Bengali Brahman, Nuncomar. During his three years of office as resident he served the Company well, but his name nowhere occurs in the official lists of those who derived pecuniary profit from the necessities and weakness of the native court. In 1761 he was promoted to be member of council, under the presidency of Vansittart, who had been introduced by Clive from Madras. The period of Vansittart's government has been truly described as "the most revolting page of our Indian history." The administration was left in the hands of the nawab, while a few irresponsible English traders had drawn to themselves all real power. The members of council, the commanders of the troops, and the commercial residents plundered on a grand scale. The youngest servant of the Company claimed the right of trading on his own account, free from taxation and from local jurisdiction, not only for himself but also for every native subordinate whom he might permit to use his name.

This exemption, threatening the very foundations of the Muslim government, finally led to a rupture with the nawab. Sometimes in conjunction only with Vansittart, sometimes absolutely alone, Hastings protested unceasingly against the policy and practices of his colleagues. On one occasion he was stigmatized in a minute by Batson with "having espoused the nawab's cause, and as a hired solicitor defended all his actions, however dishonourable and detrimental to the Company." An altercation ensued. Batson gave him the lie and struck him in the council chamber. When war was actually begun, Hastings officially recorded his previous resolution to have resigned, in order to repudiate responsibility for measures which he had always opposed. After the decisive victory of Buxar over the allied forces of Bengal and Oudh, he resigned his seat and sailed for England in November 1764.

Fourteen years' residence in Bengal had not made Hastings a rich man, estimated by the opportunities of his position. According to the custom of the time he had augmented his slender salary by private trade. At a later date he was charged by Burke with having taken up profitable contracts for supplying bullocks for the use of the Company's troops. It is admitted that he conducted by means of agents a large business in timber in the Gangetic Sundarbans. When at Falta he had married Mrs. Buchanan, the widow of an officer. She bore him two children, of whom one died in infancy at Murshidabad, and was shortly followed by her mother (1759). The other child, a son, was sent to England, and also died shortly before his father's return. While at home Hastings made the personal acquaintance of Samuel Johnson and Lord Mansfield. In 1766 he was called upon to give evidence before a committee of the House of Commons upon the affairs of Bengal.

In the winter of 1768, Hastings received the appointment of second in council at Madras. Among his companions on his voyage round the Cape were the Baron Imhoff, a speculative portrait-painter, and his wife, a lady of some personal attractions and great social charm, who was destined henceforth to be Hastings's lifelong companion. At Madras he won the good-will of his employers by devoting himself to the improvement of their manufacturing business, and he kept his hands clean from the prevalent taint of pecuniary transactions with the nawab of the Carnatic. He drew up a scheme for the construction of a pier at Madras, to avoid the dangers of landing through the surf, and instructed his brother-in-law in England to obtain estimates from the engineers Brindley and Smeaton.

In 1772 he was nominated to the second place in council in Bengal with a promise of the reversion of the governorship when Mr. Cartier should retire. The second governorship of Clive was marked by the transfer of the *dīwānī* or financial administration from the Mogul emperor to the Company, and by the enforcement of stringent regulations against the besetting sin of peculation. But Clive was followed by two inefficient successors; and in 1770 occurred the most terrible Indian famine on record, which is credibly estimated to have swept away one-third of the population. In April 1772 Warren Hastings took his seat as president of the council at Fort William. His first care was to effect a radical reform in the system of government. Clive's plan of governing through the agency of the native court had proved a failure. The directors were determined "to stand forth as *dīwān*, and take upon themselves by their own servants the entire management of the revenues." All the officers of administration were transferred from Murshidabad to Calcutta, which Hastings boasted at this early date that he would make the first city in Asia.

This reform involved the ruin of many native reputations, and for a second time brought Hastings into collision with Nuncomar. At the same time a settlement of the land revenue on leases for five years was begun, and the police and military systems of the country were placed upon a new footing. Hastings was a man of immense industry, with an insatiable appetite for detail. The whole of this large series of reforms was conducted under his own personal supervision. As a measure of economy, the stipend paid to the titular nawab of Bengal, who was then a minor, was reduced by one-half—to sixteen *lakhs* a year (say £160,000). Macaulay imputes this reduction to Hastings as a characteristic act of financial immorality; but it had been expressly enjoined by the court of directors, in a despatch dated six months before Hastings took up office. His bargains with Shuja-ud-Dowlah, the nawab wazīr of Oudh, stand on a different basis. The Mahrattas had got possession of the person of the Mogul emperor, Shah Alam, from whom Clive obtained the grant of Bengal in 1765, and to whom he assigned in return the districts of Allahabad and Kora and a tribute of £300,000.

With the emperor in their camp, the Mahrattas were threatening the province of Oudh. Hastings, as a deliberate measure of policy, withheld the tribute due to the emperor, and resold Allahabad and Kora to the wazīr of Oudh. The Mahrattas retreated, and danger for the time was dissipated by the death of their principal leader. The wazīr now determined to satisfy an old quarrel against the adjoining tribe of Rohillas, who had established themselves for some generations in a fertile tract west of Oudh. They were not so much the occupiers of the soil as a dominant caste of warriors and freebooters. But in those troubled days their title was as good as any to be found in India. After some hesitation, Hastings allowed the Company's troops to be used to further the designs of his Oudh ally, in consideration of a payment to the Bengal treasury. The Rohillas were defeated. Some of them fled the country, and so far as possible Hastings obtained terms for those who remained. The fighting, no doubt, on the part of the wazīr was conducted with all the savagery of Oriental warfare; but there is no evidence that it was a war of extermination.

Meanwhile the Regulating Act, passed by the North ministry in 1773, changed the constitution of the Bengal government. The council was reduced to four members with a governor-general, with certain indefinite powers of control over the presidencies of Madras and Bombay. Hastings was named in the act as governor-general for a term of five years. The council consisted of General Clavering and Colonel Monson, two third-rate politicians of considerable parliamentary influence; Philip Francis (*q.v.*), then only known as an able permanent official; and Barwell, of the Bengal Civil Service. At the same time a supreme court of judicature was appointed, composed of a chief and three puisne judges, to exercise an indeterminate jurisdiction at Calcutta. The chief-justice was Sir Elijah Impey, already mentioned as a schoolfellow of Hastings at Westminster. The tendency of the Regulating Act was to establish for the first time the influence of the crown, or rather of parliament, in Indian affairs. The new members of council disembarked at Calcutta on Oct. 19, 1774; and on the following day commenced the long feud which scarcely terminated twenty-one years later with the acquittal of Warren Hastings by the House of Lords. Taking advantage of an ambiguous clause in their commission, the majority of the council (for Barwell uniformly sided with Hastings) reviewed the recent measures of the governor-general. All that he had done they condemned; all that they could they reversed. Hastings was reduced to the position of a cipher at their meetings. They listened to detailed allegations of corruption brought against him by Nuncomar.

Hastings disdained to reply, and referred his accuser to the supreme court. The majority of the council, in their executive capacity, resolved that the governor-general had been guilty of peculation, and ordered him to refund. A few days later Nuncomar was thrown into prison on a charge of forgery preferred by a private prosecutor, tried before the supreme court sitting in bar, found guilty by a jury of Englishmen and sentenced to be hanged. Hastings always maintained that he did not cause the charge to be instituted, and the legality of Nuncomar's trial is thoroughly proved by Sir James Stephen. The majority of the council abandoned their supporter, who was executed in due course. He had forwarded a petition for reprieve to the council, which Clavering took care should not be presented in time, and which was subsequently burnt by the common hangman on the motion of Francis. Meanwhile, Hastings had sent an agent to England with a general authority to place his resignation in the hands of the Company under certain conditions. The resignation was promptly accepted, and one of the directors was appointed to the vacancy. But in the meantime Colonel Monson had died, and Hastings was thus restored, by virtue of his casting vote, to the supreme management of affairs. He refused to ratify his resignation; and when Clavering attempted to seize the governor-generalship, he judiciously obtained an opinion from the judges of the supreme court in his favour. Hastings was never again subjected to gross insult, and his general policy prevailed.

A crisis was now approaching in foreign affairs. Bengal was prosperous, and free from external enemies on every quarter. But the government of Bombay had hurried on a rupture with the Mahratta confederacy at a time when France was on the point of declaring war against England, and when England was faced with revolt in America. Hastings shouldered the whole responsibility of military affairs. The French settlements in India were promptly occupied. On the part of Bombay, the Mahratta war was conducted with procrastination and disgrace. But Hastings avenged the capitulation of Wargaon by the complete success of his own plan of operations. Goddard with a Bengal army marched across India, and achieved almost without a blow the conquest of Gujarat. Popham stormed the rock fortress of Gwalior, then deemed impregnable and the key of central India; and by this feat held in check Sindhia, the most formidable of the Mahratta chiefs. The Bhonsla Mahratta raja of Nagpur, whose dominions bordered on Bengal, was won over by the diplomacy of an emissary of Hastings.

But while these events were taking place, a new source of embarrassment had arisen at Calcutta. The supreme court assumed a jurisdiction of first instance over the entire province of Bengal. The English common law, was arbitrarily extended to an alien system of society *Zamíndárs*, or government renters, were arrested on mesne process; the sancity of the *senána* was violated by the sheriff's officer; the deepest feelings of the people and the entire fabric of revenue administration were alike disregarded. On this point the entire council acted in harmony. Hastings and Francis went joint-bail for imprisoned natives of distinction. At last, after the dispute between the judges and the executive threatened to become a trial of armed force, Hastings set it at rest by a characteristic stroke of policy. A new judicial office was created in the name of the Company, to which Impey was appointed. The understanding between Hastings and Francis was for a short period extended to general policy. Francis received

patronage for his friends, while Hastings was to be unimpeded in the control of foreign affairs. But a difference of interpretation arose. Hastings recorded in an official minute that he had found Francis's private and public conduct to be "void of truth and honour." They met as duellists. Francis fell wounded, and soon afterwards returned to England.

The Mahratta war was not yet terminated, when a more formidable danger threatened the English in India. The Madras' authorities had irritated beyond endurance the two greatest Mussulman powers in the peninsula, the nizam of the Deccan and Hyder Ali, the usurper of Mysore, who began to negotiate an alliance with the Mahrattas. A second time the genius of Hastings saved the situation. On the arrival of the news that Hyder had descended from the highlands of Mysore, cut to pieces the only British army in the field, and swept the Carnatic up to the gates of Madras, he adopted a daring policy. He signed a blank treaty of peace with the Mahrattas, who were still in arms, reversed the action of the Madras government towards the nizam, and concentrated all the resources of Bengal against Hyder Ali. Sir Eyre Coote was sent by sea to Madras with all the troops and treasure available; and reinforcements marched southwards under Colonel Pearse along the coast line of Orissa. The landing of Coote preserved Madras from destruction, though the war lasted through many campaigns and only terminated with the death of Hyder. Pearse's detachment was decimated by an epidemic of cholera (perhaps the first mention of this disease by name in Indian history); but the survivors penetrated to Madras, held Bhonsla and the nizam in check, and corroborated the lesson taught by Goddard—that the Company's sepoys could march anywhere, when boldly led.

Hastings had to provide the ways and means for this exhausting war. He reformed the collection of the land tax and the government monopolies of opium and salt were placed upon a remunerative basis. Pressing demands were met by loans, and in at least one case from the private purse of the governor-general. Hasting's fertile mind at once turned to the hoards of the native princes. Chait Sing, raja of Benares, the greatest of the vassal chiefs who had grown rich under British protection, lay under suspicion of disloyalty. The wazir of Oudh had fallen into arrears for the maintenance of the Company's garrison posted in his dominions, and his administration was in disorder. In his case the ancestral hoards were under the control of his mother, the begum of Oudh, into whose hands they had passed when Hastings was powerless in council.

Hastings resolved to make a progress up country to arrange the affairs of both provinces, and bring back all the treasure that could be squeezed out of its holders. When he reached Benares and presented his demands, the raja rose in insurrection, and the governor-general barely escaped with his life. But Popham rallied a force for his defence. The insurgents were defeated again and again; Chait Sing took to flight, and an augmented permanent tribute was imposed upon his successor. The wazir of Oudh consented to everything demanded of him. The begum was charged with having abetted Chait Sing in his rebellion; and after severe pressure applied to herself and her attendant eunuchs, a fine of more than a million sterling was exacted from her. Hastings appears to have been uneasy about the incidents of this expedition, and to have anticipated censure in England. He therefore procured documentary evidence of the rebellious intentions of the raja and the begum, to the validity of which Impey obligingly lent his extra-judicial sanction.

The remainder of Hastings's term of office in India was passed in comparative tranquillity. But in England the long struggle between the Company and the ministers of the crown for the supreme control of Indian affairs and the attendant patronage had reached its climax. The success of Hastings's administration alone postponed the solution. His original term of five years would have expired in 1778; but it was annually prolonged by special act of parliament until his voluntary resignation. Indian affairs formed at this time the hinge on which party politics turned. On one occasion Dundas carried a motion in the House of Commons, censuring Hastings and demanding his recall. The directors of the Company were disposed to agree; but in the court of proprietors Hastings always possessed a sufficient majority. Fox's India Bill led to the downfall of the Coalition ministry in 1783. The act which Pitt carried in 1784 introduced a new constitution, in which Hastings felt that he had no place. In February 1785 he sailed from Calcutta, after a dignified ceremony of resignation, and amid enthusiastic farewells from all classes.

On his arrival in England, after a second absence of sixteen years, he was well received. Pitt had never taken a side against him, while Thurlow was his pronounced friend. But Francis, whom he had discomfited in the council chamber at Calcutta, was more than his match in the parliamentary arena. Burke had taken the subject races of India under the protection of his eloquence. Francis, who had been the early friend of Burke, supplied him with the animus against Hastings, and with the knowledge of detail, which he might otherwise have lacked. The Whig party followed Burke's lead. Dundas, Pitt's favourite subordinate, had already committed himself by his earlier resolution of censure; and Pitt was induced by motives which are still obscure to incline the ministerial majority to the same side. To meet the oratory of Burke and Sheridan and Fox, Hastings wrote an elaborate minute with which he wearied the ears of the House for two successive nights, and he subsidized a swarm of pamphleteers. The impeachment was decided upon in 1786, but the actual trial did not commence until 1788. For seven long years Hastings was upon his defence on the charge of "high crimes and misdemeanours." During this anxious period he bore himself with characteristic dignity.

At last, in 1795, the House of Lords gave a verdict of not guilty on all charges laid against him; and he left the bar at which he had so frequently appeared, with his reputation clear, but ruined in fortune. The wealth he brought back from India was swallowed up in the expenses of his trial He forwarded a petition to Pitt praying that he might be reimbursed his costs from the public funds. This petition, of course, was rejected. At last, when he was reduced to actual destitution, it was arranged that the East India Company should grant him an annuity of £4,000 for a term of years, with £90,000 paid down in advance. This annuity expired before his death; and he was compelled to make more than one fresh appeal to the bounty of the Company, which was never withheld. Shortly before his acquittal he had fulfilled the dream of his childhood, by buying back the ancestral manor of Daylesford, where the remainder of his life was passed in honourable retirement. In 1813 he was called on to give evidence upon Indian affairs before the two houses of parliament, which received him with exceptional marks of respect. The university of Oxford conferred on him the honorary degree of D.C.L.; and in the following year he was sworn to the privy council. He died on Aug. 22, 1818, in his 86th year, and lies buried behind the chancel of the parish church, which he had recently restored at his own charges.

In physical appearance, Hastings "looked like a great man, and not like a bad man." The body was wholly subjugated to the mind. A frame naturally slight had been further attenuated by rigorous habits of temperance, and thus rendered proof against the diseases of the tropics. Against his private character not even calumny has breathed a reproach. As brother, as husband and as friend, his affections were as steadfast as they were warm. A classical education and the instincts of family pride saved him from the greed and the vulgar display which marked the typical "nabob." Concerning his second marriage, it suffices to say that the Baroness Imhoff was nearly forty years of age, with a family of grown-up children, when the law of her native land allowed her to become Mrs. Hastings. She survived her husband, who cherished towards her to the last the sentiments of a lover. Her children he adopted as his own; and it was chiefly for her sake that he desired the peerage which was twice held out to him.

Hastings's public career will probably never cease to be a subject of controversy. He was the scapegoat upon whose head parliament laid the accumulated sins, real and imaginary, of the East India Company. If the acquisition of the Indian empire can be supported on ethical grounds, Hastings needs no defence. No

one who reads his private correspondence will admit that even his least defensible acts were dictated by dishonourable motives. On certain of his public measures no difference of opinion can arise. He was the first to attempt to open a trade route with Tibet, and to organize a survey of Bengal and of the eastern seas. He persuaded the *pundits* of Bengal to disclose the treasures of Sanskrit to European scholars. He founded the Madrasa or college for Mahommedan education at Calcutta, primarily out of his own funds; and he projected the foundation of an Indian institute in England. The Bengal Asiatic Society was established under his auspices, though he yielded the post of president to Sir W. Jones.

No Englishman ever understood the native character so well as Hastings; none ever devoted himself more heartily to the promotion of every scheme, great and small, that could advance the prosperity of India. Natives and Anglo-Indians alike venerate his name, the former as their first beneficient administrator, the latter as the most able and most enlightened of their own class If Clive's sword conquered the Indian empire, it was the brain of Hastings that planned the system of civil administration, and his genius that saved the empire in its darkest hour.

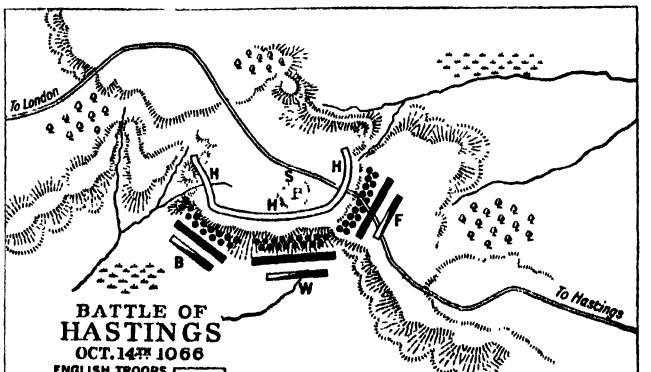
See G. R. Gleig, *Memoirs of Warren Hastings* (3 vols., 1841); A. Lyall, *Warren Hastings* (1889 2nd ed. 1902); L. J. Trotter, *Warren Hastings* (1890); G. W. Forrest, *The Administration of Warren Hastings* (Calcutta, 1892); F. M. Holmes, *Four Heroes of India* (1892); G. B. Malleson, *Life of Warren Hastings* (1894); C. Lawson, *The Private Life of Warren Hastings* (1895); L. W. Hunter, *Warren Hastings' Defence of his Administration* (1908); G. W. Hastings, *A Vindication of Warren Hastings* (1909). *See* also J. Stephen, *The Story of Nuncomar* (1885); J. Strachey, *Hastings and the Rohilla War* (1892); S. C. Grier, *Letters of Warren Hastings to his Wife* (1905), M. E. M. Jones, *Warren Hastings in Bengal, 1772–4* (1918); H. Dodwell, *Warren Hastings' Letters to Sir John Macpherson* (1927) (J. S. Co.; X)

HASTINGS, WILLIAM, BARON (*c.* 1430–1483), a son of Sir Leonard Hastings (d. 1455), was master of the Mint; and chamberlain of the royal household under Edward IV. Created a baron in 1461, he married Catherine, daughter of Richard Neville, earl of Salisbury. He was faithful to Edward IV. during the king's exile in the winter of 1470–1471. After his return he fought for him at Barnet and at Tewkesbury; he has been accused of taking part in the murder of Henry VI.'s son, prince Edward, after the latter battle He was made captain of Calais in 1471, and was with Edward IV. when he met Louis XI. of France at Picquigny in 1475, on which occasion he received gifts from Louis and from Charles the Bold of Burgundy. After Edward IV.'s death Hastings refused to ally himself with Richard, duke of Gloucester, afterwards King Richard III. During a meeting of the council on June 13, 1483 he was seized and at once put to death. This dramatic incident is related by Sir Thomas More in his *History of Richard III.*, and has been worked by Shakespeare into his play *Richard III.*

HASTINGS, a municipal, county and parliamentary borough and watering-place of Sussex, England, one of the Cinque Ports, 62 m. S.E. by S. from London, on the S.R. Pop. (1921) 66,495. Rock shelters on Castle hill and numerous flint implements which have been discovered at Hastings suggest an extensive early population, and there are earthworks and a promontory camp probably of early Iron Age or Roman-British date. Hastings was not a Roman settlement, but it was a place of some note in the Anglo-Saxon period. In 795 land at Hastings (Haestingaceaster, Haestingas, Haestingaport) was included in a grant, which may possibly be a forgery, of a South Saxon chieftain to the abbey of St. Denis in France; and a royal mint was established at the town by Aethelstan. The battle of Hastings (*q.v.*) in 1066 was fought near the present Battle Abbey, about 6 m. inland. After the Conquest William I. made the earthworks of the existing castle. By 1086 Hastings was a borough and had given its name to the rape of Sussex in which it lay. The town at that time had a harbour and a market. Whether Hastings was one of the towns afterwards known as the Cinque Ports at the time when they received their first charter from Edward the Confessor is uncertain, but in the reign of William I. it was among them. These combined towns, of which Hastings was the head, had special liberties and separate jurisdiction under a warden. The only charter peculiar to Hastings was granted in 1589 by Elizabeth, and incorporated the borough under the name of "mayor, jurats and commonalty," instead of the former title of "bailiff, jurats and commonalty." Hastings returned two members to parliament probably from 1322, and certainly from 1366, until 1885, when the number was reduced to one.

It is situated at the mouth of two narrow valleys, and, being sheltered by hills on the north and east, has an especially mild climate. A parade fronts the English Channel, and connects the town on the west with St. Leonard's, the residential quarter which is included within the borough Both Hastings and St. Leonard's have fine piers; there is a covered parade known as the Marina, and the Alexandra Park of 75 ac. was opened in 1891. There are also numerous public gardens. The sandy beach is extensive, and affords excellent bathing. On the brink of the West Cliff stand a square and a circular tower and fragments of the castle, erected soon after the time of William the Conqueror; together with the ruins, excavated in 1824, of the castle chapel, a transitional Norman structure 110 ft. long, with a nave, chancel and aisles. Besides the chapel there was formerly a college, both being under the control of a dean and secular canons. The deanery was held by Thomas à Becket, and one of the canonries by William of Wykeham. Titus Oates, whose father was rector of the parish, was baptized in 1619 in the Church of All Saints. The prosperity of the town depends almost wholly on its reputation as a watering-place, but there is a small fishing industry. The fish-market is beneath the castle cliff. The parliamentary borough returns one member. The county borough was created in 1888.

Battle of Hastings.—On Sept. 28, 1066, William of Normandy, bent on asserting by arms his right to the English crown, landed at Pevensey. King Harold, who had destroyed the invaders of northern England at the battle of Stamford Bridge in Yorkshire, on hearing the news hurried southward, gathering what forces he could on the way. He took up his position, athwart the road from Hastings to London, on a hill[1] some 6m. inland from Hastings, with his back to the great forest of Anderida (the Weald) and in front of him a long glacis-like slope, at the bottom of which began the opposing slope of Telham Hill. The English



FROM SIR CHARLES OMAN, "THE ART OF WAR IN THE MIDDLE AGES"

The English, under Harold, held a strong position on a hill and, but for the error of twice pursuing the Normans into the plain, might well have had the best of the battle. All day Harold's infantry withstood the assaults of the Norman foot and heavy cavalry. Only when Harold was mortally wounded, were the Normans able to pierce the English line, and thus open the way for the completion of the Norman conquest of England

army was composed almost entirely of infantry. The shire levies, for the most part destitute of body armour and with miscellane-

[1]Freeman called this hill Senlac and introduced the fashion of describing the battle as "the battle of Senlac." J. H. Round, however, proved conclusively that this name, being French (Senlecque), could not have been in use at the time of the Conquest, that the battlefield had in fact no name, pointing out that in William of Malmesbury and in Domesday Book the battle is called "of Hastings" (*Bellum Hastingense*), while only one writer, Ordericus Vitalis, describes it 200 years after the event as *Bellum Senlacium*. *See* Round, *Feudal England*, p. 333 *et seq.* (1895).

ous and even improvised weapons, were arranged on either flank of Harold's guards (*huscarles*), picked men armed principally with the Danish axe and shield.

Before this position Duke William appeared on the morning of Oct. 14. His host, composed not only of his Norman vassals but of barons, knights and adventurers from all quarters, was arranged in a centre and two wings, each corps having its archers and arblasters in the front line, the rest of the infantry in the second, and the heavy armoured cavalry in the third. Neither the arrows nor the charge of the second line of foot-men, who, unlike the English, wore defensive mail, made any impression on the English standing in a serried mass behind their interlocked shields.[1]

Then the heavy cavalry came on, led by the duke and his brother Odo, and encouraged by the example of the minstrel Taillefer, who rode forward, tossing and catching his sword, into the midst of the English line before he was pulled down and killed. All along the front the cavalry came to close quarters with the defenders, but the long powerful Danish axes were as formidable as the halbert and the bill proved to be in battles of later centuries, and they lopped off the arms of the assailants and cut down their horses. The fire of the attack died out and the left wing (Bretons) fled in rout. But as the *fyrd* levies broke out of the line and pursued the Bretons down the hill in a wild, formless mob, William's cavalry swung round and destroyed them, and this suggested to the duke to repeat deliberately what the Bretons had done from fear. Another advance, followed by a feigned retreat, drew down a second large body of the English from the crest, and these in turn, once in the open, were ridden over and slaughtered by the men-at-arms. Lastly, these two disasters having weakened the defenders both materially and morally, William subjected the *huscarles*, who had stood fast when the *fyrd* broke its ranks, to a constant rain of arrows, varied from time to time by cavalry charges. These magnificent soldiers endured the trial for many hours, from noon till close on nightfall; but at last, when the Norman archers raised their bows so as to pitch the arrows at a steep angle of descent in the midst of the *huscarles*, the strain became too great. While some rushed forward alone or in twos and threes to die in the midst of the enemy, the remainder stood fast, too closely crowded almost for the wounded to drop. At last Harold received a mortal wound, the English began to waver, and the knights forced their way in. Only a remnant of the defenders made its way back to the forest; and William, after resting for a night on the hardly-won ground, began the work of the Norman Conquest. Tactically, the battle was a victory for the skilful combination of horseman and archer, its effect increased by ruse, over the infantryman.

HASTINGS, a city of south-western Michigan, U.S.A., on the Chicago, Kalamazoo and Saginaw and the Michigan Central railways; the county seat of Barry county, which has over 200 lakes. The population was 5,132 in 1920 (94% native white) and was estimated locally at 6,000 in 1928. It is in the heart of the pleasure-resort section; shipping point for wheat, corn, live stock and dairy products; and has a large milk condensery, machine shops and factories making tables, car-seals, book-cases and cabinets, automatic fire extinguishers and automobile accessories. The city was founded about 1835 and incorporated in 1871.

HASTINGS, a city of Minnesota, U.S.A., 20m. S.E. of Saint Paul, on the Mississippi river; the county seat of Dakota county. It is served by the Burlington and the Chicago, Milwaukee, St. Paul and Pacific railways. The population was 4,571 in 1920, and was estimated locally at 5,500 in 1928. A State hospital for the insane is situated here. The city was founded about 1820 and incorporated in 1857.

HASTINGS, a city of Nebraska, U.S.A., 75m. W. by S. of Lincoln, on Federal highway 38; the county seat of Adams county, and an important railroad centre, served by the Burlington, the Chicago and North Western, the Missouri Pacific, the St. Joseph and Grand Island and the Union Pacific railways. The population was 11,647 in 1920 (87% native white). Hastings is the seat of Hastings college (Presbyterian), opened in 1882, and of a State hospital for the insane. It is an important shipping point for grain and live stock, and has a large jobbing and wholesale trade. There are two large cold-storage plants. The manufactures (including brick, brooms, harness and automobile pumps) were valued in 1925 at $4,421,417. The city was settled in 1872 and incorporated in 1874. The population reached 13,584 in 1890; fell to 7,188 in 1900, following Nebraska's period of hard times; and increased 62% between 1900 and 1920.

HASTINGS-ON-HUDSON, a village of Westchester county, New York, U.S.A., 17 m. above New York city, on the E. bank of the river, and served by the New York Central railroad. The population was 6,311 in 1925. It is the site of the cottage plant of the Orphan Asylum society in New York city (inc. 1807). Chemical, brass and pavement works are the chief industries. The village was incorporated in 1879.

HAT: *see* HAT MANUFACTURE; HEAD-DRESS.

HATCH, EDWIN (1835–1889), English theologian, was born at Derby on Sept. 14, 1835, and had a distinguished academic career in Canada and Great Britain. His treatises *On the Organization of the Early Christian Churches* (1881, his Brampton lectures), and on *The Influence of Greek Ideas and Usages on the Christian Church* (the Hibbert lectures for 1888) provoked criticism on account of the challenge they threw down to the high-church party, but the research and fairness displayed were admitted on all hands. He died on Nov. 10, 1889.

See W. Sanday in *The Expositor* (February, 1890).

HATCHET, a small, light form of axe with a short handle (*see* TOOL); for the war-hatchet of the North American Indians and the symbolical ceremonies connected with it *see* TOMAHAWK.

HATCHETTITE, sometimes termed *Mountain Tallow, Mineral Adipocire*, or *Adipocerite*, a mineral hydrocarbon occurring in the coal-measures of Belgium and elsewhere, occupying in some cases the interior of hollow concretions of iron-ore, but more generally the cavities of fossil shells or crevices in the rocks. It is of yellow colour and translucent, but darkens and becomes opaque on exposure. It has no odour, is greasy to the touch, and has a slightly glistening lustre. Its hardness is that of soft wax The melting point is 46° to 47° C., and the composition is C. 85·55, H. 14·45.

HATCHMENT or **ACHIEVEMENT,** in heraldry, the setting out of armorial bearings, with all that belongs to them, shield, helm and crest, supporters and motto or word. The term "hatchment" is now usually applied to armorial bearings enclosed in a black lozenge-shaped frame suspended against the wall of a deceased person's house. It remains for from six to twelve months, when it is removed to the parish church. This custom is falling into disuse, though a hatchment was shown in a London street in 1928. It is usual to hang the hatchment of a head of a house at the universities of Oxford and Cambridge over the entrance to his lodge or residence.



FROM THE ENCYCLOPAEDIA HERALDICA

HATCHMENT OF DECEASED MAN, WIFE SURVIVING

The man's arms, on black background, impinge on his widow's, white background

If for a bachelor the hatchment has a black ground. If for a single woman, her arms are represented upon a lozenge, bordered with knotted ribbons, also on a black ground. If the hatchment be for a married man, his arms upon a shield impale those of his surviving wife; or if she be an heiress they are placed upon a scutcheon or pretence, and crest and other appendages are added. The dexter half of the ground is black, the sinister white. For a wife whose husband is alive the same arrangement is used,

[1] There was long a difference of opinion as to whether the English were, or were not, defended by any other rampart than that of the customary "shield-wall." Freeman, apparently as a result of a misunderstanding of a passage in Henry of Huntingdon and the slightly ambiguous verse of Wace in the *Roman du Rou* (ll. 6,991–6,994 and ll. 7,815–7,826), affirms that Harold turned "the battle as far as possible into the likeness of a siege," by building round his troops a "palisade" of solid timber (*Norman Conquest*, iii. 444). This was proved to be a fable by J. H. Round, who sums up the controversy in his *Feudal England*, p. 340 *et seq.*, where references to other monographs on the subject will be found. *See* also Oman, *History of the Art of War in the Middle Ages*, i., p. 154–155 (1924).

but the sinister ground only is black. For a widower the same is used as for a married man, but the whole ground is black; for a widow the husband's arms are given with her own, but upon a lozenge, with ribbons, without crest or appendages, and the whole ground is black. When there have been two wives or two husbands the ground is divided into three parts per pale, and the division behind the arms of the survivor is white. Colours and military or naval emblems are sometimes placed behind the arms of military or naval officers. It is thus easy to discern from the hatchment the sex, condition and quality, and possibly the name of the deceased In Scottish hatchments it is not unusual to place the arms of the father and mother of the deceased in the two lateral angles of the lozenge, and sometimes the 4, 8 or 16 genealogical escutcheons are ranged along the margin.

HATFIELD, town in Hertfordshire, England, 17½ m. N. of London by the L N E railway. Pop. (1921) 5,695. The church of St. Etheldreda contains an Early English round arch with the dog-tooth moulding, but the rest is Decorated and Perpendicular. The Salisbury chapel, north of the chancel, built by Robert Cecil, first earl of Salisbury, is of classic and Gothic styles. In the vicinity is Hatfield House, close to the site of a palace of the bishops of Ely erected in the 12th century. From this palace comes the proper form of the name of the town, Bishop's Hatfield. In 1538 the manor was resigned to Henry VIII. by Bishop Thomas Goodrich of Ely, in exchange for certain lands in Cambridge, Essex and Norfolk; and after that monarch the palace was successively the residence of Edward VI., Queen Elizabeth, during the reign of her sister Mary, and of James I., who exchanged it in 1607 for Theobalds, near Cheshunt, an estate of Robert Cecil, earl of Salisbury, in whose family Hatfield House has since remained. The west wing built in 1608–11 was destroyed by fire in 1835 when the dowager marchioness of Salisbury, widow of the 1st marquess, was burnt. Hatfield House was built, and has been restored and maintained, in the richest style of its period. Some 15th century buildings are now used as offices. The park is 10 m. in circumference. Beyond the river Lea is an example of a monks' walled vineyard.

HATHERLEY, WILLIAM PAGE WOOD, 1ST BARON, cr. 1868 (1801–1881), lord chancellor of Great Britain, son of Sir Matthew Wood, a London alderman and lord mayor who became famous for befriending Queen Caroline and braving George IV., was born in London on Nov. 29, 1801. He was educated at Winchester, Geneva university, and at Trinity college, Cambridge, of which he became a fellow in 1824. He entered Lincoln's Inn, and was called to the bar in 1824. He practised as an equity draughtsman and before parliamentary committees. In 1845 he became Q.C., and in 1847 became M.P. for the city of Oxford. In 1849 he was appointed vice-chancellor of the county palatine of Lancaster, and was solicitor-general in 1851–52. When the Liberal party returned to power in 1853, he was raised to the bench as a vice-chancellor. In 1868 he was made a lord justice of appeal, but before the end of the year was selected by Mr. Gladstone to be lord chancellor. He retired in 1872, but sat occasionally as a law lord. He died in London on July 10, 1881.

HATHRAS, a town of British India, in the Aligarh district of the United Provinces, 29 m. N. of Agra. Pop. (1921), 38,763. At the end of the 18th century it was held by a Jat chieftain, whose ruined fort still stands at the east end of the town, and was annexed by the British in 1803. Hathras has rapidly risen to commercial importance, and now ranks second to Cawnpore among the trading centres of the Doab.

HAT MANUFACTURE. The hat, a covering for the head worn by both sexes, is distinguished from the cap or bonnet by the possession of a brim. The history of the hat as part of the apparel of both sexes, with the various changes in shape which it has undergone, is treated in the article HEAD-DRESS.

At the present day the hat trade is divided into four sections. The first is concerned with the manufacture of hats made from fur; the second, with those made from wool. The productions from these two sections are known as fur felt hats and wool felt hats respectively. The third section engages itself in the manufacture of hats made from materials plaited or woven from straw or vegetable products of a fibrous nature such as palm leaf, hemp, bamboo, rush, etc. This section is known as the straw hat section of the industry (*see* STRAW AND STRAW MANUFACTURES). The fourth has to do with hats made from silk plush and is termed silk hatting.

Fur Felt Hats.—The manufacture of fur felt hats under modern conditions entails a series of processes in which highly skilled labour must be employed. The furs used in the industry are coney (rabbit), hare, muskrat, nutria and beaver The three latter are aquatic and before they can be utilised, have to be washed thoroughly in a strong solution of whale oil soap and water to remove the scum and dirt with which the fur fibres are encrusted. Hare and coney do not require this preliminary washing. All long coarse guard hairs are plucked from the skin, leaving only the smooth soft fur

After plucking, the remaining fur is treated with a solution of nitrate of mercury, process known as *carrotting,* its object being to open out the minute branches or *barbs* with which each fur fibre is covered. Carrotted skins are fed into a machine which cuts the hide into short shreds, the fur fibre emerges on an endless belt, the hide, now denuded of fur and useless for hat manufacturing purposes being discarded. Fur fibre having been sorted according to its quality value, now undergoes an operation known as *blowing* by which the fibres are fed into a machine whose mechanism contains numerous revolving cylinders bearing thousands of steel teeth or pickers. The action of this machine separates from the individual fur fibres the *kemp* or colouring matter useless for hat manufacturing purposes, and the *down* of the fibre the portion from which fur felt hats are made.

The accumulation of millions of fur fibres into a *hood* from which a finished hat is made is known as *forming;* this, as having reference to the manufacture of fur felt hats, is the process by which fur fibres are knit closely together to form a fabric which shall have the requisite configuration, thickness, homogeneity and stability. For this purpose, a quantity of fur, varying according to the weight and dimensions of hood that is to be made, is fed into a machine and projected into a chamber containing a minutely perforated copper cone. This cone revolves, and to its damp outer side are drawn by suction the myriads of mist-like fur particles; thus the cone rapidly becomes covered with a film of fur. The cone, with its coating of fur, is wrapped round with flannel and, protected further with a metal cover, is immersed in hot water after which the formed hood is removed from the cone.

Each fur fibre has a number of minute branches or barbs and when a mass of such fibres is subjected to heat, moisture and motion with the addition of pressure, the fibres become firmly interlocked. Repetitions of this treatment result in fur felt the shape of which is relatively much the same as that of the original mass, but decreased in size through the working together of fibres and the consequent shrinkage. It is usual to form the hat body or "hood" (the unit which, after many processes, finally emerges as a completed hat) as a cone about 29 in. in height and about 20 in. in diameter. As the hood is handled, not as a cone but in the flat, the diameter of the cone is not considered in the terminology. Thus, the size of the hood above mentioned would be referred to as 29×31, the latter figure being the width of the flat hood across the corners at the base.

After a hood has been formed, the fabric has little cohesion and has to be hardened or shrunk, the object being to interlock or knit together the individual hair fibres so closely that they become inseparable. In the hardening operation, the formed hoods, saturated with water, are stacked together in lots of six to ten, rolled up in a wet cloth and manipulated by hand. Some shrinkage occurs. During this process, the operator must be careful not to tear the hood or treat the delicate fabric so roughly as to cause a "shove" or other damage

The universal method is to divide the hardening process into four successive shrinking operations known as (*a*) *hardening,* (*b*) *starting,* (*c*) *planking,* (*d*) *second or final planking.*

These operations are not closely defined, and the extent to which each is carried varies with different manufacturers and with special requirements. To indicate the progressive steps, a hood

29 in. × 31 in. (height 29 in., width across base 31 in.) after hardening will be considered as an example and the following table will show the approximate relative dimensions:

Operation	Dimensions inches
A. After hardening	29 x 31
B. „ starting	18 x 24
C. „ planking	11 x 16½
D. „ second planking	10¼ x 15¼

Briefly the following is a description of operations B., C. and D.

Starting is a shrinking operation employing an open kettle of boiling water and a machine with three deeply corrugated revolving rollers. The operator takes four to six hoods, wets them in boiling water, piles them one on the other, rolls them up, wraps a canvas cloth round them and tosses the bundle between the rollers of the machine. After a time, the bundle is taken out, unwrapped, unrolled and the hats immersed in boiling water. Each hood is then subjected to hand manipulation. The same hoods are then stacked up again, this time however, their relative positions are changed. They are rolled up again but the rolling is started from another corner or side, the canvas is wrapped on and the bundle tossed between the rollers. These operations are repeated until the operator finds that the shrinking has been carried far enough.

Planking is an operation similar to "starting" employing a three-roller machine over an open hot water bath. The pressure used is somewhat greater, more manipulation is performed and the hoods are put through the machine a greater number of times.

Second planking is another shrinking operation employing similar equipment but requiring still greater pressure and increased manipulation.

The operations by which fur fibre is converted into a fur felt hood comprise what is known as the wet side of hat manufacturing; the processes by which the hood is converted into a finished hat being termed the dry side of the industry. In this regard no general methods are adopted, so much depending on the particular shape or style of headwear it is purposed to produce. Usually, before a hood is converted into a hat, a certain amount of stiffening or proofing is applied. In this operation the hood is treated with a solution composed of shellac and methylated spirit. The hood after this application is placed in a hot oven or kiln the spirit in the solution tending to slightly open the "pores" of the fabric, the heat, whilst evaporating the spirit, driving the shellac into the opened "pores" and there solidifying. The object of this process is to weld the fur fibres so closely together that they cannot be separated during subsequent operations.

The operation of *blocking* or *shaping* is that whereby the hood is converted into its ultimate shape. As a rule, the hood is saturated with dry steam and whilst in this condition pulled over a wooden block the shape of the hat to be produced. The dry steam softens the shellac or "proofing" in the hood allowing the whole to become malleable. The wooden block with its felt covering is now allowed to dry and in drying the shellac again hardens, thus once more tightening up the fur fibres so that the whole fabric has moulded itself to the configuration of the block on which it has been placed. When quite dry, the hood, now converted into a definite shape, is removed from the block and can be regarded as a hat, the trimming of which is merely a matter of fashion requirements.

Wool Felt Hats.—In the manufacture of these articles the wool used is technically known as *noils*, being the short fibre separated by *stapling* from the *tops* or longer wool fibres used in the weaving of cloth. The *noil* is carded through a machine carrying a number of cylinders clothed with wire card. This has a cleaning and strengthening effect and the wool noil emerges in a continuous web rather like a lace curtain. This web is wrapped round a double cone which is cut through the middle giving two half cones of carded wool known technically as *formes*.

A forme varies in size and in weight according to the type of hat for which it is intended, but before it can be made into a hat it has to be reduced to a *hood*, as in fur felt hat production. This process known as hardening is conducted by means of steam and rotary rubbing, the action serving to shrink and consolidate the wool, the final hardening being obtained by means of machine rolling whilst the formes are immersed in boiling water. The forme, having been reduced to a hood, is thoroughly dried.

In the shrinking processes, various surface inequalities become apparent on the hood and in order to remove the same and get a perfectly even face to the fabric and to obtain a degree of lustre the hoods are passed through a machine containing a wheel or bob coated with fine sand paper and revolving at a high speed. This is termed pouncing or buffing.

Wool felt hat production from the hood stage proceeds very closely on the lines adopted in the manufacture of fur felt hats.

The operation of dyeing both fur and wool hats is conducted whilst they are in the hood stage and prior to their being stiffened or proofed.

The continent of Europe supplies approximately 90% of the world's fur and wool hoods for hat manufacturing.

Silk Hats.—The silk hat was invented in Florence about 1760, but it was not until the beginning of the 19th century that it was worn to any extent.

A silk hat consists of a light stiff body covered with a plush of silk, the manufacture of which in a brilliant glossy condition is the most important element in the industry. Originally the bodies were made of felt and various other materials, but now calico is chiefly used The calico is first stiffened with a varnish of shellac, and then cut into pieces sufficient for crown, side and brim. The side-piece is wound round a wooden hat block, its edges are joined by hot ironing, and the crown-piece is put on and similarly attached to the side. The brim, consisting of three thicknesses of calico cemented together, is now slipped over and brought to its position, and thereafter a second side-piece and another crown are cemented on. The whole of the body, thus prepared, now receives a coat of size; subsequently it is varnished, and thus made ready for the operation of covering. In covering this body, the under brim, generally of merino, is first attached, then the upper brim, and lastly the crown and side sewn together are drawn over. All these by hot ironing and stretching are drawn smooth and tight, and as the varnish of the body softens with the heat, body and cover adhere all over to each other without wrinkle or pucker. Dressing and polishing by means of damping, brushing and ironing come next, after which the hat is "velured" in a revolving machine by the application of haircloth and velvet velures, which cleans the nap and gives it a smooth and glossy surface. The brim has only then to be bound, the linings inserted, and the brim finally curled, when the hat is ready for use.

HATSHEPSET or **HATASU** (*fl.* 1500 B.C.), Egyptian queen, daughter of Thotmes I., sister and queen of the short-reigned Thotmes II, after whose death she secured the crown in spite of opposition from the future Thotmes III, who was the son either of Thotmes I. or of Thotmes II. She acquired fame by her magnificent terrace-temple at Dēr el-Bahri and by her obelisks at Thebes, the expenses of which were partly met by the treasure-hunting expeditions which she sent to South Arabia. The long military inactivity of her reign, during which State affairs were in the hands of her partisans, shook Egyptian power in Asia. In 1841 her tomb was discovered on a cliff behind the Valley of the King's Tomb. Her successor Thotmes III. had her name and figure cut off from the sculptures in her temple and treated the remains of her partisans in a similar manner.

See *Camb. Anc. Hist.* (vol. ii. 1924).

HATTIESBURG, a city of south-eastern Mississippi, U.S.A., on the Leaf river; the county seat of Forrest county. It is on Federal highways 11 and 49, and is served by the Bonhomie and Hattiesburg Southern, the Illinois Central, the Mississippi Central and the Southern railways. The population was 13,270 in 1920 (37% negroes) and was estimated locally at over 20,000 in 1928. It is in the heart of the long-leaf pine belt, which, although the timber is fast vanishing, still supplies many saw-mills. A large plant of the Hercules Powder company makes turpentine, resin and other articles from the pine stumps, and there are railroad shops and sundry smaller manufacturing industries. The factory

output in 1925 was valued at $6,826,847. Hattiesburg is the seat of the State Teachers college (established 1910) and of the Mississippi Woman's college. During the World War an army cantonment (Camp Shelby) was situated here. The city was founded about 1882, as a lumber centre, and was named after the wife of a railway official who was influential in its establishment. It was incorporated as a town in 1884 and as a city in 1899. In 1908, when Forrest county was erected from part of Perry, it became the county seat. It has a commission form of government.

HATTINGEN, a town in the Prussian province of Westphalia, on the river Ruhr, 21 m. N.E. of Düsseldorf. Pop. (1925) 14,285. Hattingen, which received communal rights in 1396, was one of the Hanse towns. The manufactures include tobacco, and iron and steel goods.

HATTO I. (850?–913), archbishop of Mainz, belonged to a Swabian family, and was probably educated at the monastery of Reichenau, of which he became abbot in 888. The German king, Arnulf, appointed him archbishop of Mainz in 891. He presided over the synod of Tribur in 895, accompanied the king to Italy in 894 and 895, and in 899, when Arnulf died, became regent of Germany, and guardian of the young king, Louis the Child. He compelled Zwentibold, king of Lorraine, an illegitimate son of Arnulf, to recognize Louis. In 896 he secured for himself the abbey of Ellwangen and in 898 that of Lorsch. He assisted the Franconian family of the Conradines in its feud with the Babenbergs, and was accused of betraying Adalbert, count of Babenberg, to death. He retained his influence during the whole of the reign of Louis; and on the king's death in 911 helped to secure the election of Conrad, duke of Franconia, to the vacant throne. When trouble arose between Conrad and Henry, duke of Saxony, afterwards King Henry the Fowler, the attitude of Conrad was ascribed by the Saxons to the influence of Hatto, who wished to prevent Henry from securing authority in Thuringia, where the see of Mainz had extensive possessions. He was accused of complicity in a plot to murder Duke Henry, who in return ravaged the archiepiscopal lands in Saxony and Thuringia. He died on May 15, 913. Stories of cruelty and treachery gathered round his name

See E. Dümmler, *Geschichte des ostfränkischen Reichs* (Leipzig, 1887–88); G. Phillips, *Die grosse Synode von Tribur* (Vienna, 1865); J. Heidemann, *Hatto I., Erzbischof von Mainz* (1865); G. Waitz, *Jahrbücher der deutschen Geschichte unter Heinrich I.* (Berlin and Leipzig, 1863); and J. F. Böhmer, *Regesta archiepiscoporum Maguntinensium,* ed. C. Will (Innsbruck, 1877–86).

HATTON, SIR CHRISTOPHER (1540–1591), lord chancellor of England and favourite of Queen Elizabeth, was a son of William Hatton (d. 1546) of Holdenby, Northants, and was educated at St. Mary Hall, Oxford. A handsome and accomplished man and a good dancer, he attracted the notice of Queen Elizabeth, became one of her gentlemen pensioners in 1564, and captain of her bodyguard in 1572. He received numerous estates and many positions of trust and profit from the queen, and rumour, probably untrue, asserted that he was Elizabeth's lover. Hatton had been made vice-chamberlain of the royal household and a member of the privy council in 1578, and had been a member of parliament since 1571. In 1578 he was knighted, and was now regarded as the queen's spokesman in the House of Commons, being an active agent in the prosecutions of John Stubbs and William Parry. He was one of the negotiators for a marriage between Elizabeth and Francis, duke of Alençon, in 1581; was a member of the court which tried Anthony Babington in 1586; and was one of the commissioners who found Mary queen of Scots guilty. He advised William Davison (*q.v.*) to forward the warrant for her execution to Fotheringay. In the same year (1587) Hatton was made lord chancellor, although he had no great knowledge of the law. He died in London on Nov. 20, 1591, and was buried in St. Paul's cathedral. Elizabeth showed her affection for her favourite in an extravagant and ostentatious manner. She called him her *mouton,* and forced the bishop of Ely to give him the freehold of Ely Place, Holborn, and his name is perpetuated in Hatton Garden. Hatton was a patron of learning, and among his friends was Edmund Spenser. He wrote the fourth act of a tragedy, *Tancred and Gismund,* and his death occasioned several panegyrics in both prose and verse.

See Sir N. H. Nicolas, *Life and Times of Sir Christopher Hatton* (1847); and *Correspondence of the Family of Hatton, being chiefly Letters addressed to Christopher, first Viscount Hatton,* 1601–1704, edited with introduction by E. M. Thompson (1878).

HATTON, JOHN LIPTROT (1809–1886), English musical composer, was born at Liverpool on Oct. 12, 1809. He was virtually a self-taught musician, and found his way to London as a member of Macready's company at Drury Lane in 1832. Ten years after this he was appointed conductor at the same theatre for a series of English operas, and in 1843 his own first operetta, *Queen of the Thames,* was given with success. He had a successful career in Austria and the United States, and from about 1853 was engaged at the Princess's theatre to provide and conduct the music for Charles Kean's Shakespearean revivals. Hatton excelled in the lyrical forms of music, and won popularity by such songs as "To Anthea," "Good-bye, Sweetheart," and "Simon the Cellarer," the first of which may be called a classic in its own way. He died at Margate on Sept. 20, 1886.

HATZFELDT, FRANZ LUDWIG, PRINCE VON (1756–1827), born at Vienna on Nov. 22, 1756 entered the Prussian army in 1795, and in 1806 was made governor of Berlin. Although he showed great moderation when Napoleon entered that city, and had forbidden the removal of arms from the arsenal and the destruction of bridges, the Emperor threatened to bring him before a court-martial and to have him shot as a spy. Hatzfeldt was saved by the entreaties of the princess von Hatzfeldt. After the final defeat of Napoleon, Hatzfeldt was one of the leaders of reaction in Prussia, and won the approbation of Metternich by the ejection of all liberal elements from the government in 1824. Ambassador at Vienna from 1822, he died there on Feb. 3, 1827.

HATZFELDT, MELCHIOR (1593–1658), COUNT OF GLEICHEN and Imperialist general, was born on Oct. 10, 1593 at Krottorf, Hesse. He served with the Imperialist army in the Thirty Years' War, was defeated by the Swedes, led by Bauer, at Wittstock (1636), and in the following year assisted at the relief of Leipzig. From 1639 to 1643 he led the campaigns in Westphalia and the Rhine lands. In 1644 he raised a new army in Bohemia; but in 1645, owing to his defeat at the battle of Jankau, in which he was made prisoner by Torstensson, he was succeeded in his command by Gallas. He retired in 1646. The war in Poland in 1657 brought him from his retirement. He led an army of 16,000 men to the help of the king of Poland against the Swedes, and captured Cracow. He then advanced against Thorn, but his health failed, and he surrendered the command to Montecucculi. He died on Jan. 9, 1658 at Powitzka, near Traehenberg.

See J. Krebs, *Aus dem Leben des kaiserl. Feldmarschalls Grafen Melchior von Hatzfeldt* (1910).

HAUCH, JOHANNES CARSTEN (1790–1872), Danish poet, was born of Danish parents at Frederikshald, Norway, on May 12, 1790. In 1803 he returned with his father to Denmark and served as a volunteer against the English in 1807 before he entered the University of Copenhagen. He became the friend and associate of Steffens and Oehlenschläger, warmly adopting the romantic views about poetry and philosophy. His early dramatic poems (1816) and a lyrical drama, *Rosaura* (1817) had no success, and Hauch decided to resume his scientific studies. An accident which entailed the amputation of a foot drove him back to literature. Again his plays—on historical subjects—were indifferently received, whereupon he turned to fiction, and produced a series of romantic novels. In 1842 he collected his shorter *Poems.* In 1846 he was appointed professor of the Scandinavian languages in Kiel, but returned to Copenhagen when the war broke out in 1848. His dramatic talent was now at its height, and he produced one admirable tragedy after another. In 1861 he published another collection of *Lyrical Poems and Romances;* and in 1862 the historical epic of *Valdemar Seir,* volumes which contain his best work. From 1851, when he succeeded Oehlenschläger, to his death, he held the honorary post of professor of aesthetics at the University of Copenhagen. He died in Rome on March 4, 1872. Of Hauch's dramas *Marshal Stig* is perhaps the best, and of his novels the patriotic tale of *Vilhelm Zabern* is admired the most.

See G. Brandes, "Carsten Hauch" (1873) in *Danske Digtere* (1877); F. Rönning, *J. C. Hauch* (1890), and in *Dansk Biografisk-Lexicon*, vol. vii. (1893). Hauch's novels were collected (1873–74) and his dramatic works (3 vols., 2nd ed., 1852–59).

HAUCK, ALBERT (1845–1918), German theologian, was born at Hassertrüdingen, M.-Franken, on Dec. 9, 1845, and studied at the universities of Erlangen and of Berlin. He took orders, and from 1875–8 was pastor at Frankenheim. Hauck was professor of theology at Erlangen (1882–89), and at Leipzig (1889–98), and then for a year rector of the university. He died on April 7, 1918. His most important work is *Kirchengeschichte Deutschlands* (5 vols 1887–1911; 5th ed. 1920). He edited the 3rd edition of the *Realencyclopädie* of Protestant theology (24 vols. 1896–1913).

HAUER, FRANZ, RITTER VON (1822–1899), Austrian geologist, born in Vienna on Jan. 30, 1822, was son of Joseph von Hauer (1778–1863), who was equally distinguished as a high Austrian official and authority on finance and as a palaeontologist. In 1886 Franz Hauer became superintendent of the imperial natural history museum in Vienna. Among his special geological works are those on the Cephalopoda of the Triassic and Jurassic formations of Alpine regions (1855–1856). His most important general work was that of the *Geological Map of Austro-Hungary*, in twelve sheets (1867–1871; 4th ed, 1884, including Bosnia and Montenegro). He died on March 20, 1899.

PUBLICATIONS.—*Beiträge zur Paläontolographie von Österreich* (1858–59); *Die Geologie und ihre Anwendung auf die Kenntnis der Bodenbeschaffenheit der österr.-ungar. Monarchie* (1875; ed. 2, 1878). See *Memoir* by Dr. E. Tietze; *Jahrbuch der K. K. geolog. Reichsanstalt* (1899, reprinted 1900, with portrait).

HAUFF, WILHELM (1802–1827), German poet and novelist, was born at Stuttgart on Nov. 29, 1802, and educated at the Klosterschule at Blaubeuren, and the university of Tübingen. For the children of the Württemberg minister of war, von Hügel, to whom he acted as tutor, he wrote his *Märchen*, which he published in his *Märchenalmanach auf das Jahr 1826*. To the same period belong his *Mitteilungen aus den Memoiren des Satan* (1826) and *Der Mann im Monde* (1825) The latter, a parody of the novels of H. Clauren (pseudonym of K G. S. Heun) was published under Clauren's name, and Hauff was mulcted in damages. Nevertheless he went on to write a *Kontroverspredigt über H. Clauren und den Mann im Monde* (1826). His historical romance *Lichtenstein* (1826), treating of the reign of duke Ulrich of Swabia, was one of the early imitations of Walter Scott His other works include the charming *Bettlerin vom Pont des Arts; Phantasien im Bremer Ratskeller* (1827); and some short poems which have passed into *Volkslieder*, among them *Morgenrot, Morgenrot, leuchtest mir zum frühen Tod;* and *Steh' ich in finstrer Mitternacht.* Hauff died prematurely on Nov. 18, 1827. The freshness and originality of Hauff's talent, his inventiveness and his genial humour have made him a minor classic.

See his *Sämtliche Werke*, ed. G. Schwab (3 vols., 1830-34; 5 vols., 18th ed., 1882); ed F. Bobertag (1891–97); and a selection by M. Mendheim (3 vols., 1891). These and later editions contain biographical material.

HAUG, MARTIN (1827–1876), German orientalist, was born at Ostdorf near Balingen, Württemberg, on Jan. 30, 1827. He studied oriental languages, especially Sanskrit, at Tübingen and Göttingen, and in 1854 settled as *Privatdozent* at Bonn. In 1856 he removed to Heidelberg, where he assisted Bunsen in his literary work; and in 1859 he went out to India, where he became superintendent of Sanskrit studies and professor of Sanskrit in Poona. The result of his researches into Zend literature was a volume of *Essays on the sacred language, writings and religion of the Parsees* (Bombay, 1862). Having returned to Stuttgart in 1866, he was called to Munich as professor of Sanskrit and comparative philology in 1868. He died on June 3, 1876.

HAUGE, HANS NIELSEN (1771–1824), Norwegian preacher, was born in the parish of Thunö, Norway, on April 3, 1771, the son of a peasant In his twenty-sixth year, believing himself to be divinely commissioned, he began to preach, calling people to repentance and attacking rationalism. In 1804 he was arrested, and only released from prison in 1814. He died at Breddwill, near Christiania, on March 29, 1824. His pietistic adherents, who did not formally break with the church, but placed great stress on the evangelical doctrines of faith and grace, were called *Haugianer* or *Leser* (*i.e.*, Readers).

See C. Bang, *Hans Nielsen Hauge og hans Samtid* (Christiania; 2nd ed., 1875); O. Rost, *Nogle Bemaerkninger om Hans Nielsen Hauge og hans Retning* (1883).

HAUGESUND, a seaport of Norway in Stavanger *amt* (county), on the west coast, 34m. N. by W. of Stavanger. Pop. (1927) 17,117. It is an important fishing centre, particularly for herrings which form the chief export. Mackerel and lobsters are also important. The principal imports are coal and salt. There are factories for woollen goods and margarine, and a small shipbuilding industry. The town is difficult of access by land. Haugesund is the reputed death-place of Harald Haarfager, to whom an obelisk of red granite was erected in 1872 on the thousandth anniversary of his victory at the Hafsfjord (near Stavanger) whereby he won the sovereignty of Norway. The memorial stands 1¼m. N. of the town, on the Haraldshaug.

HAUGHTON, WILLIAM (*fl.* 1598), English playwright, collaborated in many plays with Henry Chettle, Thomas Dekker, John Day and Richard Hathway. He was working for the Admiral's Company from 1597 to 1602, and Philip Henslowe, on March 10, 1600, lent him ten shillings "to release him out of the Clink." He had a share with Dekker and Chettle in *The Patient Grissill* (1599), and *Englishmen for my Money, or A Woman will have her Will* (1598) is ascribed to his sole authorship.

Englishmen for my Money is reprinted in vol. x. of W. C. Hazlitt's edition of Dodsley's *Old Plays;* also by W. W. Greg (1912, Malone Society Reprints), and by A. C. Baugh (1917). A list of lost and doubtful plays in which Haughton had a share is given in E. K. Chambers, *The Elizabethan Stage,* vol. iii. (1923).

HAUGWITZ, CHRISTIAN AUGUST HEINRICH KURT, COUNT VON, FREIHERR VON KRAPPITZ (1752–1832), Prussian statesman, was born on June 11, 1752, at Peucke near Öls. In 1791 he was elected by the Silesian estates general director of the province. At the invitation of Frederick William II. he entered the Prussian service, became ambassador at Vienna in 1792 and a member of the cabinet at Berlin.

Haugwitz, who had attended the young emperor Francis II. at his coronation and been present at the conferences held at Mainz to consider the attitude of the German powers towards the Revolution, was at first opposed to intervention in France, but eventually entered on the negotiations for the subsidy treaty between Great Britain and Prussia, and Great Britain and Holland, signed at The Hague on April 19, 1794. Haugwitz, however, was not the man to direct a strong and aggressive policy; and in October the denunciation by Great Britain of The Hague treaty broke the last tie that bound Prussia to the Coalition. The separate treaty with France, signed at Basle on April 5, 1795, was mainly due to the influence of Haugwitz.

No guarantee of the retention of the Rhine provinces of the Empire had been inserted in the Basle treaty; but Haugwitz and the king hoped to preserve them by establishing the armed neutrality of North Germany and securing its recognition by the French republic. This policy was rendered futile by the victories of Napoleon Bonaparte and the virtual conquest of South Germany by the French. Haugwitz recognized this fact, and in vain urged Frederick William III. to join the new Coalition in 1798. When the king refused his urgent advice to demand the evacuation of Hanover by the French in 1803, he offered to resign, and in Aug. 1804 he was replaced by Hardenberg. In his retirement Haugwitz was still consulted, and used his influence against Hardenberg's policy of a *rapprochement* with France. He was recalled, as Hardenberg's colleague in the foreign office, in 1805. He pursued a vacillating policy, and was definitely worsted by Napoleon. The ultimatum he was to have conveyed to the French emperor was never delivered. Instead he signed the treaties of Schönbrunn (Dec. 15, 1805) and Paris (Feb. 15, 1806), which gave Hanover to Prussia in return for Ansbach, Cleves and Neuchâtel. The Prussian ultimatum to Napoleon was eventually forced upon him, and with the battle of Jena (Oct. 14), his political career came to an end.

The last eleven years of his life were spent in Italy, and he died in Venice on Feb. 9, 1832. During his retirement in Italy he wrote memoirs in justification of his policy, a fragment of which dealing with the episode of the treaty of Schönbrunn was published at Jena in 1837.

See L. von Ranke, *Hardenberg u. d. Gesch. des preuss. Staates* (Leipzig, 1879–81), note on Haugwitz's memoirs in vol. II.; *Denkwürdigkeiten des Staatskanzlers Fürsten von Hardenberg*, ed. Ranke (5 vols., Leipzig, 1877).

HAUNTINGS. The supposed manifestations of existence by spirits of the dead in houses or places familiar to them in life. *See* SPIRITUALISM and PSYCHICAL RESEARCH.

HAUPT, MORITZ (1808–1874), German philologist, was born at Zittau, in Lusatia, on July 27, 1808. On the close of his university course at Leipzig (1830) he studied Greek, Latin, German, Old French, Provençal and Bohemian. In Sept. 1837 he "habilitated" at Leipzig as *Privatdozent*, and his first lectures, dealing with such diverse subjects as Catullus and the *Nibelungenlied*, indicated the twofold direction of his labours He became professor extraordinarius (1841) and then professor ordinarius (1843) of German language and literature. But, having taken part in 1849 with Otto Jahn and Theodor Mommsen in a political agitation for the maintenance of the imperial constitution, Haupt was deprived of his professorship by a decree of April 22, 1851. Two years later, however, he was called to succeed his friend Lachmann at Berlin, and became a member of the Berlin academy. He died on Feb. 5, 1874

Haupt edited texts of Ovid, Catullus, Tibullus, Propertius, Horace and Virgil As early as 1836, with Hoffmann von Fallersleben, he started the *Altdeutsche Blätter*, which in 1841 gave place to the *Zeitschrift fur deutsches Altertum*, of which he continued editor till his death. Hartmann von Aue's *Erec* (1839) and his *Lieder*, *Büchlein* and *Der arme Heinrich* (1842), Rudolf von Ems's *Guter Gerhard* (1840) and Conrad von Wurzburg's *Engelhard* (1844) are the principal German works which he edited. Three volumes of his *Opuscula* were published at Leipzig (1875–77).

See Kirchhoff, "Gedächtnisrede," in *Abhandl. der Königl. Akad. der Wissenschaften zu Berlin* (1875); Otto Belger, *Moritz Haupt als Lehrer* (1879); Sandys, *Hist. Class. Schol.* iii. (1908).

HAUPTMANN, GERHART (1862–), German author, was born in Obersalzbrunn, Silesia, on Nov. 15, 1862, the son of an innkeeper. He was educated locally and in Breslau, and was at first intended for a farmer. His instincts were, however, always artistic. In 1880–81 he spent two years at the Breslau school of art, followed by a year's study at Jena university. He then travelled in France, Spain and Italy and in 1884 established himself in Rome as a sculptor. Obliged by reasons of health to return to Germany, he lived in Dresden, Berlin (where he had thoughts of going on the stage) and Erkner, near Berlin, later settling at Schreiberhau, Silesia.

A man of great versatility and exceptionally wide artistic sympathies, Hauptmann hesitated long before choosing literature as his means of expression. His earliest work was *Promethidenlos* (1885). In 1889 he began the series of dramas which set him at a bound at the head of the German dramatic writers of his time. Hauptmann's first drama, *Vor Sonnenaufgang* (1889), appeared at a moment when the cultivated German public read nothing but Scandinavian, French and Russian authors, and German writers, to gain a hearing, were obliged to adopt foreign pseudonyms. Hauptmann's genius forced German attention back to its native authors. He was at heart always rather a romanticist than a naturalist, but circumstances forced him to begin as a naturalist. *Vor Sonnenaufgang* aroused a storm of criticism similar to that encountered by Ibsen and Strindberg, by whose side he took his place. He persevered, however, with a series of dramas depicting the life of the working classes or the poverty-stricken middle classes until, by 1910, German naturalism was fully established. These naturalist dramas include *Einsame Menschen* (1891), *Fuhrmann Henschel* (1898), *Gabriel Schillings Flucht* (1912), and most notably *Die Weber* (1892), a social drama on the grand scale, representing the rise, outbreak, development and failure of a miniature revolution, and perhaps Hauptmann's greatest work. These dramas had created the type of German naturalism; but in Hauptmann exact and conscientious observation was mellowed by his great sensibility and feeling for beauty and genuine poetic gift. His romantic tendencies found play as early as 1892 in the somewhat fantastic *Hanneles Himmelfahrt*, while *Die Versunkene Glocke* (1896) and *Und Pippa Tanzt* (1906) are fairy pieces in a rather vague symbolic style. Hauptmann's insight, intellectual honesty and earnest purpose maintained him in the position which he had won as the foremost and most representative German writer. His later plays, however, the best of which was perhaps *Der Weisse Heiland* (1919), met with less appreciation than his earlier work. The subjective vision which now permeated his work perhaps hardly replaced his earlier peculiar gift for reproducing the life of others. Hauptmann's narrative work is less famous than his dramatic, but he has produced two stories almost perfect in form and content. *Der Narr in Christo Emanuel Quint* (1910) and *Der Ketzer von Soana* (1918), as well as one of the most famous of German novels in *Atlantis* (1912). Hauptmann's verse, though dignified and sincere, lacks warmth.

See C Holl, *Gerhart Hauptmann*, etc. (1913); W. Bonsels, *Das junge Deutschland und der grosse Krieg, aus Anlass des Briefwechsels Romain Rollands mit G. Hauptmann uber den Krieg und die Kultur* (1914); A. Esprey, *G. Hauptmann und wir Deutschen* (1916); J. H. Marschan, *Das Mulied bei G. Hauptmann*, bib. (1919); Paul Fechter, *Gerhart Hauptmann* (1922); P. Schlenther, *G Hauptmann* (1922).

HAUPTMANN, MORITZ (1792–1868), German musical composer and writer, was born at Dresden, on Oct. 13, 1792, and studied music under Scholz, Lanska, Grosse and Morlacchi, the rival of Weber. Afterwards he completed his education as a violinist and composer under Spohr, and till 1820 held various appointments in private families, varying his musical occupations with mathematical and other studies bearing chiefly on acoustics and kindred subjects. For a time also Hauptmann was employed as an architect, but all other pursuits gave place to music, and a tragic grand opera, *Mathilde*, dates from 1826. In 1822 he entered the orchestra of Cassel, again under Spohr's direction, and taught composition and musical theory to Ferdinand David, Burgmüller, Kiel and others His compositions at this time chiefly consisted of motets, masses, cantatas and songs. In 1842 Hauptmann became cantor at the Thomas-school of Leipzig where one of his predecessors had been J S. Bach, and professor at the conservatoire Here his unique gift as a teacher developed, and was acknowledged by a crowd of enthusiastic pupils, among whom were Joachim, von Bülow, Sullivan and Cowen. He was, as already indicated, a mathematician and a philosopher as well as a musician, and brought his studies in philosophy to bear on music. His most important publication was *Die Natur der Harmonik und Metrik* (1853, Eng. trans. *The Nature of Harmony and Metric*, 1888), a standard work. He died on Jan 3, 1868.

Amongst his vocal compositions—by far the most important portion of his work—may be mentioned two masses, choral songs for mixed voices (*Op.* 32, 47), and numerous part songs, which remain in the repertory of most German choirs

See a selection from the two German volumes of his letters to Hauser, Spohr and others, *Letters of a Leipzig Cantor* (1892).

HAURÉAU (JEAN), BARTHÉLEMY (1812–1896), French historian, was born in Paris. He was a deputy to the National Assembly of 1848; contact with the revolution gradually cooled his old ardour. He became director of the ms. department of the Bibliothèque Nationale but resigned after the *coup d'état* of 1851, and refused to accept any administrative post until after the fall of the empire. He was director of the national printing press from 1870 to 1881, and in 1893 became director of the Fondation Thiers. He died on April 29, 1896.

Hauréau devoted his life to the religious, philosophical and more particularly the literary history of the middle ages. From the time of his appointment to the Bibliothèque Nationale up to the last days of his life he made abstracts of all the mediaeval Latin writings (many anonymous or of doubtful attribution) relating to philosophy, theology, grammar, canon law and poetry, carefully noting on cards the first words of each passage. After his death this index of *incipits*, arranged alphabetically, was pre-

sented to the Académie des Inscriptions, and a copy was placed in the ms. department of the Bibliothèque Nationale.

See notice by Paul Meyer prefixed to vol. xxxiii. of the *Histoire littéraire de la France.*

HAUSA, a long-headed people of northern Nigeria (Emirates of Sokoto, Katsina, Zaria) and, in the French area north of Kano, the sultanate of Zinder. They are of mixed blood; the organization is feudal with local centralization. The paramount chief is assisted by a council of notables and court functionaries. The Muslim laws of inheritance are applied. Marriage between brothers-in-law and sisters-in-law is common. The oldest brother of the deceased succeeds to headship of the family. They are cultivators and great traders, whose harmonious language is spread over the whole of Central Africa. They are Mohammedans, but there are many animistic survivals and traces of totemism, with belief in witchcraft. The priest-king was killed in certain eventualities.

See Tremearne, *Hausa Superstitions and Customs;* Meek, *The Northern Tribes of Nigeria* (1925). (H. LAB.)

LANGUAGE

The Hausa language is, perhaps, the most important of the many languages of West Africa—certainly the most important in Northern Nigeria. It is spoken as their mother tongue by over 3¼ million people in the 14 Hausa States (enclosed between the Niger, the Benue and the southern edge of the Sahara), but it extends far beyond these limits. The late Robert Needham Cust expressed the opinion that "it has a great extra-territorial expansion, and from various causes, especially the dispersion of Hausa slaves among other tribes"—to which might have been added, the frequent journeys of Hausa traders back and forth across the Sahara—"it has obtained the rank of a Lingua Franca, and it is the general vehicle of communication between tribes speaking different languages."

Affinities and Structure.—The languages of Africa fall into three distinct families, now, by general agreement, called the Sudanic, Bantu and Hamitic. To the first belong such as Twi, Ewe, Yoruba, the Shilluk of the Upper Nile, the Luo ("Kavirondo") of Kenya Colony, and many others, which have no grammatical inflections, contain chiefly words of one syllable and make great use of *tone,* pitch, or "musical intonation" to distinguish words otherwise alike in sound, but different in meaning, while there is little or no stress accent. The Bantu family (*q.v.*) has a somewhat elaborate grammatical structure; stress accent is very marked, but most of the languages also possess tone. The Hamitic languages, which include Hausa, Berber, Somali, Galla and several others, as well as Ancient Egyptian, are classed as *Inflected* and share with the other two great families (the Indo-European and Semitic) the possession of *grammatical gender,* or the distinction of masculine and feminine indicated by the form of a word, as in our pronouns "he" and "she," or terminations like *-ess* as in "lion-ess." (It is curious that this feature is absent from all known languages outside the three great families mentioned above, sex being indicated, where necessary, by using a different word, as we do, *e.g.*, in the case of "bull" and "cow," or by adding the word for "man" and "woman," saying, for instance, "man-lion" and "woman-lion.") The plural, as a rule, is indicated either by a termination ("suffix") or a change of vowel in the body of the word, comparable to our "man, men," "mouse, mice." More than one plural is used (in Hausa at least two of these are recognized): one to indicate several individuals of a species, another to express multitude (sometimes called a "collective plural") and one enumerating several *kinds* of the same object. There is no article, definite or indefinite, in the Bantu languages (one or two exceptions seem to arise from European influence). Hausa agrees with them in this respect, though some other Hamitic tongues do not. Another point of resemblance is the position of the genitive; both Hamitic and Bantu place the thing possessed before the possessor, whereas the more typical Sudanic languages reverse this arrangement and say, *e.g.*, "the king's horse" (or rather, literally, "king horse," there being no possessive inflection). In Hausa this would be *doki-n sarki* "(the) horse of (the) king" and in Swahili (to take a specimen Bantu language) it would be *farasi* ("horse") *wa* ("of") *mfalme* ("king"). As already implied, Hausa possesses the masculine and feminine genders which (there being no neuter) are applied to things without life as well as to persons. The pronoun "he" is in Hausa *shi,* "she" is *ita;* there are other forms used with different tenses of the verb. Masculine and feminine nouns are distinguished from each other by their terminations, and adjectives have to agree with them.



MUSLIM HAUSA HEADSMAN

A mixture of Arab with Negro blood has made this people of the central Sudan intelligent and keen-witted, especially at trading

Phonology.—The *sounds* of Hausa have only in recent years been studied with any approach to accurate analysis, and the last word has not been said on the subject. They should not in themselves prove difficult, provided sufficient attention is paid to such hints as those given by Capt. F. W. Taylor in his *Hausa Grammar; e.g.*, "When learning Hausa colloquially it is of the greatest importance to watch a native's mouth. Generally speaking, he has a wide mouth and often articulates with the corners drawn well back and all the front teeth showing. . . . Apparently (the tongue) is larger and less mobile, and appears to be used more *en bloc* and in a more frontal position than is the case with the average Englishman."

A very important point, as regards pronunciation of the Hausa language, is the existence of tones, a feature absent from other Hamitic languages, and indicating the fact that the Hausa people, though Hamitic by language, are not so by race. Their language must have been brought to them by immigrants from the north—perhaps at the time when the Batutsi entered Ruanda and ancestors of the present royal family came into Uganda. (But in these last instances, the immigrants acquired the Bantu language of the country.) Tones are found in many, if not most of the Bantu languages, and are an essential characteristic of the Sudanic, where many words, otherwise similar, can only be distinguished in this way; so essential that the originally Sudanic-speaking Hausa imported it into their acquired tongue. "Hausa," says Capt. Taylor, "occupies a position midway between the tone languages, such as Yoruba, and the stress languages, such as English, for, though the tones of the Hausa nouns are almost constant, the verb undergoes so many changes that it has in many cases discarded a pitch accent and acquired a stress accent."

Literature.—Hausa is written by the natives in the Arabic character (here called Ajami) with certain distinctive peculiarities which prevent its being easily read by anyone familiar with Arabic script only. There exist large numbers of Ajami mss., though only a few have appeared in print. Some poems of a religious character, collected by the late Canon Charles Robinson, were published by the Cambridge University Press in 1902, and the two volumes of Hausa tales edited and translated by Capt. R. Sutherland Rattray contain, both the Hausa text in Roman transliteration, and the original Ajami in facsimile. The language was systematically studied by William Balfour Baikie, the British consul at Lokoja, on the Niger, from 1857 to 1864; by the missionary, James Frederick Schön (died 1889), whose first attempt at a grammar was published in 1843 (he afterwards produced a fuller grammar and a dictionary which is still valuable); and the great traveller, Heinrich Barth (1821–65). Schön wrote down, from the dictation of two native youths, the narrative of their life and travels, and a number of folk-tales, which have been published under the title of *Magana Hausa.* Mention should also be made of Maj. Edgar's *Litafi na tatsuniyoyi na Hausa*—three volumes of Hausa stories. Others have collected proverbs, of which, as in most African languages, there is a great variety, usually shrewd and racy, and of great value, as throwing light on native ways of thought. The requirements of native education have already necessitated the production of several readers

and other school books, and the whole of the Bible has been translated into Hausa.

It may be of interest to give a few proverbs as specimens of the language:

Rashin farin wata, tamrārō kē haskē
"When the moon is not full, the stars are bright."

Kāzā mai-yāyā ita kē tsōrō shirwa
"It is the hen with chickens that fears the hawk."

Idan mugun mutun yā shibka zanba, kai ka sa lauje ka yankē.
"If a bad man has sown evil, do you set your sickle to it and cut it down."

Alla bā Ka da kēta, gōnar mayē ruē Kakwāēyi.
"Allah, Thou hast no evil, Thou sendest rain (even) on the wizard's garden."

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HAUSER, KASPAR (*c* 1812–1833), a German youth whose origin is surrounded with mystery. The first record of him is in May 1828, when he appeared in Nuremberg, dressed as a peasant, and with a helpless and bewildered air that attracted attention. In his possession was found a letter purporting to be written by a labourer, stating that the boy was given into his custody on Oct. 7, 1812, and that according to agreement he had instructed him in reading, writing and the Christian religion, but had kept him in close confinement. With this letter was enclosed another purporting to be written by the boy's mother, stating that he was born on April 30, 1812, that his name was Kaspar, and that his father, an ex-cavalry officer in the 6th regiment at Nuremberg, was dead. For some time the lad was detained at Nuremberg as a vagrant; Professor Daumer then undertook his guardianship and the charge of his education. Earl Stanhope became interested in his history, and sent him in 1832 to Ansbach to be educated. He became clerk in the office of Feuerbach, president of the court of appeal; and his strange history was almost forgotten when interest in it was revived by his death as the result of a wound received on Dec. 14, 1833. Whether the wound was self-inflicted or whether, as he alleged, it was dealt by a stranger, is unknown. Kaspar Hauser's story has been used by Jakob Wassermann in a novel (1908) and by Kurt Martens in a play (1904).

The theory of Daumer and Feuerbach and other pamphleteers (*see* E. E. Evans, *Story of Kaspar Hauser from Authentic Records*, 1892) was that the youth was the crown prince of Baden, the legitimate son of the grand-duke Charles of Baden, and that he had been kidnapped at Karlsruhe in Oct. 1812 by emissaries of the countess of Hochberg (morganatic wife of the grand-duke) in order to secure the succession to her offspring; but this theory was answered in 1875 by the publication in the Augsburg *Allgemeine Zeitung* of the official record of the baptism, post-mortem examination and burial of the heir supposed to have been kidnapped. See *Kaspar Hauser und sein badisches Prinzentum* (Heidelberg, 1876). The evidence was analyzed by Andrew Lang in his *Historical Mysteries* (1904), with results unfavourable to the "romantic" version of the story. Lang's view was that possibly Kaspar was a sort of "ambulatory automatist," an instance of a phenomenon, known by other cases to students of psychical abnormalities, of which the characteristics are a mania for straying away and the persistence of delusions as to identity; but he inclines to regard Kaspar as simply a "humbug." The "authentic records" purporting to confirm the kidnapping story Lang stigmatizes as "worthless and impudent rubbish."

See also J. Mayer, *Authentische Mitteilungen über Kaspar Häuser* (1913); and H. Pies, *Kaspar Hauser, Augenzeugenberichte und Selbstzeugnisse* (2 vols., 1925).

HAUSMANN, JOHANN FRIEDRICH LUDWIG (1782–1859), German mineralogist, was born at Hanover on Feb. 22, 1782. He was educated at Göttingen, and in 1811 returned there as professor, holding his chair for over 40 years. Hausmann wrote on gypsum, pyrites, felspar, tachylite, cordierite and on some eruptive rocks, and he devoted much attention to the crystals developed during metallurgical processes. He died Dec. 26, 1859.

PUBLICATIONS.—*Grundlinien einer Encyklopädie der Bergwerkswissenschaften* (1811); *Reise durch Skandinavien* (5 vols., 1811–18); *Handbuch der Mineralogie* (3 vols., 1813; 2nd ed., 1828–47).

HAUSRATH, ADOLPH (1837–1909), German Protestant theologian, was born at Karlsruhe on Jan. 13, 1837, and was educated at Jena, Göttingen, Berlin and Heidelberg, where he became *Privatdozent* in 1861, professor extraordinary in 1867 and ordinary professor in 1872. He was a disciple of the Tubingen school. Among other works he wrote *Der Apostel Paulus* (1865), *Neutestamentliche Zeitgeschichte* (1868–73, 4 vols.; Eng. trans.), *D. F. Strauss und die Theologie seiner Zeit* (1876–78, 2 vols.), and lives of *Richard Rothe* (2 vols. 1902), and *Luther* (1904). Under the pseudonym George Taylor he wrote several historical romances, *Antinous* (1880), and others. He died on Aug. 2, 1909.

HAÜSSER, LUDWIG (1818–1867), German historian, was born at Kleeburg, Alsace, became professor of history at Heidelberg, and was a member of the Baden parliament. Haüsser was one of the leaders of the party which desired the exclusion of Austria from the German Confederation. He died at Heidelberg on March 19, 1867. Haüsser's chief work is *Die deutsche Geschichte vom Tode Friedrichs des Grossen bis zur Gründung des deutschen Bundes* (Leipzig, 1854–57, 4 vols.). *See* E. Marcks, *Ludwig Haüsser* (1903).

HAUSSMANN, GEORGES EUGENE, BARON (1809–1891), French financier, whose name is associated with the rebuilding of Paris, was born in that city on March 27, 1809, of a Protestant family, German in origin. He was educated at the Collège Henri IV., and subsequently studied law, attending simultaneously the classes at the Paris conservatoire of music, for he was a good musician. He became *sous-préfet* of Nérac in 1830, and advanced rapidly in the civil service until in 1853 he was chosen by Persigny prefect of the Seine in succession to Jean Jacques Berger, who hesitated to incur the vast expenses of the imperial schemes for the embellishment of Paris. Haussmann laid out the Bois de Boulogne, and made extensive improvements in the smaller parks. The gardens of the Luxembourg Palace were cut down to allow of the formation of new streets, and the Boulevard de Sebastopol, the southern half of which is now the Boulevard St. Michel, was driven through a populous district. A new water supply, a gigantic system of sewers, new bridges, the opera, and other public buildings, the inclusion of outlying districts—these were among the new prefect's achievements, accomplished by the aid of a bold handling of the public funds which called forth Jules Ferry's indictment, *Les Comptes fantastiques de Haussmann*, in 1867. A loan of 250 million francs was sanctioned for the city of Paris in 1865, and another of 260 million in 1869. These sums represented only part of his financial schemes, which led to his dismissal by the government of Émile Ollivier. After the fall of the Empire he spent about a year abroad, but he re-entered public life in 1877, when he became Bonapartist deputy for Ajaccio. He died in Paris on Jan. 11, 1891. Haussmann had been made senator in 1857, member of the Academy of Fine Arts in 1867, and grand cross of the Legion of Honour in 1862. His name is preserved in the Boulevard Haussmann. His later years were occupied with the preparation of his *Mémoires* (3 vols., 1890–1893). *See* also PARIS.

HAUSSONVILLE, JOSEPH OTHENIN BERNARD DE CLÉRON, COMTE D' (1809–1884), French politician and historian, was born in Paris on May 27, 1809, the son of Charles Louis Bernard de Cléron, comte d'Haussonville (1770–1846), chamberlain at the court of Napoleon. After holding various diplomatic posts, he was elected to the chamber of deputies in 1842, and became a life-senator in 1878. In the senate he defended the religious associations against the anti-clericals. He died in Paris on May 28, 1884.

His works include: *Histoire de la politique extérieure du gouvernement français de 1830 à 1848* (2 vols. 1850), *Histoire de la réunion de la Lorraine à la France* (4 vols. 1859), *L'Eglise romaine et le premier empire*, 1800–14 (5 vols., 1864–79); *La France et la Prusse devant l'Europe* (a pamphlet, 1870). He edited at Brussels *Le Bulletin français*.

His wife Louise (1818–1882), daughter of Duc Victor de Broglie published *Robert Emmett* (1858) and other books.

His son GABRIEL PAUL OTHENIN DE CLÉRON was born at Gurcy-le-Châtel (Seine-et-Marne) on Sept. 21, 1843. In 1891, as representative of the Comte de Paris in France, he tried to strengthen the Orleanist party, but their prospects were dashed in 1894 by the death of the comte de Paris. D'Haussonville died in Paris on Sept. 1, 1924.

His works include: *Etudes biographiques et littéraires* (2 series, 1879 and 1888); *Le Comte de Paris, souvenirs personnels* (1895); *Souvenirs sur Madame de Maintenon* (with G. Hanotaux, 3 vols. 1902–04); *Ombres françaises et visions anglaises* (1913).

HAUTE-GARONNE, a frontier department of south-western France, formed in 1790 from portions of the provinces of Languedoc (Toulousain and Lauraguais) and Gascony (Comminges and Nébouzan). Pop. (1926) 431,505. Area, 2,458 sq m. It is bounded north by the department of Tarn-et-Garonne, east by Tarn, south-east by Aude and Ariége, south by Spain and west by Gers and Hautes-Pyrénées. Quaternary and Tertiary deposits occupy the centre of the department. Towards the south the land rises gradually to the Pyrenees, which on the Spanish border exceed 10,000 ft. Two passes, the Port d'Oo and the Port de Vénasque, exceed 9,800 and 7,900 ft. respectively. The Garonne flows in a northerly direction and receives the Pique, the Salat, the Louge, the Ariége, the Touch and the Save. Except in the mountains the climate is mild, the mean annual temperature being rather higher than at Paris. The rainfall, which averages 24 in. at Toulouse, exceeds 40 in. in the mountains; and sudden inundations of the Garonne cause much damage. Thick forests of oak, fir and pine furnish timber for shipbuilding. Wheat, maize and other grains are the principal crops, and there is generally a surplus for export. Market-gardening flourishes around Toulouse. Vineyards are extensive, though the wine is of medium quality; and chestnuts, apples and peaches are grown. Cattle and sheep are reared and co-operative dairies are numerous in the mountains; but deforestation has tended to reduce the area of pasture-land, the soil, unretained by tree roots, having been gradually washed away. Haute-Garonne has deposits of zinc and lead, and salt-workings; there is an ancient marble-working industry at St. Béat. The mineral springs of Bagnères-de-Luchon Encausse, Barbazan and Salies-du-Salat are well known. Manufactures include iron and copper goods, woollen, cotton and linen goods, leather, paper, boots and shoes and tobacco. The main line of the Southern railway from Bordeaux to Cette passes through Toulouse. The Canal du Midi traverses the department for 32 m. and the lateral canal of the Garonne for 15 m. The Garonne is navigable below its confluence with the Salat. There are two arrondissements—Toulouse and St. Gaudens—subdivided into 39 cantons and 589 communes. Toulouse is the seat of a court of appeal and of an archbishop, the headquarters of the XVII. army corps and the centre of an academy; and St. Gaudens, Bagnères-de-Luchon and St. Bertrand-de-Comminges are important. St. Aventin, Montsaunès and Vénerque possess old churches in the Romanesque style. The choir of St. Just at Valcabrère dates from the 8th or 9th century and part of the nave from the 11th century. There are ruins of a Cistercian abbey at Bonnefont near St. Martory. Gallo-Roman remains have been discovered at Martres. Near Revel is the reservoir of St. Ferréol, constructed for the canal du Midi in the 17th century.

HAUTE-LOIRE, a department of central France, formed in 1790 of Velay and portions of Vivarais and Gévaudan, three districts formerly belonging to the old province of Languedoc, of a portion of Forez formerly belonging to Lyonnais, and a portion of lower Auvergne. Pop. (1926) 260,610. Area, 1,931 sq.m. It is bounded north by Puy-de-Dôme and Loire, east by Loire and Ardèche, south by Ardèche and Lozère and west by Lozère and Cantal. Forming a portion of the Plateau Central, it is traversed from north to south by four mountain ranges. Its highest point, the Mont Mézenc (5,755 ft.), in the south-east, belongs to the mountains of Vivarais, which are continued along the eastern border by the Boutières chain The Lignon divides the Boutières from the Massif du Mégal, which is separated by the Loire from the mountains of Velay, a granitic range overlaid with volcanic rocks. The Margeride mountains run along the western border. The Loire waters the eastern half of the department. The Allier, which joins it at Nevers, traverses the western portion. The chief affluents of the Loire within the department are the Borne on the left, joining it near Le Puy, and the Lignon, on the right. The winters are long and rigorous. Rye, oats, barley and wheat are cultivated and aromatic and medicinal plants are abundant on the plateaus. Lentils, peas, mangelwurzels and other forage and potatoes are also grown. Horned cattle belong principally to the Mézenc breed; goats are numerous. The woods yield pine, fir, oak and beech. Lace-making and coal-mining (around Brassac and Langeac) are main industries. There are also mines of antimony and stone-quarries. Silk-milling, caoutchouc-making, paper-making, glass-blowing and wood-sawing are also carried on. The principal imports are flour, brandy, wine, live-stock, lace-thread and agricultural implements. Exports include fat stock, wool, aromatic plants, coal, lace. The department is served chiefly by the Paris-Lyon-Méditerranée company. There are two arrondissements—Le Puy and Brioude—with 28 cantons and 266 communes.

Haute-Loire forms the diocese of Le Puy in the ecclesiastical province of Bourges, and belongs to the academie (educational division) of Clermont-Ferrand. Its court of appeal is at Riom. The churches of Chamalières, St. Paulien and Sainte-Marie-des-Chazes are Romanesque in style; Le Monastier preserves the church, in part Romanesque, and the buildings of the abbey to which it owes its origin. Arlempdes and Bouzols (near Coubon) have the ruins of large feudal châteaus. The rocky plateau overlooking Polignac is occupied by the ruins of the stronghold of the ancient family of Polignac, including a square donjon of the 14th century. Interesting Gallo-Roman remains have been found on the site.

HAUTE-MARNE, a department of north-eastern France, made up of districts belonging to the former province of Champagne (Bassigny, Perthois, Vallage), with smaller portions of Lorraine and Burgundy, and some fragments of Franche-Comté. Area, 2,415 sq.m. Pop. (1926) 195,370. It is bounded north-east by Meuse, east by Vosges, south-east by Haute-Saône, south and south-west by Côte d'Or, west by Aube, and north-west by Marne. Its greatest elevation (1,693 ft.) is in the plateau of Langres between the sources of the Marne and those of the Aube; the watershed between the Rhone and the Seine and Meuse, formed by the plateau of Langres continued north-east by the Monts Faucilles, has an average height of 1,500 or 1,600 ft. To the north is Bassigny (the *paybas* or low country, as distinguished from the highlands), a district characterized by monotonous flats of little fertility and extensive wooded tracts. The principal river of the department is the Marne It receives on the right the Rognon, and on the left the Blaise. The western portion is watered by the Aube and its tributary the Aujon, both of which have their sources on the plateau of Langres. The Meuse rises in the Monts Faucilles, and has a course of 31 m. within the department. The Apance, the Amance, the Salon and the Vingeanne are tributaries of the Saône. The mean temperature is 51° F, nearly that of Paris; the rainfall is slightly below the average for France.

Agriculture is carried on by small proprietors. The chief crops are wheat and oats; potatoes, lucerne and mangel-wurzels are next in importance. Horse and cattle-raising flourish in Bassigny. The white wine of Soyers is notable. The department is rich in iron and building stone is quarried. The warm springs of Bourbonne-les-Bains are among the earliest known and most frequented in France. Industrial establishments include blast furnaces, foundries, forges, plate-rolling works, and shops for nail-making and smith's work of various descriptions. St. Dizier is the chief centre of manufacture and distribution. The cutlery trade is important at Nogent-en-Bassigny and in the neighbourhood of Langres. Val d'Osne is well known for its metal-work. Flour-milling, glove-making (at Chaumont), basket-making and tanning are also carried on. The principal import is coal, while manufactured goods, iron, stone, wood and cereals are exported. The line of the Eastern railway from Paris to Belfort passes through Chaumont and Langres. The canal from the Marne to the Saône

and that of the Haute-Marne together cover 99 m.; there is a canal 14 m. long from St. Dizier to Wassy. There are two arrondissements (Chaumont and Langres), with 28 cantons and 550 communes. Chaumont is the capital. The department forms the diocese of Langres; it belongs to the VII. military region and to the educational circumscription (académie) of Dijon, where also is its court of appeal. At Montier-en-Der the remains of a 7th century abbey include a church with nave and aisles of the 10th, and choir of the 13th century. Wassy, the scene of the massacre of Protestants in 1562, has a church largely of the Romanesque period. Vignory has a church of the 11th century. Joinville, a metallurgical centre, preserves a château in the Renaissance style. Pailly, near Langres, has a late 16th century château.

HAUTES ALPES, a department in south-east France, formed in 1790 out of the south-eastern portion of the old province of Dauphiné, together with a small part of north Provence. It is bounded north by the department of Savoie, east by Italy and south and south-east by the department of the Basses Alpes, south by the last-named department, and west by the departments of the Drôme and of the Isère. Its area is 2,178 sq m. Pop. (1926) 87,963. It is very mountainous and includes the Pelvoux mass of Primary rocks rising to a height of 12,973 ft. in the north, the high line of the Cothian alps 12,609 ft. in the east, and the Papillon mountains of Mesozoic rocks in the south. The department consists of the basins of the upper Durance (with tributaries, Guisane, Gyronde and Guil), of the upper Drac, leading to Grenoble, and of the Buëch. The department is divided into two arrondissements (Gap and Briançon), 24 cantons and 186 communes. Pop. (1926) 87,963. There are no large industries and commerce is almost wholly local. The prolonged winter greatly hinders agricultural development, while the pastoral region has been greatly damaged and forests destroyed by the ravages of Provençal sheep, vast flocks of which are driven up here in the summer, as the pastures are leased out to a large extent, and but little utilized by the inhabitants. It now forms the diocese of Gap (this see is first certainly mentioned in the 6th century) in the ecclesiastical province of Aix en Provence; in 1791 there was annexed to it the archiepiscopal see of Embrun, which was then suppressed. There are 114 m. of railway in the department. This includes the main line from Briançon past Gap towards Grenoble. About 16½ m. west of Gap is the important railway junction of Veynes, whence branch off lines to Grenoble, to Valence by Die and Livron, and to Sisteron for Marseilles. The chief town is Gap; Briançon and Embrun are the other towns.

HAUTE-SAÔNE, a department of eastern France, formed in 1790 from the northern part of Franche Comté. It is traversed by the river Saône, bounded north by the department of the Vosges, east by the territory of Belfort and the department of Haut-Rhin, south by Doubs and Jura and west by Côte-d'Or and Haute-Marne. Pop. (1926) 226,313; area, 2,075 square miles. The department is the upper basin of the Saône from the Ballon de Servance (3,970 ft.) in the north-east to its confluence with the Ognon in the south-west, and it also includes the right side of the lower Ognon valley extending over to the left side in the upper part of that valley towards Belfort. The sandstones and granite of the southern Vosges give place to limestones framing the two valleys at a level of 800–1,000 ft., and the water that soaks through these limestones emerges as springs feeding the streams in the valleys 200 ft. lower down. The north-eastern districts are cold, due in part to the coldness of the soil, and have an annual rainfall ranging from 36 to 48 inches. Towards the south-west the climate becomes more temperate. At Vesoul and Gray the rainfall reaches only 24 in. per annum.

Half of the area of Haute-Saône is arable land, growing wheat, oats, meslin and rye and potatoes. The vine flourishes mainly in the arrondissement of Gray; tobacco is grown. Apples, plums and cherries (from which the kirsch, for which the department is famous, is distilled) are the chief fruits. The woods which cover a quarter of the department are composed mainly of firs in the Vosges and of oak, beech, hornbeam and aspen elsewhere. Horses and horned cattle thrive on the river pastures. Mines of coal (at are worked. The hot springs of Luxeuil (*q.v.*) are the most famous of the department. There are iron-working establishments, copper-foundries, engineering works, steel-foundries and factories at Plancher-les-Mines and elsewhere for producing ironmongery, nails, pins, files, saws, screws, shot, chains, agricultural implements, locks, spinning machinery, edge tools, glass-works, potteries and brick and tile-works, cotton factories, of which Héricourt (pop. in 1926, 4,897) is the chief centre, paper-mills, print-works, fulling mills, hosiery factories and straw-hat factories, as well as sugar works, distilleries, dye-works, saw-mills, starch-works, the chemical works at Gouhenans, oil-mills, tan-yards and flour-mills. The department exports wheat, cattle, cheese, butter, iron, cotton-cloth, wood, pottery, kirschwasser, plaster, leather, glass, etc. The Saône provides a navigable channel of about 70 m., which is connected with the Moselle and the Meuse at Corre by the Canal de l'Est along the valley of the Coney. Gray is the chief emporium of the water-borne trade of the Saône. Haute-Saône is served chiefly by the Eastern railway. There are two arrondissements—Vesoul and Lure—comprising 28 cantons, 583 communes, Haute-Saône is in the district of the VII. army corps (Besançon), and in its legal, ecclesiastical and educational relations depends on Besançon.

Vesoul, the capital of the department, Gray, Lure and Luxeuil are the principal towns. The Roman ruins and mosaics which may be seen at Membrey, and the church (13th and 15th centuries) and abbey buildings in and around Faverney (10th, 13th and 14th centuries), in the arrondissement of Vesoul, are of antiquarian interest.

HAUTE-SAVOIE, a frontier department of France, formed in 1860 of the old provinces of the Genevois, the Chablais and the Faucigny, previously the northern portion of the duchy of Savoy neutralised in 1815. It is bounded N. by the canton and Lake of Geneva, E. by the Swiss canton of the Valais, S. by Italy and the department of Savoie, and W. by the department of the Ain. Pop. (1926) 245,317. Area, 1,775 sq.m. It slopes from the Mont Blanc (15,782 ft.) chain on the south-east down to the lake and canton of Geneva and the Rhone (945 ft.) on the west. It is drained by many streams, the chief of which are the Arve and the Fier, feeders of the Rhone; the Fier forms the lake of Annecy. The climate varies considerably with the altitude; the maximum rainfall is in May and June. The tourist industry is highly important, especially at Chamonix. Cattle and poultry are reared, and Gruyère cheeses and honey are made. There are chalybeate springs at Évian and Amphion, and at St. Gervais and elsewhere. Anthracite and asphalt mines are numerous, as well as stone quarries. There is much trade in pine and other wood from mountain forests. Cotton is manufactured at Annecy, Cluses is the centre of the clock-making industry, and there is a well-known bell foundry at Annecy le Vieux. The department is divided into three arrondissements (Annecy, the principal town, Bonneville and Thonon), 28 cantons and 315 communes. It forms the diocese of Annecy in the province of Chambéry, is in the district of the XIV. army corps (Lyons) and in the Académie (educational division) of Chambéry, where is its court of appeal. Thonon (the old capital of the Chablais) is the chief town on the south shore of the Lake of Geneva and, after Annecy, the largest place in the department.

HAUTES-PYRÉNÉES, a department of south-western France, on the Spanish frontier, formed in 1790, half of it being taken from Bigorre and the remainder from Armagnac, Nébouzan, Astarac and Quatre Vallées, districts of the province of Gascony. Pop. (1926) 187,875. Area, 1,750 sq.m. Hautes-Pyrénées is bounded south by Spain, west by the department of Basses-Pyrénées, north by Gers and east by Haute-Garonne. The south of the department, comprising two-thirds of its area, is occupied by the central Pyrénées composed of palaeozoic rocks with mesozoic rocks on the northward facing slopes. The ancient volcanic rocks stand out as the highest peaks, some exceeding 10,000 ft., the Vignemale (10,820 ft.) being the highest in the French Pyrénées. The imposing *cirques* (Cirques de Troumouse, Gavarnie and Estaubé), with glaciers and waterfalls, and the pleasant valleys

undulating hills clothed with cornfields, vineyards and meadows. To the north-east, the cold and wind-swept plateau of Lannemezan (about 2,000 ft.) with miocene and glacial deposits, presents a striking contrast to the plain below. The Adour and its tributary, the Gave de Pau, and the Neste, an affluent of the Garonne, drain the department. The sources of the second and third lie close together in the Cirque of Gavarnie. An important section of the Pyrenees, which carries the Massif Néouvielle and the Pic du Midi de Bigorre runs northward between these two valleys. The Adour descends from the Pic du Midi through the Campan valley and leaves the mountains at Bagnères and then divides into a multitude of channels, notably the Canal d'Alaric (36 m. long), to irrigate the rich plain of Tarbes. Beyond Hautes-Pyrénées it receives the Arros, which flows through the department from south to north-north-west; on the left it receives the Gave de Pau; it is navigable in the lower stretches. The Gave de Pau, larger than the upper Adour, after passing Argelès, a well-known centre for excursions, and Lourdes, leaves the mountains. The Neste is important as furnishing the plateau of Lannemezan with a canal, the Canal de la Neste, the waters of which are partly used for irrigation and partly for supplying the streams that rise there and are dried up in summer—the Gers and the Baïse, affluents of the Garonne. The climate of Hautes-Pyrénées, cold on the highlands, gives on the plains, hot summers, fine autumns, mild winters and rainy springs. On the plateau of Lannemezan, summers are dry and scorching, winters very severe. The average annual rainfall at Tarbes, in the north, is about 34 in.; at the higher altitudes it is much greater. The mean annual temperature at Tarbes is 59° Fahr.

Hautes-Pyrénées is agricultural in the plains, pastoral in the highlands. The more important cereals are wheat and maize, chiefly in the Adour valley, and the northern part of the department, which is much used for the feeding of pigs and poultry, especially geese; rye, oats and barley are grown in the mountain districts. The wines of Madiran and Peyriguère are well known and chestnut trees and fruit trees are grown on the lower slopes. Horse breeding is important around Tarbes and Bagnères-de-Bigorre and there is a famous stud at Tarbes. The horse of the region has Arab, English and Navarrese blood and is well fitted for saddle and harness. Cattle raising is important; the milch-cows of Lourdes and the oxen of Tarbes and the valley of the Aure are highly esteemed. Sheep and goats are also reared. The forests, which occur chiefly in the highlands are mainly coniferous and still contain wild animals (bears, wolves, etc.). There are at Campan and Sarrancolin quarries of fine marble, which is sawn and worked at Bagnères. There is a group of slate quarries at Labassère and an important slate works at Tarbes. Deposits of lignite, lead, manganese and zinc are found. The principal mineral springs in the valley of the Gave de Pau are Cauterets (hot springs containing sulphur and sodium), St. Sauveur (springs with sulphur and sodium), and Barèges (hot springs with sulphur and sodium), and in the valley of the Adour Bagnères (hot or cold springs containing calcium sulphates, iron, sulphur and sodium) and Capvern near Lannemezan (springs containing calcium sulphates).

The department has flour-mills and saw-mills, a large military arsenal at Tarbes, paper-mills, tanneries and manufactories of agricultural implements and looms. The spinning and weaving of wool are carried on chiefly at Bagnères-de-Bigorre.

Of the passes (*ports*) into Spain, even the chief, Gavarnie (7,398 ft.), is not accessible to carriages. The Southern railway main line from Bayonne to Toulouse, traverses the department. There are two arrondissements, those of Tarbes and Bagnères-de-Bigorre, 26 cantons and 480 communes. Tarbes is the capital of Haute-Pyrénées, which is attached to the appeal court of Pau and forms part of the region of the XVIII. army corps (Bordeaux). There are bishops at Tarbes and Lourdes, under the archbishop of Auch. The department is in the académie (educational division) of Toulouse. Tarbes, Lourdes, Bagnéres-de-Bigorre and Luz-St. Sauveur are the principal towns. St. Savin, in the valley of the Gave de Pau, and Sarrancolin have interesting Romanesque churches. The church of Maubourguet was built by the Templars in the 12th century.

HAUTE-VIENNE, a department of central France, formed in 1790 of Haut-Limousin and of portions of Marche, Poitou and Berry. Pop. (1926) 351,311. Area, 2,119 sq.m. It is bounded north by Indre, east by Creuse, south-east by Corrèze, south-west by Dordogne, west by Charente and north-west by Vienne. The highest altitude (2,549 ft.) is in the extreme south-east, and belongs to the treeless but well-watered plateau of Millevaches, formed of granite, gneiss and mica. From that point the department slopes towards the west, south-west and north. To the north-west of the Millevaches are the Ambazac and Blond Hills, and the mountains of Limousin are on the south. The Vienne traverses the department from east to west, forming in its upper course the basin of Limoges, passing Eymoutiers, St. Léonard, Limoges and St. Junien, and receiving most of its tributaries from the south. The altitude, inland position and cold soils of Haute-Vienne and the northern exposure of its valleys make the winters long and severe; but the climate is milder in the west and north-west. The annual rainfall often reaches 36 or 37 in. and even more in the mountains. Rye, wheat, buckwheat and oats are the cereals most grown, but the chestnut still forms the staple food of large numbers. Potatoes, walnuts and cider-apples are cultivated. Good breeds of horned cattle and sheep are reared in the valleys and find a ready market in Paris. Horses for remount purposes are also raised. The quarries furnish granite and large quantities of kaolin, which is both exported and used in the porcelain works of the department. Limoges is a centre of the porcelain industry and has important liqueur distilleries. Agricultural implements and hats are other industrial products, and there are breweries, dye-works, tanneries, iron foundries and printing works. Wine and alcohol for liqueur-manufacture, coal, raw materials for textile industries, hops, skins and various manufactured articles are among the imports.

The department is served by the Orléans Railway. It is divided into the arrondissements of Limoges, Bellac and Rochechouart (29 cantons and 205 communes), and belongs to the académie (educational division) of Poitiers and the ecclesiastical province of Bourges. Limoges, the capital, is the seat of a bishopric and of a court of appeal, and the headquarters of the XII. army corps. The other principal towns are St. Yrieix and St. Junien. Solignac, St. Léonard and Le Dorat have fine Romanesque churches. There are important remains of the château of Chalusset (S.S.E. of Limoges), and the château of Rochechouart dates from the 13th, 15th and 16th centuries.

HAUT-RHIN, department of France, formed after the Revolution in 1790 from the southern portion of Alsace, and incorporated in 1870 with the German empire; it was resuscitated by the Treaty of Versailles in 1918, when Alsace-Lorraine became French once more. It is bounded north by Bas-Rhin, east by the State of Baden, south by Switzerland, south-west by the territory of Belfort and west by the Vosges. Pop. (1926), 490,654.

The department which is 1,354 sq.m. in area occupies the southern portion of the Rhine trough. The Vosges and Black Forest are the remains of a Hercynian block, rifted, apparently, at some stage in the uprise of the Alps, with the result that the deep Rhine trough from Basle northwards was formed. Loess deposits occur in the south and along the foot of the Vosges, and give good soil, with layers useful for the manufacture of bricks. Haut-Rhin is one of the most fertile parts in central Europe. The hills are richly wooded, chiefly with fir, beech and oak. The agricultural products are corn, potatoes, flax, grapes and other fruit. Cotton spinning and weaving is the most important industry centred in Mulhouse, Colmar, Guebwiller, and the Vosges valleys. Other industries are the manufacture of woollen and silk goods, chemicals, paints, machinery, pottery, bricks, tiles and paper. Potash is produced near Mulhouse, and also lime. Haut-Rhin is also important for its wine.

Haut-Rhin is at a disadvantage as regards commerce, owing to its isolation from the rest of France, and the fact that the Rhine, its main outlet, has its mouth outside France. The Rhine is navigable for small vessels as far as Basle, but the department is served by the Ill; the Rhine-Rhone canal is another outlet. This department and Bas-Rhin, however, gain from the fact that

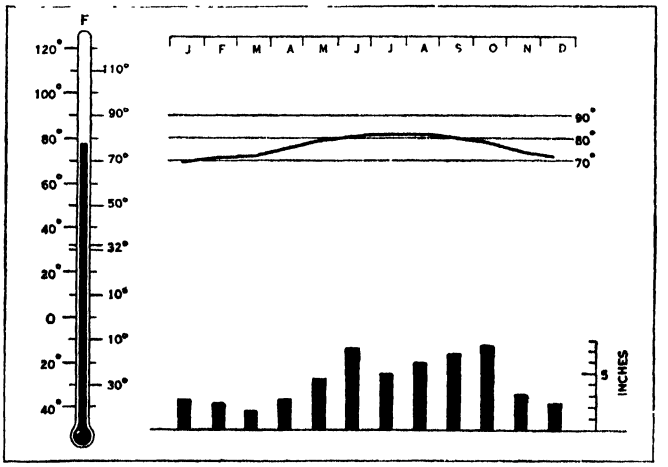
they are in the French customs boundary, and thus have French markets open to their industrial products.

Colmar is the capital of the department, which includes six arrondissements (Colmar, Altkirch, Guebwiller, Mulhouse, Ribeauville, and Thann), 26 cantons, and 385 communes. It is under the académie of Strasbourg. Colmar is the seat of Superior Regional Tribunal. It is the bishopric of Strasbourg. The other important towns are Mulhouse, Guebwiller, and Altkirch. Most of the towns are situated on the Ill; there are no important towns on the Rhine south of Strasbourg, owing to its marshy banks. The department is served by the rail from Basle via Mulhouse and Colmar to Strasbourg.

HAÜY, RENÉ JUST (1743–1822), French mineralogist, was born at St. Just, Oise, on Feb. 28, 1743. An accident directed his attention to crystallography. Happening to let fall a specimen of calcareous spar, he was led by examination of the fragments to make experiments which resulted in the statement of the geometrical law of crystallization associated with his name (*see* CRYSTALLOGRAPHY). The value of this discovery, the mathematical theory of which is given by Haüy in his *Traité de minéralogie*, was immediately recognized, and when communicated to the Academy, it secured for its author a place in that society. Haüy's name is also known for the observations he made in pyro-electricity. When the Revolution broke out, he was saved by the intercession of E. Geoffroy Saint-Hilaire. In 1802, under Napoleon, he became professor of mineralogy at the museum of natural history, but was deprived at the Restoration He died in Paris on June 3, 1822.

Among his numerous works may be mentioned *Tableau comparatif des résultats de la cristallographie, et de l'analyse chimique relativement à la classification des minéraux* (1809); *Traité des pierres précieuses* (1817); *Traité de cristallographie* (2 vols., 1822). He also contributed papers, of which 100 are enumerated in the Royal Society's catalogue, to various scientific journals, especially the *Journal de physique* and the *Annales du Muséum d'Histoire Naturelle.*

HAVANA or **HABANA,** capital and commercial metropolis of the Republic of Cuba, the largest city of the West Indies and one of the most progressive tropical cities in the New World, lies on the northern coast of the island of Cuba, toward the western end, at 23° 9′ N. lat. and 82° 22′ W long The population was 235,981 in 1899, the year following independence, and 562,968 in



WEATHER GRAPH OF HAVANA. THE MERCURY STANDS AT THE NORMAL ANNUAL MEAN TEMPERATURE; THE CURVE SHOWS THE NORMAL MONTHLY MEAN TEMPERATURE, AND THE COLUMNS INDICATE THE NORMAL MONTHLY PRECIPITATION

1927. Havana is the seat of the Federal executive, of the national Congress and of the Supreme Court of the nation. It boasts one of the finest natural harbours of the Caribbean region, completely protected and accessible to ships of virtually any draught. In recent years the city has undergone a wide-spread change to modernity, the narrow harbour entrance as well as the outer shore have been flanked by a broad avenue, important streets have been cut through the older city, and the narrow centre, for some years unimaginably congested with motor traffic, has been made more easily accessible to the outer suburbs and the newer sections.

Physical Appearance and Transport.—Havana occupies a peninsula west of the harbour, Morro castle, a landmark and powerful fortress of the Spanish colonial days, occupying the opposite point of the narrow harbour entrance. This entrance-strait, some 250 metres wide and 1,400 metres long, leads to the inner harbour, which lies east and south of the city, whose water front in the older sections is lined with wharves and docks, to which ocean-plying ships tie up and unload. There are three distinct arms of the inner bay, called, respectively, Marimalena or Regla bay, Guanabacoa bay and the Bay of Atares. About three-quarters of the imports and a large portion of the exports of the island pass through Havana, and shipping from every country of the world centres there. It is now the terminus of the train ferry from the United States carrying loaded cars of freight to and from Key West. The passage of this train ferry occupies six hours from the United States port to the Cuban, and a large proportion of the perishable freight between the two countries travels by this unique route; a similar train ferry is to connect Havana and New Orleans. Havana is also the terminus of the air-mail and passenger planes from the United States and an important station in the air-mail connection from the United States south-eastward to Haiti, Santo Domingo, Porto Rico and the lesser Antilles and, west and south, via Yucatán and Central America, to the Panama Canal Zone.

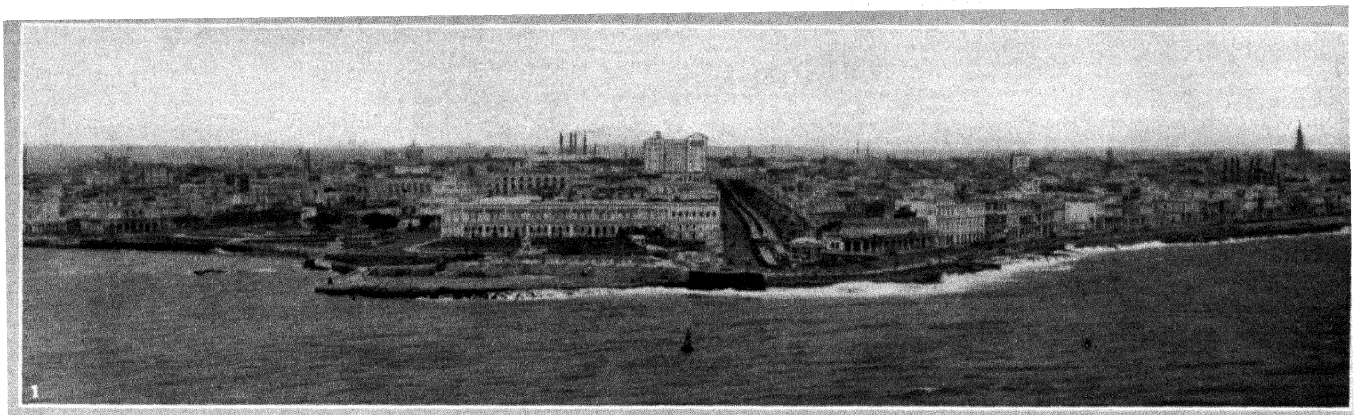
The aspect of Havana from the sea is striking and picturesque. The suburbs, with beautiful residences and country clubs, lie along the seacoast, and at the entrance of the harbour, the Morro, with its picturesque lighthouse rises to the left, while on the right the city, built of the white coral limestone of the West Indies, rises on either side of the superb avenue, properly called the Paseo de Martí, but commonly known by its old Spanish name of the Prado. The lower Prado is lined with residences, but the so-called Upper Prado leads to the Parque Central on one side of which has been built the pretentious and costly new Legislative Palace, begun by President José Miguel Gomez about 1910 and finished under President Gerardo Machado in 1929.

Streets and Buildings.—From well out toward the western suburbs, the Malecón, or sea wall, a wide avenue which skirts the sea and city, has furnished a colourful foreground which now is extended along inside the harbour, on reclaimed ground which covers the shallows of the harbour entrance, and creates wide parks and valuable commercial lands. The Malecón merges at the Prado into the new Avenida del Puerto, which with a width varying from 15 to 37 metres, connects this outer drive to the old, narrow streets of the business section. This new entrance to the old business streets of O'Reilly, Obispo (Pi y Margall) etc., has wiped out much of the old down-town congestion. Most of the old streets of Havana, laid out to furnish shade along their narrow drives and walks and to carry only a few dozen old fashioned Cuban coaches (*quitrines* or *volantas*) now carry the hundreds of automobiles in one direction only, giving a more ordered control of the traffic problem.

Many new public buildings are being built along the Malecón and the Avenida del Puerto, including the handsome Capitanía, or office of the captain of the port and the new section has also a number of fine parks, notably the Parque del Maine, with its handsome monument dedicated to the American battleship "Maine," which was blown up in Havana harbour on Feb. 15, 1898. Another recent and important public building is the Presidential palace, the residence of the chief executive, at the head of the Avenida de las Misiones, a wide new thoroughfare; this avenue leads from Avenida del Puerto inland, and is designed to be lined for its short length with the embassies and legations of foreign Governments.

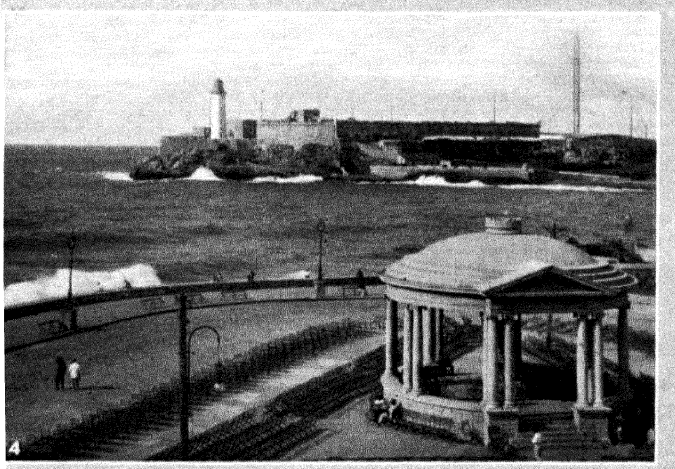
Old Landmarks.—Of the older landmarks, one of the most important is the old palace of the Spanish governors, now the office of the Ayuntamiento or city government; this fine old pile stands on the site of the original parish church, on the eastern side of the Plaza de Armas, the old centre of the colonial city. The palace was erected in 1773–92 and remodelled in 1835 and 1851. It was the scene of the surrender by the Spaniards of the sovereignty of the island to the United States at the close of the

HAVANA











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VIEWS OF HAVANA AND ITS HARBOUR

1. Havana, the capital of Cuba, as seen from Morro Castle across the entrance to the harbour. The wide street which runs through the centre of the city at right angles to the water front is the Prado
2. A closer view of the Prado, one of the finest of the residential streets. Here, as in other parts of the city, the white coral limestone of the West Indies is generally used for building material
3. View of the harbour front of Havana
4. From Havana looking across the harbour entrance-strait to Morro Castle, a fortress built by the Spaniards in the late 16th century
5. Air view of the lower portion of Havana, showing the Malecon, or sea wall. It is built on reclaimed ground which covers the shallows of the harbour entrance, creating wide parks and additional land for commercial purposes. A wide avenue extends along the harbour from the western suburbs to the Prado

fever epidemics. Havana is now one of the most carefully protected ports in the world, so far as sanitary measures are concerned, and its death rate has long since been reduced to normal proportions. Recent changes in the water system, with additions of new reservoirs, has brought the excellent water from the hills into the capital and the fetid Havana of the colonial period is now a memory only.

Communications.—Havana is the terminus of the chief railways of the island, every community of the republic seeking communication with the capital. It is also the focus of the important new Central highway, extending the length of the island, with Havana as the radiating centre of the two branches east and west; the highway was begun in 1927, to be completed in 1930, of solid concrete base, concrete bridges and surfaced with asphalt composition. Havana also has the most complete steamship service with the outside world, being a principal stop for passenger liners to and from the Panama Canal and the Caribbean region, and in touch with United States and European ports by direct lines. Cable, telephone and radio link it to the outside world

History.—Havana was founded in 1514 by Diego Velásquez in an unhealthy site now occupied by the town of Batabaño, but was early removed to its present site and rapidly assumed an increasing importance in the Spanish colonies of the New World. In 1634 its important strategic position was recognized by a royal decree declaring it to be the "Llave del Nuevo Mundo y Antemural de las Indias Occidentales." (Key to the New World and Bulwark of the West Indies), and the arms of the town to-day carry the symbolic key and its two fortresses. The town has been the object of numerous attacks by English, French and Dutch pirates. In 1537 it was sacked and burned, in 1555 it was plundered by French buccaneers and in 1856 Sir Francis Drake threatened it; but in 1589 Philip II. of Spain ordered the erection of the Punta and the Morro, the ancient defences, and the residence of the governor of the island was removed from Santiago de Cuba to Havana, which gained the rank of a city in 1592. It is estimated that the population of the city was about 3,000 by 1600 but had doubled by 1655, when many Spaniards fled there from Jamaica after the capture of that island by the English. During the 17th century Havana became the port of rendezvous of the east-bound fleets of Spanish galleons and was thus the object of many attacks by the English, Dutch and French. The port was blockaded four times by the Dutch in the first half of the 17th century and in 1671 the city walls were begun, being completed in 1702. The European wars of the 17th and 18th centuries were marked by various incidents in local history. After the end of the Spanish War of Succession (1713) came a period of comparative prosperity in slave-trading and general commerce. The creation, in 1740, of a monopolistic trading-company was an event of importance in the history of the island. English squadrons threatened the city several times in the first half of the 18th century, but it was not until 1762 that an investment, made by Admiral Sir George Pocock and the earl of Albermarle, was successful. The siege lasted from June to August and was attended by heavy losses on both sides. The British commanders wrung great sums from the church and the city as prize of war and price of good order. By the treaty of Feb. 10, 1763, at the close of the Seven Years' War, Havana was restored to Spain in exchange for the Floridas. The English turned over the control of the city on July 6. Their occupation greatly stimulated commerce, and from it dates the modern history of the city and of the island. The gradual removal of obstacles from the commerce of the island from 1766 to 1818 particularly benefited Havana. At the end of the 18th century the city was one of the seven or eight great commercial centres of the world, and in the first quarter of the 19th century was a rival, in population and in trade, of Río Janeiro, Buenos Aires and New York. In 1789 a bishopric was created at Havana suffragan to the archbishopric at Santiago. From the end of the 18th century Havana, as the centre of government, was the centre of movement and interest. During the administration of Miguel Tacón Havana was improved by many important public works; his name is frequent in the nomenclature of the city.

In general, the history of Havana under the Spaniards, and since independence, has been the history of Cuba. Various pirate raids, the slave traffic in the 18th and 19th centuries, filibustering expeditions in the 19th century, and the war (ushered in by the blowing up of the U.S. battleship "Maine" in Havana harbour, Feb. 15, 1898) between Spain and the United States in 1898–99, all had direct bearing on the history of Havana and the city suffered and triumphed with them. These are noted in the article on Cuba.

Havana, like other cities of the West Indies, has suffered from the hurricanes that scourge that region, the most violent being those of 1768, 1810 and 1846, while in 1907 and again in 1926, Havana suffered severely from notable hurricanes.

BIBLIOGRAPHY.—There is little descriptive data in book form in English, and the most important references are those under the article on Cuba (*q.v.*). In Spanish, there are some valuable works, including the following: J. M. de la Torre, *Lo que fuimos y lo que somos, o la Habana antigua y moderna* (Havana, 1857); P. J. Guiteras, *Historia de la conquista de la Habana, 1762* (Philadelphia, 1856); J. de la Pezuela, *Sitio y rendición de la Habana en 1762* (Madrid, 1859); A. Bachiller y Morales, *Monografía histórica* (Habana, 1883), minutely covering the English occupation (the best account) of 1762–63; María de las Mercedes, comtesse de Merlin, *La Habana* (Paris, 1844). (W. THO.)

HAVANT, a market town, Hampshire, England, 67 m. S.W. from London by rail. Pop. of urban district (1921) 4,402. Warblington, 1 m. S.E. (pop. [1921] 4,083) has a church with traces of pre-Norman work, and some remains of a Tudor castle. Havant lies near the head of Langstone harbour. The church of St. Faith, largely rebuilt in 1875, retains some Early English work. There are breweries and tanneries. The island of Hayling, which lies off the coast, was in the possession of successive religious bodies from the Conquest (when it was given to the Benedictines of Jumièges, near Rouen), until the Dissolution. The church of South Hayling, a seaside resort, is fine Early English.

HAVEL, a river of Prussia, Germany, rising at a height of 223 ft. on the Mecklenburg plateau, 7 m. N.W. of Neu-Strelitz, and after threading several lakes flowing south as far as Spandau. Thence it curves south-west, past Potsdam and Brandenburg, traversing another chain of lakes, and finally continues north-west until it joins the Elbe from the right some miles above Wittenberg after a total course of 221 m. and a total fall of only 158 feet. Its banks are mostly marshy or sandy, and the stream is navigable from the Mecklenburg lakes downwards. Several canals connect it with other rivers. Area of river basin, 10,159 sq.miles.

HAVELBERG, a town in the Prussian province of Brandenburg, on the Havel just above its junction with the Elbe. Pop. (1925) 5,408. Havelberg was formerly a strong fortress and changed hands frequently during the Thirty Years' War. The town was incorporated in 1875, and is built partly on an island in the Havel, and partly on hills on the right bank of the river, on one of which stands the fine Romanesque cathedral dating from the 12th century.

HAVELOCK, SIR HENRY (1795–1857), British soldier, one of the heroes of the Indian Mutiny, the second of four brothers (all of whom entered the army), was born at Ford Hall, Bishop-Wearmouth, Sunderland, on April 5, 1795, the son of a wealthy shipbuilder. Educated at Charterhouse school, he entered the Middle Temple in 1813, studying under Chitty, the eminent special pleader. But in 1815 he took a commission in the Rifle Brigade (95th), procured for him by the interest of his brother William. In 1823, having exchanged into the 21st and thence into the 13th Light Infantry, he followed his brothers William and Charles to India, first qualifying himself in Hindustani under Dr. Gilchrist, a celebrated Orientalist.

At the close of 23 years' service he was still a lieutenant, and it was not until 1838 that, after three years' adjutancy of his regiment, he became captain. Before this, however, he had held several staff appointments, notably that of deputy assistant adjutant-general of the forces in Burma till the peace of Yandabu, of which he, with Lumsden and Knox, procured the ratifications at Ava from the "Golden Foot," who bestowed on him the "gold leaf" insignia of Burmese nobility. In 1828 he published at Serampore *Campaigns in Ava,* and in 1829 he married Hannah Shepherd, daughter of Dr. Marshman. About the same time he

became a Baptist, being baptized by John Mack at Serampore. During the first Afghan war he was present as aide-de-camp to Sir Willoughby Cotton at the capture of Ghazni, on July 23, 1839, and at the occupation of Kabul. After a short absence in Bengal to secure the publication of his *Memoirs of the Afghan Campaign,* he returned to Kabul in charge of recruits, and became interpreter to General Elphinstone. In 1840, being attached to Sir Robert Sale's force, he took part in the Khurd-Kabul fight, in the celebrated passage of the defiles of the Ghilzais (1841) and in the fighting from Tezeen to Jalalabad. Here, after many months' siege, his column in a sortie *en masse* defeated Akbar Khan on April 7, 1842. He was now made deputy adjutant-general of the infantry division in Kabul, and in September he assisted at Jagdalak, at Tezeen, and at the release of the British prisoners at Kabul, besides taking a prominent part at Istaliff. He also served in the Mahratta and Sikh campaigns of 1843 and 1845. After two years spent in England he became (1854), quartermaster-general, then full colonel, and lastly adjutant-general of the troops in India.

In 1857 he was selected by Sir James Outram to command a division in the Persian campaign. Peace with Persia set him free just as the Mutiny broke out; and he commanded a column "to quell disturbances in Allahabad, to support Lawrence at Lucknow and Wheeler at Cawnpore, to disperse and utterly destroy all mutineers and insurgents." At this time Lady Canning wrote of him in her diary. "General Havelock is not in fashion, but all the same we believe that he will do well. No doubt he is fussy and tiresome, but his little old stiff figure looks as active and fit for use as if he were made of steel." Havelock proved himself the man for the occasion. At Fatehpur, on July 12, at Aong and Pandoobridge on the 15th, at Cawnpore on the 16th, at Unao on the 29th, at Busherutgunge on the 29th and again on Aug. 5, at Boorhya on Aug. 12, and at Bithur on the 16th he defeated overwhelming forces. Twice he advanced for the relief of Lucknow, but twice prudence forbade a reckless exposure of troops wasted by battle and disease in the almost impracticable task. Reinforcements arriving at last under Outram, he crowned his successes on Sept. 25, 1857 by the capture of Lucknow. There he died on Nov. 24, 1857, of dysentery, brought on by the anxieties and fatigues connected with his victorious march and with the subsequent blockade of the British troops. He received a K.C.B. Other honours, a major-generalship and a baronetcy, he did not live to receive; they were conferred on his heir.

See J. C. Marshman, *Life of Havelock* (1860); A. Forbes, *Havelock* (English Men of Action Series, 1890); F. M. Holmes, *Four Heroes of India* (1892); G. B. Smith, *Heroes of the Nineteenth Century* (1901); L. J. Trotter, *The Bayard of India* (1903).

HAVELOK THE DANE, an Anglo-Danish romance. The hero, under the name of CUHERAN or CUARAN, was a scullion-jongleur at the court of Edelsi (Alsi) or Godric, king of Lincoln and Lindsey. At the same court was brought up Argentille or Goldborough, the orphan daughter of Adelbrict, the Danish king of Norfolk, and his wife Orwain, Edelsi's sister; and Edelsi, to humiliate his ward, married her to the scullion Cuaran. But, inspired by a vision, Cuaran and Goldborough set out for Grimsby, where Cuaran learned that Grim, his supposed father, was dead. His foster-sister, moreover, told him that his real name was Havelok, that he was the son of Gunter (or Birkabeyn), king of Denmark, and had been rescued by Grim, who though a poor fisherman was a noble in his own country, when Gunter perished by treason. The hero then wins back his own and Goldborough's kingdoms, punishing traitors and rewarding the faithful. The story exists in two French versions: as an interpolation between Geffrei Gaimar's *Brut* and his *Estorie des Engles* (*c.* 1150) and in the Anglo-Norman *Lai d'Havelok* (12th century). The English *Havelok* (*c.* 1300) is written in a Lincolnshire dialect and embodies abundant local tradition. The name of Havelok (Habloc, Abloec, Abloyc) is said to correspond in Welsh to Anlaf or Olaf. The close similarity between the Havelok saga and the story of Hamlet (Amlethus), as told by Saxo Grammaticus, was pointed out long ago by Scandinavian scholars (*see* HAMLET). Part of the Havelok legend lingers in local tradition. Havelok destroyed his enemies in Denmark by casting down great stones upon them from the top of a tower, and Grim is said to have kicked three of the turrets from the church tower in his efforts to destroy the enemy's ships. John Weever (*Antient Funerall Monuments,* p. 749, 1631) says that Grimsby merchants were free from toll in Elsinore through the interest of Havelok, the Danish prince; and the common seal of the town of Grimsby represents Grim, with "Habloc" on his right hand and Goldborough on his left.

The unique English ms. of *Havelok* (Mss. Laud Misc. 108) in the Bodleian was edited for the Roxburghe club by Sir F. Madden in 1828. This edition contains the two French versions. There are subsequent editions by W. W. Skeat (1868) for the E. E. Text Society, by F. Holthausen (1901), and by W. W. Skeat and K. Sisam (1915); and a modern English version by Miss E. Hickey (1902). Gaimar's text and the French *lai* are edited by Sir T. D. Hardy and C. F. Martin in *Rerum Brit. med. aev. scriptores,* vol. i (1888). *See* also the account of the saga by H. L. Ward (*Cat. of Romances,* i. 423–446); for the identification of Havelok with Anlaf Curan *see* G. Storm, *Englische Studien,* iii. 533 (1880), a reprint of an earlier article; E. K. Putnam, *The Lambeth Version of Havelok* (Baltimore, 1900).

HAVENSTEIN, RUDOLF (1857–1923), German financier, was born at Meswitz on March 10, 1857, the son of an official in the Prussian judicial department. He studied at Heidelberg and Berlin and entered the judicial service, transferring in 1890 to the Ministry of Finance. He became president of the Prussian State bank in 1900, and in 1908 succeeded Koch as president of the Reichsbank, the affairs of which he conducted during the critical war and post-war periods. He was blamed for giving excessive credits after the war and thus conducing to the deterioration of the currency. He died in Berlin on Nov. 20, 1923.

HAVERFIELD (BALGUY), EVELINA (1867–1920), English war hospital worker, daughter of the 3rd Baron Abinger, was born on Aug. 9, 1867. She married Major Haverfield, R.A., in 1887, and *en secondes noces* General Balguy in 1899. She collected abandoned troop horses on the veldt during the Boer War and nursed them back to good condition. She was among the first London suffragists to be sentenced to imprisonment and organized a branch of the Women's Social and Political Union. She joined the Women's Emergency Corps in August 1914, founded and organized the Women's Volunteer Reserve, and was commandant-in-chief of the Women's Reserve Ambulance (Green Cross) Corps. She gave heroic service to the Serbian wounded during the war, and returned to Serbia in 1919 to establish an orphanage for Serbian children. She succumbed to pneumonia, brought on by fatigue and exposure, on March 21, 1920, at Baiyna-Bachta.

HAVERFIELD, FRANCIS JOHN (1860–1919), English historian and archaeologist, was born at Shipston-on-Stour on Nov. 8, 1860. Educated at Winchester and New college, Oxford, he became a tutor at Christ Church in 1891, and Camden professor of ancient history in 1907. Haverfield was an authority on the history and antiquities of Roman Britain, and was entrusted by Mommsen with the editing of the British section of the *Corpus Inscriptionum.* He died at Oxford on Sept. 1, 1919. Amongst his publications were *The Romanization of Roman Britain* (1905, 4th ed. 1923), *Ancient Town Planning* (1913), and many monographs on Roman history.

For a bibliography of his works see *The Journal of Roman Studies,* vol. viii.

HAVERFORD, a township of Delaware county, Pa., U.S.A., and a village of the same name, 9m. N.W. of Philadelphia, served by the Pennsylvania railroad. The population of the township was 6,631 in 1920. It is a residential suburb and the seat of Haverford college, founded in 1833 by the Society of Friends. This is one of the few older colleges which have remained small. The enrolment is kept at about 250, while the endowment has grown to over $4,000,000, permitting a faculty of unusual size in proportion to the number of students, and a total expenditure for each student of about twice the amount he pays for lodging, board and tuition. The Quaker spirit has been carefully cherished. Three times a month the college in a body attends the Friends' meeting.

HAVERFORDWEST (Welsh Hwlffordd), chief town of Pembrokeshire, South Wales, municipal borough and a county of itself with its own lord lieutenant. Pop. (1921) 5,756. Situated

at the highest navigable point on the western Cleddau where the river is also bridgeable, it is also a focus of routes from St. Davids, Fishguard, Cardigan, Narberth, Pembroke and Milford Haven. The streets are steep because the houses cluster around the castle on a hillock. The site is undoubtedly older than the Norman intrusion as the district abounds in place names of Scandinavian origin. Large numbers of Flemings were permitted by Henry I. to settle in the hundred of Roose or Rhos in the years 1106–08, 1111, 1156. The castle, though first mentioned in 1214, is believed to have been built in 1120 by Gilbert de Clare, first Earl of Pembroke, with the object of keeping an important road to Ireland open as well as of protecting the English and Flemish colonists. The church of St. Mary has an elaborate carved 15th century oak ceiling as well as many interesting memorials. To the west of the church is a curious vaulted building (perhaps late 12th century) once the record office, but now a market hall. Other churches are St. Thomas' (15th century) and St. Martin's (14th century). There are also ruins of an 11th century Augustinian priory. The old walls and fortifications of the mediaeval town have almost disappeared. The earliest charter known is one from Henry II. Further charters were presented by King John, William Marshall II., and Edward V. In 1536, under Henry VIII. Haverfordwest was declared to be a town and county of itself and was further empowered to send representative burgers to parliament. The castle was garrisoned for the king in the Civil War but was captured by Parliament in 1644–45 and afterwards demolished. The town remained prosperous through maritime commerce during the 17th and 18th centuries, but with the rise of Milford Haven the trade of Haverfordwest declined. The town, today, relies on the marketing of agricultural produce, but still retains an importance out of proportion to its modern significance. A special feature of such towns is the large number of charities. In Haverfordwest these include John Perrot's bequest (1579) yielding about £350 annually for the improvement of the town and Tasker's charity school founded in 1684

HAVERHILL, a market town of Suffolk, England. Pop. of urban district (1921) 4,083. It is 55 m. N N.E. from London by the L.N.E. railway, on the Long Melford-Cambridge branch. The church of St. Mary is Perpendicular, but extensively restored. There are large manufactures of cloth, silk, matting, and a considerable agricultural and transport trade.

HAVERHILL (hāv'rĭl), a city of Essex county, Massachusetts, at the head of navigation on the Merrimack river, 33 m. N. of Boston. It is served by the Boston and Maine railroad. The population was 53,884 in 1920 (24·7% foreign-born white). The city has an area of 34·35 sq.m., extending for 9 m. along the N. bank of the river, and including on the opposite bank the former town of Bradford. The surface is undulating, with several detached round hills (250 to 340 ft. high), and there are five lakes within the boundaries. The public parks have an area of 259 ac. and there is a system of supervised playgrounds. Haverhill has been an important industrial centre for over two centuries. The manufacture of slippers, shoes and boots, which has long been the leading industry, was established about 1795, and the city now makes about ⅛ of all the women's shoes produced in the country. The husband of Hannah Dustin (*see* below) was a brickmaker, and that industry has been carried on in the same locality ever since. The manufacture of woollen hats dates from the middle of the 18th century, and woollen mills were established in 1835. The aggregate factory output in 1925 was valued at $55,163,457. The assessed valuation of property for 1927 was $08,149,900. Haverhill was founded in 1640 by the Rev. John Ward, a native of Haverhill, England. The Indian name of the place was Pentucket. The site was bought from the Indians in 1642 for £3.10s., and the deed is preserved in the museum of the Historical society. The frontier settlement suffered severely from the Indians. In 1698 Hannah Dustin, with her new-born child and nurse, were kidnapped and carried north to the vicinity of Penacook, now Concord, New Hampshire. With the aid of the nurse and a captive English boy, Mrs. Dustin tomahawked and scalped ten Indians, and escaped down the river to her home. In 1708 a party of 250 French and Indians attacked the village, killing 40 of the inhabitants. There was a destructive fire in 1873, and again in 1882, when almost the whole of the shoe district was burned. A petition from Haverhill to the House of Representatives in 1842, praying for the peaceable dissolution of the Union, was one of the most violently debated of the long series presented by John Quincy Adams in his defence of the right of petition. Haverhill was the birthplace (1807) and the home until 1836 of John Greenleaf Whittier. The Whittier homestead, now kept as a literary shrine, is the scene of his *Snow-Bound,* and his poems are full of allusions to places in the city and incidents in the lives of its people. Haverhill was incorporated as a town in 1645; as a city in 1869. Bradford, settled in 1649 and annexed to Haverhill in 1897, is the seat of Bradford academy (1803), one of the oldest schools for girls in the country. In 1909 the city adopted a commission form of government.

HAVERSACK or **HAVRESACK,** the bag in which horsemen carried the oats for their horses (through the French from Ger. *Habersack,* an oat-sack, a nose-bag, *Hafer* or *Haver,* oats). In Scotland and the north of England *haver,* meaning oats, is still used, as haver-meal or haver-bread. Haversack is now used for the strong bag made of linen or canvas, in which soldiers, sportsmen or travellers, carry their personal belongings, or more usually the provisions for the day.

HAVERSTRAW, a village of Rockland county, New York, on the W. bank of the Hudson river, 35 m. above New York city. It is served by the Erie and the West Shore railways. The population in 1925 was 5,925. The village has a beautiful location at the base of High Tor (832 ft.), on a wide bay of the river. It has a silk mill and dye plant, and extensive manufactures of brick and brickmaking machinery. A mile distant are large calico print works employing 2,000 workers. The region was settled by the Dutch, probably as early as 1648. Near the village is the house where Benedict Arnold and Major André met before daylight on Sept. 22, 1780, to plan for the betrayal of West Point. In 1826 a short-lived Owenite community (dissolved within five months) was established near West Haverstraw. Haverstraw was incorporated under the name of Warren in 1854, and re-incorporated as Haverstraw in 1873.

HAVET, JULIEN (Pierre Eugene) (1853–1893), French historian, was born at Vitry-sur-Seine, the second son of Ernest Havet. His valedictory thesis at the Ecole des Chartes, *Série chronologique des gardiens et seigneurs des Iles Normandes* (1876), was a definitive work and but slightly affected by later research. In 1878 he followed his thesis by a study called *Les Cours royales dans les Iles Normandes.* His first work on the Merovingian institutions was *Du sens du mot "romain" dans les lois franques* (1876), a critical study on a theory of Fustel de Coulanges (*q.v.*). In this he showed that the status of the *homo Romanus* of the barbarian laws was inferior to that of the German freeman; that the Gallo-Romans had been subjected by the Germans to a state of servitude; and, consequently, that the Germans had conquered the Gallo-Romans. He died prematurely at St. Cloud on Aug. 19, 1893.

The two posthumous volumes, *Questions mérovingiennes* and *Opuscules inédits* (1896), contain besides important papers on diplomatic and on Carolingian and Merovingian history, a large number of short monographs ranging over a great variety of subjects. *Mélanges Havet* (1895) contains a bibliography of his works compiled by his friend Henri Omont.

HAVILDAR, the Hindustani name of the sepoy non-commissioned officer in the British native army of India, who ranks below a *jemadar* but above a *naik,* and which corresponds to the rank of sergeant in the British Service. The *havildar* wears 3 chevrons as his badge of rank. The name is a corruption of the Persian *hawālādār* or *hawāldār, i.e.,* one holding a position of trust, such as a steward, agent or subordinate revenue officer, and in this sense it has many applications in India and Persia. As a military rank it was introduced into the native army of India in the 18th century.

HAVILLAND, GEOFFREY DE (1885–), British aeronautical engineer, was born at Haslemere, and educated at St. Edward's school, Oxford, and at the Crystal Palace school of engineers. He learnt to fly on his own ground at Haslemere, and made his first ascent in June 1910, in an aeroplane designed by

himself. He took up aeroplane designing commercially, and produced the "Airco" and "De H" machines, becoming director of the De Havilland Aircraft Company.

HAVRE, LE, the second seaport of France and capital of an arrondissement in the department of Seine-Inférieure, on the estuary of the Seine, 143 m. W.N.W. of Paris and 55 m. W. of Rouen. Pop. (1926) 155,129. Until 1516 Havre was only a fishing village possessing a chapel dedicated to Notre-Dame de Grâce, to which it owes the name, Havre (harbour) de Grâce, given to it by Francis I. when he began the construction of its harbour. The town in 1562 was delivered over to the keeping of Queen Elizabeth by Louis I., prince de Condé, leader of the Huguenots, but the English were expelled in 1563 by Charles IX. and his mother, Catherine de Medici, in person. Defences and harbour-works were continued by Richelieu and completed by Vauban. The English bombarded it in 1694, 1759, 1794 and 1795. It was a port of considerable importance as early as 1572, and despatched vessels to the whale and cod-fishing at Spitsbergen and Newfoundland. In 1672 it became the entrepôt of the French East India company, and afterwards of the Senegal and Guinea companies. Napoleon I. raised it to a war harbour of the first rank, and under Napoleon III. works begun by Louis XVI. were completed. During the World War Britain and America used Havre as a base and point of landing for troops and stores. Also after the fall of Antwerp and Ostend the Belgian Government was transferred here and housed in the Hôtel des Régales at St. Adresse to the northwest. After the armistice it formed one of the American embarkation points. Trade has again reached its highest pre-war point.

The greater part of the town stands on the level strip of ground but on the north rises an eminence, la Côte the richer quarter. The central point of the town is the Place de l'hôtel de ville in which are the public gardens. The church of Notre-Dame, dating from the 16th and 17th centuries is a mixture of late Gothic and Renaissance styles of architecture but the tower is older. The carved oak organ case was the gift of Cardinal Richelieu. The chief buildings of Havre, including the hôtel de ville, the law courts, and the exchange, are all of modern erection. The museum contains a collection of antiquities and paintings. Havre is the seat of a sub-prefect, and a tribunal of first instance, a tribunal of commerce, a board of trade arbitrators, a tribunal of maritime commerce, a chamber of commerce and a branch of the Bank of France. There are 14 basins (the oldest of which dates back to 1669) with more than 8 m. of quays. Work has been continued on the 1909 programme of port improvements, which includes a large graving dock and wharfage in tidal basin, a floating dock and pontoons, a basin for large oil tankers and reservoirs in the outer harbour, and a wharf and mole for goods storage in the north part of the port. A petroleum pipe line to Paris has been built. The chief docks are the Bassin Bellot and the Bassin de l'Eure. In the latter the mail-steamers of the Compagnie Générale Transatlantique are berthed; and the Tancarville canal, by which river-boats unable to attempt the estuary of the Seine can make the port direct, enters the harbour by this basin. The port, which is an important point of emigration, has regular steam-communication with New York and with many of the other chief ports of Europe, North, South and Central America, the West Indies and Africa. Havre is the great French port for cotton and coffee and also imports copper and other metals, wool, rum, foreign wines, oil seeds and dyewoods. Its industries are rope making, timber for building, wire drawing, machinery making, flour-milling, oils, dye extracting from woods, spinning and weaving, toy and chemical works.

HAVRE, a city of northern Montana, U.S.A., 35m. from the Canadian border, on the Milk river and Federal highway 2; a division point on the Great Northern railway, and the county seat of Hill county. The population was 1,033 in 1900; 5,429 in 1920; and was estimated locally at over 7,000 in 1928. It has railroad shops, a creamery, a flour mill, and a cold storage plant and is an important shipping point for wheat, live stock and poultry. Irrigation works are under construction in the vicinity. The city was settled about 1880 and was incorporated in 1896.

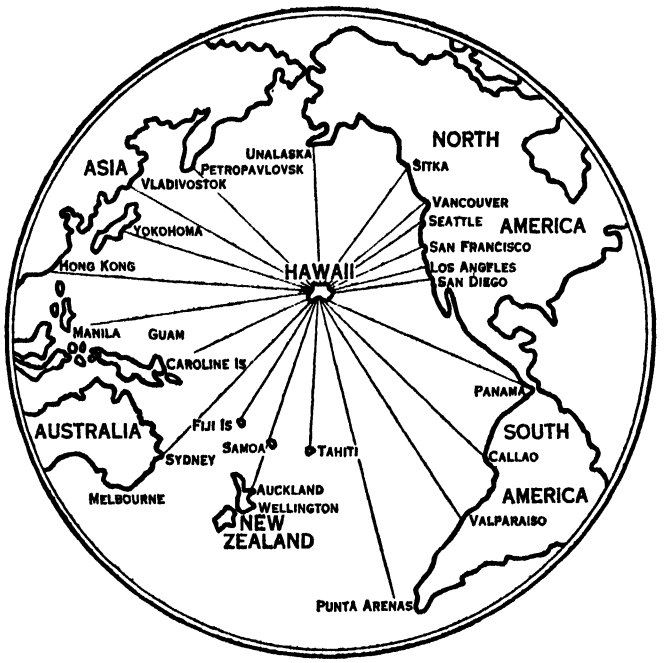
HAVRE DE GRACE, a city of Harford county, Md., U.S.A., 36m. N.E. of Baltimore, at the head of Chesapeake Bay and the mouth of the Susquehanna river. It is served by the Baltimore and Ohio and the Pennsylvania railways, and by steamboat lines. The population was 4,377 in 1920 (18% negroes). It has several manufacturing industries and a considerable trade in coal, lumber and fish. There is a fine race-track here, of national repute, and at Aberdeen, 5m. S.E., are the U.S. artillery-proving grounds.

HAWAII (hah-wī'i; native hah-vah'ē-ē), **HAWAIIAN** or **SANDWICH ISLANDS,** capital Honolulu (*q.v.*), geographically a chain of islands near the centre of the north Pacific ocean, 1,578 m. from E S.E. to W.N.W., between 18° 55′ and 28° 25′ N. and 154° 48′ and 178° 25′ W. Politically, as a Territory of the United States, it consists of the islands ceded by the Republic of Hawaii to the United States in 1898 and made a Territory by Congress in 1900, and hence excludes the small coral island, Midway, which was acquired by the United States in 1859 and has been used since 1902 as a cable station, and includes two small uninhabited coral islands not in the chain, Johnston (or Cornwallis) and Palmyra.

Hawaii, comprising both volcanic and coral islands built up from depths of 15,000 to 18,000 ft., is the northernmost of the central Pacific island groups. It has the largest area (6,412 sq.m.), and greatest altitude (13,825 ft.). It is also the most isolated of important land areas. The nearest important groups to the south are Samoa, 2,263, and Tahiti, 2,390 nautical miles. To the north, Unalaska in the Aleutian islands is 2,106, and to the west, Guam is 3,337 miles. The distances in nautical miles from Honolulu to principal ports of the Pacific are: San Francisco, 2,091; Los Angeles, 2,228; Seattle, 2,409; Sitka, 2,395; Yokohama, 3,394; Sydney, 4,420; Panama, 4,685; Manila, 4,838; Hongkong, 4,936; Valparaiso, 5,918. Cape Horn is 6,488 miles. The large, high, inhabited islands, Hawaii (4,016 sq.m.), Maui (728), Molokai (261), Lanai (139), Kahoolawe (44), Oahu (598), Kauai (547) and Niihau (73), together with their nearby small uninhabited islands, form the east-south-east fourth or about 375 m. of the chain, extending to 22° 14′ N. and 160° 15′ W. The islands of the remainder of the chain are so small that their total area is only 6 sq m., and yet they afford a rich field for the naturalist. Those in the west half of this part of the chain are coral (mostly sand) islands; those in the other half, forming a transition link with the large inhabited islands, are lava-rock. The islands of the entire chain apparently were formed beginning at the westerly and finishing at the easterly end, where there are still active volcanoes.

Westerly Islands.—The small westerly group are remains of larger islands which have mostly eroded. The lava-rock ones rest on more or less extensive banks lying at small depths, and the coral ones are sand islands or islets on the rims of large atolls. Those of lava-rock are Nihoa or Bird (895 ft. high), Necker (276), French Frigates shoal (a rock 120 ft. high and 16 sand islets) and Gardiner (170); the coral ones, 10–40 ft. high, are Laysan, Lisiansky, Pearl and Hermes reef (12 islets), Midway (Sand island, a cable station and Eastern island), and Ocean or Cure (Green island, and two islets). In addition there are Frost shoal, Brooks shoal, Maro reef, Dowsett reef and Gambia bank, which are just awash or do not reach the surface. None are inhabited except for the cable station at Midway. For a time Laysan was occupied for its guano until the deposits became exhausted. Necker has stone platforms and enclosures, perhaps temples, of unknown origin; stone images and dishes found there are in Honolulu museum. The Hawaiians anciently visited Nihoa and Necker to obtain materials for their famous feather work as well as for fish. There is little vegetation except grasses and shrubs. The waters abound in fish and turtles, and, especially at Pearl and Hermes reef, a species of hair seal found nowhere else. These islands are most noted, however, for their bird life, and in 1909 all of them except Midway were created by the National Government into the Hawaiian Islands Bird Reservation, to protect them from Japanese poachers who, for the feathers, killed some 300,000 birds in one season. Collectively, they form the largest and most

numerous bird colony in the world. One naturalist estimated at over ten millions the number of birds, resident and migratory, in a single year at Laysan alone, an island 1¼ m. by 1 m., with a lagoon a mile long in the centre. These are of many varieties, some not found elsewhere, including frigate, man-o'-war, tropic, mutton and miller birds, the Laysan canary, finch, duck and honey-eater, terns, curlews, turnstones, stilts, plover, shovelers,



MAP SHOWING CENTRAL GEOGRAPHICAL RELATION OF HAWAII TO FOUR CONTINENTS

boobies, tatlers, petrels and shearwaters that burrow like rabbits, rails that have only rudimentary wings and cannot fly, and, most numerous, albatrosses that indulge much in curious dances, two by two. Many are remarkably unafraid of man.

Hawaii.—The island of Hawaii, which contains two-thirds of the area of the group, is roughly triangular in shape, with sides of 90, 75 and 60 m.; it consists of five volcanic mountains about 20 m. apart, connected by saddles 3,000–7,000 ft. high, formed by overlapping lava flows. Being the newest island, and still in the making by volcanic action, little of its 297 m. of coast is bordered with coral reefs, and there has been little erosion except along the 60 m. of the north-east coast from the principal harbour, Hilo, to the north end of the island, the windward side of the older mountains, where copious rains and ocean waves and currents have created valleys and cliffs increasing northward in depth and height and culminating in the Waipio and Waimano valleys, several thousand feet deep, receding from coastal cliffs 1,500 ft. high. Throughout the rest of the island there is not a stream except at times of unusual rain—partly because of the porosity of the rocks and soils, and, on the leeward side, partly because of insufficiency of rain.

The Kohala mountain or range (5,505 ft.), the oldest, its windward side deeply eroded, its top a water sponge, its leeward side dry, with the higher slopes covered with cinder cones, forms the north angle of the island. Next, south-easterly, is Mauna Kea ("White Mountain," so-called from the snow on its summit). There are glacial markings on its upper windward slopes. At 13,000 ft. there is a small lake, which often freezes over, and nearby are extensive quarries of fine-grained, compact greyish stone, of which the Hawaiians of old made their best adzes and other implements. The crater has disappeared, blown up in an explosive eruption, or covered by reddish cinder cones, which in great numbers dot the summit and upper slopes. This is not only the highest mountain of the group but the highest island mountain in the world (13,825 feet). In a real sense it is also the highest of all mountains in the world, for, although many others are higher above sea-level, this starts from a great plain 18,000 ft. below sea-level and is built up from that as a single mountain, rising within a distance of 50 m., to a height of nearly 32,000 feet.

South-westerly from Mauna Kea is Hualalai (8,269 ft.), whose summit, like that of Mauna Kea, has no great crater and is covered with cinder cones, but, unlike Mauna Kea, has many small pit craters. Its only flow in historic times was in 1801. Further south is Mauna Loa, "Long Mountain," twin of and 150 ft lower than Mauna Kea. Except for the cinder cones of the latter it would be higher. It is an immense lava dome, not only the largest volcano, but the largest mountain in the world in cubic content; it discharges more lava than any other volcano. On the summit is an elongated pit crater, Mokuaweoweo (3·7 sq.m.), with vertical walls 500 to 600 ft. high, from which radiate black and brown lava flows of bygone ages. While at times, especially preceding eruptions, the summit crater is exceedingly active, no flow has originated there in historic times. All historic flows, except submarine, have burst from the sides at elevations of 7,000 to 13,000 ft., usually on two lines running north-east and south-west respectively from the summit. The principal flows of the last century were in 1832–43–51–52–55–59 (33 m. long, 1 m. wide in places), 1868, 1877 (submarine), 1880–81–87–99; 20th century 1907-16–19 and 1926.

Lastly and easternmost, is Kilauea, with the largest and most spectacular of all active craters, an oval pit 4·14 sq.m. in area, with walls now 500 ft. high—1,000 ft. a century ago. It is hardly a distinct mountain, for, although an independent volcano and older than Mauna Loa, it is merely a hole in the side of the latter at an elevation of 4,000 ft.; it is reached by motor in an hour, over 30 m. of concrete road through tropical forests from Hilo. Except for occasional flows over the floor of the main pit, visible activity has, for several decades, been confined to an oval inner pit, Halemaumau, 3,000 by 3,500 ft., and 1,300 ft. deep in 1928. Operating in cycles, the lava rises until it overflows and breaks through some subterranean passage and drains out, only to begin the cycle again. During the 19th century and the early years of the 20th the only flows of size outside the crater, and some distance from it, were those of 1823–40–68 and 1920–21, but small quantities of lava have erupted nearer in 1832–68, 1922 and 1923. Just before the last drop-out, in 1924, the lake of boiling molten lava covered about 50 ac., and when the lava fills the present enlarged caldera it will cover about 190 acres.

Only two explosive eruptions have occurred in historic times, those of Kilauea in 1790 and 1924, the earlier of which destroyed a division of a Hawaiian army. Earthquakes have been numerous and tidal waves occasional on the east coast of Hawaii island, but have done little damage, except in 1868, when, at the time of the lava flow of that year, a landslide 1 by 3 m., the so-called "mud flow," killed 31 persons; a tidal wave swept away several small villages, killing 46 persons, many houses were levelled, great cracks opened and the coast subsided some feet. All historic flows of Mauna Loa and Kilauea have been in regions of few or no habitations. That of 1826 covered the small village of Hoopuloa without loss of life. The lavas are of two kinds, *pahoehoe*, of smooth but wrinkled, shiny surface, and *aa*, exceedingly broken and jagged. Since 1911 a volcanic observatory has been maintained at Kilauea, and in 1916 the National Government created the Hawaii National park consisting of the Kilauea and Mauna Loa sections (116 and 28 sq.m.) on Hawaii, and the Haleakala section (26 sq.m.) on Maui, to which was added in 1927 a strip (72 sq.m) connecting the first two sections. In the Kilauea section, visited by 60,000 persons annually, besides the active volcano, there is much of interest, such as numerous other pit craters, sulphur banks, pumice beds, lava tubes, tree molds, lava trees, lava spatters in trees, stalactites, Pele's hair (Pele being the Hawaiian goddess of volcanoes), tropical forests and birds and sulphur-steam baths.

Maui, Molokai, Lanai, Kahoolawe and Molokini (the last uninhabited), probably once a single island, are now separated by channels only 6 to 10 m. wide and 250 to 600 ft deep. They are separated from Hawaii by a channel 26 m. wide and 6,192 ft. deep, and from Oahu by one 23 m. wide and 2,244 ft. deep.

Maui, shaped like the head and bust of a woman, consists of

two mountains (East and West Maui) connected by a low isthmus 6 m. wide. One of these mountains, Haleakala ("House of the Sun," 10,032 ft.), has on its summit the largest of all extinct craters, 20 m around and 2,720 ft. deep; on whose floor of 19 sq.m. are 16 reddish cinder cones 400 to 900 ft. high. The view from the summit is the grandest in the Territory. The windward side, a succession of gorges, rich in waterfalls and verdure, supplies the water for the irrigation of the arid isthmus. It is traversed by a wonderfully scenic drive. The other mountain, whose highest peak is Puu Kukui (5,788 ft.), being much older, is marked by deep radiating canyons such as the Iao or Wailuku valley (4,000 ft. deep), which is of marvellous beauty.

Molokai likewise consists of two mountains, Mauna Loa (1,382 ft.) at the west end and Kamakou (4,958 ft) at the east end, connected by a saddle 400 ft. high, both cut off by erosion on the windward side, so that the island is narrow and of fairly even width, 40 by 7 miles. The windward side, one of the most scenic coasts of the group, is a precipice, 500 to 4,000 ft. high, sheer from the ocean, the highest part of which is deeply indented by magnificent valleys, and on a low peninsula, projecting from the base of which, near its centre, is the famous leper settlement.

Lanai (3,480 ft.) and **Kahoolawe** (1,472 ft.) are single mountains, with cliffs on their southerly coasts exposed to the ocean, their northerly coasts being protected by Maui and Molokai. Cattle, sheep and goats have destroyed their forests except on the summit of Lanai. Recently, a pineapple company has acquired Lanai, constructed a harbour on the south coast and a model city in the centre of an extensive interior plateau, which it is reducing to cultivation. Molokini is a small crescent-shaped, barren, rocky island, 160 ft. high, the ruin of a volcano, between East Maui and Kahoolawe.

Oahu was once two immense volcanoes; erosion has made of it two parallel mountain ranges, one, Koolau (Konahuanui, 3,105 ft.) twice as long as the other and older, Waianae (Kaala, 4,030 ft.), connected by a saddle 800–1,200 ft. high, is roughly square in shape except for the extension of the Koolau range at the east, which is the longest in the group; both ranges are among the most rugged Their outer sides are precipices with marginal lower country, 0–7 m. wide, at their bases, and are most scenic with lofty, fluted faces and broken sky-lines. There are many small, recent tufa, ash and lava cone craters, mostly coastal, especially in and about Honolulu. There are also elevated coral formations and evidences of earlier and greater subsidences. This island, though third in size and fifth in height, is important agriculturally. It contains the capital and trade centre on the lee coast of the east end and the land-locked Pearl harbour (10 sq.m.) at the crotch of the ranges (*see* HONOLULU). The picturesque sites of this island are easily accessible; the most noted panoramic view being that of the windward side, which bursts suddenly on one upon arrival at the Pali (precipice), the only traversable pass (1,200 ft.), 6 m. up a beautiful valley back of Honolulu.

Kauai, separated from Oahu by a channel 63 m. wide and 11,232 ft. deep, is roughly circular in form, about 25 m. across, and consists mainly of one mountain (Waialeale, 5,250 ft.), with marginal low lands except on the north-west. It is the oldest, most disintegrated, and most verdant of the larger islands, abounding in rivers and waterfalls. Its chief scenic attractions are the Grand canyon of the Waimea (3,000 ft. deep) in the south-west, comparable in colours and forms to the Grand canyon of the Colorado; the spacious Hanalei valley in the north; and the Napali coast of precipices, 4,000 ft. high, on the north-west. This, with its canyons, fluted ridges, pinnacles, caves and waterfalls, is a most remarkable scenic region, though difficult of access.

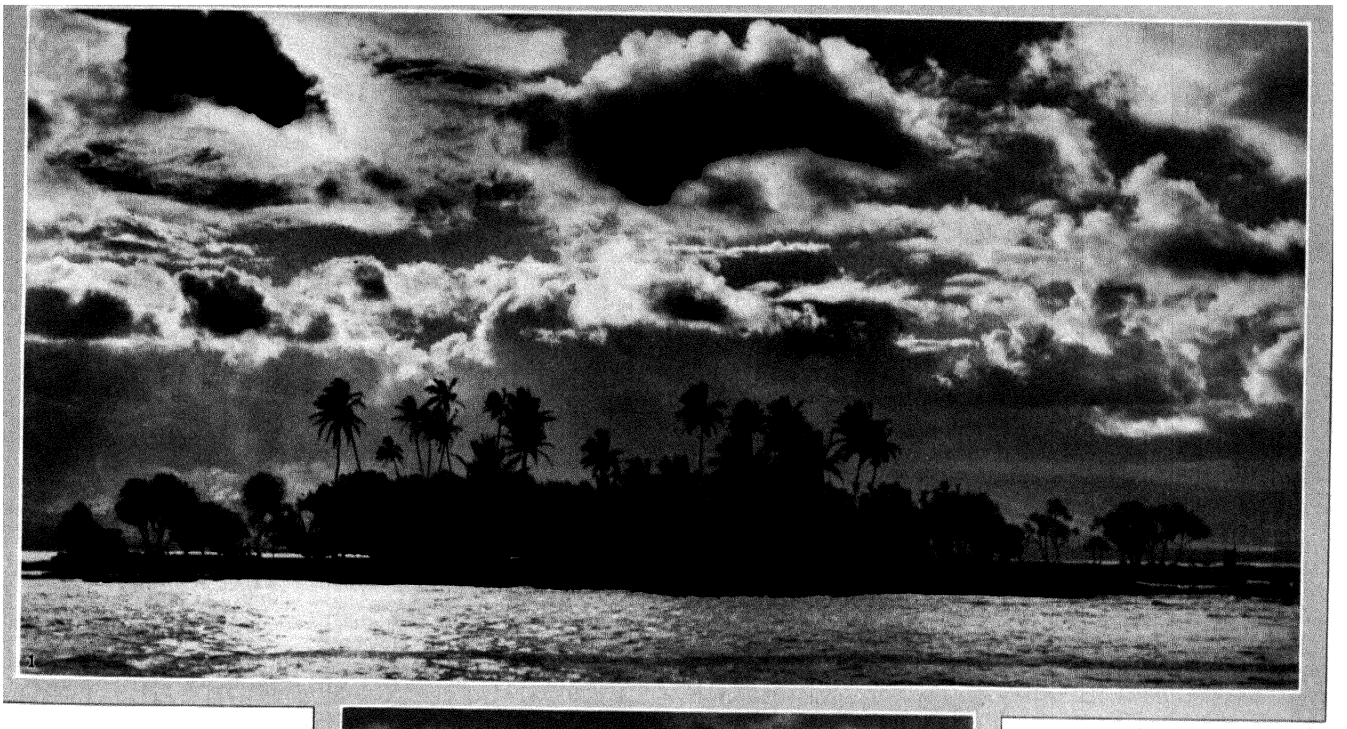
Niihau, separated from Kauai by a channel 15 m. wide and 3,300 ft. deep, is a small island, 17 by 6 m., of which the east central third is a tableland 1,300 ft. high, with cliffs on the ocean side, and the remainder lowland of coral origin. The entire island is a sheep ranch privately owned. Lehua and Kaula, uninhabited, are crescent-shaped remains of tufa cones, respectively ½ m. N. and 23 m. S.W. of Niihau. Both are rookeries.

Climate.—The chief determinants are the prevailing north east trade winds from over cool ocean currents and the remarkable heights and contours of the land areas. The result is a climate cooler than elsewhere in the same latitude, equable temperatures abundant sunshine and absence of tropical storms. Mauna Loa and Haleakala form such barriers to the trade winds that their leeward slopes have regular land and sea breezes. At times especially in winter, a "kona," or southerly wind, brings muggi ness and heavy rain. The windward slopes are cooler than the leeward, and the temperature falls about 1° F for each 300 ft of altitude There is no distinctly rainy or dry season, but usually more rain falls in winter than in summer. There is wide variation in temperature, rainfall and wind for neighbouring localities. In 1905–26 the temperature varied on Hawaii island from 98° (lee shore) to 25° (at 6,685 ft.), and on Maui the annual rainfall varied from 2·46 in. (at 90 ft. on the isthmus) to 562 in. (at 5,000 ft. only 8½ m. distant), said to be the lowest and highest of all *official* records. The summit of Kauai has perhaps, the greatest average rainfall in the world. The greatest in 24 hours was 31·95 in. on windward Hawaii. At the Bureau office in Honolulu, on leeward Oahu, the average annual rainfall was 28·60 in. and the mean annual temperature 74·6°, with a maximum of 88°, a minimum of 56°, a mean maximum of 79·4° and a mean minimum of 69·5°. Four miles distant, at 1,028 ft the average rainfall was 155·02 inches. Usually there is snow on Mauna Kea and Mauna Loa and sometimes on Haleakala.

Flora.—The isolation of Hawaii, its division into islands, the barriers of deep canyons and high precipices, and the wide variations in rainfall, temperature, wind, barometric pressure and geologic age of different localities, have evolved a flora that not only is exceptionally extensive for the area, but ranks first in the world in percentage of endemic genera and species The number of species is over two-thirds that of New Zealand, which has 16 times the area. The percentage of endemics is 83, as compared with 34 in Samoa, 35 in Tahiti, 53 in Fiji and 75 in New Zealand. There are about 900 species of flowering plants (over 300 being trees), 140 ferns (from the moss-like *Trichomanes parvulum*, the size of a finger nail, to the stately tree-fern, *Cibotium menziesii*, 35 ft. high), and also many hundred mosses, lichens, fungi and algae. The species are most numerous and best defined on the older islands; some are extremely localized. One endemic violet is confined to an area of a few square yards. In a 56 ac. oasis of rich soil surrounded by lava flows in the National park, there are 40 species of trees, several unique; one, when discovered, consisted of only a single specimen. From this a new genus was named, *Hibiscadelphus*, of which two other species have since been discovered, one of them a single specimen on Maui. Some species of trees vary from 1 ft. to 40 ft. and others from 30 to 100 in height according to altitude. Several species of violets have woody stems 6 ft. high. Most developed are the *Lobelioidae*, of which there are over 100 species; these range from dwarf forms to palm-like giants 40 ft. high. This tribe is more developed only in South America. There are some 60 species of composites, a score of which are arborescent, such as the silversword (*Argyroxiphium sandwicense*). Hawaii, however, is poor in native palms, of which there is only one genus with ten species, and in orchids, of which there are only three insignificant species. There are but few trailing forest vines, though the luxuriant and brilliant-flowered *ieie* (*Freycinetia arnotti*) and the glossy, fragrant *maile* (*Alyxia olivaeformis*), favourite for *leis* (wreaths), are common. The forests are tropical and only a few trees shed their leaves seasonally.

Six botanical regions or zones are commonly treated more or less separately: strand, lowland, lower forest, middle forest, mountain bog and upper forest, with subdivisions of dry and wet, windward and leeward, etc., each having in large measure its distinct flora, but with considerable overlapping. Above 11,000 ft. there is practically no vegetation.

Hundreds of species have been introduced into the islands since their discovery by Europeans and about 25 were introduced anciently by the Hawaiians. Among the ancient introductions are the coco-nut, breadfruit; *ohia ai* or mountain apple (*Jambosa*



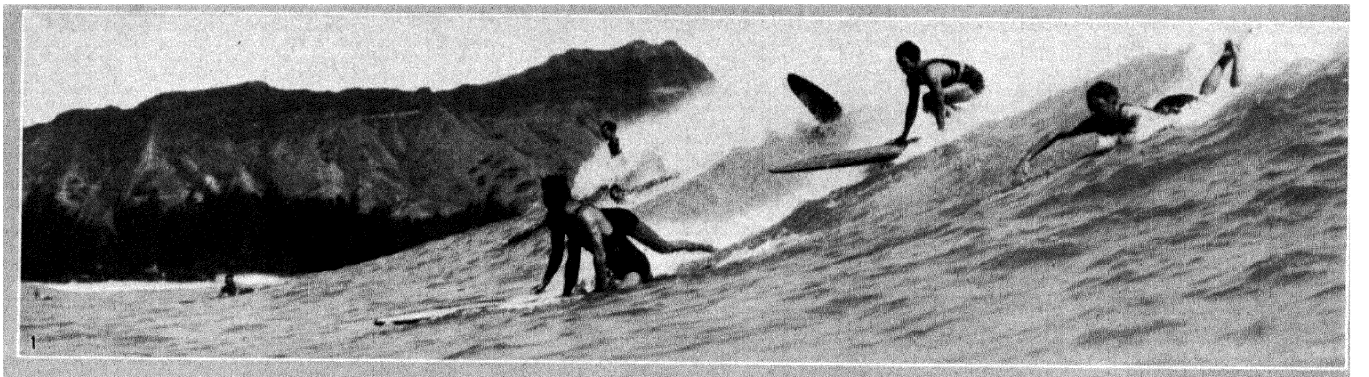


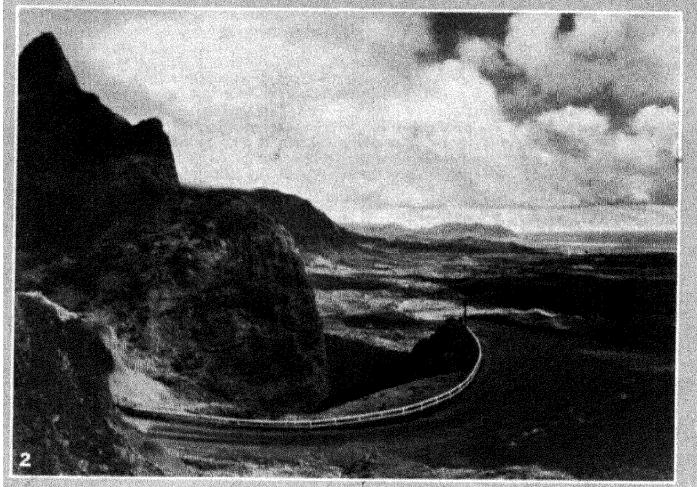
BY COURTESY OF THE MATSON NAVIGATION COMPANY

COCONUT ISLAND IN HILO HARBOUR

Two views of Coconut Island, a small pleasure island in Hilo Harbour, Hawaii, named from the grove of tall coconut palms which are its most conspicuous feature. It is part of the park system of Hilo City with which it is connected by a bridge

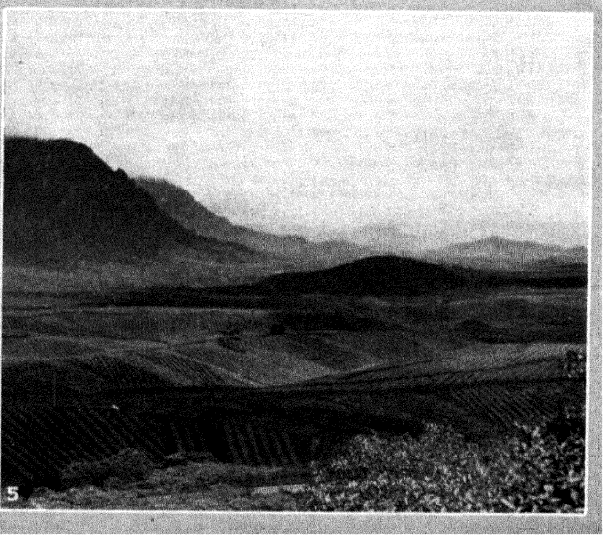
HAWAII











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HONOLULU AND THE HAWAIIAN ISLANDS

1. **Surf riding at Waikiki Beach, Honolulu**
2. Nuuanu Pali, a valley pass six miles from Honolulu, which affords a famous panoramic view. It is the only traversable pass on the windward side of the island of Oahu
3. Mauna Kea and Mauna Loa, twin mountains on the Island of Hawaii, as seen from Hilo Bay. Mauna Kea (White Mountain), so called from the snow on its summit, reaches an altitude of 13,825 feet, the highest island mountain in the world. Mauna Loa (Long Mountain), 150 feet lower than Mauna Kea, has an immense lava dome; it is not only the largest volcano, but the largest mountain in the world in cubic content
4. View of Honolulu, capital of the Hawaiian Islands, and of its harbour, from the crater of the Punchbowl, an extinct volcano a mile behind the city
5. Panoramic view from the Nuuanu Pali (*see* fig. 2)

malaccensis); taro (*Colocassia antiquorum,* roots used for making a paste, *poi,* the principal food of the Hawaiians); sweet-potato; yam; banana; pia or arrowroot (*Tacca pinnatifida*); sugar cane; gourd; *awa* and *ti* (*Piper methysticum* and *Cordyline terminalis*), roots used for making drinks, and leaves of *ti,* for wrappers, plates, etc.; olona (*Touchardia latifolia,* yielding exceedingly strong and durable fibre for fish nets, etc.); *wauke* (*Broussonetia papyrifera*), fibre used for making *kapa* or paper cloth; *kukui* or candle-nut (*Aleurites moluccana*), useful for candles, oil, dyes, paint, gum, food and medicine; *milo* (*Thespesia populnea*) and *kou* (*Cordia subcordata*), now almost extinct, and *kamani* (*Callophyllum inophyllum*), all three yielding beautiful wood valued for making calabashes and other dishes; and *hau* (*Paritium tiliaceum*), useful for making outriggers and rope and training over arbours for shade, *noni* (*Morinda citrifolia*), useful for dyes and perhaps ginger. Among the more common later introductions are the avocado or alligator pear, mango, pineapple, orange and other citrous fruits, papaya, guava, coffee, grape, fig, *poha* or cape gooseberry, litchi, mulberry, tamarind, date, passion fruits, eugenias, cherimoya, custard apple and the Queensland nut.

Fauna.—Isolation and wide variations in local conditions have had much the same effect, though in lesser degree, on the fauna as on the flora, resulting in a high percentage of endemics and extreme localization. There is only one certainly indigenous land mammal, a small bat Dogs, hogs, and perhaps rats and mice, were introduced anciently by the Hawaiians, and many domestic mammals have been brought in since Cook's discovery; some very early, as goats and English pigs by Cook in 1778; cattle and sheep by Vancouver in 1793, and horses by Cleveland in 1803. Spotted deer (*Cervus axis*) were introduced in 1867 and the mongoose in 1883, to destroy rats.

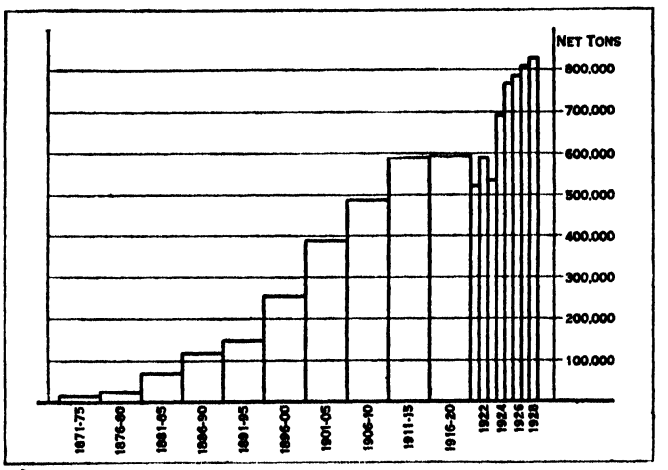
There were about 125 species of birds, resident and migrant, of which, perhaps, a score are now extinct. On the inhabited islands the native birds are disappointingly few, as their habitats are mostly in the forests and on the heights. A striking example of bird evolution is found in the song-bird family (*Drepanididae*) with 60 species, all peculiar to Hawaii. Most prized for feather work were the yellow feathers of the now-extinct *mamo* (*Drepanis pacifica*) and nearly-extinct *oo* (*Moho nobilis*); the vermilion, of the *iiwi* (*Vestiaria coccinea*); and the crimson, of the *apapani* (*Himatione sanguinea*). Very common are the brown *elepaio* (*Chasiempis sandwicensis*); the green-and-yellow *amakihi* (*Chlorodrepanis* spp.); and the *ou* (*Psittirostra psittacea*), the best Hawaiian songster. A wild goose, *nene* (*Bernicia sandwicensis*), confines itself to dry areas. The birds most commonly seen on the lower and more open areas are exotics. Chickens were anciently introduced by the natives, and the later introductions include, besides various domestic fowls, the skylark, Chinese thrush, mynah, turtle dove, pigeon, linnet, blue-cheeked parrot, rice bird, English sparrow, pheasant, quail and California partridge.

The only native land reptiles are seven species of small skinks and geckos, commonly called lizards. There are no snakes, and the frogs and toads are introductions. Although there are several thousand species of indigenous insects, mostly endemic, they are not troublesome or destructive. The noxious forms are mostly introductions, such as the sugar-cane leaf-hopper and borer, rice-borer, Mediterranean fruit fly, melon fly, Japanese beetle, horn fly, cutworms, army worms, termites, fleas and mosquitoes. Perhaps no animal group has contributed more light on the subject of evolution than the 500 species of land and fresh-water shells of Hawaii, especially the beautiful tree shells (*Achatinellidae*). The exceptionally rich marine animal life includes more than 650 species of fish, many of which are fantastic in shape and colour. Among introduced fishes are trout, carp, black bass, catfish, goldfish and top minnows.

Industries.—Sandalwood was Hawaii's first important commercial product. The industry (1800–40) originated through fur-traders, and was at its height during 1810–25. The wood was shipped to China, and the king and chiefs found the business so lucrative that they compelled most of the available population to get the wood from the forests, so that it was soon exhausted. But before that whaling (1820–80) began. The vessels usually called twice a year for rest, repairs, supplies, storage or transhipment of oil and whalebone and engagement of Hawaiians as seamen. The average annual calls during 1840–60, when the industry was at its height, averaged about 400. Whaling was also local. The discovery of petroleum (1859) and the destruction of whaling vessels in the Civil War and by the northern ice pack in 1871 lessened its importance. Hawaiians were excellent seamen; in 1846 about a fifth (3,000) of the young men of 15–30 were so engaged.

The chief product of the islands has long been sugar. Small quantities were produced from 1802 to 1835, when the industry really began, and yet the output had increased to only 13,036 short tons by 1876, when there was great impetus from the reciprocity treaty with the United States. It increased to 229,414 tons by 1898, the year of annexation, 517,090 in 1910 and 811,333 in 1927. For 25 years acreage and number of employees have remained fairly constant, but better methods have greatly increased the output. The sugar and pineapple industries, especially have profited from scientific methods as applied through the sugar planters', pineapple planters' and U.S.A. experiment stations, University of Hawaii and Territorial Bureau of Agriculture and Forestry. The yield per acre averages $7\frac{3}{4}$ tons of sugar on irrigated and 5 tons on unirrigated land, with a maximum of 18 tons. The cane, however, requires from 14 to 30 months to grow and only a little over half the area (120,000 ac.), is harvested each year. Two or three crops at different stages grow at the same time. About half the area is irrigated—by conduits from mountain streams and pumping from artesian and surface wells. The irrigation system of one plantation cost nearly $6,000,000. Before a field is harvested it is set on fire to burn off the leaves. Conveyance to the mills is by railway, flumes and overhead trolley. The centrifugal drying process for sugar was invented in Hawaii in 1851. All but one plantation ships sugar raw, mostly to their co-operative refinery in California. Corporations own the mills and raise most of the cane. Of the 45,000 or so unskilled employees about 95% work by contract and are provided with living quarters, gardens, medical attendance and other advantages without cost.

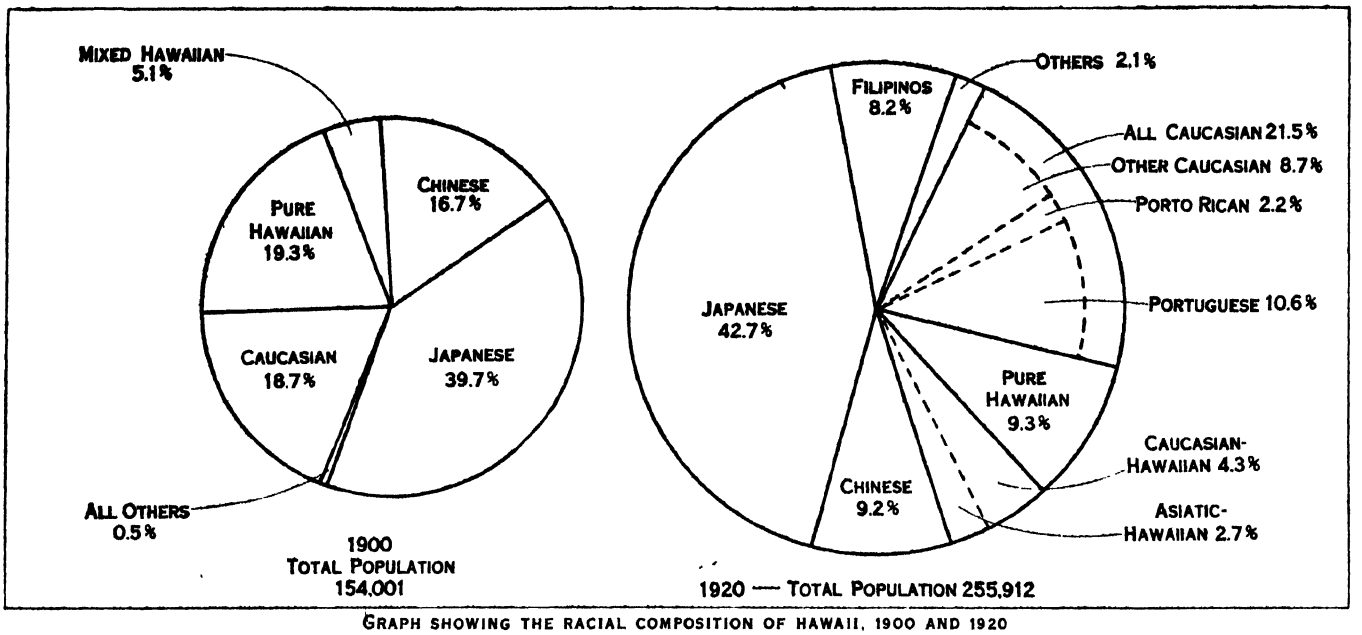
The pineapple industry, a growth of this century, is second only to sugar in importance. The output of all companies has increased from 1,893 cases in 1903, to 8,879,252 (213,102,048



GRAPH SHOWING THE PRODUCTION OF SUGAR IN HAWAII, 1871–1928

cans) in 1927. The area cultivated is about 50,000 acres. This industry, unlike sugar, had to create its market.

The live stock, coffee and rice industries have successively occupied second place. There are numerous ranches and dairies, many with thoroughbred stock—cattle, sheep, horses, hogs and poultry. The coffee industry, one of the oldest, is taking on new life. The coffee is of superior quality, known as "Kona" from the district on western Hawaii where most of it is raised. Rice is a waning industry. The banana industry is steady, though not large. Other industries which are still small or have had their day, but some of which have possibilities, are silk, cotton, tobacco,



GRAPH SHOWING THE RACIAL COMPOSITION OF HAWAII, 1900 AND 1920

rubber, vanilla, sisal, potato, wheat, flour, macadamia nut, etc. While Hawaii exports and imports a larger percentage of what it produces and consumes than most countries, there is nevertheless much subsistence farming, and several industries, such as live stock, fish, fruit and vegetable, figure largely in local trade. Little lumber is produced. Practically the only mineral products are building stone, lime and salt. Much has been done since 1850, and especially since 1895, to promote homesteading of public lands, not altogether successfully; but since 1920 a new policy has been pursued, with greater success, under which permanent improvements are made in advance by the Government, settlers are selected with reference to their qualifications, long-time loans at low rates are made and instruction is given by specialists.

Although Hawaii is essentially an agricultural country, the principal industries are such as require much manufacturing directly, as in sugar, pineapple, rice, coffee and fish mills and canneries, and indirectly, as in iron, fertilizer and can works of large size. The principal iron works has long held a leading place in manufacturing sugar machinery. Manufactures of poi, biscuits, macaroni, starch, soft drinks, confectionery, shoes, clothing, furniture, musical instruments, concrete pipes and tiles, lime, boats, etc., are on a small scale. There have been but two serious strikes on sugar plantations (1909 and 1920) and there is little unionism. There is a workman's compensation law. Railway, telephone, telegraph and wireless utilities are under the Interstate Commerce Commission and other utilities under the Territorial Public Utilities Commission. The tourist business, as an industry, is next to sugar and pineapples. Tourists increased from 8,000 in 1921 to 17,500 in 1927. The great prosperity of Hawaii for half a century is reflected in the resources ($108,052,385 on Dec. 31, 1927) of its 12 banks and 11 trust companies. On June 30, 1927, there were 111,861 savings accounts, with deposits of $27,102,219. There were 1,071 Hawaiian corporations, and 194 foreign corporations.

Commerce.—In 1927 imports were $88,837,477, and exports $111,504,035 ($25,138,247 and $46,486,412 in 1910). Trade is mostly with the mainland of the United States ($79,665,662 of imports and $109,236,321 of exports in 1927), while $9,171,815 of imports and $2,267,714 of exports were with foreign countries. The exports comprised sugar, $69,827,821; fruits and nuts, mostly canned pineapples, $34,934,087; coffee, $1,779,829; sugar machinery, $512,877; hides, $170,034; and molasses, tallow, wool, canned fish, bananas, rice, honey, etc. Imports from the mainland of the United States comprise a wide range of articles, while those from foreign countries are largely food stuffs from Japan, China, New Zealand and Australia, fertilizers from Chile and Germany, and jute bags from India.

Communications.—At Honolulu, besides model concrete wharves and sheds, there are dry-docks, electric freight-handling apparatus, automatic coal-handling plants, and oil tanks connecting with the wharves by pipe lines. From 1910 to 1927 trans-oceanic steamers, exclusive of naval vessels, army transports and coal-bunker vessels, increased from 570 to 1,089, sailing vessels decreased from 257 to 10, the combined tonnage increased from $2,666,780 to $8,228,331 in value, and passengers from about 90,000 to about 300,000, including through passengers. Thirteen steamers engage exclusively in interisland traffic. There are many airports, 360 m. of seven railways, hundreds of miles of concrete and macadam roads, and over 35,000 motor vehicles. The larger islands have telephone systems. Honolulu has an electric street railway. Hawaii was the first country to establish wireless for commercial purposes. Besides a cable there are four powerful wireless plants for trans-Pacific communication and smaller plants for communication between the islands and with ships at sea.

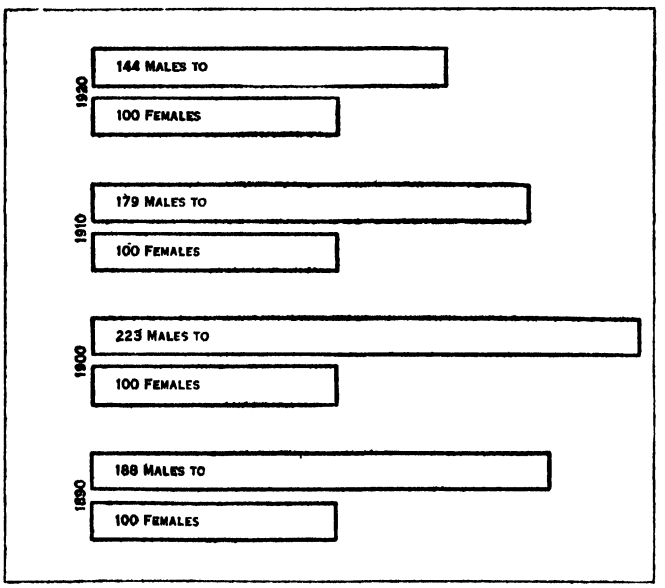
Population and Immigration.—Since the discovery (1778), the population has changed from extreme homogeneity to extreme heterogeneity, due to decrease of Hawaiians during the first century and immigration of others during the last half century. The discoverer estimated the Hawaiians at 400,000 but probably they did not exceed 300,000. Their decrease, due to many causes, has been rapid, but latterly at a diminishing rate. They now seem destined to disappear more through intermarriage with other races than through excess of deaths. The part-Hawaiians are increasing more rapidly than the pure Hawaiians are decreasing. The birth-rate of the former and death-rate of the latter are the greatest among all the races. In 1823 the missionaries estimated the Hawaiians at 142,050. The first census (1832) showed a total population of 130,313, including the few foreigners. That of 1872 showed low ebb in the total, 56,897 (51,531 Hawaiians and part-Hawaiians). That of 1878, just after the Reciprocity Treaty with the United States began to stimulate immigration, showed 57,985, divided 47,508 and 10,477. That of 1900, when Hawaii became a Territory, showed 154,001, divided 37,656 (low ebb of Hawaiians and part-Hawaiians) and 116,345.

The last census (1920) showed 255,912, divided 41,750 and 214,162. On June 30, 1927, the total was estimated at 333,420: Hawaiian, 20,931; Caucasian-Hawaiian, 15,208; Asiatic-Hawaiian, 9,437; American and northern European, 34,750; Portuguese, 28,417; Spanish, 1,774; Porto Rican, 6,572; Filipino, 52,124; Chinese 25,198; Japanese, 132,242; Korean, 6,214; others 553. These include many crosses. The distribution was: City of Honolulu, 106,600; remainder of city and county of Honolulu, 64,650; city of Hilo, 12,394; remainder of county of Hawaii, 66,160; county of Maui, 47,060; county of Kauai, 35,970; county of Kalawao, 586. Immigration of large numbers of Chinese, Japanese

and Korean adult males formerly produced highly abnormal ratios of aliens to citizens, males to females, singles to married and adults to children, but latterly, due to cessation of such immigration, deaths and departures, marriage, immigration of wives and births within the Territory, there has been a rapid tendency toward normality, retarded somewhat by similar immigration of Filipinos.

In 1927, 217,618 (65·27%) were U.S.A. citizens and 115,802 were not (including Filipino immigrants who are neither citizens nor aliens but owe allegiance to the United States). Native-born constituted 41·1% in 1900, 51·1% in 1910 and 53·3% (or, omitting the recently-arrived Filipinos, 57·2%) in 1920. Males fell from 69·1% in 1900 to 64·1% in 1910, and to 59·1% in 1920, notwithstanding the large influx of Filipino males. Increase of population except of Americans and Filipinos, is now mainly through births. Departures of most others exceed arrivals. In 1927 the birth-rate was 37·16 and the death-rate 11·87 per 1,000. The birth-rate was highest among Asiatic-Hawaiians (74·26), next among Caucasian-Hawaiians (59·74), and lowest among Americans and northern Europeans (11·65). Japanese births were 46·8% of the total and the rate per 1,000 was 43·88. The death rate was highest among Hawaiians (31·11), next among Caucasian-Hawaiians (16·06), Filipinos (15·29) and Asiatic-Hawaiians (14·52), and lowest among Americans and northern Europeans (6·85%), followed closely by Spanish (8·41%), Japanese (8·85%) and Koreans (9·76%). There is a growing tendency toward intermarriage among all races, although least among Japanese and Koreans. It is increasingly difficult to classify by races because of mingling; racial antagonisms are absent.

Experiments in Immigration.—On the "cognate race" plan, Polynesians from the South Sea islands were introduced in 1859, 1865, 1868–71, 1874 and 1878–85, 2,454 in all, but they were disappointments, both as labourers and prospective citizens, and most of them were returned to their homes. On the "desirable citizen" plan, Caucasians other than Latins were introduced, as Americans in 1870 and 1898, Norwegians in 1881, Germans in 1882–85 and 1897, Galicians in 1898, Russians in 1909–14 and



GRAPH SHOWING THE RELATIVE PROPORTION OF MALES AND FEMALES IN HAWAII AT EACH CENSUS FROM 1898 TO 1920

Poles in 1914, about 4,450 in all, but most of them soon outgrew the status of unskilled labourers or left the islands.

Attention was then directed chiefly to the Latins, particularly the Portuguese. Consequent upon the pressing demand for labour occasioned by the Reciprocity Treaty and after investigation of the relative merits of immigrants from many countries, 10,798 Portuguese were brought from Madeira and the Azores in 1878–90 and 337 in 1899. They proved to be industrious, thrifty and law-abiding. They brought their families and most of them remained and multiplied. In 1906–13, 5,196 more were introduced, many from Portugal. Simultaneously 7,695 Spanish were brought from Malaga, but most of these have left, and, although many Portuguese also have left, those in the Territory had increased to 28,417 by 1927. In 1898, 255 Italians were introduced and in 1900–01 about 5,000 Porto Ricans. Most of the latter remained and, contrary to first indications, the majority have developed well and increased to 6,572. About 100 negroes and their families (1901) and about 500 Hindus (1908–11) were introduced, most of whom soon left. Aside from the Portuguese,—the Chinese, Japanese, Koreans and Filipinos have constituted the bulk of the labour immigrants. The Chinese came first (1,632 in 1852–67); then, opposition having developed, 148 Japanese were introduced in 1868, but, the Japanese Government objecting, no more were brought in and the Chinese continued to come (2,819 in 1868–77) when, in 1878, the immigration of Portuguese began, but not to the exclusion of the Chinese, who continued to come unassisted in large numbers (20,791 in 1878–85). The Chinese became so numerous that restrictive measures were applied in 1883 and attention was again turned to Japan. Chinese immigration almost ceased, the total for 1886–99 having been only 6,129, of whom 5,241 came in 1895–97, just before the Federal Chinese exclusion laws were extended to Hawaii upon annexation. Japanese came in large numbers, at first assisted and then unassisted, 65,034 during 1885–99, of whom 19,908 came the last year, fearing that such immigration also might be inhibited. Many went from Hawaii to the mainland, the arrivals having been 96,092 and the departures, to the mainland and Japan, 92,221 during 1900–15, but after the "Gentlemen's Agreement" of 1907 between the United States and Japan the arrivals were largely women, which resulted in rapid increase through births. Opposition on the mainland led to Japanese exclusion in 1924. The Chinese immigrant population resident in the islands decreased from 25,762 in 1900 to 21,674 in 1910, but the total of both immigrant and Hawaiian-born Chinese increased, through excess of births over deaths and departures, to 23,507 in 1910 and 25,178 in 1927. The Japanese increased from 61,115 in 1900 to 79,675 in 1910, 109,274 in 1920 and 132,242 in 1927. Koreans to the number of 7,859 came in 1903–05, but there were only 4,533 in 1910 and 4,950 in 1920; since then they have increased through births to 6,214 in 1927.

Finally, largely because of the enactment of Federal laws prohibiting assisted immigration from foreign countries, the sugar companies turned to Filipinos as the only available source, beginning in 1906, and, although many go to the mainland, the number has grown to 2,361 in 1910, 21,031 in 1920 and 52,124 in 1927, and they have become the largest racial element on the sugar plantations. The Filipinos, like the Porto Ricans, contrary to adverse predictions and some early disappointments, have responded well to better food and health conditions and training in ways of industry and thrift. Under the Federal laws the oriental immigrants cannot be naturalized because they belong to the excluded races, and the Latin immigrants usually cannot qualify because of illiteracy, but the Hawaiian-born children of all are citizens by birth. These for the most part display ability and character, and, particularly among the orientals, both the parents and the children are ambitious for the latter's education. While the racial diversity, and especially the large number of Japanese, furnish Hawaii's greatest problems, they appear to be in process of solution.

GOVERNMENT AND EDUCATION

The Hawaiian Islands are a Territory, an integral part, not a possession, of the United States, governed under an Organic Act, effective from June 14, 1900. The Federal officers are a delegate to Congress, elected for two years, who may introduce bills and debate but not vote, two judges of a Federal district court and a U.S.A. attorney and marshal, appointed for six years by the president with the consent of the Federal Senate, and various officials of the Treasury, Post-office, Agriculture, Commerce and Interior departments. The Territorial legislature, which meets biennially, consists of a senate of 15 members elected, seven or eight at each biennial election, for four years, and a house of representatives of 30 members elected for two years. The president, with the consent of the Federal Senate, appoints for four

years the governor, the secretary, who acts as governor in the absence or disability of the latter, the chief justice and two associate justices of the supreme court and the eight judges of the five circuit courts. The governor, with the consent of the Territorial senate, appoints for four years, and with like consent may remove, the attorney-general, treasurer, auditor, commissioner of public lands, superintendent of public works, superintendent of public instruction, surveyor, high sheriff, and, for various terms, all members of boards and commissions, among which are those of health, harbours, public instruction, public utilities, agriculture and forestry, fish and game, farm loan, pension, university regents, registration of voters and inspectors of election.

Hawaii, having previously been an independent sovereignty, is the most highly organized Territory created by Congress and the only one to which has been given the administration and revenue of its public lands. The chief justice appoints for two years one or more district magistrates for each of the 27 district courts. Certain designated circuit judges serve also as judges of the land court (Torrens), the court of domestic relations and the juvenile courts. Equity and law are kept distinct but with simplified procedures. Appeals may be taken from the Federal district court and, when a Federal question or a value in excess of $5,000 is involved, from the Territorial supreme court to the Federal circuit court of appeals of the ninth circuit. Local governments were first created in 1905. These are (1928) the city and county of Honolulu, comprising the island of Oahu and all small islands not included in any other county and hence extending 1,350 m. W. and 1,100 m. S. of Honolulu, the city and county seat; county of Hawaii, comprising the island of that name, county seat at Hilo; county of Maui, comprising the islands of Maui, Molokai (except the leper settlement), Lanai and Kahoolawe, county seat at Wailuku; county of Kauai, comprising the islands of Kauai and Niihau, county seat at Lihue; county of Kalawao, comprising the leper settlement. Each includes also the small islands within 3 m. of the shores of the larger ones. Each, except Kalawao, which is only an inchoate county under the board of health, has a board of supervisors, sheriff, clerk, auditor, attorney and treasurer elected for two years. Honolulu has also a mayor. Territorial and local officers and the Federal judges, attorney and marshal must, in general, be citizens of the United States and have resided in the Territory one to three years next preceding election or appointment.

The qualifications of voters are citizenship, residence of a year in the Territory and three months in the district, age of 21 years, ability to speak, read and write the English or Hawaiian language, and registration, which is permanent except that if one fails to vote at any election his name is struck out and he must reregister in order to vote. Absent seamen may vote, but those in the army or navy may not. Except Kauai supervisors and the Kalawao sheriff, all Territorial and local elective officers are elected at large or from multi-member districts. Direct primaries have been in operation since 1913 and woman suffrage since 1920. The political parties are the Republican and Democratic, the former preponderating. Citizenship by birth and naturalization are governed by the Federal Constitution and laws. At the last general election (1926) the registered voters numbered 40,569, as follows: Hawaiian and part-Hawaiian, 17,763; Caucasian, 16,808 (10,793 Anglo-Saxon and 6,115 Latin, mostly Portuguese); Oriental, 5,998 (3,092 Japanese, 2,096 Chinese). Over 85% of those who registered voted.

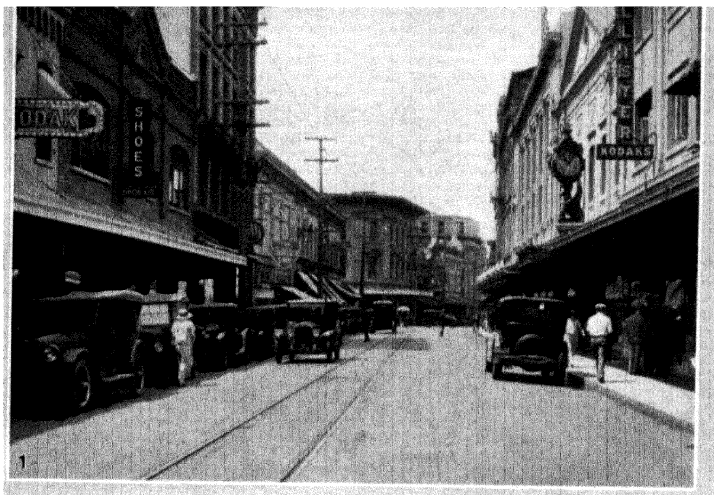
Finance.—On June 30, 1927, the Territory had a cash balance of $1,613,679.74, with no floating debt. On April 10, 1928, the bonded debts were: Of the Territory, $27,010,000 (4 and 4½%), of which $10,791,871.55 was incurred for the local governments, which reimburse the Territory in interest and sinking funds; of the city and county of Honolulu, $7,330,000 (5 and 5½%); and in the same city and county, $2,863,767.80 of district improvement bonds (5 and 6%) payable solely by the property benefited. Most bonds sell at a premium. All such debts have been incurred since 1910 for public improvements, for which also much current revenue has been expended. For the year ended June 30, 1927, the revenue was $17,519,921.65; of which $8,138,292.60 went to the Territory and $8,381,629.05 to the local governments (as compared with $2,621,758 and $1,394,695 in 1910), derived from property, income, inheritance, personal, vehicle and insurance taxes, licence fees, water and sewer rates, fines and costs, sales and leases of public land, etc. The assessed value of property was $414,064,603 as compared with $150,268,467 in 1910. The Territory has also paid in taxes to the Federal Government an average of about $10,700,000 a year during the last decade—ranking each year above 13–17 States. In 1925 the legislature provided for a Territorial budget system, a pension system for Territorial employees, and a uniform accounting system for the Territorial and local governments.

Education.—A dozen years after the arrival of the first missionaries in 1820 there were 900 schools with 53,000 pupils (40% of the population, mostly adults); a dozen years later about 80% were literate. In 1824 the regent and chiefs prescribed schools and compulsory attendance. In 1831 and 1834 there were founded two higher institutions for training teachers and religious assistants, which were also largely manual and industrial training schools, said to be the first of the kind established in what is now the United States. It was his knowledge of these industrial schools that led a missionary's son, Gen. Samuel C. Armstrong, to establish Hampton institute in Virginia. His father was minister of public instruction 1847–60. In the '30s and '40s pupils came from Spanish California, Kamchatka and other Pacific islands to attend an English-taught school opened in Honolulu in 1833.

The educational system includes all grades from kindergarten to university, as well as a normal school and schools for the physically defective, feeble-minded and juvenile delinquents and evening classes. Much attention is given to agricultural, trade and industrial vocational work (including part-time schools), home economics and medical, dental and nutritional needs. The university (about 1,000 students) maintains an aquarium and marine biological laboratory, conducts extension work and renders important service in industrial experimental and research work. Prominent among private schools are Oahu college (1,000 students) founded in 1841 (where most of the Anglo-Saxons are prepared for mainland universities), the Kamehameha schools (for Hawaiians) largely industrial, St. Louis college (Catholic, for all races), and the Mid-Pacific institute (for all races). School attendance is compulsory for children from six to 14 years of age. English has been the medium of instruction since long before annexation to the United States.

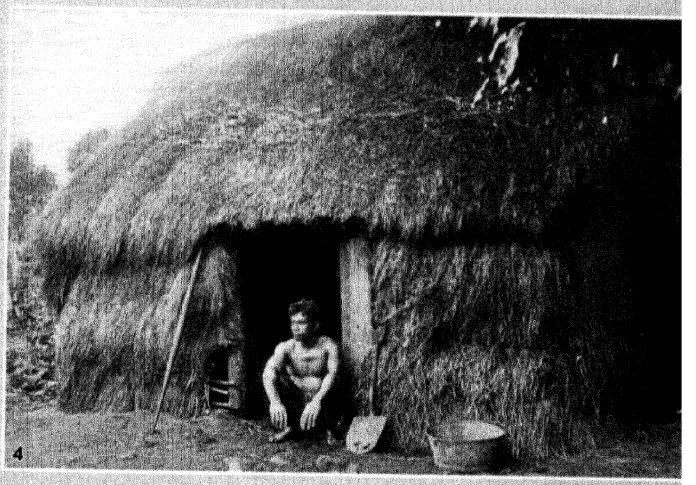
The public school system is under the Territorial Government, buildings and other physical equipment under the local governments. The cost is over $5,000,000 a year. On Dec. 31, 1927, there were (exclusive of the university) 186 public schools with 2,286 teachers and 66,577 pupils, and 47 private schools with 440 teachers and 9,497 pupils. The pupils comprised 74,119 American born and 1,955 foreign born—by race, 3,971 Hawaiians, 9,080 part-Hawaiians, 7,633 Portuguese, 337 Spanish, 1,137 Porto Ricans, 4,499 other Caucasians, chiefly Americans, 7,304 Chinese, 36,692 Japanese, 1,568 Koreans, 3,043 Filipinos and 810 others. In some schools 40–50 races and interracial mixtures are represented. In addition there are many racial language schools, chiefly Japanese, which hold short sessions before or after the public school hours. There is an excellent Territorial public library at Honolulu, with branches or stations throughout the Territory, and public libraries at the other county seats, all of which co-operate closely with the schools.

Charities.—The department of public health is second in importance only to that of education. Physicians are employed or subsidized for the benefit of all, however indigent or remote from population centres. The principal institution is the Molokai leper settlement, with its auxiliary hospital in Honolulu. Formerly emphasis was laid on isolation, but since 1909 it has been placed on treatment, and the number of lepers has greatly decreased. At one time there were over 1,200 lepers in these institutions and many at large; in 1927 there were 654 confined and few at large. There are many charitable and welfare institutions throughout the islands.

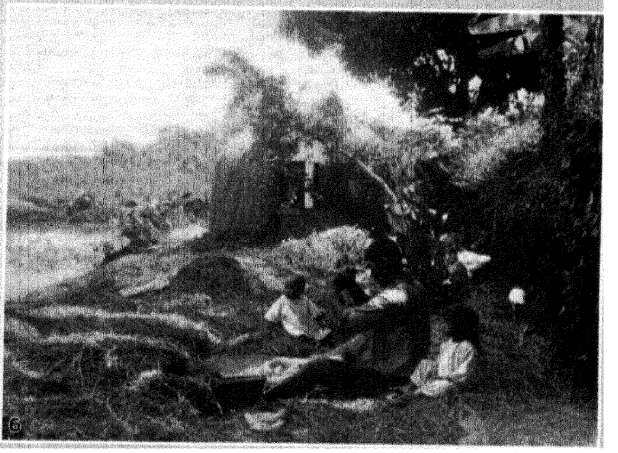










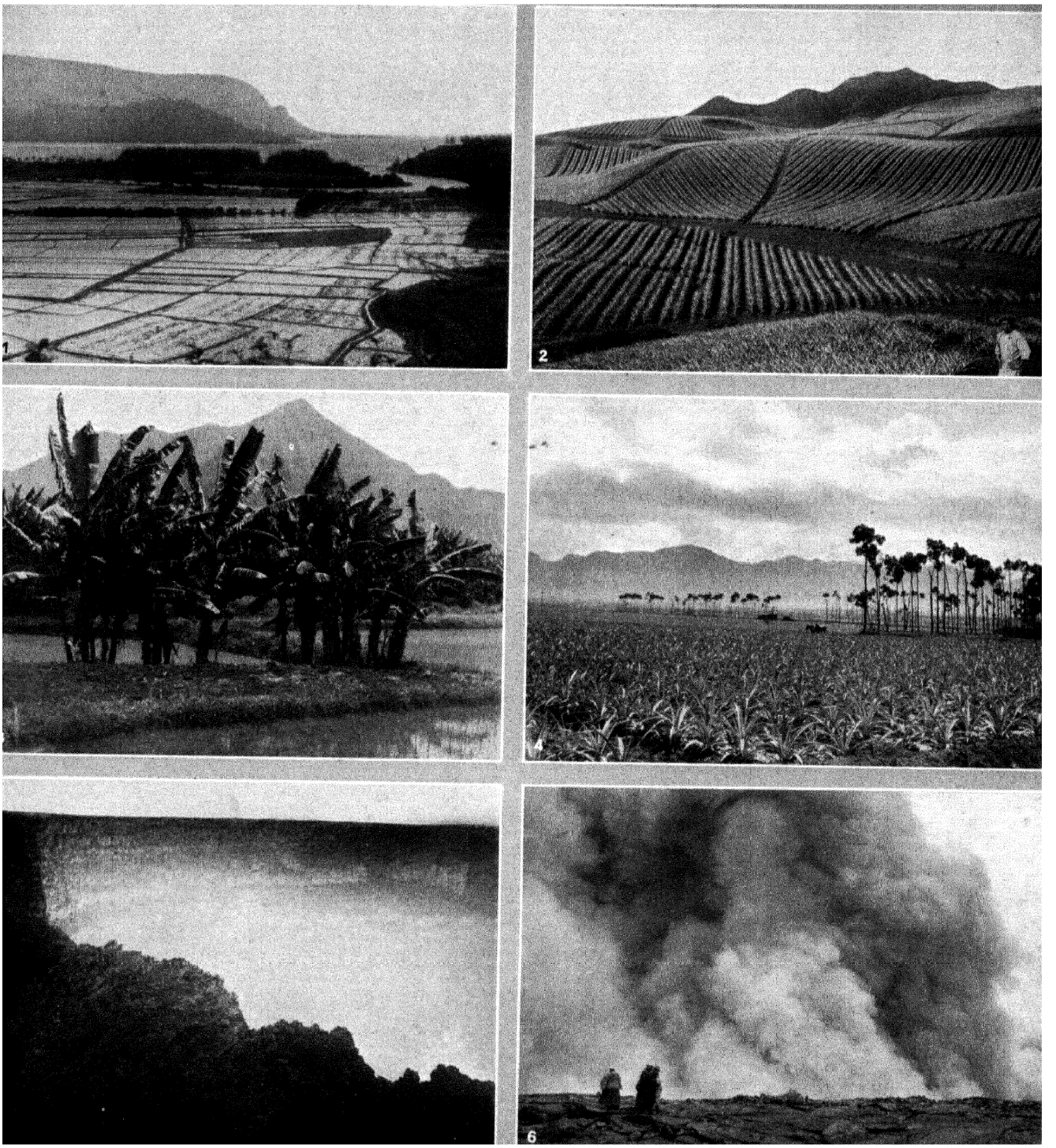


BY COURTESY OF (3, 5, 6) THE MATSON NAVIGATION COMPANY; PHOTOGRAPHS, (1) BURTON HOLMES FROM EWING GALLOWAY, (2, 4) EWING GALLOWAY

TOWN AND COUNTRY SCENES IN THE HAWAIIAN ISLANDS

1. Ford Street, a principal thoroughfare of Honolulu, capital of the Hawaiian Islands. It is macadamized with crushed lava. The business houses, from two to six storeys in height, are of brick or stone. Service by trolley car covers the entire district including the famous suburb of Waikiki
2. Women selling *leis* in Honolulu. These flower garlands are offered especially on steamer days being purchased to deck incoming and outgoing travelers. Most of the women are wearing *holokus*, the mother hubbard gown adopted under the influence of the early missionaries
3. A scene in Moanalua Gardens at Moanalua (Two waters), Honolulu, one of the many parks throughout the city and its suburbs
4. Hawaiian grass hut, a type of dwelling rapidly being replaced by frame houses. It consists of a wooden frame with steep pitched roof covered with closely woven layers of grass, sometimes a foot thick, sloping downward to shed the rain. The doorway is usually the only opening
5. Grass house in Honolulu on the estate of Queen Emma, wife of Kamehameha IV., king of Hawaii 1854–63
6. Making poi, the favourite Hawaiian dish, from the root of the taro plant. The taro root is a vegetable resembling the sweet potato in appearance. After having been cooked in ground ovens, it is mashed with a stone pestle, kneaded into a paste and allowed to ferment slightly. It is considered very nutritious

HAWAII



PHOTOGRAPHS, (1) BURTON HOLMES FROM EWING GALLOWAY, (2) E. M. NEWMAN FROM PUBLISHERS PHOTO SERVICE, (3) LOS ANGELES STEAMSHIP COMPANY BY COURTESY OF ALVIN D. KEECH, (4, 6) DE COU FROM EWING GALLOWAY, (5) PUBLISHERS PHOTO SERVICE

HAWAII UNDER CULTIVATION AND VIEWS OF HALEMAUMAU CRATER

1. Rice fields on Kauai, showing the Bay of Nawiliwili. Formerly second in importance among the island's industries, rice-growing now takes fifth place and very little is exported. It is chiefly grown by the Chinese, and a submerged cultivation is generally employed
2. Pineapple fields. The growing of pineapples for canning and export was first successfully attempted in 1901 by a company holding a 12-acre plantation; today there are about 50,000 acres under cultivation
3. A banana plantation near Honolulu in the midst of rice fields. Although originally introduced by the Hawaiians, the banana of modern cultivation is usually a foreign variety, the Chinese banana being one of the most common. It is exported in small quantities
4. Close view of a pineapple field. The plant yields two crops, the first being harvested eighteen or twenty months after planting
5. A section of Halemaumau, the inner pit of Kilauea, photographed at night by the glow of its own fire. The pit, which is in the centre of Kilauea, the largest continuously active volcano in the world, was 1,300 feet deep in 1928 with about 190 acres of molten lava
6. Halemaumau in eruption as seen from the brink of the crater. Although the surrounding mountain side is covered with solidified lava from early eruptions, there have been few eruptions with serious results, since the lava, upon reaching the edge of the crater, usually forces a subterranean passage through which it drains off

HISTORY

History Before Discovery.—Polynesia was probably the last habitable area to be occupied by man. The Polynesians, although of similar features, language, customs, religion and traditions, are not a pure race. They are supposed to be mainly of Aryan origin, with infusions of other bloods, and to have come from Asia by way of the Malay peninsula and Java, and thence from island to island by various routes in their migrations eastward, northward and southward, and to have reached Hawaii, probably from Samoa, about A.D. 500. The next five centuries were for the Hawaiians a period of seclusion and peace. Then, in the 11th to 13th centuries, a time of activity throughout Polynesia, intercourse was resumed with Tahiti, Samoa and other islands over 2,000 m. to the south by huge sailing canoes. During this period many chiefs, who intermarried with Hawaiian reigning families, and priests came to Hawaii, both classes became powerful and the severity of tabus and frequency of human sacrifices increased. Then followed another long period of isolation, the last centuries of which were full of wars and rebellions —the result of pressure of population, rapacity of the nobility and dynastic ambitions and jealousies.

Feudalism grew up much as it did in mediaeval Europe and from much the same causes. The unit of land, the *ahupuaa,* usually extended from the shore to the mountain top, with rights in the adjoining sea waters, so that the occupants had the means of supplying all their wants—the sea for fish, the littoral for coconuts, the valley for taro, their principal food, the lower slopes for sweet potatoes, yams and bananas and the mountain for wood The next subdivision was the *ili,* either subservient to the *ahupuaa* or independent. Within these were small areas, *kuleanas,* occupied by the common people, who also had certain rights of fishery, water and mountain products. Besides open sea fisheries, there were stone-walled fish-ponds, some now a thousand years old, built semi-circularly from the shore. Taro was raised in terraces flooded by conduits from streams. Elaborate systems of water rights were evolved. A conqueror or a successor king often redistributed the lands.

The Hawaiians were a brown race, with straight or wavy black hair, attractive features, large and of fine physique, like the New Zealand Maoris, whose dialect resembled theirs. The chiefs were physically superior to the common people, often weighing 300 to 500 pounds. Their mentality also was better. Being of pure blood, they inbred to advantage. Polygamy and polyandry were practised, especially among the chiefs. Rank descended mainly through the mother. The language is soft and musical, vowels and liquids predominating. There are only 12 letters, the vowels and h, k, l, m, n, p and w, l and r and k and t being interchangeable, and, as each syllable consists of only a vowel or a consonant followed by a vowel, there are only 40 syllables to make the more than 20,000 words. The Hawaiians were fond of oratory, poetry, history, story-telling, chants, riddles, conundrums and proverbs, and paid much attention to the proper use and pronunciation of words. Without writing, knowledge of all sorts was preserved and taught to successive generations by persons specially trained for the purpose. Without metals, pottery or beasts of burden, implements, weapons and utensils were made of stone, wood, shell, teeth and bone, and great skill was displayed in arts and industries. The feather-work (capes, robes, helmets, *leis, kahilis*) has not been excelled. Houses were of wood frames and thatched, with stone floors covered with mats. Food was cooked in holes in the ground, *imus,* by means of hot stones, but many foods, including fish, were often eaten raw. Many of the best foods were tabu to women. Men usually wore only a *malu* or girdle and women a skirt of *kapa* or paper cloth or leaves or fibre, though both sometimes wore mantles thrown over the shoulders. Canoes were outrigger or double, sometimes 100 ft. long. They have hardly been surpassed as sailors, fishermen or swimmers. They were skilful navigators, knowing stars, winds and currents. Their year began on Nov. 20 and consisted of 12 lunar months with occasionally an intercalary month. They had remarkable knowledge of animals and plants and were great warriors, using spears, javelins, clubs and slings, but no shields or bows, the latter being small and used only for shooting rats and mice for sport.

They excelled in athletics, in which there were frequent contests, even between champions of different islands, in surfboarding on the crests of waves, swimming, wrestling, boxing, spear-throwing (at each other), coasting down permanently prepared courses standing on narrow sleds, bowling, foot-racing, etc. Surfing has now become a favourite sport for others as well as Hawaiians. They gambled much and made narcotic and fermented drinks of the *awa* and *ti* roots, but not distilled liquours. They were fond of music, vocal and instrumental, and had percussion, string and wind instruments, including a nose flute but no mouth flute. The *ukulele* is of Portuguese origin, developed and popularized by the Hawaiians. Their dances were largely the notorious *hula* of many varieties, the better forms of which have latterly become popular with others. They loved flowers, which they wore much in *leis* or wreaths about necks and hats. This has become customary with the whites, especially on arrivals and departures of steamers and on May day. They tattooed little. Their proverbially courteous, generous, hospitable spirit has affected the remainder of the population.

There were four principal gods, *Kane, Kanaloa, Ku* and *Lono,* and innumerable lesser gods and tutelar deities. Animals, plants, places, professions, families, all objects and forces had their gods or spirits. Temples of stone and idols of wood abounded and hardly anything was undertaken without religious ceremonies. On important occasions there were human sacrifices. There was a vague belief in a future state. Priests and sorcerers were potent. There were "cities of refuge" to which one might flee and be safe. Cannibalism was unknown but infanticide prevalent. The political and religious systems were closely interwoven.

During the last period before the discovery, although there were occasional bright intervals under highminded kings, and notwithstanding that there was so much that was praiseworthy, in general, the nobility and priesthood became more and more aristocratic and tyrannical, the common people more and more degraded; destruction of life was frightful; property was insecure; there was little encouragement for industry; the laws, chief among which were the intricate and oppressive tabus, bore heavily upon the masses, especially the women, and their administration became largely a matter of arbitrariness and favouritism.

History After Discovery.—A vessel of the Spaniard Alvarado de Saavadra's squadron, fitted out by Cortez, sailing from Mexico to the Moluccas, was wrecked at Keei, Hawaii, in 1527. Conceded until recently, it is now disputed, that the Spaniard Juan Gaetano discovered Hawaii in 1555, and Capt. James Cook is considered the discoverer of Hawaii. Cook first landed at Waimea, Kauai, on Jan. 18, 1778. The natives thought him the god Lono. On his return the next year, he was killed, after a period of friendly relations with the natives, on Feb 14, 1779, in an affray at Kaawaloa, Hawaii, where a monument to him now stands.

Then followed a period of contact with pre-missionary whites (1778–1820), a period of political consolidation and religious disintegration. Kamehameha I., the most striking figure in Hawaiian history, came to the throne of one of the then four kingdoms in 1782, and, equipping himself better than his foes with vessels, firearms and aids, foreign and native, succeeded by 1795 in conquering all the islands except Kauai and Niihau, and in securing the latter by cession in 1810. Having effected consolidation, he organized the Government, checked oppression encouraged industry and suppressed crime, until, as it was said, "the old, men and women, and little children could sleep safely in the highways." He thwarted Russian designs upon the islands (1815–16) and eliminated Spanish pirates (1818). It was in this period that the sandal-wood trade developed. In 1804 an epidemic, probably cholera, destroyed much of the population.

Benign foreign influences were exerted by such voyagers as Vancouver (1792–94), Cleveland (1803) and Kotzebue (1816), and such residents as John Young and Isaac Davis, captured (1790) boatswain and mate, and Don Francisco de Paula Marin, immigrant (in 1791) from Andalusia, who introduced useful

plants and animals and inculcated higher ideals. But baleful foreign influences were exerted by numerous Botany bay convicts, pirates, buccaneers, beach-combers, adventurers and others, who introduced the art of distillation, fire arms, venereal diseases and vices of all kinds.

Kamehameha treated foreigners well but combated their vices. Indulging a little at first, he later abstained from the use of liquors and ordered the destruction of distilleries. Having unsuccessfully sought to obtain teachers of Christianity, he adhered to the Hawaiian religion and enforced strict observance of it, but with lessening severity. The last human sacrifices were in 1807. However, foreign influences undermined faith in the old religious systems, and shortly after his death (May 8, 1819), these were abolished (about Nov. 1, 1819) under the leadership of his favourite queen, Kaahumanu, and his queen of highest rank, Keopuolani—not, however, without a bloody battle (Dec. 20, 1819) between the progressives and conservatives. Thus, union under a single Government, the establishment of peace and order, and the dissolution of the old politico-religious bonds, prepared the way for new social forces.

The Third Period of Hawaiian History began with the arrival of the first company of missionaries from New England on March 31, 1820. Fourteen other companies followed during the next 35 years, in all over 150 men and women—ministers, teachers, physicians, printers, farmers and business men. They introduced the church, the school and the press. The Hawaiians were most eager to learn. By Jan. 7, 1822, the missionaries had learned the language, reduced it to writing and begun printing the first text-book. Two months later the first printed law was issued. By 1840 50 books had been printed. In 1834 two Hawaiian newspapers were published. An English newspaper, founded in 1843, is still published. The first press on the Pacific coast was imported from Hawaii into Oregon in 1839. The New Testament was completed in 1832, the Old in 1839, the dictionary in 1865. Of great assistance was William Ellis, English missionary in Tahiti, who visited Hawaii in 1822. While Christianity soon came to be regarded as the national religion, and churches were well attended everywhere, little interest was taken in it as a personal matter until 1829, when there were 185 church members, of whom 117 joined that year.

Interest culminated in the "Great Revival" of a decade later, which added a fifth of the population. The first convert (1823) was Keopuolani, head queen of Kamehameha, mother of the next two kings and highest chief by blood in the nation. Indeed the chiefs, especially the females, led in embracing and supporting the new religion and learning. Kaahumanu, Kamehameha's favourite queen, was converted in 1825 and was thereafter known as the "New Kaahumanu," as strong for good as she had theretofore been haughty and cruel, and of the ten who joined the church in 1826, nine were chiefs, including Kalanimoku, known as the "Iron Cable." Kaahumanu and Kalanimoku were the strongest characters in the nation.

Women in Power.—Kamehameha I., recognizing the weaknesses of his son, Liloliho (Kamehameha II.), had appointed Kaahumanu to be his *kuhina nui*, or premier, with power almost equal to that of the king. She acted as regent when the king and queen visited England in 1824, and, they having died there of the measles, she continued as regent until her death (1832), the new king, Kauikeaouli (Kamehameha III.) being then an infant. Kalanimoku had been prime minister and treasurer to Kamehameha I. and continued such under Kaahumanu until his death in 1827. Kaahumanu was succeeded as *kuhina nui* by Kinau, daughter of Kamehameha I. and mother of Kamehameha IV. and Kamehameha V., until her death in 1839, and then by Kekauluohi, mother of King Lunalilo, until her death in 1845. These noble women, Keopuolani, Kaahumanu, Kinau and Kekauluohi and others, like Kapiolani, whose courageous defiance of *Pele* (1824) was sung by Tennyson, and Bernice Pauahi Bishop, who twice refused the crown and gave (1884) all the Kamehameha lands to found schools for her race, would have done credit to any nation.

The first score or so of years after the arrival of the missionaries was a crucial period, not so much because of the inherent difficulties of civilizing and christianizing a barbarous and pagan race as because of the opposition of whites. This opposition came not only from the beach-combers and grog-shop keepers, but, more dangerously, from British, French and American consuls and naval officers. They opposed the laws against licentiousness and drunkenness, slandered the missionaries, made unjust claims against the Government, insisted that they were not subject to Hawaiian laws, attacked with arms the homes of missionaries and chiefs, aimed at the overthrow of the Government; the British consul claimed that the islands had become British territory.

Democratic Sovereigns.—This period was not, however, without bright spots in helpful foreign influences both from residents and from such visitors as Lord Byron of the British navy, cousin of the poet, who brought back the bodies of the king and queen in 1825, and Capt. Jones (1826) and Capt. Finch (1829) of the American navy, the former of whom negotiated the first treaty entered into by Hawaii. Whaling had become active in 1820 and the sugar industry in 1835. There was trouble over Catholic priests who came in 1827; they were banished in 1831, on the ground, among others, that they were reviving idolatry which had been abolished in 1819, but returned in 1836–37. Meanwhile, due to increasing complications with foreigners, growth in liberal and humane sentiments on the part of the chiefs and in realization of their natural rights by the common people, a conviction arose of the need of a better defined and more advanced form of Government as a condition of peace, progress and independence.

Hence, after vain attempts to secure from New England teachers of the science of government, the missionaries were induced to detach one of their number, W. Richards. He rendered notable service to the Government as did two other missionaries, G. P. Judd and R. Armstrong, similarly detached later. After hearing a course of lectures on government (1839) delivered to the king, chiefs and leading commoners, the king promulgated the *Declaration of Rights*, called Hawaii's *magna charta*, June 7, 1839, the *Edict of Toleration*, June 17, 1839, and the first Constitution, Oct. 8, 1840. The first compilation of laws was published in 1842. The Catholics began their cathedral in 1840, and ever since, through churches and schools, have done much good work. Contrary to the usual course of history, in Hawaii democratization evolved from the top downward rather than from the bottom upward.

But troubles with foreigners were not at an end. French naval officers in 1839, 1842, 1849 and 1851 made unjust demands, the first and third times accompanied by force. A British naval officer took possession in 1843 and held it until the flag was restored by higher authority. After the ceremonies, the king, addressing his people on the means of preserving independence, used the expression *"Ua mau ke ea o ka aina i ka pono"* ("The life of the land is perpetuated by righteousness"), which has since been Hawaii's official motto. Diplomatic missions secured recognition of independence from the United States in 1842 and England and France in 1843.

Further troubles with foreigners, and especially the outrageous French demands of 1849 and 1851, led to other diplomatic missions, and in the latter year a secret proclamation putting the islands under the protection of the United States. The French, having learned this, retracted and the United States declined the protectorate, but, as a result of further troubles and dangers, within and without, including threatened filibustering from California, and the "manifest destiny" sentiment awakened in the United States by the acquisition of the Oregon Territory and California, negotiations were opened in 1854 for annexation to the United States but were terminated by the death of the king. The troublesome foreign representatives were removed and fairer treaties entered into. Mormon missionaries first came in 1850, and that church now has a large membership and a magnificent temple and is doing good work.

New Codes.—Encouragement of immigration began in 1852 and has continued ever since. A small-pox epidemic in 1853

numbered its victims in thousands. Meanwhile, after the adoption of the crude Constitution of 1840, every effort was made to organize and perfect the Government. An able lawyer, John Ricord, was appointed attorney-general in 1844 and made a famous report to the legislature of 1845, as a result of which he was requested to draft comprehensive organic acts, which were enacted in 1846–47. W. L. Lee was appointed chief justice in 1846. He was chief drafter of the penal code of 1850, the more modern Constitution of 1852 and chief compiler of the civil code of 1859. Action was taken in 1845 and subsequent years by which the old feudal tenures were changed to allodial, and the interests of Government, Crown, chiefs and common people were severed and all claims adjudicated by a board of which Lee was chairman. R. C. Wyllie, a Scot, was minister of foreign affairs 1845–65. For able and untiring service, Lee, Wyllie and Ricord are among the outstanding personages in Hawaiian history. A tower of strength was Kekuanaoa (father of Kamehamehas IV. and V.), governor and judge of Oahu. The long and fruitful reign of the liberal-minded Kamehameha III. ended on Dec. 15, 1854. Hawaii had become a civilized and christianized country with constitutional Government, highly creditable legislative, executive and judicial branches, personal and property rights secure, allodial tenures, modern industries, the respect of other nations and independence assured.

The next two kings, high-minded, educated and travelled, Kamehameha IV. (1854–63) and V. (1863–72), feeling that the Government had become democratized too rapidly and that American interests were becoming too preponderant, were slightly reactionary and pro-British. The former and his consort, Queen Emma, are remembered for their founding of the Queen's hospital (1860) and the inauguration (1862) of the Episcopal Church, which, especially since annexation, has prospered. The American Board, which had sponsored the missionaries, deeming Hawaii qualified to graduate (the first nation to do so) from the field of Christian missions, withdrew in 1863 and transferred its work to the Hawaiian Board. Kamehameha V., after calling and dismissing a Constitutional Convention, himself promulgated a new Constitution (1864), which changed that of 1852 less than had been feared.

With his death ended the beneficent Kamehameha dynasty, and after the brief reign (1873–74) of the liberal, popular, pro-American Lunalilo, elected against Kalakaua, came the decidedly reactionary reign (1874–91) of the latter, elected as pro-American against Queen Emma as pro-British. The principal forces for good, the chiefs and missionaries, had largely died off. At first Kalakaua ruled fairly well and was largely instrumental in bringing about the Reciprocity treaty with the United States (1876), which produced far-reaching results. Efforts had been made from time to time since 1848 to effect such a treaty, partly for the economic benefits and partly as an alternative to annexation. The treaty was terminable after seven years on one year's notice, and agitation having arisen in the United States for such termination, an extension for seven years and until one year's notice was obtained in 1887 but only by giving the United States the exclusive right to enter Pearl harbour and maintain a naval coaling and repair station there—a right which was not exercised.

Reaction and Annexation.—There was ever-increasing endeavour by the king to restore the ancient order with its heathen customs and ideas of absolutism and Divine right, accompanied by extravagance, corruption, personal interference in politics and fomentation of race feeling, until the second generation of missionaries and their associates, including many patriotic Hawaiians, finding it impossible to stem the tide by ordinary means, rose in peaceful revolution, but with ample force in the background, and compelled the king to promulgate (1887) a new Constitution providing for responsible ministerial government and other guarantees. The struggle continued, however, not only until the end of that reign (1891), during which there was an armed insurrection (1889) by the reactionaries, but even more hotly during the following reign of the king's sister, Liliuokalani. She had some superior qualities as a poet and musical composer and was interested in welfare work; however, it was deemed necessary to depose her (Jan. 17, 1893) and set up a Provisional Government. Annexation to the United States was to be sought.

This failed for the time being and a republic, with probably the most advanced Constitution ever adopted, and Sanford B. Dole, a missionary's son, as president, was established on July 4, 1894. It continued, disturbed only by an unsuccessful insurrection in 1895, until annexation was accepted, largely because its desirability was emphasized by the Spanish war, by the Joint Resolution of Congress of July 7, 1898. The transfer of sovereignty took place on Aug. 12, 1898, and the Territorial Government was established by Congressional Act of April 30, 1900, effective on June 14, 1900. There has since been uninterrupted prosperity and progress.

The governors of the Territory have been S. B. Dole, 1900–03; G. R. Carter, 1904–07; W. F. Frear, 1907–13; L. E. Pinkham, 1913–18; C. J. McCarthy, 1918–21; W. R. Farrington, 1921.

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(W. F. FR.)

HAWARDEN (pronounced Harden, Welsh *Penarlâg*), a town of Flintshire, N. Wales, 6 m. W of Chester, connected by a branch with the L.M.S.R. Pop. (parish, 1921) 8,016. There is an early encampment on Truman's hill west of St. Deiniol's church, an early English building restored in 1857 and 1878. Hawarden castle—built in 1752, added to and altered in 1814—stands in a fine wooded park near the mediaeval castle of the same name. The latter suffered in Welsh raids and at the hands of the Parliamentarians in the 17th century. The modern house passed to W. E. Gladstone. The Grammar school dates from 1606. St. Deiniol's Hostel, founded to house Mr. Gladstone's library, is much used by students.

HAWAWIR, an Arabicized tribe of Berber origin dwelling in the Bayuda desert, Sudan, owning herds of oxen, sheep and camels. *See* H. A. MacMichael, *History of the Arabs of the Sudan* (1922).

HAWAZNIA: *see* BAKKARA.

HAWEIS, HUGH REGINALD (1838–1901), English preacher and writer, was born at Egham, Surrey, on April 3, 1838. On leaving Trinity College, Cambridge, he travelled in Italy and served under Garibaldi in 1860. On his return to England he was ordained and held various preferments. A lively and very fashionable preacher, he was much interested in music, and wrote books on violins and church bells, besides contributing an article to the 9th edition of the *Encyclopædia Britannica* on bell-ringing. He died on Jan 29, 1901.

HAWES, STEPHEN (*fl.* 1502–1521), English poet, was born, if his own statement of his age may be trusted, about 1474. He was educated at Oxford, and travelled in England, Scotland and France. He became groom of the chamber to Henry VII. as early as 1502. Hawes could repeat by heart the works of most of the English poets, especially the poems of John Lydgate, whom he called his master. He was still living in 1521. His capital work is *The Passetyme of Pleasure, or the History of Graunde Amour and la Bel Pucel, conteining the knowledge of the Seven Sciences and the Course of Man's Life in this Worlde*, printed by Wynkyn de Worde, 1509, but finished three years earlier The poem is a long allegory in seven-lined stanzas of man's life in this world. It is divided into sections after the manner of the Morte Arthur and borrows the machinery of romance. Its main motive is the education of the knight, Graunde Amour, based, according to W. J. Courthope (*Hist. of Eng. Poetry*, vol. i. 382), on the *Marriage of Mercury and Philology*, by Martianus Capella, and the details of the description prove Hawes to have been well acquainted with mediaeval systems of philosophy. This long poem, dull as it is, was widely read and esteemed, and certainly exercised an influence on the genius of Spenser

The *Pastime of Pleasure* was edited by T. Wright for the Percy Society in 1845. The remaining works of Hawes are all of them bibliographical rarities. *The Conversyon of Swerers* (1509) and *A Joyfull Medytacyon to all Englonde*, a coronation poem (1509), was edited by David Laing for the Abbotsford Club (1865). *A Compendyous Story . . . called the Example of Vertu* (pr. 1512) and the *Comfort of Lovers* (not dated) complete the list of his extant work. *See* also G. Saintsbury, *The Flourishing of Romance and the Rise of Allegory* (1897); the same writer's *Hist. of English Prosody* (vol. i., 1906); and an article by W. Murison in the *Cambridge History of English Literature* (vol. ii, 1908).

HAWFINCH, *Coccothraustes coccothraustes*, one of the largest of the finch family (*Fringillidae*), found over nearly the whole of Europe and north Asia and in Africa north of the Atlas. It breeds in nearly all the English counties to Yorkshire. In coloration it bears some resemblance to a chaffinch, but its much larger size and enormous beak make it easily recognizable, while the singular bill-hook form of some of its wing-feathers will be found remarkable Though frequenting gardens and orchards as well as woods, it is exceedingly shy. It has an unfortunate predilection for green peas In winter it may gather in flocks. It is unusual in that courtship begins while the birds are still in flocks, the mated pairs then separating to find individual territories.

HAWICK, burgh of barony and police burgh, Roxburghshire, Scotland. Pop. (1921), 16,353 It is situated at the confluence of the Slitrig (which flows through the town) with the Teviot, 10 m. S.W. of Jedburgh by road and 52¾ m. S.E. of Edinburgh by the L.N.E.R. The only church of historical interest is that of St. Mary's, the third of the name, built in 1763. The first church, believed to have been founded by St. Cuthbert (d. 687), was succeeded by one dedicated in 1214, which was the scene of the seizure of Sir Alexander Ramsay of Dalhousie in 1342 by Sir William Douglas. The Buccleuch memorial hall, commemorating the 5th duke of Buccleuch, contains a technical school and a museum. The Moat or Moot hill at the south end of the town is an earth mound 30 ft. high and 300 ft. in circumference, possibly the place where formerly the court of the manor met. The Baron's tower, founded in 1155 by the Lovels, lords of Branxholm and Hawick, and afterwards the residence of the Douglases of Drumlanrig, is said to have been the only building that was not burned down during the raid of Thomas Radcliffe, 3rd earl of Sussex, in April 1570. Bridges across the Teviot connect Hawick with the suburb of Wilton, and St. Leonard's park and race-course are situated on the Common, 2 m. S.W. The town is governed by a provost, bailies and council. The leading industries are the manufacture of hosiery, yarn and tweeds. There are, besides, dye works, saw-mills, iron-foundries and nursery gardens. The markets for live stock are also important.

In 1537 Hawick received from Sir James Douglas of Drumlanrig a charter which was confirmed by the infant Queen Mary in 1545, and remained in force until 1861, when the corporation was reconstituted by act of parliament. Sir Robert Umfraville (d. 1436), governor of Berwick, burned the town about 1417. In 1514, the year after the battle of Flodden, in which Hawick burghers had suffered severely, a number of young men routed an English force at Hornshole on the Teviot 2 m. below the town. This event is celebrated every June in the ceremony of "Riding the Common"—in which a facsimile of the captured pennon is carried in procession to the accompaniment of a chorus "Teribus, ye Teri Odin," supposed to be an invocation to Thor and Odin—a survival of Northumbrian paganism. An equestrian statue was erected in 1914 to mark the quater-centenary of the victory.

Two m. S.W. of Hawick is the massive peel of Goldielands—the "watch-tower of Branxholm," a typical Border stronghold. One mile beyond it, occupying a commanding site on the left bank of the Teviot, stands Branxholm castle, the Branksome hall of *The Lay of the Last Minstrel*, once owned by the Lovels, but since the middle of the 15th century the property of the Scotts of Buccleuch. It was destroyed in 1570 and was rebuilt the next year, the peel forming part of the modern mansion.

HAWK, a word of indefinite meaning, often used to include all diurnal birds of prey not vultures or eagles. In a more restricted sense, it excludes buzzards, falcons, harriers and kites. Hawks are characterized by short wings, long legs, and a bill curved down directly from the cere, or bare patch at the base, with the edges of the upper beak wavy but not notched. The female is always considerably larger than the male, the irides are yellow, deepening with age to orange or red, and the plumage is striped below in the young, barred in the adult. The largest is the goshawk (*q.v.*), while the male of the smallest, *Accipiter tinus*, is about the size of a song-thrush. Arboreal in habit, they feed largely on birds which they seize in their talons with a rapid swoop.



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE SPARROW HAWK, AN ARBOREAL BIRD OF PREY

The common sparrow-hawk (*A nisus*) extends from Ireland to Japan and southward to India and North Africa. Two allied forms replace it in North America, the sharp-shinned hawk, *A. fuscus*, and Cooper's hawk, *A. cooperi*. *A. tinus* is South American and numerous other species occur there, in Asia, Australia, Africa, and south-east Europe. (*See* FALCONRY.)

HAWKE, EDWARD HAWKE, BARON (1705–1781), British admiral, son of a barrister, entered the navy on Feb. 20, 1720, and served the time required to qualify him to hold a lieutenant's commission on the North American and West Indian stations. When war began with Spain in 1739, he served as captain of the "Portland" (50) in the West Indies. His ship was old and rotten. She nearly drowned her captain and crew, and was broken up after she was paid off in 1742. In the following year Hawke was appointed to the "Berwick" (70), and fought his ship in the ill-managed battle of Toulon on Jan. 11, 1744. In July 1747 he attained flag rank, and was named second in command of the Channel fleet. He was sent in command of the fourteen ships detached to intercept a French convoy on its way to the West Indies. On Oct. 14, 1747 he fell in with it in the Bay of Biscay, attacked at once, and captured six of the eight French ships.

In 1747 Hawke had been elected M.P. for Portsmouth, which he continued to represent for thirty years, though he can seldom have been in his place, and it does not appear that he often spoke. In the interval between the war of the Austrian Succession and

the Seven Years' War, Hawke was almost always on active service. From 1748 till 1752 he was in command at home, and he rehoisted his flag in 1755 as admiral in command of the Western Squadron. In June 1756 the news of John Byng's retreat from Minorca reached England. Hawke was at once sent out to relieve him in the Mediterranean command, and to send him home for trial. Minorca had fallen, from want of resources rather than the attacks of the French, before he could do anything for the assistance of the garrison of Fort St. Philip. He returned to England in January 1757, and next month was promoted full admiral.

When Pitt's great ministry was formed in June 1757, Hawke was not included in the Board of Admiralty, but he was continued in command of important forces in the Channel. In the late summer of 1757 he commanded the abortive expedition against Rochefort During the end of 1757 and the beginning of 1758 he continued cruising in the Channel in search of the French naval forces. In May of that year he was ordered to detach a squadron under the command of Howe to carry out further combined operations. He retired in June for a time on the ground of health, but happily he was able to hoist his flag in May 1759, the "wonderful year" of Garrick's song.

France was then collecting an army for the invasion of England in the Morbihan in Brittany; its transport was to be covered by a fleet to be made up by uniting the squadron at Brest with the ships at Toulon. The proposed combination of the French fleet was defeated by the annihilation of the Toulon squadron on the coast of Portugal by Boscawen in May, but the Brest fleet was still untouched and the troops were still at Morbihan. It was the duty of Hawke to prevent attack from this quarter. The way in which he discharged his task marks an epoch in the history of the British navy. Until his time, or very nearly so, it was still believed that there was rashness in keeping great ships out after September. Hawke maintained his blockade of Brest till far into November. By the care he took to obtain fresh food, and the energy he showed in pressing the Admiralty for stores, he kept his men healthy. Early in November severe gales forced him off the French coast, and he anchored in Torbay. His brief absence allowed the French admiral, M. de Conflans, time to put to sea, and to steer for the Morbihan. Hawke, who had left Torbay on Nov. 13, learnt of the departure of the French at sea on the 17th from a look-out ship, and followed the French admiral to the Morbihan. He sighted the French about 40 m. to the west of Belleisle on the morning of Nov. 20. The British fleet was of twenty-one sail, the French of twenty. There was also a small squadron of British ships engaged in watching the Morbihan as an inshore squadron, which was in danger of being cut off. After making a motion to give battle, Conflans changed his mind and gave the signal to his fleet to steer for the anchorage at Quiberon, thinking that the British admiral would not dare to follow him, for the coast is one of the most dangerous in the world, and the wind was rising to a storm. Hawke, however, caught up the rear of the French fleet in the afternoon. It was dark before the action began in Quiberon Bay. Five ships only were taken or destroyed, but others ran ashore, and the French navy as a whole lost all confidence. Two British vessels were lost, but the price was little to pay for such a victory. No more fighting remained to be done. The fleet in Quiberon Bay suffered from want of food, and its distress is recorded in the lines:—

"Ere Hawke did bang
Mounseer Conflang
You sent us beef and beer;
Now Mounseer's beat,
We've nought to eat,
Since you have nought to fear."

Hawke returned to England in Jan. 1760 and had no further service at sea. Sixteen years later (1776) he received a peerage as Baron Hawke of Towton. From 1766 to 1771 he was first lord of the Admiralty. His administration was much criticized. He was no favourite with Chatham's partizans. It is very credible that, having spent all his life at sea, his faculty did not show in the uncongenial life of the shore. As an admiral at sea and on his own element Hawke had no superior. On his death on the 17th of October 1781 his title passed to his son, Martin Bladen (1744–1805), and it is still held by his descendants, the 7th Baron (b. 1860) being the well-known cricketer who for so many years captained the Yorkshire eleven.

There is a portrait of Hawke in the Painted Hall at Greenwich. His *Life* by Montagu Burrows (1883) superseded all earlier authorities; it is supplemented in a few early particulars by Sir J. K. Laughton's article in the *Dict. Nat. Biog* (1891).

HAWKER, ROBERT STEPHEN (1803–1875), English antiquary and poet, was born at Stoke Damerel, Devonshire. He became vicar of Morwenstow, a village on the north Cornish coast, in 1834. He had an eccentric and powerful personality and was the original of Mortimer Collins's Canon Tremaine in *Sweet and Twenty*. He died in Plymouth on Aug. 15, 1875. Before his death he was formally received into the Roman Catholic Church, a proceeding which aroused a bitter newspaper controversy. The best of his poems is *The Quest of the Sangraal: Chant the First* (Exeter, 1864). Among his *Cornish Ballads* (1869) the most famous is on "Trelawny," the refrain of which, "And shall Trelawny die," etc., he declared to be an old Cornish saying.

See *The Life and Letters of R. S. Hawker* (1905) by his son-in-law, C. E. Byles, which contains a bibliography of his works, now very valuable to collectors. *See* also Boase and Courtney, *Bibliotheca Cornubiensis*. His *Poetical Works* (1879) and his *Prose Works* (1893) were edited by J. G. Godwin. A complete edition of his poems by C E Byles, with the title *Cornish Ballads and other Poems*, appeared in 1904.

HAWKERS and PEDLARS. The designations of itinerant dealers who convey their goods from place to place to sell. The word "hawker" seems to have come into English from the German or Dutch in the early 16th century. In an act of 1533 (25 Henry VIII. c. 9, s 6) we find "Sundry evill disposed persons which commonly beene called haukers . . . buying and selling of Brasse and Pewter" The earlier word for such an itinerant dealer is "huckster," which is found in 1200, "For that they have turned God's house intill hucksteress bothe" (*Ormulum* 15, 817).

"Pedlar" occurs much earlier than the verbal form "to peddle," which is therefore a derivative from the substantive. The origin is to be found in the still older word "pedder," one who carries about goods for sale in a "ped," a basket or hamper. This is now only used dialectically and in Scotland The French term for a hawker or pedlar of books, *colporteur*, has been adopted by the Bible Society and other English religious bodies as a name for itinerant vendors and distributors of Bibles and other religious literature.

The occupation of hawkers and pedlars has been regulated in Great Britain, and the two classes have also been technically distinguished. The Pedlars act, 1871, defines a pedlar as "any hawker, pedlar, petty chapman, tinker, caster of metals, mender of chairs, or other person who, *without* any horse or other beast bearing or drawing burden, travels and trades on foot and goes from town to town or to other men's houses, carrying to sell or exposing for sale any goods, wares or merchandise . . . or selling or offering for sale his skill in handicraft." Any person who acts as a pedlar must have a certificate, which is to be obtained from the chief officer of police of the police district in which the person applying for the certificate has resided during one month previous to his application. He must satisfy the officer that he is above 17 years of age, is of good character, and in good faith intends to carry on the trade of a pedlar. The fee for a pedlar's certificate is five shillings, and the certificate remains in force for a year from the date of issue. The act requires a register of certificates to be kept in each district, and imposes a penalty for the assigning, borrowing or forging of any certificate. It does not exempt any one from vagrant law, and requires the pedlar to show his certificate on demand to certain persons. It empowers the police to inspect a pedlar's pack, and provides for the arrest of an uncertificated pedlar or one refusing to show his certificate. A pedlar's certificate is not required by commercial travellers, sellers of vegetables, fish, fruit or victuals, or sellers in fairs. The Hawkers act, 1888, defines a hawker as "anyone who travels *with* a horse or other beast of burden, selling goods," etc. An excise licence (expiring on March 31 in each year) must be taken out by

every hawker in Great Britain. The duty imposed upon such licence is £2. A hawker's licence is not granted, otherwise than by way of licence, except on production of a certificate signed by a clergyman and two householders of the parish or place wherein the applicant resides, or by a justice of the county or place, or a superintendent or inspector of police for the district, attesting that the person is of good character and a proper person to be licensed as a hawker. There are certain exemptions from taking out a licence—commercial travellers, sellers of fish, coal, etc., sellers in fairs, and the real worker or maker of any goods. The act also lays down certain provisions to be observed by hawkers and others, and imposes penalties for infringements. In the United States there is no distinction between the words pedlar and hawker. In that country, and, in a lesser degree, in Great Britain, the improvement in transportation, the increase of the chain or multiple shops and the growth of the mail order business, has caused a great decrease in the number of pedlars. In their place the canvassing salesman has become common, the distinction between the two being that the canvassing salesman takes orders from samples, or from pictures of the goods, whereas the pedlar carries his stock with him.

HAWKESWORTH, JOHN (*c.* 1715–1773), English miscellaneous writer, succeeded Samuel Johnson in 1744 as compiler of the parliamentary debates for the *Gentleman's Magazine*, and from 1746 to 1749 contributed poems signed Greville, or H. Greville, to that journal. In company with Johnson and others he started a periodical called *The Adventurer*, which ran to 140 numbers, of which 70 were from the pen of Hawkesworth himself. He died on Nov. 16, 1773, and was buried at Bromley, Kent, where he and his wife had kept a school. Hawkesworth was a close imitator of Johnson both in style and thought, and was at one time on very friendly terms with him. It is said that he presumed on his success, and lost Johnson's friendship as early as 1756. He edited the works of Swift (12 vols., 1754–55, and 27 vols., 1766–79), and Cook's papers relative to his first voyage (3 vols., 1773), and was the author or adapter of several plays.

HAWKHURST, a town in Kent, England, 47 m. S.E. of London, on a branch of the S.R. Pop. (1921) 3,120. It lies mainly on a ridge above the valley of the Kent Ditch, a tributary of the Rother. The neighbouring country is hilly and well wooded, and the church of St. Lawrence, founded from Battle abbey in Sussex, is Decorated and Perpendicular, its east window belonging to the earlier period.

HAWKINS or HAWKYNS, **SIR JOHN** (1532–1595), English admiral, was born at Plymouth in 1532, and belonged to a family of Devon shipowners and skippers. His father, William Hawkins (d. 1553), thrice represented Plymouth in parliament, and is described by Hakluyt as one of the principal sea-captains in the west parts of England; his elder brother, also called William (d. 1589), was closely associated with him in his Spanish expeditions, and took an active part in fitting out ships to meet the Armada; and his nephew, the eldest son of the last named and of the same name, sailed with Sir Francis Drake to the South Sea in 1577, and served as lieutenant under Edward Fenton (*q.v.*) in the expedition which started for the East Indies and China in 1582. His son, Sir Richard Hawkins, is separately noticed.

Sir John Hawkins was bred to the sea in the ships of his family. When the great epoch of Elizabethan maritime adventure began, he took an active part by sailing to the Guinea coast, where he robbed the Portuguese slavers, and then smuggled the negroes he had captured into the Spanish possessions in the New World. After a first successful voyage in 1562–1563, two vessels which he had rashly sent to Seville were confiscated by the Spanish government. With the help of friends, and the open approval of the queen, who hired one of her vessels to him, he sailed again in 1564, and repeated his voyage with success, trading with the Creoles by force when the officials of the king endeavoured to prevent him. These two voyages brought him reputation, and he was granted a coat of arms with a demi-Moor, or negro, chained, as his crest. The rivalry with Spain was now becoming very acute, and when Hawkins sailed for the third time in 1567, he went in fact, though not technically, on a national venture. Again he kidnapped negroes, and forced his goods on the Spanish colonies. Encouraged by his discovery that these settlements were small and unfortified, he on this occasion ventured to enter Vera Cruz, the port of Mexico, after capturing some Spaniards at sea to be held as hostages. He alleged that he had been driven in by bad weather. The falsity of the story was glaring, but the Spanish officers on the spot were too weak to offer resistance. Hawkins was allowed to enter the harbour, and to refit at the small rocky island of San Juan de Ulloa by which it is formed. Unfortunately for him, and for a French corsair whom he had in his company, a strong Spanish force arrived, bringing the new viceroy. The Spaniards pretended to accept the arrangement made before their arrival, and then when they thought he was off his guard attacked him on Sept. 24. Only two vessels escaped, his own, the "Minion," and the "Judith," a small vessel belonging to his cousin Francis Drake. The voyage home was miserable, and the sufferings of all were great.

For some years Hawkins did not return to the sea, though he continued to be interested in privateering voyages as a capitalist. In the course of 1572 he recovered part of his loss by pretending, with the knowledge of Lord Burleigh, to betray the queen for a bribe to Spain. In 1573 he became treasurer of the navy in succession to his father-in-law Benjamin Gonson, and then comptroller; and for the rest of his life he was the principal administrative officer of the navy. Burleigh noted that he was suspected of fraud in his office, but the queen's ships were kept by him in good condition. In 1588 he served as rear-admiral against the Spanish Armada and was knighted. In 1590 he was sent to the coast of Portugal to intercept the Spanish treasure fleet, but did not meet it. In giving an account of his failure to the queen he quoted the text "Paul doth plant, Apollo doth water, but God giveth the increase," which exhibition of piety is said to have provoked the queen into exclaiming, "God's death! This fool went out a soldier, and has come home a divine." In 1595 he accompanied Drake on another treasure-hunting voyage to the West Indies, which was even less successful, and he died at sea off Porto Rico on the 12th of November 1595.

Contemporary evidence can be produced to show that Hawkins was greedy, unscrupulous and rude. But if he had been a more delicate man he would not have risked the gallows by making piratical attacks on the Portuguese and by appearing in the West Indies as an armed smuggler; and in that case he would not have played an important part in history by setting the example of breaking down the pretension of the Spaniards to exclude all comers from the New World. His morality was that of his time, whether in England or elsewhere.

See R. A. J. Walling, *A Sea-dog of Devon* (1907); and Southey in his *British Admirals*, vol. iii. The original accounts of his voyages compiled by Hakluyt have been reprinted by the Hakluyt Society, with a preface by Sir C. R. Markham.

HAWKINS, SIR JOHN (1719–1789), English writer on music, was born on March 30, 1719, in London, the son of an architect. He studied law, devoting his leisure hours to his favourite study of music. A wealthy marriage in 1753 enabled him to indulge his passion for acquiring rare works of music; he bought, for example, the collection formed by Dr. Pepusch, and subsequently presented it to the British Museum. His great work, the *General History of the Science and Practice of Music*, in 5 vols. (republished 1853 and 1876), was brought out in 1776, when the first volume of Burney's history also appeared. The relative merits of the two works were eagerly discussed by contemporary critics. But Hawkins's, which is essentially a collection of rare and valuable pieces of music with a more or less continuous commentary, has in a fact a different aim from Burney's. Hawkins wrote also a biography of Samuel Johnson, with whom he was intimately acquainted. He died on May 21, 1789.

HAWKINS or HAWKYNS, **SIR RICHARD** (*c.* 1562–1622), English seaman, was the only son of Admiral Sir John Hawkins (*q.v.*) by his first marriage. In 1582 he accompanied his uncle, William Hawkins, to the West Indies. In 1585 he was captain of a galliot in Drake's expedition to the Spanish Main, in 1588 he commanded a queen's ship against the Armada, and in 1590

served with his father's expedition to the coast of Portugal. In 1593 he purchased the "Dainty," a ship originally built for his father and used by him in his expeditions, and sailed for the West Indies, the Spanish Main and the South Seas to prey on the oversea possessions of the king of Spain. Hawkins, however, in an account of the voyage written 30 years afterwards, maintained that his expedition was undertaken purely for the purpose of geographical discovery. After visiting the coast of Brazil, the "Dainty" passed through the Straits of Magellan, and in due course reached Valparaiso. Having plundered the town, Hawkins pushed north, and in June 1594, a year after leaving Plymouth, arrived in the Bay of San Mateo. Here the "Dainty" was attacked by two Spanish ships. Hawkins was hopelessly outmatched, and at last, when he himself had been severely wounded, many of his men killed, and the "Dainty" was nearly sinking, he surrendered on the promise of a safe-conduct out of the country for himself and his crew. Through no fault of the Spanish commander this promise was not kept. In 1597 Hawkins was sent to Spain, and imprisoned first at Seville and subsequently at Madrid. He was released in 1602, and, returning to England, was knighted in 1603. In 1604 he became member of parliament for Plymouth and vice-admiral of Devon, a post which, as the coast was swarming with pirates, was no sinecure. In 1620–1621 he was vice-admiral, under Sir Robert Mansell, of the fleet sent into the Mediterranean to reduce the Algerian corsairs He died in London on April 17, 1622.

See his *Observations in his Voiage into the South Sea* (1622), republished by the Hakluyt Society.

HAWKSBILL (*Eretmochelys imbricata*), a marine turtle, so called from the shape of its snout, common in the tropical parts of the Indian, Pacific and Atlantic oceans, and producing the tortoise-shell (*q v*) of commerce. Its flesh is valueless, though the eggs are edible. The hawksbill is carnivorous. (*See* TORTOISE.)

HAWKSHAW, SIR JOHN (1811–1891), English engineer, was educated at Leeds grammar school. He became chief engineer of the Lancashire and Yorkshire railway, for which he constructed a large number of branch lines In 1850 he removed to London and began to practise as a consulting engineer, at first alone, but subsequently in partnership with Harrison Hayter. In London he was responsible for the Charing Cross and Cannon Street railways, together with the two bridges which carried them over the Thames; he was engineer of the East London railway, which passes under the Thames through Sir M. I. Brunel's well-known tunnel; and jointly with Sir J. Wolfe Barry he constructed the section of the Underground railway which completed the "inner circle" between the Aldgate and Mansion House stations. Hawkshaw was concerned with many railway works in all parts of the world—Germany, Russia, India, Mauritius, etc. He advocated, in opposition to Robert Stephenson, steeper gradients than had previously been thought desirable or possible, and he protested against the maintenance of the broad gauge on the Great Western, as he foresaw that it complicated railway extension.

In 1862 he became engineer of the Amsterdam ship-canal, and in the next year he may fairly be said to have been the saviour of the Suez canal by presenting a favourable report on the question to the Khedive. As a member of the International Congress to consider the construction of an interoceanic canal across Central America, he preferred the Nicaraguan route. He regarded the Panama scheme as impracticable at a reasonable cost, although publicly he expressed no opinion on the matter and left the Congress without voting. He was engineer of the Severn tunnel, one of the most notable engineering undertakings of the 19th century. He died in London on June 2, 1891.

HAWKSMOOR, NICHOLAS (1661–1736), English architect, was born in Nottinghamshire in 1661 and died in London on March 25, 1736. He became a pupil of Sir Christopher Wren, through whose influence he became deputy-surveyor at Chelsea and Greenwich hospitals and clerk of the works at Whitehall, St. James's and Westminster. He succeeded Wren as surveyor-general of Westminster Abbey. Hawksmoor shared in much of the work done by Wren and Sir J. Vanbrugh; the early Gothic designs of the two towers of All Souls', Oxford, north quadrangle, and the library at Queen's college, Oxford, appear, however, to be his own. He also designed several London churches, notably St. Mary Woolnoth (1716–19) and St. George's, Bloomsbury (1720–30).

See H. S. Goodhart-Rendel, *Nicholas Hawksmoor* (1924).

HAWKWEED, the name given to species of the genus *Hieracium*, of the family Compositae, containing some 450 species inhabiting the northern hemisphere, South Africa and the Andes. The flowering heads, generally yellow, are borne, often several at a time, on an elongated axis, the component flowers being ligulate. Various hawkweeds are troublesome weeds, especially in grassland. Some 20 or more species occur in the British Isles and upwards of 40 species are found in North America, including several from the Old World which are widely naturalized as weeds. Of the latter, the orange hawkweed or devil's paint-brush (*H. aurantiacum*), of south Europe, sometimes cultivated, and the field hawkweed (*H. pratense*) have become pestiferous. G. Mendel (*q.v.*) employed hawkweeds in some of his experiments in heredity, but they proved extremely unsatisfactory material on account of the small size of the individual flowers and because some are parthenogenetic. (*See* COMPOSITAE.)

HAWKWOOD, SIR JOHN (d. 1394), an English adventurer who attained great wealth and renown as a condottiere in the Italian wars of the 14th century His name is variously spelt as Haccoude, Aucud, Aguto, etc., by contemporaries. He was perhaps the son of a tanner of Hedingham Sibil in Essex, and was apprenticed in London, whence he went, in the English army, to France under Edward III. and the Black Prince. He was certainly of knightly rank, which he may have received from Edward III. On the peace of Bretigny in 1360, he collected a band of men-at-arms, and moved southward to Italy, where the White Company, as his men were called, assisted the marquis of Monferrato against Milan in 1362–63, and the Pisans against Florence in 1364. After several campaigns in central Italy, Hawkwood in 1368 entered the service of Bernabo Visconti. In 1369 he fought for Perugia against the pope, and in 1370 for the Visconti against Pisa, Florence and other enemies. In 1372 he defeated the marquis of Monferrato, but soon afterwards, resenting the interference of a council of war resigned his command, and the White Company passed into the papal service, in which he fought against the Visconti in 1373–1375. In 1375 the Florentines agreed to pay him and his companion 130,000 gold florins in three months on condition that he would not fight against them; and in the same year the priors of the arts and the gonfalonier awarded him a pension of 1,200 florins per annum. In 1377, under the orders of the cardinal Robert of Geneva, legate of Bologna, he massacred the inhabitants of Cesena, but in May of the same year, disliking the executioner's work put upon him by the legate he joined the anti-papal league, and married, at Milan, Donnina, an illegitimate daughter of Bernabo Visconti. In 1378 and 1379 Hawkwood was constantly in the field; he quarrelled with Bernabo in 1378, and entered the service of Florence, receiving, as before 130,000 gold florins. He served the republic up to 1382, when for a time he was an English ambassador at the papal court. He fought in Naples in 1383 for the marquis of Padua against Verona in 1386, and in 1388 made an unsuccessful effort against Gian Galeazzo Visconti, who had murdered Bernabo. In 1390 the Florentines took up the war against Gian Galeazzo in earnest, and appointed Hawkwood commander-in-chief. His campaign against the Milanese army in the Veronese and the Bergamask was a triumph of generalship, and in 1392 Florence forced a satisfactory peace from Gian Galeazzo. His latter years were spent near Florence. On his death in 1394 the republic gave him a public funeral. Paolo Uccelli painted his portrait in terre-verte on the inner façade of the cathedral.

Of his children by Donnina Visconti, who was probably his second wife, the eldest daughter married Count Brezaglia of Porciglia, podestà of Ferrara, who succeeded him as Florentine commander-in-chief, and another a German condottiere, Conrad Prospergh. His son, John, returned to England and settled at Hedingham Sibil. The children of the first marriage were two

sons and three daughters, of whom the youngest married John Shelley, an ancestor of the poet.

See Muratori, *Rerum Italicarum scriptores,* and supplement by Tartinius and Manni; *Archivio storico italiano;* Temple-Leader and Marcotti, *Giovanni Acuto* (Florence, 1889; Eng. transl., Leader Scott, London, 1889); Nichol, *Bibliotheca topographica Britannica,* vol. vi.; J. G. Alger in *Register and Magazine of Biography,* v. 1.; and article in *Dict. Nat. Biog.*

HAWLEY, HENRY (*c.* 1679–1759), British lieutenant-general, entered the army, it is said, in 1694. Under Cumberland's orders he led the cavalry in the campaign of Culloden, and at that battle his dragoons gained an evil name by their ruthless butchery of the fugitive rebels. He died at Portsmouth in 1759.

HAWORTH, an urban district in the Keighley parliamentary division of the West Riding of Yorkshire, England, 10 m. N.W. of Bradford, on a branch of the L.M.S. railway. Pop. (1921), 6,600. It is picturesquely situated at an altitude of 600 ft., surrounded by moorland, on the steep slope of a tributary valley of the Worth, which flows north to join the Aire. The parsonage was the home of Charlotte and Emily Brontë, and a memorial near the west window of St. Michael's church bears their name, and that of their father, the Rev. Patrick Brontë. In 1895, a museum was opened by the Brontë Society, and in Aug. 1928 the parsonage was presented by Sir James Roberts to the Brontë Society as a permanent museum and library. The worsted industry of Haworth is important.

HAWSER, a small cable or thick rope used at sea for the purposes of mooring or warping, in the case of large vessels made of steel. When a cable or tow line is made of three or more small ropes it is said to be "hawser-laid." The "hawse" of a ship is that part of the bows where the "hawse-holes" are made. These are two holes cut in the bows of a vessel for the cables to pass through, having small cast-iron pipes, called "hawse-pipes," fitted into them to prevent abrasion. In bad weather at sea these holes are plugged up with "hawse-plugs" to prevent the water entering.

HAWTHORN, an eastern suburb and residential area of Melbourne, Australia. (*See* MELBOURNE.)

HAWTHORN, the common name for *Crataegus,* in botany, a genus of shrubs or small trees belonging to the family Rosaceae, native of the north temperate regions, especially America. It is represented in the British Isles by the hawthorn, white-thorn or may, *C. Oxyacantha,* a small, round-headed, much-branched tree, 10 to 20 ft. high, the branches often ending in single sharp spines. The leaves, which are deeply cut, are 1 to 2 in. long and very variable in shape. The flowers are sweet-scented, in flat-topped clusters, and ½ to ¾ in. in diameter, with five spreading white petals alternating with five persistent green sepals, a large number of stamens with pinkish-brown anthers, and one to three carpels sunk in the cup-shaped floral axis. The fruit, or haw, as in the apple, consists of the swollen floral axis, which is usually scarlet, and forms a fleshy envelope surrounding the hard stone.

The common hawthorn is a native of Europe as far north as 60½° in Sweden, and of North Africa, western Asia and Siberia, and has been naturalized in North America and Australia. It thrives best in dry soils, and in height varies from 4 or 5 to 12, 15 or, in exceptional cases, as much as between 20 and 30 ft. Hawthorn has been for many centuries a favourite park and hedge plant in Europe, and numerous varieties have been developed by cultivation; these differ in the form of the leaf, the white, pink or red, single or double flowers, and the yellow, orange or red fruit. In England the hawthorn, owing to its hardiness and closeness of growth, has been employed for enclosure of land since the Roman occupation, but for ordinary field edges it is believed it was not generally in use till about the end of the 17th century. James I. of Scotland, in his *Quair,* ii. 14 (early 15th century), mentions the "hawthorn hedges knet" of Windsor Castle. The first hawthorn hedges in Scotland are said to have been planted by soldiers of Cromwell at Inch Buckling Brae in East Lothian and Finlarig in Perthshire. Annual pruning, to which the hawthorn is particularly amenable, is necessary if the hedge is to maintain its compactness and sturdiness. When the lower part shows a tendency to go bare the strong stems may be "plashed," *i.e.,* split, bent over and pegged to the ground so that new growths may start. The wood of the hawthorn is white in colour, with a yellowish tinge. Its great hardness, however, renders it valuable for the manufacture of various articles, such as the cogs of mill-wheels, flails and mallets, and handles of hammers and for engraving. The custom of employing the flowering branches for decorative purposes on the 1st of May is of very early origin; but since the



FROM COOPER AND WESTELL, "SHRUBS OF THE BRITISH ISLES"

FLOWER-BEARING SPRAY OF THE HAWTHORN. A SHRUB THAT ATTAINS AN AVERAGE HEIGHT OF FROM 4 TO 15 FEET, AND IS USED THROUGHOUT EUROPE AS A PARK AND FIELD HEDGE. BELOW ARE THE FRUITS (HAWS)

alteration in the calendar the tree has rarely been in full bloom in England before the second week of that month. Branches of the Glastonbury thorn, *C. Oxyacantha,* var. *praecox,* which flowers both in Dec. and in spring, were formerly highly valued in England, on account of the legend that the tree was originally the staff of Joseph of Arimathea.

The number of species in the genus is from 70 to 100 according to the view taken as to whether or not some of the forms, especially of those occurring in the United States, represent distinct species. *C. coccinea,* a native of Canada and the eastern United States, with bright scarlet fruits, was introduced into English gardens towards the end of the 17th century. *C. Crus-Galli,* with a somewhat similar distribution and introduced about the same time, is a very decorative species with showy, bright red fruit, often remaining on the branches till spring, and leaves assuming a brilliant scarlet and orange in the autumn; numerous varieties are in cultivation. *C. Pyracantha,* known in gardens as pyracantha, is evergreen and has white flowers, appearing in May, and fine scarlet fruits of the size of a pea which remain on the tree nearly all the winter. It is a native of south Europe and was introduced into Britain early in the 17th century.

HAWTHORNE, NATHANIEL (1804–1864) American romancer, was born at Salem (Mass.) on July 4, 1804, and died at Plymouth (N.H.) on May 19, 1864. He was the most distinguished craftsman of the New England school of letters. His quiet life, wholly detached from the major activities of the times, was largely given over to brooding solitude. Brought up in the old seaport town, and returning there to live for long periods of time, he was a child of the Salem eclipse. The Salem that nourished his imagination was already living on its memories—memories that ran back to the earliest days of the Massachusetts Bay Colony, and were darkened by a waning prosperity. The seat of government early passed to Boston and with its passing a deep provincialism settled on the countryside that came to sinister expression in the unhappy witch-craft persecutions. In the 18th

century the town enjoyed a temporary prosperity from overseas commerce, and thrifty sea-captains built dignified houses out of the profits of the China trade. Then came a swift decline, the passing of commerce to other ports, and a musty quiet about the wharves.

Of this grim decay the Hathorne family—the "w" was inserted in the name by Nathaniel in early manhood—might well seem a striking symbol to one who inherited only the shadow of its former dignity. For a time the Hathorne family were important members of the local gentry but later the family fortunes declined and the Hathornes slipped from their proud position. "From father to son, for above 100 years, they followed the sea;" but they amassed no wealth and built no great house in Salem. Capt. Nathaniel Hathorne, father of the novelist, married Elizabeth Clark Manning, daughter of a neighbour, but a few years later he died, leaving his wife and three small children in meagre circumstances. It was a strange household in which the boy was reared, a sort of Puritan nunnery with the mother and daughters slipping wraith-like from room to room, fearful of every contact, given to solitude—a household infected with gloom, the natural spirits repressed, mirthless and passionless except for the one consuming passion of renunciation, yet enjoying a certain grim Puritan culture and sustained by a deep family pride that remembered greater days and would hide its genteel poverty from a critical world.

From such an upbringing Hawthorne got those mental characteristics that set him so completely apart from his fellows—a strong pride, a sense of aloofness and alienation from the common interests, a suspicious, defensive hostility towards a world that ignored his timid gestures of *rapprochement*. A barrier slowly rose about his soul over which he was never willing or able to climb, and within this barrier he dwelt alone, sceptical, critical, keenly observant, weaving the threads of fancy into fantastic shapes, discovering obscure symbolisms in every substantial fact, and investing the children of his imagination with a rare ascetic beauty. From the solitude of those early years he never escaped. At nine he injured a foot and for months was shut up in the house with only crutches to help him about. At 14 he went with the family to Raymond, a wilderness hamlet in Maine, and there by the quiet waters of Sebago lake he dreamed and played alone. Three years later, in 1821, he was sent by his uncles to Bowdoin college, a raw little school at Brunswick (Me.), where he spent four years with little other profit than the making of two friendships that were to endure through life—with Horatio Bridge who was to push him lovingly towards public recognition, and with Franklin Pierce, afterwards President of the United States, who was to send him to the American consulate at Liverpool and make possible his European experience.

Upon his graduation in 1825 he returned to Salem, where his manner of life was already predetermined. The passion of the artist was stirring within him, a passion somewhat pale and austere as became a child of Puritanism, but infused with a fine integrity; and under the compulsions of that passion he set himself to master the craft of the short story, till then scarcely practised in America. He slipped quietly back into the shadowy existence of the Herbert street house and the grim past of Salem with its tales of his Hathorne ancestry. It was, he said, "the sensuous sympathy of dust for dust," a "strange, indolent, unjoyous attachment," that wove about him a net too strong to break. Twelve years he spent thus, serving a laborious apprenticeship to his art, without masters, learning the secret of smooth-flowing sentences, discovering how to weave harsh words into soft tapestries and throw about them an atmosphere of dark loveliness. It was an unhappy time, harassed by pride and self-depreciation and longing; but it taught him the art of creative selection, and endowed his pen with the gift of emotional unity. From the labours of those years little was salvaged—*Fanshawe*, an abortive romance he later rejected, some fugitive stories in obscure magazines, some hack work, and at last 18 stories and sketches published in 1837 under the title *Twice Told Tales*. The little volume thus timidly offered to an indifferent public made scarcely a ripple; yet certain of the stories, like "The Minister's Black Veil," were finished products of the art he had been perfecting during his 'prentice years, and prophetic of the path his maturer art was to follow.

It was while he was enjoying the modest reputation that came from the publication of his volume that he found the one great contentment of his life in his love for Sophia Peabody. The Peabodys were old Salem stock that had got on but indifferently well till the family fortunes were taken in charge by the eldest daughter. Elizabeth Peabody was a capable woman, responsive to all the current social enthusiasms and aflame with the New England passion for learning. She was an abolitionist, a transcendentalist, an assistant to Bronson Alcott in the Temple school, and a sympathetic friend to every Utopian dreamer of the times. On the removal of the family to Boston she set up a book-shop that soon became the unofficial headquarters of the transcendental movement. From it was issued *The Dial*, as well as three volumes of Hawthorne's children's stories. It was here that Hawthorne came into intimate contact with the vigorous intellectual life of the New England Renaissance. He was not greatly influenced by the body of transcendental thought, and even less sympathetic with the strident reform movements. He contemplated the current enthusiasms with a cool, detached scepticism that came to expression later in *The Blithedale Romance*. His opinion of civilization is somewhat mordantly suggested in *The New Adam and Eve*, but he considered the expectations of the Utopians to be ill founded and in the sardonic tale of *Earth's Holocaust* he satirized the enthusiasm of reformers. He was more concerned in securing a competence than in refashioning civilization and accepted a post in the Boston customs house, but after 27 months' experience measuring coal, he invested his slender savings in the communistic settlement at Brook farm, in West Roxbury, and in April 1841 took up his residence there. But he soon found communal living uncongenial, and the following spring he withdrew and in July married Sophia Peabody and settled in the Old Manse at Concord. There were spent the three happiest years of his life, and the fruits of his somewhat indolent labours appeared in *Mosses from an Old Manse*, published in 1846, a collection of short stories that made no advance over the earlier work.

But the earnings of his pen were meagre and uncertain and his friends took advantage of a new Democratic administration to secure Hawthorne a post in the Salem customs house. In spite of such tales as *The Snow Image*, *The Great Stone Face* and *Ethan Brand*, the three years spent there were not fruitful, and it was a stroke of good fortune to be thrown out of his place by village politics. His creative period lay just ahead. He was 45 when he sat down to write a story that had long been haunting his mind and that kindled his imagination as no other was ever to do. Written with morose intensity and great diffidence, in the midst of harassing troubles, *The Scarlet Letter* was issued in April 1850. Its popular success was immediate and at last Hawthorne had ceased to be "the obscurest man of letters in America." With the flowering of his creative powers a new restlessness seized upon him. He quitted Salem with its depressing memories, removed to Lenox, then to West Newton, then back to Concord, where the family established itself at The Wayside. During the winter at Lenox he wrote at high pressure *The House of the Seven Gables*, published in 1851, and at West Newton, close to Brook Farm, *The Blithedale Romance*, published the next year. In 1853 he received the appointment to the Liverpool consulate, and he set forth on his long-delayed pilgrimage to the old world—a pilgrimage that was to last seven years, four of them spent at Liverpool, a year and a half in Italy, and a year again in England, at Whitby and Redcar, and finally at Leamington, where in November 1859 he completed *The Marble Faun*, published early the next year under the English title *Transformation*. In the summer of 1860 he returned to The Wayside, somewhat regretfully quitting the old home that he had come to love without quite understanding. Four years of life remained to him, but he accomplished little. The war came on, his health was breaking, and the work of writing wearied and depressed him *Septimius Felton*, *The Dolliver Romance* and *Doctor Grimshawe's Secret*, are only rejected fragments from an old man's workshop. From his note-books he salvaged enough material for an unimportant volume entitled *Our*

Old Home; but his work was done. The world he had known was being destroyed by the Civil War and in the midst of battles he quietly faded out of life.

Hawthorne's range as a creative artist was narrow, but within the self-imposed bounds his imagination played freely. He was the romancer of a grim Puritan past that both fascinated and repelled him. He had thrown off the last vestige of Calvinistic dogma, but he could not free his mind from the spectre of sin that haunted the waking hours of his ancestors. His speculations took their rise from an inherited ethicism. He resented the inhibitions of Puritan Hebraism, but he was unwilling to trust a frank Hellenism. *The Scarlet Letter* is not a Puritan document. As he meditated on the morals of the problem of Hester and Dimmesdale his inveterate scepticism issued in revolutionary ethics that would have scandalized his ancestors. Hester is a triumphant protest against a false Hebraism. From the long discipline of suffering she emerges enriched and ennobled. Though Hawthorne's concern is always with the ethical, only at rare moments does his imagination fuse with creative passion; more frequently it glows with a subdued light, playing lambently about the theme, clothing it in quaint or fantastic symbolism. Not a rich nature, he was gifted nevertheless with a luminous mind and a fine seriousness, and his work is marked by a subtle and distinguished craftsmanship. Cut off by solitude from a fruitful contact with society he dwelt overmuch with shadows; yet in spite of the thin and tenuous quality of his themes he was as exquisite an embodiment of the conscience-ridden Puritan mind as Emerson was of Puritan idealism.

BIBLIOGRAPHY.—An excellent bibliography of Hawthorne is given in the *Cambridge History of American Literature*, vol. ii. Among the numerous editions of his works the following are desirable: Riverside edition (12 vols., Boston, 1883); Standard Library edition (15 vols., Boston, 1891)—includes the Life by Julian Hawthorne; New Wayside edition (13 vols., Boston, 1902). For his life *see* Julian Hawthorne, *Nathaniel Hawthorne and his Wife* (2 vols., Boston, 1885); Henry James, *Nathaniel Hawthorne* (London, 1879, New York, 1885, 1887), "English Men of Letters" series; Lloyd Morris, *The Rebellious Puritan: Portrait of Mr. Hawthorne* (1927); Herbert Gorman, *Nathaniel Hawthorne, A Study in Solitude* (1927). (V. L. P.)

HAWTREY, SIR CHARLES HENRY (1858–1923), actor, was born at Eton, where his father was master of the lower school, and educated at Rugby and Oxford. He took to the stage in 1881, and in 1883 adapted von Moser's *Bibliothekar* as *The Private Secretary*, which had an enormous success. He then appeared in London in a number of modern plays, in which he was conspicuous as a comedian. He was unapproachable for parts in which cool imperturbable lying constituted the leading characteristic. Among his later successes *A Message from Mars* was particularly popular in London and in America. He was knighted in 1922. He died in London on July 30, 1923.

HAWTREY, EDWARD CRAVEN (1789–1862), English educationalist, was born at Burnham on May 7, 1789, the son of the vicar of the parish. He was educated at Eton and King's college, Cambridge, and in 1814 was appointed assistant master at Eton. He was headmaster of the college from 1834–52. In 1852 he became provost of Eton; in 1854 vicar of Mapledurham. He died on Jan. 27, 1862, and was buried in the Eton college chapel. On account of his command of languages ancient and modern, he was known in London as "the English Mezzofanti," and he was a book collector of the finest taste. He made some excellent translations from the English into Italian, German and Greek. He had a considerable reputation as a writer of English hexameters and as a judge of Homeric translation.

HAXO, FRANÇOIS NICOLAS BENOÎT, BARON (1774–1838), French general and military engineer, was born at Lunéville on June 24, 1774, and entered the Engineers in 1793. After the second siege of Saragossa (1809), Napoleon made him a colonel. He fought in the Napoleonic campaigns and after the retreat from Moscow was made general of division. In 1813 he constructed the works around Hamburg which made Davout's defence possible, and commanded the Guard Engineers until he was captured at Kulm. After the Restoration Haxo remained faithful to Napoleon, and in the Hundred Days laid out the provisional fortifications of Paris and fought at Waterloo. The best work of his career as a military engineer was done after the second restoration, in reconstructing the old Vauban and Cormontaigne fortresses. For his services he was made a peer of France by Louis Philippe (1832). Haxo, under Marshal Gérard, directed the engineers at the famous scientific siege of Antwerp, when the fortress surrendered after a siege of little more than three weeks (Dec. 23, 1832). He was after this regarded as the first engineer in Europe, and his latter years were spent in urging upon the government and the French people the fortification of Paris and Lyons, a project which was begun in his time and completed after his death. He died at Paris on June 25, 1838.

He wrote *Mémoire sur le figuré du terrain dans les cartes topographiques* (Paris, N.D.), and a memoir of General Dejean (1824).

HAXTHAUSEN, AUGUST FRANZ LUDWIG MARIA, FREIHERR VON (1792–1866), German economist, was born near Paderborn in Westphalia on Feb. 3, 1792. He wrote *Über die Agrarverfassung in den Fürstentümern Paderborn und Corvey* (1829), a work which procured for its author a commission to investigate and report upon the land laws of the Prussian provinces with a view to a new code. His exhaustive treatise, *Die ländliche Verfassung in der Provinz Preussen* (1839) and his *Studien über die innern Zustände des Volkslebens, und insbesondere die ländlichen Einrichtungen Russlands* (Hanover, 1847–52, Eng. trans. *The Russian Empire* 1856) are classic works in their subjects. He received various honours, was a member of the combined diet in Berlin in 1847 and 1848, and afterwards of the Prussian upper house. Haxthausen died at Hanover on Dec. 31, 1866.

His other works include. *Die ländliche Verfassung Russlands* (Leipzig, 1866); *Transcaucasia; Sketches of the nations and Races between the Black Sea and the Caspian* (1854), and *The Tribes of the Caucasus* (1855).

HAY, GEORGE (1729–1811), Scottish Roman Catholic divine, was born at Edinburgh on Aug. 24, 1729. Accused of sympathizing with the rebellion of 1745, he served a term of imprisonment 1746–47. He then entered the Roman Catholic Church, studied in the Scots college at Rome, and in 1759 accompanied John Geddes (1735–99), afterwards bishop of Morocco, on a Scottish mission. Ten years later he was appointed bishop of Daulis *in partibus* and coadjutor to Bishop James Grant (1706–78). In 1778 he became vicar apostolic of the lowland district. From 1788 to 1793, he was in charge of the Scalan seminary; in 1802 he retired to that of Aquhorties near Inverury which he had founded in 1709. He died there on Oct. 15, 1811.

His theological works, including *The Sincere Christian, The Devout Christian, The Pious Christian* and *The Scripture Doctrine of Miracles,* were edited by Bishop Strain in 1871.

HAY, GILBERT, or "SIR GILBERT THE HAYE" (*fl.* 1450), Scottish poet and translator, was perhaps a kinsman of the house of Errol. He has left it on record, in the Prologue to his *Buke of the Law of Armys*, that he was "chaumerlayn umquhyle to the maist worthy King Charles of France." In 1456 he was back in Scotland, in the service of the chancellor, William, earl of Orkney and Caithness.

Hay's only political work is *The Buik of Alexander the Conquerour*, of which a portion, in copy, remains at Taymouth castle. Three of his translations exist in the collection of Abbotsford: (*a*) *The Buke of the Laws of Armys* or *The Buke of Bataillis*, a translation of Honoré Bonet's *Arbre des batailles;* (*b*) *The Buke of the Order of Knichthood* from the *Livre de l'ordre de chevalerie;* and (*c*) *The Buke of the Governaunce of Princes*, from a French version of the pseudo-Aristotelian *Secreta secretorum*. The second of these precedes Caxton's independent translation by at least ten years.

For the *Buik of Alexander see* A. Herrmann's *The Taymouth Castle MS. of Sir Gilbert Hay's Buik, etc.* (1898). The Abbotsford ms. has been reprinted by the Scottish Text Society (ed. J. H. Stevenson, 2 vols., 1901 and 1914). *The Order of Knichthood* was printed by David Laing for the Abbotsford club (1847). *See* also S.T.S. edition (*u.s.*) "Introduction," and Gregory Smith's *Specimens of Middle Scots* (1902), in which annotated extracts are given from the Abbotsford ms. the oldest known example of literary Scots prose.

HAY, IAN, pen name of John Hay Beith (1876–), British novelist, was born at Rusholme, near Manchester, on

April 17, 1876, and educated at Fettes college, Edinburgh, and St. John's college, Cambridge. At the outbreak of the World War he joined the Argyll and Sutherland Highlanders, 10th Service Batt., was mentioned in despatches and decorated with the M.C. He is best known as the author of *The First Hundred Thousand* (1915), a humorous sketch of military life in the early days of recruiting, and its sequels, *Carrying On* (1917) and *The Last Million* (1918). His novels include *Pip* (1907); *A Man's Man* (1909); *Happy-Go-Lucky* (1919, dramatized as *Tilly of Bloomsbury*); *A Safety Match* (1911, dramatized in 1921); *A Knight on Wheels* (1914); *Paid With Thanks* (1925).

HAY, JOHN (1838–1905), American statesman and author, was born at Salem, Ind., on Oct. 8, 1838. He graduated at Brown university in 1858, studied law in the office of Abraham Lincoln, was admitted to the bar in Springfield, Ill., in 1861, and soon afterwards was selected by President Lincoln as assistant private secretary, in which capacity he served till the president's death, being associated with John George Nicolay (1832–1901). Hay was secretary of the U.S. legation at Paris in 1865–67, at Vienna in 1867–69, and at Madrid in 1869–70. After his return he was for five years an editorial writer on the New York *Tribune*; in 1879–81 he was first assistant secretary of State to W. M. Evarts. Upon the inauguration of President McKinley in 1897 Hay was appointed ambassador to Great Britain, from which post he was transferred in 1898 to that of secretary of State, succeeding W. R. Day, who was sent to Paris as a member of the Peace Conference. He remained in this office until his death at Newburg, N.H., on July 1, 1905. Hay directed the peace negotiations with Spain after the war of 1898, and not only secured American interests in the imbroglio caused by the Boxers in China, but grasped the opportunity to insist on "the administrative entity" of China; influenced the Powers to declare publicly for the "open door" in China; challenged Russia as to her intentions in Manchuria, securing a promise to evacuate the country on Oct. 8, 1903. In 1904 he again urged "the administrative entity" of China and took the initiative in inducing Russia and Japan to "localize and limit" the area of hostilities. It was due largely to his management, in concert with Lord Pauncefote, the British ambassador, that negotiations for abrogating the Clayton-Bulwer treaty and for making a new treaty with Great Britain regarding the Isthmian canal were successfully concluded at the end of 1901; subsequently he negotiated treaties with Colombia and Panama, looking towards the construction by the United States of a trans-isthmian canal. He arranged the settlement of difficulties with Germany over Samoa in 1899, and the settlement, by joint commission, of the disputed Alaskan boundary in 1903. As secretary of State under Presidents McKinley and Roosevelt his guidance was invaluable during a critical period in foreign affairs, and no man of his time did more to create confidence in the increased interest taken by the United States in international matters. He also represented the best American traditions in literature. He published *Pike County Ballads* (1871)—the most famous being "Little Breeches"—a volume worthy to rank with Bret Harte; *Castilian Days* (1871), recording his observations in Spain; and a volume of *Poems* (1890); with John G. Nicolay he wrote *Abraham Lincoln: A History* (1890), a monumental work indispensable to the student of the Civil War period in America, and published an edition of Lincoln's *Complete Works* (1894). The authorship of the brilliant novel *The Breadwinners* (1883) is now certainly attributed to him. Hay was an excellent public speaker; some of his best addresses are *In Praise of Omar; On the Unveiling of the Bust of Sir Walter Scott in Westminster Abbey*, May 21, 1897; and a memorial address in honour of President McKinley. The best of his previously unpublished speeches appeared in *Addresses of John Hay* (1906); his correspondence in *Letters of John Hay and Extracts from His Diary* (1908) and in *A Poet in Exile: Early Letters of John Hay*, ed. Caroline Ticknor (1910); and his poems in *Complete Poetical Works of John Hay* (1916).

See Lorenzo Sears, *John Hay, Author and Statesman* (1914); William Roscoe Thayer, *The Life and Letters of John Hay* (1915); James Brander Mathews, *Commemorative Tributes* (1922); Alfred L. Dennis, *Adventures in American Diplomacy 1896–1906* (1928).

HAY, market town and urban district of Breconshire, south Wales, 20 m. N.W. of Hereford with G.W.R. and L.M.S. connections. Pop. (1921) 1,533. The town occupies rising ground on the south bank of the Wye, which here separates the counties of Brecknock and Radnor but immediately below enters Herefordshire, from which the town is separated on the east by the Dulas.

Hay guards an important way into Wales between the Radnor Forest and the Black Mts. This district was heavily forested in early times and settlement was unimportant until the Norman period. Bernard de Newmarch conquered the district about 1088. The manor of Hay, which probably corresponded to some existing Welsh division, he gave to Sir Philip Walwyn, but it soon reverted to the donor, and its subsequent devolution down to its forfeiture to the crown as part of the duke of Buckingham's estate in 1521, was identical with that of the lordship of Brecknock (*see* BRECONSHIRE). The motte and bailey castle, probably built in Newmarch's time and rebuilt by his great-grandson William de Breos, passed on the latter's attainder to the crown, but was again seized by de Breos's second son, Giles, bishop of Hereford, in 1215, and retaken by King John in the following year. In 1231 it was burnt by Llewelyn ab Iorwerth, and in the Barons' War it was taken in 1263 by Prince Edward, but in the following year was burnt by Simon Montfort and the last Llewelyn. From the 16th century the castle has been used as a private residence.

The Welsh name of the town is Y Gelli ("the wood"), or in full (Y) Gelli ganddryll, which roughly corresponds to *Sepes Inscissa*, used by Walter Map. Its Norman name, La Haia (from the Fr. *haie, cf.* English "hedge"), was probably intended as a translation of Gelli. Hay manor, like that of Talgarth, consisted of an Englishry and a Welshery, the latter, known as Haya Wallensis, comprising the parish of Llanigon with the hamlet of Glynfach, and in this Welsh tenures and customs prevailed. The manor is specially mentioned in the act of Henry VIII. (1535) as one of those which were then taken to constitute the new county of Brecknock.

Even down to Leland's time Hay was surrounded by a "right strong wall," but the town within the wall has "wonderfully decayed," while to the west of it was a suburb with the church of St. Mary overlooking the river. This was rebuilt in 1834. The old parish church of St. John within the walls, used as a school in the 17th century, has entirely disappeared. There are 18 almshouses for poor women, built and endowed by Miss Frances Harley in 1832–36, and Gwyn's almshouses for six aged persons, founded in 1702 and rebuilt in 1878. Hay is the centre of a rich agricultural country Its manor, like that of Talgarth, originally consisted of an Englishry and a Welshry.

HAY, a town of Waradgery county, New South Wales, Australia, on the Murrumbidgee river, 454 m. by rail west of Sydney. Pop. 3,600 It is the cathedral town of the Anglican diocese of Riverina, the terminus of the South Western railway, and the principal depot for the wool produced at the numerous stations on the banks of the Murrumbidgee and Lachlan rivers.

HAY, grass mown and dried in the sun and used as fodder for cattle. It is properly applied only to the grass when cut, but is often also used of the standing crop. In the United States various legumes are cut for hay, as below described. Another word "hay," meaning a fence, must be distinguished; the root from which it is derived is seen in its doublet "hedge," *cf.* "haw-thorn," *i.e.*, "hedge thorn." In this sense it survives in legal history in "hay bote," *i.e.*, hedge-bote, the right of a tenant, copyholder, etc., to take wood to repair fences, hedges, etc. (*see* ESTOVERS), and also in "hayward" an official of a manor whose duty was to protect the enclosed lands from cattle breaking out of the common land.

The term "haymaking" signifies the process of drying and curing grass or other herbage so as to fit it for storage in stacks or sheds for future use. It was unknown in ancient times. Before its introduction into Great Britain the animals intended for beef and mutton were slaughtered in autumn and salted down; the others were turned out to fend for themselves, and often lost all the fat in the winter they had gained the previous summer.

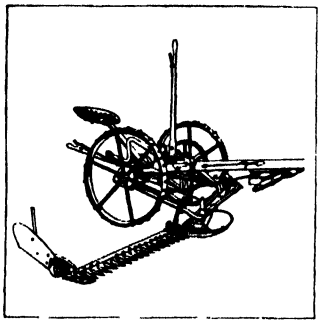
Though every country has its own methods of haymaking, the principal stages in the process everywhere are (1) mowing, (2) drying or "making," (3) "carrying" and storage in stacks or sheds.

In a wet district such as the west of Ireland the "making" is a difficult affair, and large quantities of hay are often spoiled. On the other hand, in the dry districts of south-eastern England, it is often possible to cut and carry the hay without any special "making" as the sun and wind will dry it quickly enough to fit it for stacking up without much labour. This rule also applies to dry countries like the United States and several of the British colonies, and it is for this reason that most of the modern implements used for quickly handling a bulk of hay have been invented or improved in those countries. Forage of all kinds intended for hay should be cut at or before the flowering stage if possible. The full growth and food value of the plant are reached then, and further change consists in the formation and ripening of the seed at the expense of the leaves and stems, leaving these hard and woody and of less feeding value.

Grass or other forage, when growing, contains much water, and after cutting must be left to dry in the sun and wind, a process which may at times be assisted by turning over or shaking up. In fine weather in the south of England grass is sufficiently dried in from two to four days to be stacked straight away. In the drying process the 75% of water usually present should be reduced to approximately 15% in the hay, and in wet or broken weather it is exceedingly difficult to do this. With a heavy crop or in damp weather grass may need turning in the swathe, raking up into "windrows" and then making up into cocks or "quiles," *i.e.*, round bee-hive-like heaps, before it can be "carried." A properly made cock will stand bad weather for a week, as only the outside straws are weathered, and therefore the hay is kept fresh and green. Indeed, it is a good rule always to cock hay, for even in sunny weather undue exposure ends in bleaching, which is almost as detrimental to its quality as wet-weathering.

Introduction of Machinery.—In the last quarter of the 19th century the methods of haymaking were completely changed, and even some of the principles underlying its practices were revised. Generally speaking, before that time the only implements used were the scythe, the rake and the pitchfork; nowadays—with the exception of the pitchfork—these implements are seldom used, except where the work is carried on in a small way. Instead of the scythe, the mowing machine is employed, taking a swathe as wide as 5 or 6 feet. Some 10ac. per day can easily be mown thus by one man and a pair of horses. (*See* MOWING MACHINE.)

After the mown grass has lain in the swathe a day or two till it is partly dried, it is necessary to turn it over to dry the other side. This used to be done with the hand rake, and a band of men or women would advance across a field, each turning the hay by regular strokes at each step. This was the act of "haymaking" proper. The swathes as laid by the mowing machine lent themselves to this treatment in the old days when the swathe was only some 3 to 4ft. wide, but with the wide cut of the present day it becomes impracticable. If the hay is turned and "made" at all, the operation is now generally performed by a machine made for the purpose. There is a wide selection of "tedders" or "kickers" and "swathe-turners" on the market. (*See* TEDDER.)



THE SIDE VIEW OF A HAY-MOWER
The cutting mechanism is an alternating knife, or sickle, with a separate blade to correspond to each finger on cutting bar

It is a moot point, however, whether grass should be turned at all, or left to "make" as it falls from the mowing machine. In a dry sunny season and with a moderate crop it is only a waste of time and labour to turn it, for it will be cured quite well as it lies, especially if raked up into loose "windrows" a little before carrying to the stack. On the other hand, where the crop is heavy (say over 2 tons per acre) or the climate is wet, turning will be necessary.

With heavy crops of clover, lucerne and similar forage crops turning may be an absolute necessity, because a thick swathe of a succulent crop will be difficult to dry or "make" excepting in hot sunny weather, but with ordinary meadow grass or with a mixture of "artificial" grasses, it may often be dispensed with. It must be remembered, however, that the process of turning breaks the stalks (thus letting out the albuminoid and saccharine juices) and should be avoided as far as possible in order to save both labour and the quality of the hay.

The Horse Rake.—One of the earlier mechanical inventions in connection with haymaking was the discovery of the horse rake. Before its introduction the hay, after making, had to be gathered up by the hand rake—a tedious and laborious process—but the introduction of this implement, whereby one horse and one man can do work formerly requiring six or eight men, marked a great advance. The horse rake is a framework on two wheels carrying hinged steel teeth placed 3in. apart, so that their points slide along the ground below the hay. In work it gathers up the loose hay, and when full a tipping mechanism permits the emptying of the load.

The tipping is effected by pulling down a handle which sets a leverage device in motion, whereby the teeth are lifted up and the load of hay dropped below and left behind. On some rakes a clutch is worked by the driver's foot, and this put in action causes the ordinary forward revolving motion of the driving wheels to do the tipping.

The loads are tipped end to end as the rake passes and repasses at the work, and thus the hay is left loose in long parallel rows on the field. Each row is termed a "windrow," the passage of the wind through the hay greatly aiding the drying and "making" thereof. When hay is in this form it may either be carried direct to the stack if sufficiently "made," or else put into the cocks to season a little longer. The original width of horse rakes was about 8ft., but nowadays they range up to 16 and 18 feet. The width should be suited to that of the swathe as left by the mower, and as the latter is now made to cut 5 and 6ft. wide, it is necessary to have a rake to cover two widths. The very wide rakes are only suitable for even, level land; those of less width must be used where the land has been laid down in ridge and furrow. As the swathes lie in long parallel rows, it is a great convenience in working for two to be taken in width at a time, so that the horse can walk in the space between.

The side-delivery rake, a development of the ordinary horse rake, is a useful implement, adapted for gathering and laying a quantity of hay in one continuous windrow. It is customary with this to go up the field throwing two swathes to one side, and then back down on the adjacent swathes, so that thus four are thrown into one central windrow. The implement consists of a frame carried on two wheels with shafts for a horse; across the frame are fixed travelling or revolving prongs of different varieties which pick up the hay off the ground and pass it along sideways across the line of travel, leaving it in one continuous line. Some makes of swathe-turners are designed to do this work as well as the turning of the hay.

Perhaps the greatest improvement of modern times is the method of carrying the hay from the field to the stack. An American invention known as the sweep rake was introduced by the writer into England in 1894, and now, in many modified forms, is in very general use in the Midlands and south of England, where the hay is carried from the cock, windrow or swathe straight to the stack. This implement consists of a wheeled framework fitted with long wooden iron-pointed teeth which slide along the ground; two horses are yoked to it—one at each side—the driver directing from a central seat behind the framework. When in use it is taken to the farther end of a row of cocks, a windrow, or even to a row of untouched swathes on the ground and walked forward. As it advances it scoops up a load, and when full it is drawn up to where the stack is being erected. In ordinary circumstances the sweep rake will pick up at a load two-thirds of an ordinary cart-load, but, where the hay is in

good order and it is swept down hill, a whole one-horse cart-load can be carried each time. The drier the hay the better will the sweep rake work, and if it is not working sweetly, but has a tendency to clog or make rolls of hay, it may be inferred that the latter is not in a condition fit for stacking. Where the loads must be taken through a gateway or a long distance to the stack, it is necessary to use carts or wagons, and the loading of these in the field out of the windrow is largely expedited by the use of the "loader," also an American invention of which many varieties are in the market. Generally speaking, it consists of a frame carrying a revolving web with tines or prongs. The implement is hitched on behind a cart or wagon, and as it moves forward the web picks the loose hay off the ground and delivers it on the top, where a man levels it with a pitchfork and builds it into a load ready to move to the stack. At the stack the most convenient method of transferring the hay from a cart, wagon or sweep rake is the elevator, a tall structure with a revolving web which carries teeth or spikes. The hay is thrown upon it in forkfuls at the bottom, a pony-gear causes the web to revolve, and the hay is carried in an almost continuous stream up the elevator and dropped over the top on to the stack. The whole implement is made to fold down, and is provided with wheels so that it can be moved from stack to stack. In the older forms there is a "hopper" or box at the bottom into which the hay is thrown to enable the teeth of the web to catch it, but in the modern forms there is no hopper, the web reaching down to the ground so that hay can be picked up from the ground level. Where the hay is brought to the stack on carts or wagons it can be unloaded by means of the horse fork. This is an adaptation of the principle of the ordinary crane; a central pole and jib are supported by guy ropes, and from the end of the jib a rope runs over a pulley. At the end of this rope is a "fork" formed of two sets of prongs which open and shut. This is lowered on to the load of hay, the prongs are forced into it, a horse pulls at the other end of the rope, and the prongs close and "grab" several hundredweight of hay which are swung up and dropped on the stack. In this way a large cart or wagon load is hoisted on to the stack in three or four "forkfuls." The horse fork is not suited for use with the sweep rake, however, because the hay is brought up to the stack in a loose flat heap without sufficient body for the fork to get hold of.

In Scotland and wet districts of England it is customary to "make" the hay as in the south, but it is then built up into little stacks in the field where it grew (ricks, pykes or tramp-cocks are names used for these in different districts), each containing about 10 to 15 hundredweight. These are made in the same way as the ordinary stack—one person on top building, another on the ground pitching up the hay—and are carefully roped and raked down. In these the hay gets a preliminary sweating or tempering while at the same time it is rendered safe from the weather, and, thus stored, it may remain for weeks before being carried to the big stacks at the homestead. The practice of putting up the hay into little ricks in the field has brought about the introduction of another set of implements for carrying these to the stackyard.

Various forms of rick-lifters are in use, the characteristic feature of which is a tipping platform on wheels to which a horse is attached between the shafts. The vehicle is backed against a rick, and a chain passed round the bottom of the latter, which is then pulled up the slant of the tipped platform by means of a small windlass. When the centre of the balance is passed, the platform carrying the rick tips back to the level, and the whole is thus loaded ready to move. Another variety of loader is formed of three shear-legs with block and tackle. These are placed over a rick, under which the grab-irons are passed, and the whole hauled up by a horse. When high enough a cart is backed in below, the rick lowered, and the load is ready to carry away.

Heating or Sweating.—When put into a stack the next stage in curing the hay begins—the heating or sweating. In the growing plants the tissues are composed of living cells containing protoplasm. This continues its life action as long as it gets sufficient moisture and air. As life action involves the development of heat, the temperature in a confined space like a stack where the heat is not dissipated may rise to such a point that spontaneous combustion occurs. The chemical or physical reasons for this are not very well understood. The starch and sugar contents of the tissues are changed in part into alcohol. In the analogous process of making silage (*i.e.*, stacking wet green grass in a closed building) the alcohol develops into acetic acid, thus making "sour" silage. In a haystack the intermediate body, acetaldehyde, which is both inflammable and suffocating, is produced, leading to slow combustion and ignition. If the stack contains no air it does not heat, or if it has excess of air it is safe. The danger-point in a stack is the centre at about 6ft. from the ground; below this the weight of the hay itself squeezes out the air, and at the sides and top the heat is dissipated outwards. If a stack shows signs of overheating (a process that may take weeks or even months to develop) it can be saved by cutting a gap in the side of it with the hay knife, thus letting out the heat and fumes, and admitting fresh air to the centre. The essential point in haymaking is that the hay should be dried sufficiently to ensure the sweating process in the stack reaching no further than the stage of the formation of sugar. Good hay should come out green and with the odour of coumarin—to which is due the scent of newmown hay. Only part of a stack can ever attain to a perfect state: the tops, bottom and outsides are generally wasted by the weather after stacking, while there may be three or four intermediate qualities present. In some markets hay that has been sweated till it is brown in colour is desired, but for general purposes green hay is the best.

Hay often becomes musty when the weather during "making" has been too wet to allow of its getting sufficiently dry for stacking. Mustiness is caused by the growth of various moulds (*Penicillium Aspergillus*, etc.) on the damp stems, with the result that the hay when cut out for use is dusty and shows white streaks and spots. Such hay is inferior to that which has been overheated, and in practice it is found that a strong heating will prevent mouldiness by killing the fungi.

Heavy lush crops—especially those containing a large proportion of clover or other leguminous plants—are proportionately more difficult to "make" than light grassy ones. Thus, if one ton is taken as a fair yield off one acre, a two-ton crop will probably require four times as much work in curing as the smaller crop. In the treacherous climate of Great Britain hay is frequently spoiled because the weather does not hold good long enough to permit of its being properly "made." Consequently many experienced haymakers regard a moderate crop as the more profitable because it can be stacked in first-class condition, whereas a heavy crop forced by "high farming" is grown at a loss, owing to the weather waste and the heavier expense involved in securing it.

The making of the hay by drying out the grass is thus the most critical part of the work, and as far back as the '70s of last century trials were made in Essex of machinery whereby a blast of air heated in a furnace was blown through the stuff so as to dry it artificially. At the present time similar work is being done at Oxford, whereby, by building the stacks of half-dried hay with a hollow boss inside and an arrangement of pipes, hot air is forced through the material and thus the moisture is driven out in a cloud of vapour.

In handling or marketing out of the stack hay may be transported loose on a cart or wagon, but it is more usual to truss or bale it. A truss is a rectangular block cut out of the solid stack, usually about 3ft. long and 2ft wide, and of a thickness sufficient to give a weight of 56 lb.; 36 of these constitute a "load" of 18 cwt.—the unit of sale in many markets. A truss is generally bound with two bands of twisted straw, but if it has to undergo much handling it is compressed in a hay-press and tied with two string bands. In some districts a baler is used: a square box with a compressible lid. The hay is tumbled in loose; the lid forced down by a leverage arrangement and the bale tied by three strings. It is usually made to weigh from 1 to 1½ hundredweight. The customs of different markets vary very much in their methods

of handling hay, and in the overseas hay trade the size and style of the trusses or bales are adapted for packing on ship-board.

(P. McC.)

The United States.—Hay is one of the four major field crops of the United States. In value it is usually outranked only by corn (maize) and cotton and in some years only by corn. In 1926 and 1927 it was the leading crop in total farm value in 16 important States. Hay is fundamental to the live stock industries of the entire country and is the chief feed when pasture grasses are not available. In the western States, alfalfa hay assumes the same relative importance in agriculture that corn possesses in the Mississippi valley States. In the United States, approximately 85% of all hay produced is fed to live stock in the counties where it is produced, while the remaining 15% is marketed, mostly as baled hay.

The principal kinds of hay grown in the United States, in the order of importance, are: timothy and its mixtures; alfalfa; wild hay; clover; miscellaneous cultivated grasses, such as blue-grass, redtop, and Johnson grass; annual legumes, such as soy beans, cowpeas, and vetches; and grains, such as oats and wheat, cut prior to maturity. Timothy and its mixtures, including clover, are of chief importance in the north Atlantic and east north central States, where the relatively cool, humid climates are most favourable for their growth. Alfalfa ranks first in the western, southwestern, and west north central States, where porous soils and relatively dry climates favour it. Wild hays grow in greatest quantity in the north central and south central prairie States, usually on stony, wet, slightly alkaline, sandy or gumbo soils unsuitable for cultivated crops. Annual legume hays are supreme in the east south central and south Atlantic States, where the soil and climatic conditions are generally not favourable for perennial hay crops such as timothy or alfalfa. Grain hay is produced in greatest quantity in the Pacific coast States, where, without irrigation, the foothill areas are too dry in the summer to support perennial hay crops.

The acreage of legume hays, principally alfalfa, clover and soy beans, has increased rapidly in the United States since 1900, wherever soil and climate are favourable. Legume hay has supplanted much grass hay characteristic of the early period of American agriculture. The rapidly increasing popularity of legume hays is due to the following facts: (1) They yield a greater tonnage of hay per acre than grass hays; (2) they improve the fertility of the soil because of their ability to assimilate atmospheric nitrogen and fix it in the soil in forms available to plant life, whereas grass hays deplete nitrogen in the soil; and (3) they have a much higher feed value than grass hays. Alfalfa is a more nearly perfect forage for animals than any other crop. Its protein content is two to three times higher than timothy; it contains other nutrients of great importance in the feeding of all forms of live stock; and it yields two to three times more hay per acre than timothy.

Hay-making in the United States is accomplished largely by machinery that has been designed to cut, rake, load, haul and store the hay with a minimum of hand labour. Mowers, drawn by two horses, and having sickle-bars 5 to 8ft. in length, will cut down 10 to 15ac. of standing hay in a working day of 10 hours. After cutting, the hay is allowed to wilt in the swath until the moisture has been reduced by evaporation from 70% or more to from 40 to 50%. It is then raked into windrows with either sulky or side-delivery rakes, drawn by two horses and having a capacity of 20ac. per day. In very humid or very hot climates the windrowed hay is sometimes put up in cocks by hand labour and the curing completed in the cocks. On most hay farms no cocking is done, however, because of the expense of hand labour, and curing is accomplished in the windrows to that point at which the hay contains 25 to 30% of moisture and though still slightly tough is yet sufficiently dry to go into storage where the final curing and sweating processes take place. In making legume hays, the most practical method of curing is the use of the side-delivery rake that rolls the hay into loose cylindrical windrows through which winds pass easily to hasten drying and in which the majority of the leaves are preserved from bleaching and shattering. In humid climates the common practice is to load the cured hay on wagons from the windrows by means of a hay-loader which picks up the hay and elevates it on an endless track to the wagon-rack where usually two men fork and tramp the hay into a compact load. The loads are then hauled to barns or sheds, where, by means of nets or a large fork, the hay is lifted with tackle, pulleys and horse-power into the mow. In arid and semi-arid climates the common practice is to move the cured hay from the windrows with sweep-rakes or low-built sleds to central knolls in the fields, where stacks of 15 to 100 tons are built. Stacking is accomplished by derricks or other stacking devices which utilize tackle, pulleys and horse-power to lift 400 to 800lb. of hay at a time on to the stacks, where men with forks spread and tramp the hay into a symmetrical, sloping-sided stack that will shed light rains or snows.

Hay is commonly allowed to sweat and ferment slightly in the stacks or mows prior to feeding or shipping to market. Well-cured and sweated hay contains 10 to 14% of moisture, and in this condition can be shipped long distances without damage unless it becomes wet in loading or transit. Hay for market shipment is compressed into bales of various kinds and sizes weighing from 60 to 300lb. each, and tied with from two to five wires to hold the compressed hay in a compact mass. The presses which make the bales are usually operated by engine power and are portable, so that they may be transported from one field or one farm to another. In the most common type of press, loose hay is pitched into a hopper, whence it is drawn into a chamber in which a plunger is forced back and forth to pack the hay into "flakes" within the four walls of the chamber. When a sufficient number of these flakes have been pressed together to form a bale of standard size, several wires are passed around the compressed mass of hay and the ends tied. The bale is then released from the press and the process of compressing and tying is repeated. The capacity of hay presses ranges from 15 to 60 tons per day of 10 working hours according to the size and power of the press, the size of the crew and the availability of the loose hay. In some regions hay baling is done in the fields, the hay being fed into the press directly from the windrows or smaller presses drawn by horses from one haycock to another. In other regions the presses are placed in barn driveways or beside stacks and the loose hay is pitched into the press from its place of storage.

MARKETING AND DISTRIBUTION

The marketing and distribution of baled hay in the United States is a large business. From 1921 to 1927, nearly 600,000 car lots of baled hay were loaded annually. Other large but undetermined quantities are transported by trucks directly from producer to consumer. The chief hay markets in the United States are Kansas City, Los Angeles, Chicago, San Francisco, Omaha, St. Louis, Cincinnati, Pittsburgh, New York, Boston, Seattle, St. Paul and Minneapolis, Denver, Memphis, New Orleans, Houston, Fort Worth, Atlanta, Birmingham and Jacksonville. Before 1910 the most important market demand for baled hay arose from the feeders of horses and mules in the cities, mines, logging and construction camps. With the advent of automobiles, motor trucks and tractors the horses in cities decreased approximately 70% from 1910 to 1925, and the market demand, therefore, for timothy and other grass hays has been greatly curtailed. The reduction in the demand for baled timothy and other grass hays for horse feeding has been offset, however, by the increased demand from the expanding dairy industry of the country for baled legume hays, especially alfalfa and clover. Specialized dairy management depends on specialized hay production for large quantities of legume forage, and thus the hay marketing business has become one largely associated with dairying. Other important sources of regular demand are the stock-yards at meat-packing plants and railway division points, the U.S. Army, and the specialized agricultural industries, such as cotton and fruit farming.

Standards of quality for hay have been formulated by the U.S. department of agriculture. These standards provide three numerical grades for all kinds of hay based on definite colour and foreign material requirements. The grades for alfalfa hay also have a leafiness requirement. The grade or quality of hay varies largely according to the varying amounts of these factors. In addition to

the numerical grades a sample grade is provided for hay that is unsound, badly weathered, badly overripe or badly stained, and that contains excessive amounts of foreign material or otherwise fails to meet the requirements of the numerical grades. Some of the complete grade designations in these standards are as follows: U.S. No. 2 Timothy, U.S. No. 1 Alfalfa, U.S. No. 3 Timothy Light Clover Mixed, U.S. No. 2 Alfalfa Light Grass Mixed, U.S. No. 1 Upland Prairie, U S. Sample Grade Clover (musty), and U S. Sample Grade Timothy (badly overripe). By means of these standards quality specifications may be written into a hay contract as well as specifications of weight, price, time and place of delivery, etc. Official inspectors are maintained at important shipping points and receiving markets to inspect lots of hay and to issue certificates of quality and condition, which may be used by shippers, dealers and others in marketing hay to evidence the fulfilment of hay contracts as to quality. (E. C. P.)

HAYASHI, TADASU, COUNT (1850–1913), Japanese statesman, was born in Tokyo (then Yedo), and was one of the first students sent by the Tokugawa government to study in England. He returned on the eve of the abolition of the Shogunate, and followed Enomoto (*q.v.*) when the latter, sailing with the Tokugawa fleet to Yezo, attempted to establish a republic there in defiance of the newly organized government of the emperor. Thrown into prison on account of this affair, Hayashi did not obtain office until 1871. He then rose rapidly, until, after a long period of service as vice-minister of foreign affairs, he was appointed to represent his country first in Peking, then in St. Petersburg and finally in London, where he acted an important part in negotiating the first Anglo-Japanese alliance, for which he received the title of viscount. He remained in London throughout the Russo-Japanese War, and was the first Japanese ambassador at the court of St. James's after the war. Returning to Tokyo in 1906 to take the portfolio of foreign affairs, he remained in office until the resignation of the Saionji cabinet in 1908. He was raised to the rank of count for services during the Russo-Japanese War, and in connection with the second Anglo-Japanese Alliance of 1905. He died at Tokyo on July 10, 1913.

HAYDEN, FERDINAND VANDEVEER (1829–1887), American geologist, was born at Westfield, Mass., on Sept. 7, 1829. He graduated from Oberlin college in 1850 and from the Albany medical college in 1853, where he attracted the notice of Prof. James Hall, State geologist of New York, through whose influence he was induced to join in an exploration of Nebraska. In 1856 he was engaged under the U.S. Government, and commenced a series of investigations of the western Territories, one result of which was his *Geological Report of the Exploration of the Yellowstone and Missouri Rivers in 1859–60* (1869). During the Civil War he was actively employed as an army surgeon. In 1867 he was appointed geologist-in-charge of the U.S. geological and geographical survey of the territories, and from his 12 years of labour there resulted a most valuable series of volumes in all branches of natural history and economic science; and he issued in 1877 his *Geological and Geographical Atlas of Colorado.* Upon the reorganization and establishment of the U.S. geological survey in 1879 he acted for seven years as one of the geologists. He died at Philadelphia on Dec. 22, 1887.

His other publications were: *Sun Pictures of Rocky Mountain Scenery* (1870); *The Yellowstone National Park,* illustrated by chromolithographic reproductions of water-colour sketches by Thomas Moran (1876); *The Great West: its Attractions and Resources* (1880). With F. B. Meek, he wrote (*Smithsonian Institution Contributions,* vol. 14, Art. 4) "Palaeontology of the Upper Missouri, pt. I., Invertebrate." His valuable notes on Indian dialects are in *The Transactions of the American Philosophical Society* (1862), in *The American Journal of Science* (1862) and in *The Proceedings of the American Philosophical Society* (1869). With A. R. C. Selwyn he wrote *North America* (1883) for Stanford's *Compendium.*

HAYDN, FRANZ JOSEPH (1732–1809), Austrian composer, was born on March 31, 1732, at Rohrau (Trstnik), a village on the borders of Lower Austria and Hungary. There is sufficient evidence that his family was of Croatian stock: a fact which throws light upon the distinctively Slavonic character of much of his music. He received the first rudiments of education from his father, a wheelwright with 12 children, and at an early age evinced a decided musical talent. This attracted the attention of a distant relative named Johann Mathias Frankh, who was schoolmaster in the neighbouring town of Hainburg, and who, in 1738, took the child and for the next two years trained him as a chorister. In 1740, on the recommendation of the Dean of Hainburg, Haydn obtained a place in the cathedral choir of St. Stephen's, Vienna, where he took the solo-part in the services and received, at the choir school, some further instruction on the violin and the harpsichord. In 1749 his voice broke, and the director, Georg von Reutter, took the occasion of a boyish escapade to turn him into the streets. A few friends lent him money and found him pupils, and in this way he was enabled to enter upon a rigorous course of study (he is said to have worked for 16 hours a day), partly devoted to Fux's treatise on counterpoint, partly to the "Friedrich" and "Württemberg" sonatas of C. P. E. Bach, from which he gained his earliest acquaintance with the principles of musical structure. The first fruits of his work were a comic opera, *Der neue krumme Teufel,* and a *Mass* in F major (both written in 1751), the former of which was produced with success. About the same time he made the acquaintance of Metastasio, who was lodging in the same house, and Porpora, who gave him instruction in singing and in the Italian language.

The turning-point in his career came in 1755, when he accepted an invitation to the country-house of Freiherr von Fürnberg, an accomplished amateur who was in the habit of collecting parties of musicians for the performance of chamber-works. Here Haydn wrote, in rapid succession, 18 divertimentos which include his first symphony and his first quartet; the two earliest examples of the forms with which his name is most closely associated. Thenceforward his prospects improved. On his return to Vienna in 1756 he became famous as teacher and composer, in 1759 he was appointed conductor to the private band of Count Morzin, for whom he wrote several orchestral works (including a symphony in D major erroneously called his first), and in 1760 he was promoted to the sub-directorship of Prince Paul Esterhazy's Kapelle, at that time the best in Austria. During the tenure of his appointment with Count Morzin he married the daughter of a Viennese hairdresser named Keller, who had befriended him in his days of poverty, but the marriage turned out ill and he was soon separated from his wife. From 1760 to 1790 he remained with the Esterhazys, principally at their country-seats of Esterhàz and Eisenstadt, with occasional visits to Vienna in the winter. In 1762 Prince Paul Esterhazy died and was succeeded by his brother Nicholas, surnamed the Magnificent, who increased Haydn's salary, showed him every mark of favour, and, on the death of Werner in 1766, appointed him Oberkapellmeister. With the encouragement of a discriminating patron, a small but excellent orchestra and a free hand, Haydn made the most of his opportunity and produced a continuous stream of compositions in every known musical form. To this period belong five *Masses,* a dozen operas, over 30 clavier-sonatas, over 40 quartets, over 100 orchestral symphonies and overtures, a *Stabat Mater,* a set of interludes for the service of the Seven Words, an oratorio, *Tobias,* written for the Tonkünstler-Societät of Vienna, and a vast number of concertos, divertimentos and smaller pieces, among which were no fewer than 175 for Prince Nicholas' favourite instrument, the baryton.

Meanwhile his reputation was spreading throughout Europe. A Viennese notice of his appointment as Oberkapellmeister spoke of him as "the darling of our nation"; his works were reprinted or performed in every capital from Madrid to St. Petersburg—(Leningrad). He received commissions from the cathedral of Cadiz, from the grand duke Paul, from the king of Prussia, from the directors of the Concerts Spirituels at Paris; beside his transactions with Breitkopf and Härtel, and with La Chevardière, he sold to one English firm the copyright of no fewer than 129 compositions. But the most important fact of biography during these 30 years was his friendship with Mozart, whose acquaintance he made at Vienna in the winter of 1781–82. There can have been little personal intercourse between them, for Haydn was rarely in the capital, and Mozart seems never to have visited Eisenstadt; but the cordiality of their relations and the mutual influence which

they exercised upon one another are of the highest moment in the history of 18th-century music. "It was from Haydn that I first learned to write a quartet," said Mozart; it was from Mozart that Haydn learned the richer style and the fuller mastery of orchestral effect by which his later symphonies are distinguished.

In 1790 Prince Nicholas Esterhazy died and the Kapelle was disbanded. Haydn, thus released from his official duties, forthwith accepted a commission from Salomon, the London concert-director, to write and conduct six symphonies for the concerts in the Hanover square rooms. He arrived in England at the beginning of 1791 and was welcomed with the greatest enthusiasm, receiving among other honours the degree of D.Mus. from the University of Oxford. In June 1792 he returned home, and, breaking his journey at Bonn, was presented with a cantata by Beethoven, then aged 22, whom he invited to come to Vienna as his pupil. The lessons, which were not very successful, lasted for about a year, and were then interrupted by Haydn's second visit to England (Jan. 1794 to July 1795), where he produced the last six of his Salomon symphonies. From 1795 onward he resided in the Mariahilf suburb of Vienna, and there wrote his last eight *Masses*, the last and finest of his chamber works, the Austrian national anthem (1797), the *Creation* (1799) and the *Seasons* (1801). He died on March 27, 1808, aged 77.

Haydn's place in musical history is best determined by his instrumental compositions. His operas, for all their daintiness and melody, no longer hold the stage; the *Masses* in which he "praised God with a cheerful heart" have been condemned by the severer decorum of our own day; of his oratorios the *Creation* alone survives. In all these his work belongs mainly to the style and idiom of a bygone generation: they are monuments, not landmarks, and their beauty and invention seem rather to close an epoch than to inaugurate its successor. Even the naïf pictorial suggestion, of which free use is made in the *Creation* and in the *Seasons*, is closer to the manner of Handel than to that of the 19th century: it is less the precursor of romance than the descendant of an earlier realism. But as the first great master of the quartet and the symphony his claim is incontestable. The quartets in particular exhibit a wider range and variety of structural invention than those of any other composer except Beethoven. Again it is here that we can most readily trace the important changes which he wrought in melodic idiom. Before his time instrumental music was chiefly written for the *Paradiesen-saal*, and its melody often sacrificed vitality of idea to a ceremonial courtliness of phrase. Haydn broke through this convention by frankly introducing his native folk-music, and by writing many of his own tunes in the same direct, vigorous and simple style. The innovation was at first received with some disfavour; critics accustomed to polite formalism censured it as extravagant and undignified; but the freshness and beauty of its melody soon silenced all opposition, and did more than anything else throughout the 18th century to establish the principle of nationalism in musical art. The actual employment of Croatian folk-tunes may be illustrated from the string quartets op. 17, No. 1; op. 33, No. 3; op. 50, No. 1; op. 77, No 1, and the Salomon symphonies in D and E♭, while there is hardly an instrumental composition of Haydn's in which his own melodies do not show some traces of the same influence.

In the development of instrumental polyphony Haydn's work was almost as important as that of Mozart. Having at his disposal a band of picked virtuosi he could produce effects as different from the tentative experiments of C. P. E. Bach as these were from the orchestral platitudes of Reutter or Hasse. His symphony *Le Midi* (written in 1761) already shows a remarkable freedom and independence in the handling of orchestral forces, and further stages of advance were reached in the oratorio of *Tobias*, in the Paris and Salomon symphonies, and above all in the *Creation*, which turns to good account some of the debt which he owed to his younger contemporary. The importance of this lies not only in a greater richness of musical colour, but in the effect which it produced on the actual substance and texture of composition. The polyphony of Beethoven was unquestionably influenced by it and, even in his latest sonatas and quartets, may be regarded as its logical outcome.

The compositions of Haydn include 104 symphonies, 16 overtures, 76 quartets, 68 trios, 54 sonatas, 31 concertos and a large number of divertimentos, cassations and other instrumental pieces; 24 operas and dramatic pieces, 16 *Masses*, a *Stabat Mater*, interludes for the "Seven Words," three oratorios, two Te Deums and many smaller pieces for the Church, over 30 songs, over 50 canons and arrangements of Scottish and Welsh national melodies.

His younger brother, JOHANN MICHAEL HAYDN (1737–1806), was also a chorister at St. Stephen's, and shortly after leaving the choir-school was appointed Kapellmeister at Grosswardein (1755) and at Salzburg (1762). The latter office he held for 43 years, during which time he wrote over 360 compositions for the Church and much instrumental music, which, though unequal, deserves more consideration than it has received. He was the intimate friend of Mozart, who had a high opinion of his genius, and the teacher of C. M. von Weber. His most important works were the *Missa hispanica*, which he exchanged for his diploma at Stockholm, a *Mass* in D minor, a *Lauda Sion*, a set of graduals, 42 of which are reprinted in Diabelli's *Ecclesiasticon*, three symphonies (1785), and a string quintet in C major which has been erroneously attributed to Joseph Haydn.

Another brother, JOHANN EVANGELIST HAYDN (1743–1805), gained some reputation as a tenor vocalist, and was for many years a member of Prince Esterhazy's Kapelle.

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HAYDON, BENJAMIN ROBERT (1786–1846), English historical painter and writer, was born at Plymouth on Jan. 26, 1786. His mother was the daughter of Benjamin Cobley, rector of Dodbrook, Devon. His father, a prosperous printer, stationer and publisher, was a man of literary taste. Haydon became a student at the Royal Academy in 1804. In 1807 he exhibited, for the first time "The Repose in Egypt." In 1809 he finished his well-known picture of "Dentatus." He had great ambitions which involved him in great difficulties, and in a quarrel with the Royal Academy. "The Judgment of Solomon" (1814) gained him a prize from the British Institution, and the freedom of the borough of Plymouth Haydon then joined his friend Wilkie in a trip to Paris; he studied at the Louvre; and on his return to England produced his "Christ's Entry into Jerusalem," which afterwards formed the nucleus of the American gallery of painting, erected by his cousin, John Haviland of Philadelphia.

As a result of his pecuniary difficulties in 1823 Haydon was lodged in the King's Bench, where he received consoling letters from the first men of the day. Whilst a prisoner he drew up a petition to parliament in favour of the appointment of "a committee to inquire into the state of encouragement of historical painting," which was presented by Brougham. He also, during a second imprisonment in 1827, produced the picture of the "Mock Election," the idea of which had been suggested by an incident that happened in the prison. The king (George IV.) gave him £500 for this work. Among Haydon's other pictures were "Punch" (1829), "Lazarus" (1821–23) in the possession of the Tate gallery, and the "Meeting of the Anti-Slavery Society," in the National Portrait Gallery. When the competition took place at Westminster Hall, Haydon sent two cartoons, "The Curse of Adam" and "Edward the Black Prince," but he was not allowed a prize for either. The artist's difficulties increased to such an

extent that, whilst employed on his last effort, "Alfred and the Trial by Jury," overcome by debt and disappointment he wrote "Stretch me no longer on this rough world," and put an end to his existence with a pistol-shot, on June 22, 1846.

See: Haydon's *Autobiography and Journals* (1847), of which a new edition (2 vols.) was published, with introd. by Aldous Huxley, in 1926; Tom Taylor, *Life of B. R. Haydon* (1853); F. W. Haydon, *Correspondence and Table Talk* (1876); Haydon published a pamphlet on Fresco and Oil Painting (1842) and *Lectures on Painting and Design* (1847); he was also the author of the article on PAINTING in the 7th edition of the *Encyclopædia Britannica.*

HAYES, PATRICK JOSEPH (1867–), American cardinal, was born in New York city, Nov. 20, 1867. He graduated from Manhattan college in 1888, continued his studies at St. Joseph's seminary in Troy (N.Y.), and was there ordained priest in 1892. After a graduate course at the Catholic University of Washington, he became curate of St. Gabriel's parish in New York city. In 1903 Archbishop Farley of New York, who had been his parish priest, appointed him his secretary and chancellor. In the same year Cathedral college was opened, and he became its first president, an office which he held for 11 years.

In 1914 he was consecrated titular bishop of Tagaste and bishop auxiliary of New York. In the following year he was made rector of St. Stephen's church, and on Nov. 24, 1917, was appointed Catholic chaplain bishop for the U.S. army and navy, in which capacity he travelled extensively, appointing chaplains to the various camps. He was made archbishop of New York in 1919. Early in 1924 he was summoned to Rome by Pope Pius XI. and was made a cardinal at a consistory held on March 25, having been assigned the church of Santa Maria in Via as his titular church.

See J. J. Walsh, *Our American Cardinals* (1926).

HAYES, ROLAND (1889–), American negro tenor was born in Georgia; soon after his mother, an ex-slave, moved with her two sons to Chattanooga, Tenn. When 16 years old Hayes was moulder in a stove factory, and singing in a church choir "jus' 'cause he liked to." He chanced to be heard by W. Arthur Calhoun, also a negro, and a music student at Oberlin who after much persuasion induced him to receive musical instruction and later to enter Fisk university. As one of the Fisk Jubilee singers he appeared in Boston Here he remained and entered upon a systematic musical education under the instruction of Arthur Hubbard. His first concert was given Nov. 15, 1917, at Symphony hall, Boston, and soon after he appeared with the Boston Symphony orchestra. In 1920 he went to London and sang by royal command at Buckingham palace and afterward at Wigmore hall In 1923 he gave concerts in Berlin and Vienna. The same year he appeared under Pierné with the Colonne orchestra, winning the praise of Paris where his compelling interpretation of negro spirituals, which form a part of all his programmes, came as a strange and wonderful revelation. Since 1920 he has divided his time in annual tours between the United States and Europe and few singers have won wider attention. To a lyric voice of great sweetness, purity and range he adds a scholarly understanding of music. In 1924 he was made Spingarn medallist. A bronze by Renée Vantier presents him while singing the negro spiritual "Steal away to Jesus."

HAYES, RUTHERFORD BIRCHARD (1822–1893), 19th president of the United States, 1877–1881, was born in Delaware, O., on Oct. 4, 1822. His ancestry was English and Scotch, his people having first settled in America in New England. He attended an academy at Norwalk, O., and later went to a school in Middletown, Conn. In 1842 he graduated from Kenyon college, O., and in 1845 from the Harvard Law school. The same year he was admitted to the bar, and began to practice at Lower Sandusky (now Fremont), O. Three years later he removed to Cincinnati. From 1858–61 he was city solicitor there. In 1861 he became major of a regiment of volunteers, the 23rd Ohio Infantry, and in July of that year was sent to western Virginia, for active service. He served throughout the Civil War, and was severely wounded at South mountain. By successive promotions he became a brigadier-general of volunteers, and by brevet a major-general of volunteers. In 1864 he was elected a member of Congress on the Republican ticket, and again in 1866. In the National legislature he supported his party's programme of reconstruction In 1868 he became governor of Ohio, serving until 1872. In 1875 he was again elected governor after a campaign wherein the Republicans advocated the resumption of specie payment, and the Democrats an increase of fiat paper money. The "sound money" campaign in Ohio attracted national attention, and in 1876 Hayes received the Republican nomination for the presidency over James G. Blaine. Samuel J Tilden was the Democratic candidate He had a reputation as a reformer, having destroyed the "Tweed ring" in New York and been prominently engaged in other public work. The strength of the Democratic candidate, together with the scandals of Grant's administrations which had tended to discredit the Republican party, resulted in a close election, which depended upon the contested returns from South Carolina, Florida, Oregon and Louisiana Partisans on both sides were much excited. It was agreed, however, to refer the contested returns to an electoral commission created by act of Congress. The commission voting eight to seven decided all of the contested returns in favor of the Republicans, and Hayes was declared elected on March 2, 1877.

The administration of President Hayes is notable principally for the pacification policy adopted by it with respect to the Southern States. The Federal troops, which had since the war been stationed in the Southern capitals, were withdrawn, thereby bringing about the end of the "carpet-bag governments" conducted often by unprincipled politicians from the North. This action brought Hayes into sharp conflict with many of the political leaders of his party It, however, made more rapid the slow recovery of the South from the effects of the war, and was highly beneficial to the nation. In his endeavours to bring about reforms in the civil service, and in his advocacy of the establishment of a civil service commission, Hayes also met with the opposition and disapproval of the politicians of his party. The New York faction, under the leadership of Roscoe Conkling, particularly resented his measures in endeavouring to divorce the service from politics. Another notable accomplishment of the Hayes administration was the provision for the resumption of specie payments on Jan. 1, 1879 Prior to this time Hayes vetoed a bill, known as the Bland-Allison bill, providing that a silver dollar should be coined of the weight of 412½ gr. to become full legal tender for all debts and dues, public and private, except where otherwise expressly stipulated in the contract, but the measure passed over his veto. He was at all times a sincere advocate of sound money.

Hayes has generally been considered an able executive, thoroughly honest and sincerely devoted to the interests of the people and the country generally. Upon his retirement from the Presidency, he returned to his home at Fremont, engaging actively in various philanthropic enterprises It was there that he died, after a short illness, on Jan. 17, 1893.

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HAY FEVER, HAY ASTHMA or **SUMMER CATARRH,** a catarrhal affection of the mucous membrane of the upper respiratory tract, due to the action of the pollen of certain grasses. It is often associated with asthmatic attacks. Hay fever is an example of hyper-sensitiveness to protein (*see* ANAPHYLAXIS) met with in certain individuals. The complaint has been investigated by Professor W. P Dunbar of Hamburg, who has shown that it is due to the pollens of certain grasses (notably rye) and plants, and that the severity of the attack is directly proportional to the amount of pollen in the air. He has isolated an albuminoid poison which, when applied to the nose of a susceptible individual, causes an attack, while there is no result in the case of a normal person. By injecting the poison into animals he has obtained an antiserum, which is capable of aborting an attack of hay fever. The symptoms are those commonly experienced in the case of a severe cold, consisting of headache, violent sneezing, and watery discharge from the nostrils and eyes, together with a hard dry cough and occasionally severe asthmatic parox-

ysms. The period of liability to infection naturally coincides with the pollen season.

The radical treatment is to avoid vegetation. Local treatment consisting of thorough destruction of the sensitive area of the mucous membrane of the nose often produces good results. There are various drugs, the best of which are cocaine and the extract of the suprarenal body, which, when applied to the nose, are sometimes effectual; in practice, however, it is found that larger and larger doses are required, and that sooner or later they afford no relief. The same remarks apply to a number of patent specifics, of which the principal constituent is one of the above drugs. An additional and stronger objection to the use of cocaine is that a "habit" is often contracted, with the most disastrous results. Finally Dunbar's serum may be applied to the nose and eyes on rising, and on the slightest suggestion of irritation during the day, or doses may be injected subcutaneously.

HAYLEY, WILLIAM (1745–1820), English writer, the friend and biographer of William Cowper, was born at Chichester and educated at Eton and Trinity Hall, Cambridge. His private means enabled him to live on his patrimonial estate at Eartham, Sussex, and he retired there in 1774. Hayley won contemporary fame by his poetical *Essays and Epistles* addressed to various distinguished men. On Thomas Warton's death in 1790 he was offered the laureateship, which he refused. In 1792, while writing the *Life of Milton* (1794), Hayley made Cowper's acquaintance. A warm friendship sprang up between the two which lasted till Cowper's death in 1800. After Hayley had moved in 1800 to his "marine hermitage" at Felpham, Sussex, William Blake settled near him for three years to engrave the illustrations for the *Life of Cowper*. This, Hayley's best known work, was published in 1803–04 (Chichester) in 3 vols. In 1805 he published *Ballads founded on Anecdotes of Animals* (Chichester), with illustrations by Blake, and in 1809 *The Life of Romney*. For the last 12 years of his life Hayley received an allowance for writing his *Memoirs*. He died at Felpham on Nov. 12, 1820

Hayley's *Poetical Works* were published in 3 vols. (1785); his *Poems and Plays* in 6 vols. (1788). See *Memoirs . . . of William Hayley . . . and Memoirs of his son T. A. Hayley*, ed. John Johnson (2 vols., 1823) (containing many of Hayley's letters); an article on these memoirs by Robert Southey in the *Quarterly Review*, vol. xxxi., 1825; *The Correspondence of William Cowper*, arranged by Thomas Wright (vol. iv., 1904), containing many letters to Hayley.

HAYM, RUDOLF (1821–1901), German publicist and philosopher, was born at Grünberg, Silesia, on Oct. 5, 1821, and died at St. Anton (Arlberg) on Aug 27, 1901. He studied philosophy and theology at Halle and Berlin, and was a member of the National Assembly at Frankfort in 1848. From 1851 he lectured in literature and philosophy at the University of Halle. His writings are biographical and critical, devoted mainly to modern German philosophy and literature. In 1870 he published a masterly history of the Romantic school. His biographies of W. von Humboldt (1856), Hegel (1857), Schopenhauer (1864), Herder (1877–85) and Max Duncker (1890) ably portray the relation of these thinkers to the thought of their day. In 1902 appeared his *Erinnerungen aus meinem Leben*, in 1902 *Philosophische Abhandlungen* and in 1903 *Gesammelte Aufsätze*.

HAYNAU, JULIUS JACOB (1786–1853), Austrian general, was the natural son of the landgrave—afterwards elector—of Hesse-Cassel, William IX. He entered the Austrian army as an infantry officer in 1801, saw much service in the Napoleonic wars, and between 1815 and 1847 rose to the rank of field marshal lieutenant. A capable officer, but of violent temper and fanatical hatred of revolutionary movements, he was employed against the Italian revolutionaries in 1848, and became notorious for the severity with which he repressed and punished, not without provocation, a rising in Brescia. Appointed next to command in Hungary, he was successful in the field, but was again accused of brutality. In London he was attacked and beaten by Messrs. Barclay and Perkins' draymen when visiting the brewery, and was saved from mob violence in Brussels with difficulty. He died on March 14, 1853.

See R. v. Schönhals, *Biographie des K. K. Feldzeugmeisters Julius Freiherrn von Haynau* (Vienna, 1875).

HAYNAU, a town in the Prussian province of Silesia, on the Schnelle Deichsa and the railway from Breslau to Dresden, 12 m. N.W. of Liegnitz. Pop. (1925) 10,200. It has manufactories of gloves, patent leather, paper, metal ware and artificial manures and a considerable trade in cereals.

HAYNE, ROBERT YOUNG (1791–1839), American political leader, born in St. Paul's parish, Colleton district, S.C., on Nov. 10, 1791. He studied law in the office of Langdon Cheves (1776–1857) in Charleston, S C., and in Nov. 1812 was admitted to the bar there, soon obtaining a large practice. For a short time during the war of 1812 against Great Britain, he was captain in a South Carolina regiment. He was a member of the lower house of the State legislature from 1814 to 1818, serving as speaker in the latter year; was attorney general of the State from 1818 to 1822, and in 1823 was elected, as a Democrat, to the U.S. Senate. Here he was conspicuous as an ardent free-trader and an uncompromising advocate of "States' rights," opposed the protectionist tariff bills of 1824 and 1828, and consistently upheld the doctrine that slavery was a domestic institution and should be dealt with only by the individual States. In one of his speeches opposing the sending by the United States of representatives to the Panama Congress, he said, "The moment the Federal Government shall make the unhallowed attempt to interfere with the domestic concerns of the States, those States will consider themselves driven from the Union." Hayne is best remembered, however, for his great debate with Daniel Webster (*q.v.*) in Jan. 1830. The debate arose over the so-called "Foote's resolution," introduced by Senator Samuel A. Foote (1780–1846) of Connecticut, calling for the restriction of the sale of public lands to those already in the market, but was concerned primarily with the relation to one another and the respective powers of the Federal Government and the individual States, Hayne contending that the Constitution was essentially a compact between the States, and the National Government and the States, and that any State might, at will, nullify any Federal law which it considered to be in contravention of that compact. He vigorously opposed the tariff of 1832, was a member of the South Carolina Nullification Convention of Nov. 1832, and reported the ordinance of nullification passed by that body. Resigning from the Senate, he was governor of the State in 1832–34, and as such took a strong stand against President Jackson, though he was more conservative than many of the nullificationists in the State. He was intendant (mayor) of Charleston, S.C., 1835–37, and was president of the Louisville, Cincinnati and Charleston railway 1837–39. He died at Asheville, N.C., on Sept. 24, 1839. His son, Paul Hamilton Hayne (1830–1886), was a poet of some distinction, and in 1878 published a life of his father.

See Theodore D. Jervey, *Robert Y. Hayne and his Times* (1909); and John Bomar Cleveland, *Controversy Between John C. Calhoun and Robert Young Hayne* (1913).

HAYTER, SIR GEORGE (1792–1871), English painter, was born in London, and in his early youth went to sea. He afterwards studied in the Royal Academy, became a miniature painter, and was appointed in 1816 miniaturist to the princess Charlotte. He passed some years in Italy, more especially in Rome, between 1816 and 1831. After his return to London he executed many portraits of the royal family, and was appointed principal painter to Queen Victoria and teacher of drawing to the princesses. In 1842 he was knighted. He painted various works on a large scale of a public and semi-historical character, but essentially works of portraiture, such as "The Trial of Queen Caroline" (189 likenesses), "The Meeting of the First Reformed Parliament," now in the National Portrait Gallery, "Queen Victoria taking the Coronation Oath" (accounted his finest production), "The Marriage of the Queen" and the "Trial of Lord William Russell."

HAYTON (HAITHON, HETHUM), king of Little Armenia or Cilicia from 1224 to 1269, traveller in western and central Asia, Mongolia, etc., was the son of Constantine Rupen, and became heir to the throne of Lesser Armenia by his marriage with Isabella, daughter and only child of Leo II. After a reign of 45 years he abdicated (1269) in favour of his son Leo III., became a monk

and died in 1271. Before his accession he had been "constable," or head of the Armenian army, and "bailiff" of the realm. Throughout his reign he followed the policy of friendship and alliance with the overwhelming power of the Mongols. In about 1248 he sent his brother Sempad, who was now constable in his place, on a mission to Kuyuk Khan, the supreme Mongol emperor. Sempad was well received and returned home in 1250, bringing letters from Kuyuk. After Mangu's accession in 1251, Batu (the most powerful of the Mongol princes and generals, and the conqueror—in name at least—of eastern Europe, now commanding on the line of the Volga) summoned Hayton to the court of the new grand khan. Carefully disguised, so as to pass safely through the Turkish States in the interior of eastern Asia Minor (where he was hated as an ally of the Mongols against Islam), Hayton made his way to Kars, the central Mongol camp in Great Armenia. He reported himself, and was permitted to remain some time in the Ararat region, at the foot of Mt. Alagoz, near the metropolitan church of Echmiadzin. Being joined by his suite, especially the clerical diplomatists Basil the Priest, and James the Abbot, Hayton next passed through eastern Caucasia, threading the pass of the Iron Gates of Derbent, and so reached the camp of Batu on the Volga, where he was cordially welcomed. Thence he set out (May 13, 1254) on the "very long road beyond the Caspian sea" to the residence of Mangu at or near Karakorum, south of Lake Baikal. After passing the Ural river, we only hear of his arrival at Or, probably the present Ili province, east of Balkhash, and of his reaching the Irtish, entering the Naiman country, and passing through "Karakhitai" (apparently the capital of the ruined Karakhitai empire is intended, a place perhaps situated on the Chu, mentioned out of its proper place in Hayton's record). On Sept. 13 the travellers entered Mongolia, and on the 14th (?) were received by Mangu. Here the king remained till Nov. 1, when he left with diplomas, seals and letters of enfranchisement which promised great things for the Armenian State, church and people. His return journey was by very unusual and interesting routes—through the Urumtsi region, the basin of "the sea of milk," Lake Sairam, the valley of the Ili, the neighbourhood of Kulja, and so over mountains, which probably answer to certain outliers of the Alexander range, to Talas near the present Aulie Ata, midway between the Syr Daria and the Chu. Here he met and conferred with Hulagu Khan, Mangu's brother, the future conqueror of Bagdad; probably Hayton was expected to aid in the coming forward movement of the Mongol armies against the Muslim world. From Talas Hayton made a detour to the north-west to meet another Mongol prince, Sartach the son of Batu; after which he ascended the valley of the Syr Daria, crossed into Trans-Oxiana, visited Samarkand and Bokhara, and passed the Oxus apparently near Charjui. By way of Merv and Sarakhs he then entered Khorasan and traversed north Persia, passing through Rai near Tehran, Kazvin and Tabriz, and so returning to the camp of Bachu in Armenia, now at Sisian near Lake Gokcha (July 1255). Thanks to his powerful friends, Hayton's journey was unusually rapid. Eight months after quitting Mangu's horde, he was back in Great Armenia. The narrative of this journey, which was written by a member of the king's suite, one Kirakos of Gandsak (the modern Elizavetpol), concludes with some interesting references to Buddhist tenets, to Chinese habits, to various monstrous races and to certain "women endowed with reason" dwelling "beyond Cathay." It also gives some notes, compounded of truth and legend, on the wild tribes and animals of the Gobi and adjoining regions.

The record drawn up by Kirakos Gandsaketsi was in Armenian. A ms. of his, dated 1616, was found in the Sanahin monastery in Georgia, and translated into Russian by Prince Argutinsky in the *Sibirsky Vyestnik* for 1822, pp. 69, etc. This Russian version was again translated into French by Klaproth in the *Nouveau Journal asiatique* for 1833 (vol. xii., pp. 273, etc.). Another French translation was made direct from the Armenian by M. Brosset in the *Mémoires de l'Académie des Sciences de St. Pétersbourg* for 1870; a fresh Russian version of the original, by Prof. Patkanov, appeared in 1874. *See* also E. Bretschneider, *Medieval Researches from Eastern Asiatic Sources*, i. 164–172 (1888, "Trübner's Oriental" Series); C. R. Beazley, *Dawn of Modern Geography*, ii. 381–391 (1901).

(C. R. B.)

HAYWARD, ABRAHAM (1801–1884), translator of Goethe and author of *The Art of Dining*, was born at Wilton, near Salisbury. Educated at Blundell's school, Tiverton, he entered the Inner Temple in 1824, and was called to the bar in June 1832. Hayward edited the *Law Magazine* from 1829 to 1844, and became a conspicuous figure in London literary society. His translation of Goethe's *Faust* was privately printed in 1833, and a revised edition appeared in 1834. In Feb. 1835 he was elected to the Athenaeum club under Rule II., and he remained for nearly 50 years one of its most conspicuous and most influential members. He was also a subscriber to the Carlton, but ceased to frequent it when he became a Peelite. At the Temple, Hayward, whose reputation was rapidly growing as a connoisseur not only of a bill of fare (the famous *Art of Dining* appeared in 1852) but also (as Swift would have said) of a bill of company, gave famous dinners, at which ladies of fashion appreciated the wit of Sydney Smith and Theodore Hook, the dignity of Lockhart and Lyndhurst and the oratory of Macaulay. At the Athenaeum and in political society he to some extent succeeded to the position of Croker. His sharp pen made him many enemies. He disgusted the friends of Mill by the stories he raked up for an obituary notice of the great economist (*The Times*, May 10, 1873). He broke with Henry Reeve in 1874 by a venomous review of the *Greville Memoirs*, in which Reeve was compared to the beggarly Scot deputed to let off the blunderbuss which Bolingbroke (Greville) had charged. Samuel Warren attacked him (very unjustly, for Hayward was anything but a parasite) as Venom Tuft in *Ten Thousand a Year;* and Disraeli aimed at him partially in Ste. Barbe (in *Endymion*), though the satire here was directed primarily against Thackeray. After his break with Reeve, Hayward devoted himself more exclusively to the *Quarterly*. He died in London on Feb. 2, 1884.

Two volumes of Hayward's *Correspondence* (edited by H. E. Carlisle) were published in 1886. In *Vanity Fair* (Nov. 27, 1875) he may be seen as he appeared in later life.

HAYWARD, SIR JOHN (*c.* 1560–1627), English historian, was born at or near Felixstowe, Suffolk, where he was educated, and afterwards proceeded to Pembroke college, Cambridge. In 1599 he published *The First Part of the Life and Raigne of King Henrie IV.* dedicated to Robert Devereux, earl of Essex. This was reprinted in 1642. Queen Elizabeth and her advisers disliked the tone of the book and its dedication, and the queen ordered Francis Bacon to search it for "places in it that might be drawn within case of treason." Bacon reported "for treason surely I find none, but for felony very many," explaining that many of the sentences were stolen from Tacitus; but nevertheless Hayward was put in prison, where he remained until about 1601. On the accession of James I. in 1603 he courted the new king's favour by publishing two pamphlets, one of which, an argument in favour of the divine right of kings, was reprinted in 1683 as "The Right of Succession" by the friends of the duke of York during the struggle over the Exclusion Bill. He died in London on June 27, 1627. Hayward's other works are: *Lives of the Three Norman Kings of England* (1613), *The Life and Raigne of King Edward VI.* (posthumously printed, 1630, included in *Complete History of England*, anon., vol. ii. 1706) and *Certain Veres of Queen Elizabeth's Raigne* (ed. John Bruce, Camden Society, 1840, with a life of the author).

HAYWOOD, ELIZA (1693?–1756), English writer, daughter of a London tradesman named Fowler, was born about 1693. She made an early and unhappy marriage, and her literary enemies circulated scandalous stories about her, possibly founded on her works rather than her real history. She appeared on the stage as early as 1715, and in 1721, after her elopement, she revised for Lincoln's Inn Fields *The Fair Captive*, by a Captain Hurst. Two other pieces followed, but she made her mark as a follower of Mrs. Manley in writing about 70 scandalous and voluminous novels. To *Memoirs of a certain Island adjacent to Utopia, written by a celebrated author of that country. Now translated into English* (1725), she appended a key in which the characters were explained by initials denoting living persons. The names are supplied to these initials in the copy in the British

Museum. *The Secret History of the Present Intrigues of the Court of Caramania* (1727) was explained in a similar manner. Pope attacked her in a coarse passage in *The Dunciad* (bk. ii. 11, 157 *et seq.*), which is aggravated by a note alluding to the "profligate licentiousness of those shameless scribblers (for the most part of that sex which ought least to be capable of such malice or impudence) who in libellous Memoirs and Novels reveal the faults or misfortunes of both sexes, to the ruin of public fame, or disturbance of private happiness." After some 16 years of practical silence, Mrs. Haywood achieved a certain success by her *Fortunate Foundlings* (1744); *Female Spectator* (1744–46), her ambitious character novel, *The History of Miss Betsy Thoughtless* (1751) and *The History of Jemmy and Jenny Jessamy* (1753). She died on Feb. 25, 1756.

A collected edition of her novels, plays and poems appeared in 1724, and her *Secret Histories, Novels and Poems* in 1725. *See* C. H. Whicher, *Life and romances of Mrs. Haywood* (1915) which contains a list of her writings and gives substantial extracts.

HAZĀRA, a district of British India, in the Peshawar division of the North-West Frontier Province (*q.v.*), with an area of 3,391 sq.m. It is bounded on the north by the Black mountain, the Swat country, Kohistan and Chilas; on the east by the native state of Kashmir; on the south by Rawalpindi district; and on the west by the river Indus. The district forms a wedge of territory extending far into the heart of the outer Himalayas, and consisting of a long narrow valley, shut in on both sides by lofty mountains, whose peaks rise to a height of 17,000 ft. above sea level. Towards the centre of the district the vale of Kagan is bounded by mountain chains, which sweep southward, and send off spurs on every side dividing the country into numerous minor dales. The district is well watered by the tributaries of the Indus, the Kunhar, which flows through the Kagan valley into the Jhelum, and many rivulets. To the north rise the distant peaks of the snow-clad ranges; midway, the central mountains stand clothed to their rounded summits with pines and other forest trees, while grass and brushwood spread a green cloak over the nearer hills, and cultivation covers every available slope. The chief frontier tribes on the border are the cis-Indus Swatis, Hassanzais, Akazais, Chagarzais, Pariari Syads, Madda Khels, Amazais and Umarzais. Within the district Pathans are not numerous. Pop. (1921), 622,349.

Hazāra is also the name of a race found in the Hazārajāt, the "thousands," or Hazāristān "Hazāraland," in Afghanistan, descended from military colonists settled by Jenghiz Khān in the highlands of the Upper Halmund and on the slopes of the Hindu Kūsh range north of Kabul. Probably of almost pure Mongolian origin, they now speak a Persian dialect. Strict Shī'as by sect they were only subjugated by the great Amir of Afghanistan, Abd-ur-Rahmān, in 1851, after a long resistance but were then enlisted in his engineer companies; and they are also recruited in pioneer regiments of the Indian Army. As Turks and Shī'as intermarriage with them is avoided by the Afghāns, and though they may have once taken Persian wives they have preserved the purity of the Mongolian type in a marked degree. In the western part of the Hazārajāt extending nearly to Herat and the Harūd valley the Hazāras include four tribes, Chahār Aimaq, which speak Turki and are Sunnis by sect.

See *The Encyclopaedia of Islam,* II., 1916, for full bibliographies.

HAZARD, a city of south-eastern Kentucky, U.S.A., on the Louisville and Nashville railroad; the county seat of Perry county, and a lumbering and coal-mining centre. The population was 4,348 in 1920, and was estimated locally at 10,000 in 1928. The city was founded in 1821 and incorporated in 1832.

HAZARD, a game of dice (called Craps in America), once very popular in England and played for large stakes at the famous rooms of Crockford (St. James's street, London) and Almack (Pall Mall, London). (Span. *azar,* unlucky throw at dice, misfortune, from Arab. *al,* and *zar,* dice.)

HAZARIBAGH, a town and district of British India, in the Chota Nagpur division of Behar and Orissa. The town is situated at an elevation of 2,000 feet. Pop. (1921), 17,060.

The DISTRICT comprises an area of 7,021 sq. miles. In 1921 the population was 1,276,946. The physical formation of Hazaribagh exhibits three distinct features: (1) a high central plateau occupying the western section, the surface of which is undulating and cultivated; (2) a lower and more extensive plateau stretching along the north and eastern portions; to the north the land is well cultivated, while to the east the country is of a more varied character, the elevation is lower, and the character of a plateau is gradually lost; (3) the central valley of the Damodar river occupying the entire southern section. Although the salient characteristics of the district are rock, hill and wide-spreading jungle, fine stretches of cultivation are met with in all parts, and the scenery is generally pleasing and often striking. Rice and oil-seeds are the principal crops. The most important river is the Damodar, with its many tributaries, which drain an area of 2,480 sq. miles.

The district contains four important coalfields, the Giridih, Bokaro, Rangarn and Karanpura coalfields. In the Giridih field, where the mines are owned and worked by the East Indian Railway company, the output in 1925 was over 750,000 tons. The Bokaro field produced 1½ million tons in the same year. The Karanpura field, which has suffered from lack of facilities for transport, is expected to develop with the extension of railways to the west and east. The district also contains a large part of a mica-producing belt, which extends into the districts of Gaya and Monghyr, and produces about half of the world's total output of mica. The production of shellac is another local industry of some importance. The sub-divisional town of Giridih, on which the export of coal has hitherto centred, has 18,874 inhabitants. Parasnath hill is annually visited by large numbers of Jain worshippers.

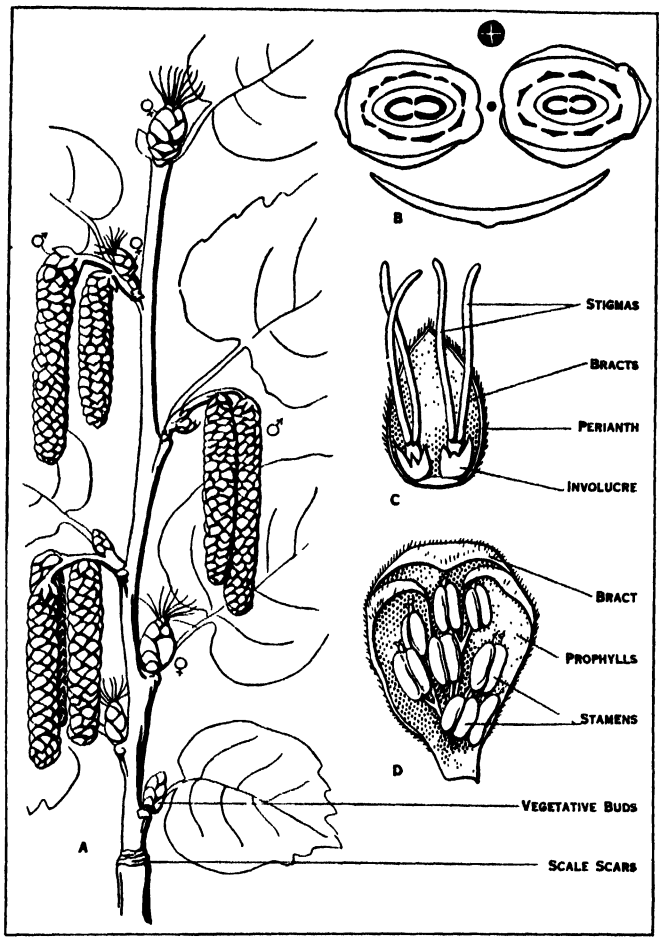
HAZEBROUCK, a town of northern France, in the department of Nord, on the canalized Bourre, 29 m. W.N.W. of Lille, on the Northern railway, between Lille and St. Omer. Pop. (1926) 11,640. It was a centre of movement for the Allies during the war of 1914–1918. Allenby occupied the town in Oct. 1914, and it remained in British hands throughout, being protected against the German advance by the forest of Nieppe. There is little of architectural interest in the town except the church of St. Eloi, a 16th century building with fine open work on the spire, and a 16th century convent, since converted into a hospital. Hazebrouck is the market for a fertile agricultural district, and has trade in live stock, grain and hops. Cloth weaving is the chief industry. Hazebrouck is an important railway junction.

HAZEL, botanically *Corylus,* a genus of shrubs or low trees of the family Betulaceae. The common Old World hazel, *Corylus avellana* (fig. 1), occurs throughout Europe, in North Africa and in central and Russian Asia, except the northernmost parts. It is commonly found in hedges and coppices, and as an undergrowth in woods, and reaches a height of some 12 ft.; occasionally it may attain to 30 ft. The bark of the older stems is of a bright brown, mottled with grey, that of the young twigs is ash-coloured, and glandular and hairy. The leaves are alternate, from 2 to 4 in. in length, downy below, roundish heart-shaped, pointed and shortly stalked. In the variety *C. purpurea,* the leaves, as also the pellicle of the kernel and the husk of the nut, are purple, and in *C. heterophylla* they are thickly clothed with hairs. The flowers are monoecious, and appear in Great Britain in Feb. and March, before the leaves. The cylindrical drooping yellow male catkins (fig. 1A) are 1 to 2½ in. long and occur 2 to 4 in a raceme; when in unusual numbers they may be terminal in position. The female flowers are small, sub-globose and sessile, resembling leaf-buds, and have protruding crimson stigmas; the minute inner bracts, by their enlargement, form the palmately lobed and cut involucre or husk of the nut. The ovary is not visible till nearly midsummer, and is not fully developed before autumn. The nuts have a length of from ½ to ¾ in., and grow in clusters. The wood of the hazel is whitish-red, close in texture and pliant, and has been used in cabinet-making, and for toys and turned articles. Curiously veined veneers are obtained from the roots; and the root-shoots are largely employed in the making of crates, coal-corves or baskets, hurdles and bands, whip-handles and other objects.

The filbert, among the numerous varieties of *Corylus avellana,*

is extensively cultivated, especially in Kent, for the sake of its nuts, which are readily distinguished from cob-nuts by their ample involucre and greater length. It may be propagated by suckers and layers, by grafting and by sowing.

In North America there are three native hazels, all with edible nuts somewhat smaller than those of the common hazel of Europe. The best known is the American hazel (*C. americana*), 3 ft. to 8



FROM PERCY GROOM, "ELEMENTARY BOTANY"

DETAILS OF THE HAZEL, A TREE CULTIVATED IN TEMPERATE ZONES FOR ITS FRUIT (NUTS). THE WOOD IS USED IN CABINET-MAKING AND FOR TOYS

A. Shoot bearing male and female inflorescences; the stem from scale scars was produced the previous year

B. and C. Two flowers that serve as receptacles for the ovules, and diagram of same

D. Staminate flower of same (enlarged) on bract

ft. high, with broadly oval pointed leaves, found in thickets from Maine to Ontario and Saskatchewan and southward to Florida and Kansas. The beaked hazel (*C. rostrata*), similar in size and aspect, but with the husk (involucre) enclosing the nut prolonged into a tubular beak, is found from Nova Scotia to British Columbia and southward to Georgia, Kansas and Oregon. The California hazel (*C. californica*), usually a shrub but sometimes a small tree 30 ft. high, occurs in forests from British Columbia to central California. (*See* FILBERT.)

HAZLETON, a city of Luzerne county, Pa., U.S.A., 30m. S. of Wilkes-Barre. It is on Federal highway 309, and is served by the Lehigh Valley, the Pennsylvania and the Wilkes-Barre and Hazleton (electric) railways. The population was 32,277 in 1920 (19% foreign-born white) and was estimated locally at over 39,000 in 1928. Hazleton is beautifully situated, on a broad tableland about 1,800ft. above sea-level on Nescopeck or Buck mountain, a spur of the Blue mountains. It is one of the important cities of the anthracite region, with large collieries surrounding it. The local coal industry dates from 1837. A hospital for the care of persons injured in the mines is maintained here by the State. The chief manufactures are silk, knit goods, shirts, iron, sheet steel, pumps, caskets and brushes. There is a large electric power plant. The assessed valuation of property in 1926 was $26,531,768. Hazleton was founded in 1820; incorporated as a borough in 1856; and as a city in 1891. It has a commission form of government.

HAZLITT, WILLIAM (1778–1830), British literary critic and essayist, was born on April 10, 1778 at Maidstone, where his father, William Hazlitt, was minister of a Unitarian congregation The father took the side of the Americans in their struggle with the mother-country, and during a residence at Bandon, Co. Cork, interested himself in the welfare of some American prisoners at Kinsale. In 1783 he migrated with his family to America, but in the winter of 1786–87 returned to England, and settled at Wem in Shropshire. His son William was sent in 1793 to the Hackney theological college. He returned, probably in 1794, to Wem, where he led a desultory life until 1802, and then decided to become a portrait painter. His elder brother John was already established as a miniature painter in London. In Jan. 1798 young Hazlitt heard S. T. Coleridge preach at Shrewsbury. Coleridge encouraged William Hazlitt's interest in metaphysics, and in the spring of the next year Hazlitt visited Coleridge at Nether Stowey and made the acquaintance of Wordsworth. On visits to his brother in London he began his long friendship with Charles Lamb, said to have been founded on a remark of Lamb's interpolated in a discussion between Coleridge, Godwin and Holcroft, "Give me man as he is *not* to be." In Oct. 1802 he went to Paris to copy portraits in the Louvre, and spent four happy months in Paris. He soon found he was not likely to excel as a portrait painter; his last portrait, one of Charles Lamb as a Venetian senator (now in the National Portrait Gallery), was executed in 1805. In that year he published his first book, *An Essay on the Principles of Human Action . . .*, which had occupied him at intervals for six or seven years. Other works followed.

In 1808 Hazlitt married Jane Stoddart. His domestic life was unhappy. His wife was an unromantic, business-like woman, while he himself was fitful and moody, and impatient of restraint. The dissolution of the ill-assorted union was nevertheless deferred for 14 years, during which much of Hazlitt's best literary work had been produced. Mrs. Hazlitt had inherited a small estate at Winterslow near Salisbury, and here the Hazlitts lived until 1812, when they removed to 19 York street, Westminster, a house that was once Milton's. Hazlitt was parliamentary reporter and subsequently dramatic critic for the *Morning Chronicle;* he also contributed to the *Champion* and *The Times;* but his closest connection was with the *Examiner,* owned by John and Leigh Hunt. In conjunction with Leigh Hunt he undertook the series of articles called *The Round Table,* a collection of essays on literature, men and manners which were originally contributed to the *Examiner.* To this time belong his *View of the English Stage* (1818), and *Lectures on the English Poets* (1818), on the *English Comic Writers* (1819), and on the *Dramatic Literature of the Age of Elizabeth* (1821). By these works, together with his *Characters of Shakespeare's Plays* (1817), and his *Table Talk; or Original Essays on Men and Manners* (1821–22), his reputation as a critic and essayist was established. Next to Coleridge, Hazlitt was perhaps the most powerful exponent of the dawning perception that Shakespeare's art was no less marvellous than his genius; and Hazlitt's criticism did not, like Coleridge's, remain in the condition of a series of brilliant but fitful glimpses of insight, but was elaborated with steady care. His lectures on the Elizabethan dramatists performed a similar service for the earlier, sweeter and simpler among them, such as Dekker, till then unduly eclipsed by later writers like Massinger.

As an essayist Hazlitt is equally great. He was intensely subjective, and the essence of his commentary, whatever the theme, is derived from himself. But Hazlitt's political sympathies and antipathies were vehement, and he had taken the unfashionable side. The *Quarterly Review* attacked him violently, stopped the sale of his writings for a time and blighted his credit with publishers. Hazlitt retaliated by his *Letter to William Gifford* (1819), accusing the editor of deliberate misrepresentation. In downright abuse and hard-hitting, Hazlitt proved himself more than a match even for Gifford. By the writers in *Blackwood's Magazine* Hazlitt

was also scurrilously treated. He had become estranged from his early friends, the Lake poets, by what he uncharitably but not unnaturally regarded as their political apostasy. His inequalities of temper separated him for a time even from Leigh Hunt and Charles Lamb, and on the whole the period of his most brilliant literary success was that when he was most soured and broken. Domestic troubles supervened; he had gone to live in Southampton Buildings in Sept. 1819, and his marriage, long little more than nominal, was dissolved in consequence of the infatuated passion he had conceived for his landlord's daughter, Sarah Walker. His own record of the transaction, published by himself under the title of *Liber Amoris, or the New Pygmalion* (1823), is an unpleasant but remarkable psychological document. Later cured of his mistress, he married a widow, a Mrs. Bridgewater. They travelled on the Continent for a year and then parted finally. Hazlitt's study of the Italian masters during this tour, described in a series of letters contributed to the *Morning Chronicle,* had a deep effect upon him, and perhaps conduced to that intimacy with the cynical old painter Northcote which, shortly after his return, engendered a curious but eminently readable volume of *The Conversations of James Northcote, R.A.* (1830). The respective shares of author and artist are not always easy to determine. During the recent agitations of his life he had been writing essays, collected in 1826 under the title of *The Plain Speaker: opinions on Books, Men and Things* (1826). *The Spirit of the Age; or Contemporary Portraits* (1825), a series of criticisms on the leading intellectual characters of the day, is in point of style perhaps the most splendid and copious of his compositions. He now undertook a work which was to have crowned his literary reputation, but which can hardly be said to have even enhanced it—*The Life of Napoleon Buonaparte* (4 vols., 1828–30). Owing to the failure of his publishers Hazlitt received no recompense for this laborious work. He died on Sept. 18, 1830. Charles Lamb was with him to the last.

Hazlitt's grandson, WILLIAM CAREW HAZLITT, the bibliographer, was born on Aug. 22, 1834. He was educated at the Merchant Taylors' school and was called to the bar at the Inner Temple in 1861. Among his many publications may be noted his invaluable *Handbook to the Popular Poetical and Dramatic Literature of Great Britain, from the Invention of Printing to the Restoration* (1867), supplemented in 1876, 1882, 1887 and 1889, a *General Index* by J. G. Gray appearing in 1893. He published further contributions to the subject in *Bibliographical Collections and Notes on Early English Literature made during the years 1893–1903* (1903), and a *Manual for the Collector and Amateur of Old English Plays* . . . (1892). He was the chief editor of the useful 1871 edition of Warton's *History of English Poetry,* and compiled the *Catalogue* of the *Huth Library* (1880). He died in 1913.

The list of the first William Hazlitt's works also includes: *Political Essays, with Sketches of Public Characters* (1819); *Sketches of the Principal Picture Galleries in England* . . . (1824); *Characteristics; in the Manner of Rochefoucauld's Maxims* (1823); *Select Poets of Great Britain: to which are prefixed Critical Notices of each Author* (1825); *Notes of a Journey through France and Italy* . . . (1826); *The Life of Titian; with Anecdotes of the Distinguished Persons of his Time* (1830), nominally by James Northcote; an article on the "Fine Arts" contributed to the seventh edition of the *Encyclopædia Britannica;* and posthumous collections made by his son.

The Collected Works of William Hazlitt (12 vols., 1902–04), ed. A. R. Waller and A. Glover, with introd. by W. E. Henley, does not include the life of Napoleon. There are many modern reprints of isolated works. The most copious source of information respecting Hazlitt is the *Memoirs of William Hazlitt, with Portions of his Correspondence* (2 vols., 1867), by his grandson. W. C. Hazlitt, a medley rather than a memoir, yet full of interest. There is an excellent monograph on *William Hazlitt* (1902) by Augustine Birrell, in the "English Men of Letters" series, and one in French by J. Douady (1907), who also published a bibliography of his works. *See* also P. P. Howe, *Life of William Hazlitt* (1922). Valuable biographical particulars have been preserved in P. G. Patmore, *My Friends and Acquaintances* (1854); in Crabb Robinson's *Diary;* in Lamb's correspondence; and in W. C. Hazlitt, *Lamb and Hazlitt* (1900). A full bibliographical list of his writings, with a collection of the most remarkable critical judgments upon them from all quarters, was prepared by Alexander Ireland (1868). Further information on the Hazlitt family is to be found in W. C. Hazlitt, *Four Generations of a Literary Family* (2 vols., 1897).

HEAD, SIR EDMUND WALKER, 8TH BART. (1805–1868), English colonial governor and writer on art, born at Rayleigh, Essex, was educated at Winchester school and Oriel college, Oxford, and became fellow of Merton college. He had a distinguished career in the home and colonial service, and was governor-general of Canada from 1854 to 1861. He received many honours. Head died in London on Jan. 28, 1868. He edited F. T. Kugler's *Handbook of Painting of the German, Flemish, Dutch, Spanish and French Schools* (1854) and the *Essays on the Administrations of Great Britain* (1864), written by his lifelong friend, Sir George Cornewall Lewis. His translation from the Icelandic of *Viga Glum's Saga* appeared in 1866.

HEAD, the upper portion of the body in man, consisting of the skull with its integuments and contents, etc., connected with the trunk by the neck (*see* ANATOMY, SKULL, and BRAIN): also the anterior or fore part of other animals. The word is used in a large number of transferred and figurative senses.

HEAD-DRESS, a covering for the head, which may be considered as (1) protective, originating as a defence against climate and physical violence; (2) ceremonial, as a badge of rank and office. Frequently combining both functions, its history is bound up with the mask, the veil, the coiffure and the tonsure (*qq.v.*); its aesthetic development belongs to a later period.

The additions and changes made to the hair, the natural protection, whether defensive or ceremonial, appear first and chiefly among men. Women have worn their hair long, while men have cut their hair or shaved their heads. The practical band employed to confine the hair and keep it from the eyes, in wide-spread use among primitive and savage people, gave rise to a variety of head-dresses worn chiefly by women and surviving in historic civilization, while the comb and hair-pin, assuming ornamental forms, became essential elements in the woman's head-dress in many lands. Two pins, worn right and left, ornamented with artificial flowers and terminating in vestigial spoons are the usual hair ornaments among the women of eastern Asia.

Defensive and protective head-coverings fall into two general classes: (1) the hat and helmet type; (2) the cloth or garment tied around or worn over the head, such as the turban. The classic world of Greece and Rome, wearing a garment that when necessary was drawn over the head, eschewed other coverings. The hat or helmet arose as a hide or leather head-cover in the north and as a wood or basketry sun-shade in the tropics, metal being a later replacement. A round cap, made of cloth or felt, closely fitting the skull or terminating in a peak, and later truncate, appeared early in Western Asia. The turban was wound either directly around the head, or usually around such a cap. Its size, shape and colour varied in different countries and in accordance with the rank and occupation of the wearer, and to it, as well as to the felt cap an aigrette or jewel was sometimes added as a badge of regal and other rank.

Ceremonial head-dresses are varied and complex, and their beginnings may be traced to primitive conditions. Like the mask, they were assumed frequently to identify the wearer with a divinity or to perpetuate the tradition of a divine ancestor. Chinese imperial head-dresses bear the symbols of the sun and moon. The pointed crown may be regarded as a solar emblem. The custom of shaving the head was common at the initiation of a warrior or priest, but a head ornament or cap was commonly a badge of rank and its prerogatives jealously guarded. In China and Japan a straight, standing knot was left on the top of the head to which the imperial cap was attached by a transverse pin. The North American Indian warrior shaved his head, leaving a medial crest, or wore a similar crest made of the hair of the moose in which a tablet bearing the symbol of a bird was embedded. This object, tied to the so-called scalp lock, serves to explain the feathers fastened to his hair as well as his feather head-dresses. The peacock feather badge of the Chinese Manchu dynasty had a similar mechanism. The feathers of the Plains Indian war bonnets, assumed to symbolize exploits, may be regarded as a composite and cumulative expression of the bird on the tablet. The horns of these war bonnets are those of the buffalo. A miniature netted shield and two feathered darts, emblems of the Twin War

HEAD-DRESS



BY COURTESY OF (1) THE SMITHSONIAN INSTITUTION, (2, 5) THE METROPOLITAN MUSEUM OF ART, NEW YORK, (8) THE MUSEUM OF FINE ARTS, BOSTON, (12) THE MUSEUM OF THE UNIVERSITY OF PENNSYLVANIA, (12) "NOMAD" AND GORDON MACCREAGH; PHOTOGRAPH (7) ORIENT AND OCCIDENT

CHARACTERISTIC HEAD-DRESS OF VARIOUS NATIONS

1. Ancient Roman helmet. 2. Ancient Egyptian head-dress. 3. Ancient Greek helmet. 4. Italian mediaeval head-dress. 5. Mediaeval French crown. 6. 15th century Flemish head-dress. 7. Siamese. 8. East Indian. 9. Former Turkish. 10. Japanese. 11. American Indian. 12. Bolivian. 13. Arabian

Gods, are of wide-spread recurrence in the head-dress of the Indian warrior. The aboriginal head-dresses of the Indian tribes of the North American continent may be regarded as emanations from ancient Mexico, where elaborate head-dresses of feathers were worn by the priests and warriors who personated the gods.

The military head-dress of historic Europe was in the main defensive, but the bear skin shako and lofty plumed hat of the 18th century were intended to increase the apparent height of the wearer and impress the enemy. Ecclesiastic head-dresses both East and West had secular origins.

The ceremonial crowns and head-dresses of women were borrowed and imitated from those of their consorts, whose rank they shared. The peasant wedding-crowns of central Europe are reminiscent. Flowers, natural and artificial, were their common and widely used hair ornaments, but the rule that women should not appear in church uncovered led to the universal use of the women's head-cloth or kerchief in Catholic Europe. The sunbonnet is a combination of this cloth with a band, by which it was tied over the head.

The head-dress of fashion for both men and women reached its highest development in Europe in the 18th century. Its simplification due to the general adoption of short hair has resulted in the employment of the felt hat now generally worn by women in Europe and America. (*See* also DRESS; COSTUME DESIGN.)

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HEAD-HUNTING. The practice of head-hunting, although due partly to the acquisitive instinct, arises from a belief in the existence of a more or less material soul matter on which all life depends. In the case of human beings this soul matter, often, apparently, in diminutive human form, is located particularly in the head. In abstracting a head the soul within is captured and thus added to the general stock of soul matter belonging to the community and so contributes to the fertility of the human population, the cattle and the crops; for the soul is conceived of, according to the Karens of Burma at any rate, as a sort of pupa, filled with a vaporous substance which bursts, when its contents spread over and fertilize the fields, passing again through the grain or herb eaten into the bodies of men or animals and so again into the seminal fluid enabling men and animals to propagate life. While precisely the same formula cannot be postulated of all head-hunters, head-hunting is generally based on a similar belief in a cycle of life dependent on the possession of soul (*see* METEMPSYCHOSIS).

Head-hunting is therefore associated (1) with ideas regarding the sanctity of the head as the seat of the soul, (2) with some forms of cannibalism where the body or part of the body is consumed in order to transfer to the eater the soul matter of the viand, (3) with phallic and often fertility cults intended to imbue the soil with productivity, and may thus develop into human sacrifice, a practice which has been generally associated with agriculture. Head-hunting, or at any rate some practice closely allied to it, is found sporadically all over the globe either actually existing or in some degenerate survival.

In Europe the actual survival of the practice is probably limited to the Balkan Peninsula, where the taking of the head affects the future life of the soul in some way that is no longer quite clear, but no doubt implied the transfer of the soul matter of the decapitated to the decapitator. Here the complete head was taken by Montenegrins at any rate as lately as 1912, the head being carried by the lock of hair worn apparently for that purpose. In the Balkan war of 1912–13, nose taking was substituted, and it was the practice to cut off the nose and upper lip with the moustache by which it was carried instead of the whole head, just as in Kafiristan and in Assam an ear is sometimes carried off instead of the whole head. In the British Isles the practice continued approximately to the end of the middle ages in Ireland and the Scottish marches, and, in the case of the Irish, Strabo accused them of honouring their dead relatives by eating their corpses, while a Martinmas pig is still killed that the fields may be sprinkled with blood and so rendered fertile. In some parts of the Continent murderers have been known to eat part of their victims to secure themselves against ill-will on the part of the ghost. The underlying idea is, no doubt, that the consumption of the flesh leads to spiritual identity.

In Africa the principle involved has shown itself rather in the form of human sacrifice than of true head-hunting, Dahomey and



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PORTION OF ASSYRIAN BAS-RELIEF DEPICTING ASSURBANIPAL'S SECOND WAR AGAINST ELAM, c. 650 B.C. ON THE LEFT IS SHOWN THE LAST STAND OF TE-UMMAN, KING OF ELAM, AND TAMRITU, HIS SON, AND IN CENTRE, THE BEHEADING OF TE-UMMAN AND TAMRITU

Ashanti being notorious examples; but even here the fact that the human sacrifices in Dahomey made the rain-magic more efficacious suggests the working of the same ideas, while we hear of a Matabele chief who anointed his body and fertilized his fields with human fat. So, too, the eating of an enemy's heart has been reported from Dahomey and Whydah, and the use of skulls as drinking cups from the Guinea coast. Bona fide head-hunting occurs in Nigeria, where a number of usages strongly suggest Indonesian culture. As in Indonesia, head-hunting among the Kagoro, and perhaps other tribes in Nigeria, is associated with the fertility of the crops and with marriage and with the service by the victim of the taker of his head in the next world.

In Asia Herodotus mentions head-hunters, and on a bas-relief from Nineveh in the British Museum is represented a battle in the 7th century B.C. between Assurbanipal and the king of Elam, in which the Assyrians are depicted as cutting and carrying off the heads of the slain. In Kafiristan on the north-west frontier of India head-hunting was practised until a recent date, wheat being showered by the women upon men returning with heads from a successful raid. In the north-east of India, Assam is famous for head-hunting. All the hill tribes living south of the Brahmaputra —Garos, Khasis, Nagas and Kukis—were head-hunters in the past, and many of the Naga tribes still practise the decaying cult.

Head-hunting in Assam is normally carried on by parties of raiders who depend on surprise tactics almost entirely. The heads, and sometimes also the hands and feet or even the whole limbs, are cut off and carried home to the village, where the head is usually placed on a stone or pile of stones kept for that purpose. The practice of cutting off the limbs has possibly a different origin, as there are tribes north of the Brahmaputra who do not take heads, but do cut off the feet and hands of slain enemies, presumably with a view to incapacitate the ghost. The skull is subsequently variously treated. After its virtue has passed into the stone on which it is laid it is either buried face downwards, as by the Angami tribe, hung up in trees, as by Semas and Lhotas, or suspended in the chief's house, or the bachelors' hall. In the latter case some tribes decorate it with a pair of buffalo horns, probably as a fertility symbol, and with long tassels of a broad-bladed grass which rustle pleasantly when the skull is swung by a dancer at a feast. In the case of several participants in a raid who are all in at the death, the head is often divided on a fixed

system, certain definite portions going to the first, second and third spears, etc. The insignia and, where tattooing is practised, the tattoo patterns worn by the successful warrior have specific reference to success in head-hunting. Thus the Angami warrior wears one hornbill feather for each success—"touching-meat" as it is called, while the Konyak warrior has his neck tattooed only if he has actually performed the act of decapitation in person, though he may tattoo his chest for "touching meat" and his face for the act of killing the enemy in person. With the Naga, the genuine head-hunter, a head must have cut its teeth to count, though a female head is at least as good as a male; but with the Kuki, whose cult is probably mixed and whose desire for heads is merely to supply a dead relative with servitors in another world, any head, even that of an embryo, is good. The Kagoro and Moroa tribes of West Africa, like the Kuki of Assam and the Kayans of Borneo, desire slaves in the next world rather than soul matter in this. The Naga never takes the head of a fellow-villager even though clan feuds within the village are very bitter and lead to much bloodshed, and even outside the village heads are not as a rule taken between men of the same or nearly related clans, a self-denying ordinance shared with the Kagoro. The younger women are everywhere great instigators of head-hunting, and refuse to marry men who have not "touched meat," probably with the idea that until they have taken life they are unlikely to beget offspring.

In Burma several tribes follow or have followed similar customs. The Wa tribe observe a definite head-hunting season when the fertilizing soul matter is required for the growing crop and all wayfarers move about at their peril. In Borneo, Indonesia generally, the Philippines, and Formosa, similar methods of head-hunting obtain, and the hill tribes of Malaya and Indo-China probably are or have been head-hunters at some period. The Ibans of Borneo are particularly enthusiastic in this respect. The practice was reported of the Philippines by Martin de Rada in 1577, and has barely disappeared among the Igorot and Tagalog of Luzon, while in Formosa it prevailed among the hill tribes. Elsewhere in Indonesia it extended through Ceram where the Alfurs were, or are, head-hunters, to New Guinea, where the Motu, like the Lhota Naga of Assam, wears a hornbill's head as the insignia of his achievement; here and there, as in the Battak country and in Timorlaut, it seems to be replaced by cannibalism.

In New Guinea the Tugeris use a bamboo knife for the act of decapitation, perhaps because iron would adversely affect the soul within. Throughout Oceania head-hunting prevailed till comparatively recently and possibly still occurs in the Solomon Islands. In the Solomon Islands the actual expedition to obtain a head formed the climax in a series of ceremonial acts extending over a number of years, and the suppression of head-hunting, on which depended an important part of the social life, has been a serious factor in the decay of society and the decrease of population which has followed under British administration. (*See* ANTHROPOLOGY.) Throughout Oceania head-hunting is closely associated with cannibalism and the latter institution has tended to obscure the former, but in many islands the importance attached to the head is unmistakable. In parts of Micronesia the head of the slain enemy was paraded about with dancing which served as an excuse for raising a fee for the chief to defray public expenditure, after which the head would be lent to another for the same purpose. In Melanesia the head is often mummified and preserved, and sometimes, as in New Britain, seems to be worn as a mask in order that the wearer may acquire the soul of the dead man. Even in Australia this underlying principle seems active as it is reported that the Australian believes that the spirit of a slain enemy enters the slayer. In New Zealand the heads of the foe were dried and preserved so that the tattoo marks and often the actual features were recognizable; this practice led to a development of head-hunting when tattooed heads became desirable curios and the demand of Europe for Maori trophies caused "pickled heads" to become a regular article of trade and export.

In North America the general practice was to take the scalp rather than the head, the idea probably being that the soul is located in the hair, an idea present in the Biblical story of Samson, common in Malaya and Indonesia, where Nagas and Borneans use the hair of their dead enemies for ornaments, as did the North American Indians; in Oceania where the Marquesans use the hair of the victims of their cannibal rites for making arm rings and necklets of magic virtue; and frequent in South America, where the heads are often preserved, as by the Jibaros, by removing the skull and packing the skin with hot sand, thus shrinking it to the size of the head of a small monkey while preserving the features intact as a vivid portrait in caricature Here, again, head-hunting is probably associated with cannibalism in a ceremonial form, and the heads of certain animals are also treated similarly (*see* LYCANTHROPY).

Head-hunting, therefore, is world-wide. It is associated with tribes still living in the stone ages, and may even go back to palaeolithic times; as in the Azilian deposits at Ofnet in Bavaria heads were found carefully decapitated and buried separately from the bodies, indicating beliefs in the special sanctity or importance of the head.

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(J. H. H.)

HEALTH, a condition of physical soundness or well-being, in which an organism discharges its functions efficiently; also in a transferred sense a state of moral or intellectual well-being (*see* HYGIENE, THERAPEUTICS and PUBLIC HEALTH). "Health" represents the O.E. *haelth,* the condition or state of being *hál,* safe or sound.

Drinking of Healths.—The custom of drinking "health" to the living is probably derived from the ancient religious rite of drinking to the gods and the dead. The Greeks and Romans at meals poured out libations to their gods, and at ceremonial banquets drank to them and to the dead. The Norsemen drank the "minne" of Thor, Odin and Freya, and of their kings at their funeral feasts. With the advent of Christianity the pagan custom survived among the Scandinavian and Teutonic peoples. Such festal formulae as "God's minne!" "A bowl to God in Heaven!" occur. The Norse "minne" was at once love, memory and thought of the absent one. Associated with these customs must have been the drinking to the health of living men. The Greeks drank to one another and the Romans adopted the custom. The Goths pledged each other with the cry "Hails!" a greeting which had its counterpart in the Anglo-Saxon "waes hael" (*see* WASSAIL). The Roman gallants drank as many glasses to their mistresses as there were letters in each one's name. Thus Martial:

> Six cups to Naevia's health go quickly round,
> And be with seven the fair Justina's crown'd.

Toasts.—The English drinking phrase, a "toast," to "toast" anyone,—not older than the 17th century—had reference at first to this custom of drinking to the ladies. A toast was at first invariably a woman, and the origin of the phrase is curious. In Stuart days it was the custom to put a piece of toast in the wine-cup before drinking, from a notion that it gave the liquor a better flavour. In the *Tatler* No. 24, the connection between this sippet of toast and the fair one pledged is explained as follows: "It happened that on a publick day" (speaking of Bath in Charles II.'s reign) "a celebrated beauty of those times was in the cross bath, and one of the crowd of her admirers took a glass of the water in which the fair one stood, and drank her health to the company. There was in the place a gay fellow, half fuddled, who offered to jump in, and swore, though he liked not the liquor, he would have the toast. He was opposed in his resolu-

tion; yet this whim gave foundation to the present honour which is done to the lady we mention in our liquor, who has ever since been called a toast."

Health drinking had by the beginning of the 17th century become a very ceremonious business in England. Toasts were often drunk solemnly on bended knees; in 1668 at Sir George Carteret's at Cranbourne the health of the Duke of York was drunk by all in turn, each on his knees, the King, who was a guest, doing the like. A Scotch custom, still surviving, was to drink a toast with one foot on the table and one on the chair. Pepys, in his *Diary* for June 19, 1663, writes: "To the Rhenish wine house, where Mr. Moore showed us the French manner when a health is drunk, to bow to him that drunk to you, and then apply yourself to him, whose lady's health is drunk, and then to the person that you drink to, which I never knew before; but it seems it is now the fashion." At dinners to royalties, until the accession of Edward VII., finger-glasses were not placed on the table, because in early Georgian days those who were secretly Jacobites passed their wine-glasses over the finger-bowls before drinking the loyal toasts, in allusion to the royal exiles "over the water."

The Loving Cup.—The ceremony surrounding the loving cup to-day is reminiscent of the perils of those times when every man's hand was raised against his fellow. The "loving-cup" sometimes has a cover, and in this case each guest rises and bows to his immediate neighbour on the right, who, also rising, removes and holds the cover with his right hand while the other drinks; this is a survival of the days when he who drank was glad to have the assurance that the right or dagger hand of his neighbour was occupied in holding the lid of the chalice. When there is no cover it is a common custom for both the left- and the right-hand neighbour to rise while the loving cup is drunk, with the similar object of protecting the drinker from attack. The stirrup cup is probably the Roman *poculum boni genii,* the last glass drunk at the banquet to a general "good night."

See Chambers, *Book of Days;* Valpy, *History of Toasting* (1881); F. W. Hackwood, *Inns, Ales, and Drinking Customs* (1909).

HEALTH INSURANCE: *see* NATIONAL INSURANCE, *Health.*

HEALTH, MINISTRY OF: *see* GOVERNMENT DEPARTMENTS.

HEALTH VISITOR, a public or private official or other person whose duty it is to see that laws relating to public health and sanitation are obeyed.

The status of health visitors in Great Britain is now fully established by the Memorandum 101 MCW issued in Feb. 1925 by the Ministry of Health. Under that Memorandum, eight institutions were approved for the training of health visitors, five in London, one in Durham, one in Leeds and one in Bristol. After April 1, 1928, the appointment of women as whole time health visitors under a local authority is not approved unless they possess the new health visitor's certificate or the diploma given under the board of education. A health visitor's certificate can be obtained by a fully trained nurse who also holds the certificate of the central midwives board if she has taken a six months course in public health work followed by an examination. On the other hand if she is not a fully trained nurse, providing that she has had six months training in hospital and has undergone a recognized two years course of training at one of the institutions and has passed the necessary examination and holds the certificate of the central midwives board she is then entitled to take an appointment under a local authority. On March 31, 1927, there were 2,230 health visitors employed by local authorities in Great Britain and of these 936 were engaged wholly on maternity and child welfare work. The remaining 1,294 combined these duties with other public appointments such as those of school nurse or sanitary inspector. There were in addition 343 health visitors employed by voluntary agencies in connection with infant welfare centres and 1,390 district nurses employed by nursing associations were also utilized by county councils for health visiting in rural areas.

HEALY, TIMOTHY MICHAEL (1855–), was born at Bantry on May 17, 1855, the son of Maurice Healy, clerk of the Bantry Union. His mother was the daughter of a schoolmaster in this little west Cork town. Three of her brothers, A. M., T. D. and Donal Sullivan, became members of parliament, as did three of her sons, Thomas, Maurice and Timothy Healy. The eldest married his cousin, a daughter of T. D. Sullivan. This group of closely related politicians was the nucleus of the "Bantry Band" which included also W. M. Murphy, M.P., founder of *The Irish Independent.* In the succeeding generation, Kevin O'Higgins, Timothy Healy's nephew by marriage, became vice-president of the Irish Free State when his uncle was made its first governor-general.

Timothy began to earn his living at 13, and his early youth was spent as a shorthand clerk in a railway office at Newcastle-upon-Tyne. Here he became well known in Irish political and literary societies. In 1878 he moved to London and began in his spare time to contribute to the New York *Nation.* In 1879 Parnell on his first mission to America found that he needed a secretary and wired for Healy, who was already known to him. In 1880, after Parnell had been elected chairman of the Irish party, a parliamentary vacancy occurred in Wexford City, and Healy was elected.

From the first he slapped the House of Commons in the face, but he attended very closely to all its business. In 1881 Gladstone's Land bill began the revolution which gave the Catholic Irish ownership of the land instead of being mere cultivators under landlords. Gladstone said that, with the exception of three Irish law officers, only Healy understood it, and it is doubtful whether anybody but Healy understood the effect of the famous "Healy clause." Introduced as an amendment, this guaranteed that in future rent should not be chargeable on tenants' improvements. When the bill became an act, Healy, called to the bar in 1884, defended the tenants' interests in innumerable cases that arose in its application. In 1883 his audacious tongue secured him the distinction of being sent to gaol. Later in the year when a Liberal seat became vacant in County Monaghan he was selected to make the first Nationalist inroad on Ulster. He won. At the general election of 1885 with the extended franchise Monaghan became a safe seat. Healy attacked South Derry and won the constituency—by surprise tactics. In 1886, however, he was defeated, but was returned for North Longford.

His relations with Parnell now became less friendly, and he joined Biggar in opposing the candidature of Captain O'Shea for Galway City. The opposition was only overborne by Parnell's personal intervention. But in 1889, when the divorce petition against Parnell was undefended, Healy drafted the resolution carried by the party in favour of Parnell remaining at his post. "Parnell," he said, "is not a man, but an institution." Later, however, in face of Gladstone's declaration, he changed his mind, and from the time the "split" began, no speeches were so envenomed as Healy's. He was twice publicly beaten; but no form of menace had ever the least effect on him. In 1892 he became member for North Louth, and, as a member of the anti-Parnellite party to which the large majority of Irish Nationalists belonged, he was specially supported by the Catholic clergy. His rivals for leadership, William O'Brien and John Dillon, had more following among the laity, but Healy was always a priests' man. At this time he devoted less time to politics, for his practice at the bar was increasing, and in 1899 he became Q.C.

On the reunion of parties in 1900 he joined O'Brien in urging that Redmond, leader of the Parnellite minority, rather than John Dillon, leader of the anti-Parnellites, should be chosen as chairman of the united body. But a long indulgence in the savage spirit of faction which followed the Parnell "split" had rendered Healy difficult to work with, and in 1902, on the motion of O'Brien, he was expelled from the United Irish League, though he retained the support of the Catholic hierarchy and of Murphy's influential newspaper. In 1906 O'Brien, having split away from Redmond's main body with a few followers, made a working alliance with his former adversary and his brother Maurice, member for Cork City. In 1910, when Healy was beaten in North Louth, O'Brien provided him with a constituency in north-east Cork.

Healy joined the English bar in 1903 and took silk in 1910.

He was unceasingly employed on English cases, more especially of a political character, and defended many of the suffragettes. In parliament no speaker was more able to draw a crowded house, and his wit and eloquence were specially popular with the Tories, because he said more biting things of the Nationalist party than Englishmen could invent. With O'Brien he opposed the budget of 1909 which led to the clash with the House of Lords; and on the Home Rule measure of 1912, while giving it general support, he furiously opposed partition.

In 1914 he was a vigorous supporter of Britain in the World War, but the course of events from 1916 onwards, culminating in the introduction of conscription, drove him finally to side with Sinn Fein, and in 1918 he resigned his seat to allow an imprisoned Sinn Feiner to be returned. Little was publicly heard of him during the years of turmoil which followed until, at the close of 1922, the constitution of the Irish Free State having been made law by the Irish parliament, and subsequently by the British, the office of governor-general had to be filled. When Healy's name was first mentioned for the post there was general incredulity, but the appointment soon commended itself to Irishmen of all sections. The Free State Government, speaking through the mouth of Healy's nephew, Kevin O'Higgins, defended the choice of "an old man of the people," while others realized that Healy, though an extreme nationalist, had in many respects a most conservative mind. Those who feared the worst from a tongue and a temper which he had never before governed were surprised by the result; for during his continuance in office as the representative of King George Healy in no way added to the Government's difficulties, while he did more perhaps than any other person to cultivate the good will of the Protestant minority. He resigned office at the end of his three years' term, in Dec. 1927. In 1928 he published a volume of memoirs, *Letters and Leaders of My Day*. *See* Liam O'Flaherty, *Life of Tim Healy* (1927) (S. G.)

HEANOR, an urban district of Derbyshire, England, 10 m. N.W. of Nottingham by the L.N.E.R. Pop. (1921) 21,436. Hosiery works and collieries employ many of the inhabitants. The ruins of Codnor castle stand near some large ironworks.

HEARING. The air around us is constantly disturbed by vibrations, which travel through it in the form of waves (*see* SOUND). Similar wave movements are transmitted by water, and by most of the solid bodies by which we are surrounded. All animals higher in the scale of evolution than the amphibia, and many of those more primitive, have developed organs by which they are able to perceive these vibrations, and their relation to their environments is thereby greatly extended. The higher animals can signal to one another by means of the sounds which they themselves produce, and their hearing mechanism is able to interpret the purport of such signals. Articulate speech and music are the highest development of this system of sound signals, and their interpretation necessitates a refined power of analysing sounds by the organ of hearing, with which is associated a corresponding development of the mental faculties. The word HEARING is used to denote both the process by which vibrations of sounds act upon the sense organs, and the particular sensation aroused in consciousness by such stimulation.

Range of Hearing.—Only those vibrations which recur within certain limits of frequency give a sensation of sound. These limits vary in different individuals. From 20 vibrations to 20,000 per second may be taken as the average range. Many animals hear sounds of much higher pitch than man is able to. On the other hand, fishes and many marine animals appear to be sensitive to relatively slow vibrations, but not to those more rapid.

The ear consists of three parts named the *outer*, *middle* and *inner ear* respectively. The outer ear collects sound waves, the middle ear transmits them to the inner ear which analyses them and converts them into nerve impulses, as which they are conducted to the brain, where they are received and interpreted. A description of the EAR is given under that heading. This section deals with its working, and with the adaptation of the structure of its various parts to the performance of their several functions.

The External Ear.—This is divided into the *auricle*, or flap of the ear, and the *meatus*. The human auricle acts, to a certain extent, as a collector of sound waves, but it is far inferior in this respect to the auricles of many animals, notably the horse and the ass. Sound waves are gathered up by the hollow recess, the concha, and projected forward on to the back of the tragus, by which they are directed into the skin-lined passage, the auditory meatus, which leads to the drum of the ear. The auricle loses some of its collecting power if the hollows of the *concha* and *tragus* are filled with wax. The form of the human auricle is adapted to collect sounds coming from the front. This is an advantage to man in communicating with his fellows, enabling him to concentrate both sight and hearing on the source of sound. Sounds are then conducted to both ears equally, and the one ear reinforces the other. When one ear is defective sounds are best heard by turning the better hearing ear to the source of sound. The advantage of correlating sight and hearing is then lost. Consequently, the deaf subject, when listening to conversation, places his open hand behind the auricle, and projects it forward, so as to increase its efficiency as a collector of sound coming from the front, whilst at the same time he is able to supplement his hearing by watching the motion of the lips of the speaker. The power of hearing sounds coming from one side is only slightly lessened when the auricle on that side has been lost as the result of injury. It would appear that the auricle, in spite of its beautiful modelling and delicate curves, is more ornamental than useful. Man possesses but little power of moving his ears, the muscles serving that function being rudimentary. Many animals can both rotate their ears, and expand them, thereby increasing their utility as sound collectors, and helping them to locate the direction of the sounds

The length of the auditory meatus is a little over 1 inch. The passage is irregular in width and curvature. This minimises resonance effects, but does not entirely obviate them. The intrinsic tone of the meatus varies in different individuals according to its size and shape, but is usually within the limits c^4 to g^6. Sounds of the same pitch are heard reinforced Helmholtz attributed the peculiarly penetrating quality of the note of the cricket to its pitch falling within this range.

The Middle Ear or Tympanum.—Waves of sound in air are of great length in comparison with the dimensions of the ear itself. They range from $\frac{3}{4}$in to 55ft. The function of the conducting mechanism of the middle ear is to convert the alternating compressions and rarefactions of the air in the meatus caused by sound waves into mechanical pushes and pulls of much smaller

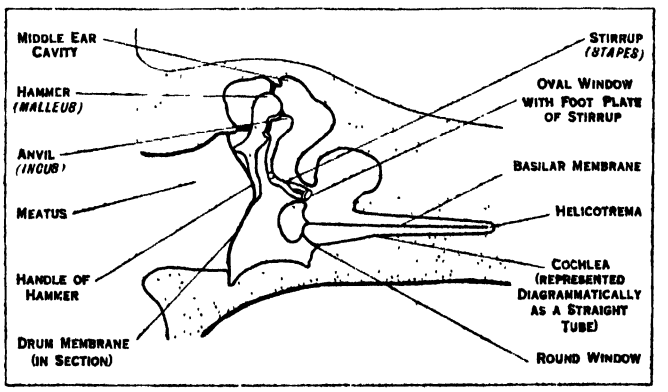

FIG. 1.—DIAGRAM OF SECTION THROUGH MIDDLE AND THE INTERNAL EAR
The drum membrane picks up the sound waves from the air in the meatus, and transmits them through the chain of small bones to the cochlea, where they are analyzed and transformed into stimulations of the nerve of hearing

range, but greatly increased force, on the footplate of the stapes, by which they are transmitted to the inner ear. The air waves in the meatus impinge on the *drum membrane*, which separates the outer from the middle ear. This is an extremely light and delicate structure. Its inertia is, consequently, very small, and it readily picks up the waves of sound without any perceptible lag, and its movements cease just as promptly when the sound ceases. Its vibrations are "dead beat." It is shaped in a subtle curve, slightly bulging in the lower half and indrawn in the upper half. Its centre, where it is attached to the tip of the malleus, is

retracted. Consequently, the fibres of which it is composed are not tense in any direction, and it has no inherent period of vibration to cause "distortion" of the sound waves. The movements of the drum membrane are communicated to a chain of small bones, the *auditory ossicles*. In birds and amphibia there is only one ossicle—the *columella*—a straight rod connecting the centre of the membrane to the oval window. In mammals the ossicles are three in number, the *malleus* or hammer, the *incus* or anvil, and the *stapes* or stirrup. The "handle" of the hammer is firmly incorporated with the upper half of the drum membrane. The anvil consists of a body having a slightly concave surface, and two processes, one long and one short. The surface in the body of the anvil is jointed on to the head of the hammer, so that the two together form a curved lever. The long process lies nearly parallel to the handle of the hammer, but is somewhat shorter. The short process of the anvil fits into a depression in the wall of the middle ear cavity above the level of the drum membrane. Both bones are suspended in position by fibrous bands strung across the cavity at this level, and these supports form the axis of the lever, round which it rotates. The long process is connected by a ball-and-socket joint to the head of the stirrup. The name of this ossicle exactly expresses its shape The footplate of the stirrup fits into an oval opening in the wall of the inner ear, named the *oval window,* to the margins of which it is connected by a fibrous membrane, but not sufficiently firmly to prevent a certain freedom of movement. The axis of the stirrup lies approximately parallel to the plane of movement of the curved lever formed by the hammer and anvil. The ratio of length of the short arm of the lever (*i.e.*, the long process of the anvil) to the long arm (*i.e.*, the handle of the hammer) is as 2:3. The amplitude of movement communicated by the lever to the stirrup is therefore only $\frac{2}{3}$ that of the tip of the handle of the hammer, but the force is increased in the proportion of 3:2. The movements of the stirrup within the nitch of the oval window are not those of a simple piston, but rather those of a trap door. Albert Gray has shown that the footplate moves as though pivoted on an axis transverse to its greatest length, at the junction of its posterior third and anterior two-thirds. Its maximum movement is, therefore, at its extreme anterior edge.

As the area of the drum membrane greatly exceeds that of the oval window, the pressure transmitted by the ossicles is concentrated. This fact, and the mechanical advantage at which the lever works, increases the force of the impulses transmitted from the drum membrane to the inner ear about ninety times.

The tension of the chain of ossicles is controlled by two small muscles, the *tensor tympani* which pulls the handle of the hammer inwards towards the inner ear, and the *stapedius* which pulls on one of the arms of the stirrup, so as to withdraw the footplate from the nitch of the oval window. The two muscles thus antagonise one another, and their combined action is to keep all the bones pressed closely into contact and to prevent any play in the joints by which they are connected. It is probable that this tightening up of the ossicular lever is part of the act of attention which distinguishes listening from casual hearing. The joint between the hammer and the anvil which connects the two arms of the lever is shaped so that it transmits directly pushes from the hammer to the anvil, but allows a certain amount of sliding movement when the hammer is pulled outwards. The advantage of this mechanism is probably as providing a safeguard against injury to the delicate structures of the inner ear in case of sudden distension of the middle ear cavity with air under pressure as may occur, for instance, in violent blowing of the nose. This forces the membrane and the hammer outwards, and would cause a violent drag on the footplate of the stirrup tending to wrench it out of the oval window, were it not for the forward slip of the hammer on the anvil, which breaks the force of the pull.

The middle ear cavity is filled with air. It has a ventilating shaft, the *Eustachian tube,* which communicates with the pharynx. In most people this tube is closed during rest, but opens with every swallowing movement, so that the air is frequently renewed, and its pressure is kept in equilibrium with that of the outer air. Unless this equilibrium is maintained the drum membrane is sucked inwards and rendered tense. This diminishes the acuteness of hearing, and causes a feeling of pressure in the ears. These symptoms are relieved by swallowing. This is a matter of common experience to aviators and miners when rapidly ascending to levels of lower, or descending to levels of higher atmospheric pressure. Partial or absolute blockage of the Eustachian tube is one of the commonest causes of deafness.

The Inner Ear or Labyrinth.—This consists of a complicated series of cavities and canals enclosed by hard bone, and filled with clear fluid. Within these are suspended a second series of sacs and tubes with extremely delicate membranous walls which are also filled with fluid, and are richly supplied with nerves. They contain the sense organs. There is no direct communication between the two concentric systems of cavities. It was formerly thought that the whole organ was concerned with hearing, but it is now generally recognized that only the anterior cavity, the *cochlea,* is sensitive to sound. The rest of the organ is concerned with the maintenance of equilibrium in the various postures assumed during rest and progression. (*See* EQUILIBRIUM)

The form of the cochlea exactly resembles a small snail shell, from which it takes its name. It measures ¼ by ¼in. It consists of a tube or tunnel coiled spirally two and a half turns, and is surrounded by dense bone. The total length of the tube is rather less than an inch and a half. It diminishes in diameter as the spiral is ascended, and is more closely coiled at its apex than at its base. A minute shelf of bone runs round the inner wall of the coiled tube, from the outer edge of which a fibrous membrane, the *basilar membrane,* stretches across to the outer wall, to which it is attached by the wedge shaped *spiral ligament*. The basilar membrane is built up of a large number (some 25,000) of fine transverse fibres, covered over on either side by layers of soft gelatinous cells. The sensitive elements of the cochlea are disposed along the upper surface of the membrane. The spiral lamina and basilar membrane thus divide the tube of the cochlea along its whole length into an upper and lower chamber, the partition being partly bony and partly membranous. A second partition, *Reissner's membrane*, runs obliquely from the spiral lamina to the outer wall of the cochlea, forming with the basilar membrane a triangular compartment within the upper chamber, to enclose the sense organ. The function of this membrane seems to be to separate the fluid surrounding the sense elements (*the endolymph*) from the surrounding fluid (*the perilymph*). The basilar membrane is not continued quite to the apex of the cochlea, there being a small gap beyond it, *the helicotrema,* by which the upper and lower chambers communicate. There are two openings in

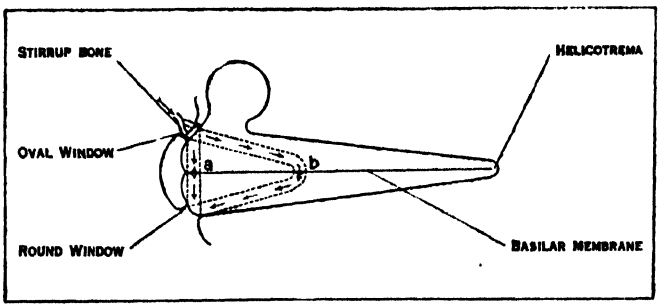

FIG. 2.—DIAGRAM SHOWING DIRECTION OF DISPLACEMENT OF FLUID, INDICATED BY ARROWS, WITHIN THE COCHLEA, WITH EACH IMPULSE TRANSMITTED FROM THE STIRRUP BONE, (a) FOR HIGH PITCHED TONE, (b) FOR MEDIUM PITCHED TONE

the bony wall separating the middle and inner ear. One, *the oval window,* is filled by the foot plate of the stapes. It opens into the upper compartment. The other, the *round window,* communicates with the lower compartment, and is filled by a rather slack membrane. (Figs. 2 and 3)

A simple diagram (fig. 2) will help to illustrate the mechanics of the inner ear. Suppose the cochlear tube to be rolled out straight, we have then a long tube, enclosed in rigid walls, divided horizontally by a yielding partition, the basilar membrane. At the near end we have the oval window opening into the upper

chamber, and the round window into the lower. At the far end is the helicotrema. Sound impulses transmitted from the drum membrane through the chain of ossicles to the stirrup tend to drive the foot plate inwards, and, consequently, to increase the pressure of the fluid within the cochlea. This causes the membrane of the round window to bulge outwards, as this is the only part of the enclosing walls which is not rigid. The consequent displacement of fluid must take place either through the helicotrema, or by bulging the basilar membrane downwards. It is only comparatively slow changes of pressure which cause to and fro movements at the helicotrema. Rapid alternations of pressure, such as those caused by sound waves, are transmitted through the cochlea across the basilar membrane, which is set in vibration. The movements of the basilar membrane stimulate the sensitive cells attached to its upper surface, by means of which a sense of hearing is aroused.

The Sensitive Mechanism.—The actual sense elements are certain elongated epithelial cells, each of which carries a row of fine hairs projecting from its free surface, called *hair cells*. In birds and amphibia the hair cells are simply packed in transverse rows on the basilar membrane. In mammals the cells are fewer in number, and are placed within the recesses of an elaborate supporting structure of *Corti's organ*, which lies on the inner half of the membrane. The framework of Corti's organ is composed of rather stiff fibres, which retain the delicate hair cells in position and protect them from pressure. This supporting framework also raises the free ends of the cells well above the surface of the basilar membrane, and increases their range of movement when the latter is vibrating. The sensory hairs project above the flat surface of Corti's organ into the substance of the *tectorial membrane*, which consists of a mass of soft jelly enmeshed in a fine network of fibres, and tethered to the outer end of the spiral lamina. Its purpose is to clog the movements of the hair processes, so that when Corti's organ is vibrating, the hairs are pulled first in one direction and then in another. Each hair cell has a nerve fibre attached to it. The hairs act like triggers. When pulled upon they release a discharge of energy from the hair cells, which travels as a nerve current through the auditory nerve to the hearing centre in the brain. According to Retzius there are about 20,000 auditory nerve-fibres connected with Corti's organ.

Analysis of Sound.—We not only hear sounds but we are able to interpret them. This implies that we distinguish the characteristic features of the different sounds which reach us. Sound waves differ in *intensity* and *pitch*. Intensity corresponds to the degree of condensation and rarefaction of the air in the successive phases of sound waves. Pitch signifies the number of waves arriving in a given time, or, what comes to the same thing, the duration of the individual waves. The greater the frequency the higher the pitch. Nearly all sounds we hear contain a mixture of pitches. In the case of *musical sounds* the form of the wave repeats itself regularly. In *noises* there is no such regularity. *Musical sounds* are either *simple tones*, which are made up of a succession of pendular vibrations all alike, or *compound tones*, composed of successive sets of waves of more or less irregular form, but each set repeating the form of the preceding set. According to Fourier's theorem any recurring wave form can be analysed in one way and in one way only, into a *fundamental* and *harmonics*. The fundamental is a simple tone having the same frequency as the recurring segment of the compound musical tone. The harmonics are all simple multiples of this number, *i.e.*, 2, 3, 4, 5, etc., times as frequent. These *partial tones* contained in the compound tone can be picked up separately by resonators. The trained musical ear can also detect them.

Noises, in spite of the irregularity of their wave forms, have pitch, or ranges of pitch, but these pitches are not so easy to detect as is the case with musical sounds. They too may be regarded as being composed of a number of different pitches, but the components are usually very numerous, and are not distributed in a harmonic series. The constituent pitches can, however, be picked out by resonators.

It follows that the nerve impulses which are sent to the brain from the cochlea must carry with them some criterion by which the *pitch* of the various constituents of the sounds may be recognised, and also the relative *intensity* of those constituents; and, further, if these two factors are determined, all sounds, musical or otherwise, can be distinguished. There is one other important characteristic of sound, and that is the rate at which the various alternations of pitch and intensity follow one another. In music this rate is regular and is called *rhythm*. In noises it is irregular, but it is none the less an important factor in determining the character of the noise.

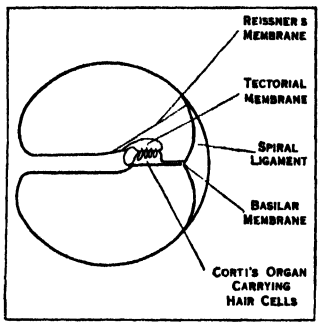

FIG. 3.—DIAGRAMMATIC SECTION ACROSS THE TUBE OF THE COCHLEA When the basilar membrane is vibrating, its movements are communicated to Corti's organ, on the upper surface of which are sensitive hair cells that project into the jelly mass of the tectorial membrane. The pulling of these hairs gives rise to the sensation of sound

Pitch Perception: Historical.—The problem of how we recognise the pitch of sounds, and detect the simple pitches contained in a compound tone, has for long been a subject of controversy. It follows from what has been said in the last paragraph that if it could be shown that the ear contains a series of resonators, each tuned to vibrate to notes of one pitch, and extending over the whole of the audible scale, and that if each of these resonators were connected by a nerve fibre to the brain, the problem would be solved in a simple manner. This explanation seems to have occurred independently to a number of the earlier investigators of the ear, amongst whom may be mentioned Cotugno, le Cat, Johannes Müller, Sir Charles Bell and Thomas Young. It was Helmholtz, however, who gave a definite form to the *resonance theory*, which is usually associated with his name. He based his conception on a generalization:—"The analysis of compound into simple pendular vibrations is an astounding property of the ear. When we turn to external nature for an analogue of such an analysis of periodic motion into simple motion, we find none but the phenomena of sympathetic resonance." Thus Helmholtz approached the study of the internal ear with the hope of recognizing in it the confirmation of this pronouncement. The anatomical evidence he was able to bring forward was, however, slight and unconvincing, and the objections were formidable. Not the least of these was the minute size of the cochlea. The fibres of which the basilar membrane is composed do not exceed $\frac{1}{500}$ of an inch at their longest, and yet it was supposed that they could vibrate to tones nearly two octaves below the pianoforte scale. At first enthusiastically received, there was subsequently a reaction in scientific opinion, and the theory for a long time was discredited. A number of alternative theories were proposed, none of which seems to offer a full explanation of the facts of hearing, while some have since been shown to be untenable. The theory most in favour for a time was the "telephone theory" of Rinne and Voltolini, which sought to evade this difficulty by referring pitch analysis to the brain. It was supposed that the whole basilar membrane vibrated like a telephone disc, and transmitted to the auditory nerve impulses which followed exactly every variation of frequency and intensity of the sound waves. It is now known that the nerve fibres do not conduct currents like the electric flow in wires, and that separate impulses are not transmitted at a greater rate than about 1,000 a second, a frequency much below that (viz., about 25,000) of the highest audible tones. So the theory fails.

The Resonance Theory of Pitch Perception.—Helmholtz' theory is that different pitches of sound impress themselves on the basilar membrane at different levels, and that, if the sound contains several pitches, each pitch causes a movement at a different level, and consequently stimulates a different set of nerves. The mechanical principle on which this happens is resonance. (*See* SOUND.) If a note of simple pitch be sounded near a harp or open piano, the string tuned to the same note is set in vibration, whilst the other strings remain silent. If a compound tone, such as a

vowel, is sung to the piano, the particular strings tuned to the various pitches contained in the compound tone each pick up the particular tone to which they are in tune, and a sound is given out by the combined vibration of these strings which can be recognized as the particular vowel sung. Helmholtz compared the transverse fibres composing the basilar membrane to the strings of a piano, and he suggested that each fibre or small group of fibres, was tuned to vibrate to one particular pitch. This conception was supported by Hensen's observation that the length of the fibres increases as the basilar membrane ascends towards the apex of the cochlea. The pitch of a stretched string depends on its length, its tension, and its mass, according to the formula for vibrating strings: $n=\frac{1}{l}\sqrt{\frac{t}{m}}$, when n = number of vibrations per sec., l = length in centimetres, t = tension in dynes, and m = mass in grammes of 1 cm. length of the string. Short, light, tense strings give high pitched tones; long, relatively loose and heavy strings give low tones.

The Resonating Mechanism of the Cochlea.—If the fibres of the basilar membrane are tuned to respond to tones ranging over ten octaves, they should show a wide range of variation in the factors, *length, tension* and *mass*. If this variation were in length alone, the longest fibres would have to be 1,000 times longer than the shortest. If they differed in mass, or in tension alone, the corresponding variations would have to be as 1:1,000,000. Measurements show a difference of a little more than 1:3 in the length of the fibres. By itself this is only sufficient to account for a range of less than one and a half octaves. The evidence for variation in tension was supplied by Dr. A. A. Gray of Glasgow in 1900, in his observations on the spiral ligament. This structure attaches the basilar membrane to the outer wall of the cochlea. It is made up of fine fibres, radiating fanwise from the outer end of the basilar fibres. Its most striking feature is a gradual increase in bulk and density from the apical to the basal end of the cochlea. This seems to point clearly to a corresponding increase in tension on the fibres to which it is connected. The tension would be greatest on the shortest fibres and least on the longest fibres, as required by theory. With regard to differentiation by mass, we have to consider not merely the mass of the fibres themselves, but also the load they carry. The load is supplied by the fluid in which they are immersed. Supposing the fibres to be vibrating at any particular level of the cochlea, there must be a corresponding oscillation of the fluid intervening between the vibrating fibres and the round and oval windows (*see* fig. 2). The further the level of vibration is from the windows, the greater will be the mass of fluid moving. Consequently, the more distant the fibres, the more heavily are they loaded. Thus the variations in all the three factors, length, tension and mass, are in accordance with the supposition that the fibres are tuned to a progressive range of pitch. This cannot be taken as an absolute proof of the theory, but it adds substance and verisimilitude to what appears at first sight a rather fanciful conception. In particular, the recognition of the part played by the fluid load explains the difficulty arising from the minute scale of the resonators. The fibres, though short, are very heavily weighted. This lowers their pitch. A model devised by Wilkinson embodies the mechanical principles outlined in the preceding paragraph. It represents a basilar membrane and round and oval windows in their relative positions. It is filled with water. Tuning forks applied to the stirrup set the basilar membrane vibrating at levels varying with the pitch of the tuning forks employed. The model illustrated roughly the supposed resonating mechanism of the cochlea.

Physiological Evidence in Favour of the Resonance Theory.—Yoshi showed that long continued subjection of guinea pigs to tones of one pitch produced damage to the cochlea at levels varying with the pitch. High pitched tones damaged the basal coil whilst lower pitches affected levels nearer the apex. Ritchie Rodger and Putelli found that in boiler makers' deafness loss of hearing was principally for those tones to which they were constantly subjected whilst at work. Weinberg and Allen found that fatigue induced by tones of one pitch caused relative deafness for that pitch, but not for other pitches. All these observations tend to show the existence of separate pitch receptors in the ear, and those of Yoshi afford evidence that these receptors form a graduated series at different levels of the cochlea. Though by no means universally accepted, the resonance theory is advancing in favour with physiologists, as it is recognised that it offers a reasonable explanation of the main facts of hearing.

One great difficulty with the resonance (or any other) theory of hearing is that it seems impossible that the localisation of the vibration in the basilar membrane can correspond in sharpness and definition with the sense of pitch aroused Some vibrations of fibres on either side of the maximum point must take place. How then do we hear a sound of single pitch? At present this question cannot be answered. Further research on the subject of the integration of nerve impulses may throw light on it. A. A. Gray has indicated a similar paradox in the sense of touch. When a small area of the skin is pressed upon by a blunt point, we feel the pressure at its point of maximum incidence, not on the whole area. Similarly we refer pitch to the level of maximum vibration of the basilar membrane.

The only serious rival of the resonance theory is Ewald's. From observations made on a model designed to illustrate the movements of the basilar membrane, he concluded that sound impulses evoke a number of evenly spaced "stationary waves" in the membrane, and that the number of these waves is different for each pitch. The membrane he used was not differentiated as to length, tension or mass. Consequently his conclusions can only have weight if the evidence for such differentiation in the cochlea is rejected. The application of his conception to the facts of hearing is full of difficulties. The same may be said of the "travelling bulge" theories of Hurst, Meyer and Ter Kuile which at one time met with considerable favour.

Perception of Intensity of Sound.—Sounds must have a certain intensity before they can be heard, but the ear is wonderfully sensitive. Rayleigh computed that the minimal energy of sound capable of being perceived by the cochlea is much the same as that of light exciting the retina, and that "the ear is able to recognise the addition and subtraction of densities far less than those to be found in our highest vacua." The sensitivity is greatest for pitches ranging from 500 to 6,000 vibrations a second. This range comprises the higher partial tones of human speech on which the distinction between the various vowels and consonants depends.

Perception of intensity of sound accords with Weber's law, which states that in order to produce a perceptible increase in intensity of a sensation an equal fraction must be added to the previous intensity of the stimulus, whatever its value This means that the ear detects much smaller differences in loudness in weak than in loud sounds.

The Nature of Nerve Impulses.—The nerve current by means of which messages are conveyed to and from the brain is not continuous, like an electric current flowing in a battery circuit, but is made up from a succession of separate impulses, all of the same strength. Adrian has recently shown that intensity of sensation is dependent on the rate at which these impulses follow one another. The rhythm of the impulses in the auditory nerve depends on intensity, not on pitch. This finally disposes of the "central analysis" of pitch theory. When the ear receives a number of sounds at the same time we distinguish not only their relative pitch, but their relative loudness. This fact seems to indicate that each constituent of the sound is separately impressed on the basilar membrane at its appropriate pitch level, and with its appropriate amplitude of vibration

Location of Sound.—Our judgment of the direction from which sound is reaching us depends mainly on the relative intensity of the sound in the two ears, it being loudest in the ear turned to the source. Location can be assisted by turning the head in different directions. High pitched sounds of short wave length cast a shadow, but low pitched sounds of long wave length bend round the head, and are heard with indistinguishable intensity in the two ears. Consequently pure tones of low pitch are difficult to locate. In the case of compound tones, the character of the sound in the two ears is altered by the weakening of the higher pitched

partials on the side of the sound shadow, and this gives a criterion for judgment of direction. It even makes it possible for familiar sounds to be located by persons deaf in one ear.

Beats.—According to the principle of interference (*see* SOUND) when two notes nearly of the same pitch are sounded together they will alternately augment and diminish each other. This gives rise to "beats." The number of beats per second equals the difference in number of vibrations in the two tones. The beats are heard as rhythmic variations in intensity. When they follow one another rapidly they are accompanied by a disagreeable sensation of roughness, which is at a maximum when the beats are about 32 a second. Helmholtz ascribed this roughness to an overlapping of the area of the basilar membrane set in vibration by each tone separately. The pitch of the two tones is distinguished by the relative position of the maximum points of the disturbance. As these points at either end of the disturbed area are vibrating at different rates the intermediate portion of the membrane will be moving in an irregular "flickering" manner. It is this "flickering" that causes the unpleasant roughness. With greater differences of pitch the maximum points are further apart, and the overlapping is less, or entirely absent.

Combination Tones.—When two tones of different pitch are sounded together moderately loud, both are heard separately, and there may also be heard a deeper tone of a frequency equal to the difference between the frequencies of the other two; for example, two tuning forks of 800 d.v. and 1,024 d.v. respectively yield a *difference tone* of 224 d v. There is also another combination tone, the *summational tone*, whose frequency is the sum of the two tones evoking it. It is much more difficult to hear, and to explain. The numerical relationship of the difference tone to the generating tones is the same as that of beats, and it is usually held that the beats generate this tone when they become sufficiently rapid. However, the roughness of beats and the difference tone can sometimes be heard together, which seems to indicate that they act in a different way on the cochlea. Much controversy has raged on the subject of beats and combination tones, and it is argued that if the ear works on the principle of resonance they ought not to be heard. This would be true if the conducting mechanism of the ear were entirely free from distortion, and if the cochlea were a perfect resonator. It is probable that the ear fulfils neither of these conditions.

Consonance and Dissonance.—Some combinations of tones blend together and appear smooth, others appear to be rough. The smooth or *consonance* intervals in music correspond to simple numerical relationships between the number of vibrations of their components. All the harmonic partials with frequencies 1:2 (octave), 1:3 (twelfth), 1:4 (double octave), and so on, are perfectly consonant. Then follow in order of lessening consonance the intervals 2:3 (fifth) and 3:4 (fourth); then with increasing dissonance 3:5 (major sixth), 4:5 (major third), 5:8 (minor sixth) and 5:6 (minor third). Helmholtz pointed out that the simpler the numerical relationship between two tones, the more evenly spaced on the scale, in relation to one another, are the two series of harmonic partials accompanying each fundamental tone. Assuming a similar distribution of the vibrating levels produced by each of these partial tones on the basilar membrane, there would be least overlapping of the areas occupied by the several tones when the frequencies of the two primaries had the simple relationship characterizing consonant intervals. Dissonance he attributed to roughness produced by overlapping of the vibrating areas of either the primary tones or their harmonics. This might account for the quality of dissonance, but is an insufficient explanation of consonance, which is more than a mere absence of dissonance. There is a unity, a sense of blending, in consonance which is not a purely negative feature. The octave interval is unique. There is a sense of identity in tones an octave apart. They are felt to be the end of one stage and the beginning of another. Modern music makes free use of dissonant intervals, but it is built up on a background or framework of simple tonal relationships. Whether this has developed out of the exigencies of tuning in stringed instruments, or is imposed by some inherent graduation of the scale of the basilar membrane on the basis of harmonic intervals, is too speculative a subject to be discussed here.

The subject of hearing has always been regarded as one of the most difficult problems of physiology. The cochlea is a small and extremely delicate organ deeply buried within recesses of one of the hardest bones in the body. This greatly increases the difficulty of investigating its structure and function. Many of the problems connected with hearing are still obscure, and call for further research. (G. WI.)

HEARING, SENSE OF. The power of hearing, that is to say of perceiving waves of sound which are propagated in the atmosphere, has as yet been found, apart from the four-legged vertebrates, only in certain insects. The sense of hearing in animals is used chiefly in the seeking out of the sexes by each other; it is, indeed, usually the male which produces the sounds, and by the strength of the notes attracts the female. This applies just as much to crickets and grasshoppers as to frogs and birds. In many mammals also, the voice and the sense of hearing are very clearly associated with mating: we have but to think of the belling of the stag.

When the sense of hearing serves other purposes also, such as the avoidance of enemies, or, among gregarious animals, mutual understanding, it is a derivative condition of late development, which is found only in the highest animals, the birds and mammals, perhaps in some reptiles also. The frog pays no heed to the noise made by an approaching man, it is only when it sees him that it takes to the water. Crickets and grasshoppers behave in a corresponding manner.

The structure of the auditory organs has certain features in common in all animals, therefore also in the insects which we are about to consider more closely. A tympanum is always present, that is a stretched membrane, which catches the waves of sound, and is thus made to vibrate. In the most simple form, the sensory cells which are affected by sound waves are attached directly to the tympanum (as in Lepidoptera, grasshoppers and cicadas).

Only in the green grasshoppers do we find the sensory cells separated from the tympanum, as they are in vertebrates. The transmission of sound, in these animals, takes place in the following manner. The tympanic membrane is set in vibration; these vibrations are communicated to the tracheal vesicles, which adjoin the inner side of the tympanic membrane, and it is these secondary vibrations which stimulate the sensory cells. The arrangement of the sensory cells is difficult to describe in detail, and is best shown by the accompanying figures. Usually, each sensory cell in the ear of an insect is like a stretched chord, and therefore is particularly sensitive to vibrations. In the green grasshoppers, the arrangement of the cells is similar to that of a pianoforte, they increase in size regularly from one end of the organ to the other. Apparently, the different-sized cells react to different sounds, but of this we do not know anything for certain.

It is remarkable that the auditory organs of insects are not situated in the head, as we are accustomed to find in vertebrates. In crickets and green grasshoppers they are situated on the front legs; in grasshoppers, cicadas and Lepidoptera on the body.

Exact experiments to prove the power of hearing in insects have been made principally by Regen, of Vienna, who used crickets. For this purpose, he made use chiefly of the well-known singing match of the male crickets, which we may so often hear in the meadows in summertime. The insects chirp alternately, and excite one another to rivalry. In 500 experiments with normal insects, this alternate chirping took place 349 times: in experiments with insects in which the auditory organs had been previously destroyed, the singing match was observed only 13 times out of 500. From this it follows, not only that the crickets are indeed able to hear, but also, that they do so with the aid of those organs, which, from their structure, we consider to be auditory organs.

Of even greater importance are the researches of this investigator on the attraction of the female by the chirping of the male. Regen was able to show that the female cricket makes straight for the cage which contains the chirping male, although he is hidden from her sight. If the auditory organs of the female are

removed, this reaction ceases immediately. It is of particular technical interest that the chirping of the male can be conveyed over the telephone in the same way as the human voice. It may then be observed that a female situated in a quite different place will spring towards the apparatus which reproduces the sounds, just as if the male were really there.

Of the other insects which possess the power of hearing only the nocturnal Lepidoptera (owlet-moths and Geometridae) have as yet been studied. These, however, show a quite different condition.

Lepidoptera are, with only very few exceptions, dumb. They thus form an exception to the rule according to which only those animals, in general, can hear which also produce sounds. They react apparently only to the sounds made by their chief enemies, bats. Eggers was indeed able to show that squeaking sounds will induce nocturnal Lepidoptera to take to flight. The insects will swerve when actually in flight as soon as they hear this noise, thus, undoubtedly, avoiding the enemy which produces it. Some species which feign death when danger threatens react also to squeaking sounds in this characteristic manner.

In addition to these examples, there are numerous observations which show that, sometimes, those insects also which have no definitely specialised auditory organs may react to sounds.

Swarms of gnats become restless at the whistle of an engine Water-beetles hastily dive below the surface when a particular high note is sounded in the neighbourhood of their aquarium. In these cases, the sound waves apparently affect hairs of some kind or another which vibrate in harmony with a particular note. We can hardly say, in these instances, that the insects *hear*. Man also is able to perceive acoustic vibrations with the hand, as, for instance, if he touches a box upon which is placed a vibrating tuning-fork. In this instance, he perceives the vibrations by means of the sense of touch, and the previously mentioned reactions of insects must also be considered as of this nature

THE STATIC SENSE

In the lower animals, we frequently find sense-organs which were formerly considered, from their anatomical structure, to be auditory organs. We now know that they have a very different function, namely, to react to the stimulus of gravity The structure and function of such a statocyst can be described in a few words. It usually consists of a ball-shaped vesicle, in the interior of which are two substances of different weight, a liquid, and a so-called *otolith*, which is better termed a *statolith*.

The latter, because of its greater specific gravity, always occupies the deepest portion of the vesicle. Such an organ serves, above all, to maintain equilibrium in flying or swimming. All flying and swimming animals take up a definite normal position during motion. Usually, they keep the back upwards (fishes, birds, most crustaceans); a few crustaceans swim with the ventral surface upwards. When the animal is in the normal position, the statolith is always in contact with a definite point in the vesicle wall, which is called the "normal point." If, for any reason, the animal fails to maintain its balance, the statolith now touches a different point in the sensitive vesicle wall. The stimulated sensory cells send an impulse to the brain, and this brings about a regulatory movement of the legs, fins, or wings, which brings the animal again into the normal position. The creature is thus automatically kept in equilibrium by the statocyst. We find such organs of equilibration in the Decapod Crustacea, in cuttlefish, and in swimming gasteropods and bivalves. Organs corresponding exactly anatomically to these are found in gasteropods and bivalves generally, but, as yet, we know nothing for certain about their function. Lastly, all vertebrates, also, have typical organs of equilibration.

The most simple method of proving experimentally that, in such cases, we are dealing with organs of equilibration is to remove the statocysts. Delage was the first to do this. If both of the balancing organs of a free-swimming gasteropod (*Pterotrachea*), of a crustacean (*Palaemon, Mysis*), or of some kind of fish are destroyed, the animal shows itself to be completely disorientated. It revolves about its longitudinal axis in swimming, turns somersaults, and so on. In some cases, certainly, we have also to take into consideration the eyes. Crustaceans which are strong swimmers orientate themselves by means of the eyes as well as by the statocysts. They place themselves so that the light falls on their backs. Since, in the water, the light always comes from above, the correct swimming position of the animal is ensured by this attitude.

For this reason, no alteration in behaviour is to be observed in such a crustacean, under normal conditions of light, if the statocysts only are removed. If, however, the animal is, at the same time, deprived of its sight, it becomes completely disorientated; if the light is caused to fall upon it from below, it swims upon its back instead of upon its ventral side.

In addition to this method of investigating experimentally by operation the function on the statocysts, there is a second which can be applied to Crustacea. At the time of moulting, when the crustacean casts the whole of the chitinous covering of its body, the inner surfaces of the statocysts and the statoliths are also shed After the moult, the creature, using its pincers, places new statoliths, usually sand-grains, in its statocysts, which are open to the exterior. If the animal is not supplied with sand, but instead is given filings of iron or nickel, it will employ these as statoliths, and thus we get an animal with statoliths which are sensitive to magnetic influences (Kreidl). If, while the creature remains quiet on the ground, we now hold a strong electro-magnet over its back, the iron statoliths are attracted to the dorsal region. They are now in exactly the same position as they occupy when a normal animal falls on its back. Just as in such an animal, the reaction to the stimulation of the sensory hairs appears as a regulatory movement through an angle of 180°. The animal throws itself violently upon its back, the statoliths, attracted by the magnet, come into contact with the ventral surface of the statocysts, and remain in this position, which is the normal one when the creature is in its ordinary attitude.

If one statocyst is left in the animal to be studied, it shows characteristic differences according to the species to which it belongs. Some, such as the freshwater crayfish, or the free-swimming gasteropods, are already very disturbed by this operation; they revolve about their longitudinal axes in swimming, to the right or to the left, according as the left or the right organ is missing.

Other species, such as certain strong-swimming crustaceans (*Mysis, Palaemon*) show, on the contrary, no disturbance. We may say, therefore, that in these animals one statocyst alone is sufficient to maintain equilibrium, while, in the others, the co-operation of both organs is necessary for normal functioning. This condition has been more definitely analysed. We may imagine that the two statocysts always work the one against the other. When the animal is in the normal position, the two statocysts function with equal strength, but are opposed the one to the other. In functioning, therefore, the one compensates the other. If, however, the animal is in an oblique position, the lower functions more vigorously than the upper, and brings about a return to the normal position.

The fact that the scallop and its relations possess asymmetrical statocysts is of some theoretical interest. The left one works more strongly than the right. While a normal symmetrical animal, from being in an oblique position finds itself back in the normal one, in which the plane of symmetry is vertical, just the opposite happens in the case of these bivalves, which, strange to say, are able to swim. If they are placed in water so that their median plane is vertical, they turn in swimming back into an oblique position, which for them is the normal one.

The statocysts have a quite different structure in some animals, in jellyfish, among others. These creatures, which float about upon the open sea, bear, on the margin of the umbrella, eight peculiar sense organs, which usually take the form of club-shaped projections, weighted at one end with crystals (auditory concretions). According to the position which such a tentaculocyst occupies in space, there is a difference in the pressure and pull on the nervous tissue at its base, and, therefore, the effect upon the swimming muscles, which are in connection with the nervous system, also differs. For this reason, the jellyfish Cotylorhiza

shows, when swimming, as is usual, in a vertical position, an equal activity in all its swimming muscles, which are drawn up into a ring. If, however, the animal is placed on its side, the tentaculocysts below and above occupy quite different positions; in the lower there is a stronger movement than in the upper, and the creature rights itself again. In most of the other jellyfish matters are indeed somewhat different, and are not yet fully understood.

While in all the cases previously mentioned the statocysts bring about compensatory movements which bring the animal, if it loses its balance, back into the normal position, we know, on the other hand, of instances in which such compensation is completely lacking. The common crab, which, as a rule, does not swim, but creeps about upon the floor of the sea, shows a very peculiar connection between the statocysts and the stalked eyes.

If such an animal is moved about in the hand, it may be seen that the stalked eyes endeavour to hold their field of vision, and move so that they adjust the effect of the movements of the body upon the field of vision. For example, if the crab is turned about its transverse axis, so that the head is downwards, the stalked eyes are directed upwards; they are turned downwards if the head region is raised. The meaning of this phenomenon at once becomes clear if we consider the behaviour of human beings.

Man also is able to move his head about in space, at will; to raise it, lower it, move it backwards or forwards, and, in spite of all these movements, is able to keep his eyes fixed on a particular object.

In both cases, in mammals and in crustaceans, it can be proved that the movements of the muscles of the eyes are chiefly determined by the organs of equilibration. If the statocysts of a crustacean are removed, these movements of the stalked eyes are no longer to be observed. To each position of the body in space there corresponds a single position of the eyes in relation to the body with which it is very closely bound up. The tendency of the eyes is always to adjust their position so that it will correspond to the position of the body in space.

In many cases, the statocyst does not serve in any way as an organ of equilibration, but makes it possible for the animal to move vertically upwards or downwards (positive and negative geotaxis). This kind of movement is found chiefly in animals which live in sand or marine ooze. It can easily be understood that, for certain functions of life, these creatures must be able to reach the open water above them, for example, for the deposition of eggs; on the other hand, they must also be able to withdraw into the sheltering sand when danger threatens. If we consider a worm which bears in its head a pair of such statocysts, we shall see that, in order to make sure of reaching the depths, it has only to place itself so that the statoliths touch the foremost points of the statocysts. The common lug-worm of the European coasts (*Arenicola marina*) is such an animal, so also are certain Holothurians (*Synapta*), and, lastly, the mud-dwelling isopods of the genera Anthura and Cyanthura. Negative geotaxis, which directs the animal vertically upwards, can best be observed in our terrestrial gasteropods. If a handful of such creatures is thrown into a vessel full of water, they all creep vertically upwards on the glass wall, and thus escape death by drowning. It is probable that this movement also is connected with the statocysts, but, at present, there is no proof of this.

It is of interest, that an array of cases is known to science in which an active maintenance of equilibrium, or a strong geotactic movement is indeed present, but in which statocysts are absent. The anatomy of the majority of animals is so well-known today that it is very unlikely that organs exist which have been overlooked. We are forced to the conclusion that other organs have an auxiliary function as statocysts. In most animals, the internal organs are suspended from the abdominal wall by a number of slings, just as in man. It has been proved in some cases that the internal organs take over, in a certain measure, the rôle of statocysts. In accordance with the position which the animal occupies in space, the direction of the pull upon the suspensory sheets varies. This enables the animal to perceive its position in space. The starfish affords a fine example of this. If it is placed upon its back, it turns over again. If the stomach is filled with iron filings, the animal lying upon its back, and an electro-magnet is brought near the ventral surface, the animal does not turn over, since the suspensory organs are now subjected to the same pull as that which they sustain when the creature is in its normal position. Geotactic movements in the absence of statocysts occur very frequently. They may be observed in sea-anemones, starfish and many other animals. (W. v. Bud.)

HEARN, LAFCADIO (1850–1904), author of books about Japan, was born on June 27, 1850 in Leucadia (pronounced Lefcadia, whence his name, which was one adopted by himself), one of the Greek Ionian islands. He was the son of Surgeon-major Charles Hearn, of King's County, Ireland, who, during the English occupation of the Ionian islands, was station there, and who married a Greek wife. Artistic and rather bohemian tastes were in Lafcadio Hearn's blood. His father's brother Richard was at one time a well-known member of the Barbizon set of artists, though he made no mark as a painter through his lack of energy. Young Hearn had rather a casual education, but was for a time (1865) at Ushaw Roman Catholic college, Durham. The religious faith in which he was brought up was, however, soon lost; and at 19, being thrown on his own resources, he went to America and at first picked up a living in the lower grades of newspaper work. The details are obscure, but he continued to occupy himself with journalism and with out-of-the-way observation and reading, and meanwhile his erratic, romantic and rather morbid idiosyncrasies developed. He was for some time in New Orleans, writing for the *Times Democrat,* and was sent by that paper for two years as correspondent to the West Indies, where he gathered material for his *Two Years in the French West Indies* (1890). At last, in 1891, he went to Japan with a commission as a newspaper correspondent, which was quickly broken off. But here he found his true sphere.

The list of his books on Japanese subjects tells its own tale: *Glimpses of Unfamiliar Japan* (1894); *Out of the East* (1895); *Kokoro* (1896); *Gleanings in Buddha Fields* (1897); *Exotics and Retrospections* (1898); *In Ghostly Japan* (1899); *Shadowings* (1900); *A Japanese Miscellany* (1901); *Kotto* (1902); *Japanese Fairy Tales* and *Kwaidan* (1903), and (published just after his death) *Japan, an Attempt at Interpretation* (1904), a study full of knowledge and insight. He became a teacher of English at the University of Tokyo, and soon fell completely under the spell of Japanese ideas. He married a Japanese wife, became a naturalized Japanese under the name of Yakumo Koizumi, and adopted the Buddhist religion. For the last two years of his life (he died on Sept. 26, 1904) his health was failing, and he was deprived of his lectureship at the university. But he had gradually become known to the world at large by the originality, power and literary charm of his writings. Lafcadio Hearn's books were indeed unique for their day in the literature about Japan, in their combination of real knowledge with a literary art which is often exquisite.

See Elizabeth Bisland, *The Life and Letters of Lafcadio Hearn* (2 vols., 1906); G. M. Gould, *Concerning Lafcadio Hearn* (1908).

HEARNE, SAMUEL (1745–1792), English explorer, was born in London. In 1756 he entered the navy, and was some time with Lord Hood; at the end of the Seven Years' War (1763) he took service with the Hudson's Bay Company. In 1768 he examined portions of the Hudson Bay coasts with a view to improving the cod fishery, and in 1769–1772 he was employed in north-western discovery, searching especially for certain copper mines described by Indians. His first attempt (Nov. 1769) failed through the desertion of his Indians; his second (Feb. 1770) through the breaking of his quadrant; but in his third (Dec. 1770 to June 1772) he was successful, not only discovering the copper of the Coppermine river basin, but tracing this river to the Arctic Ocean. He reappeared at Fort Prince of Wales on June 30, 1772. Becoming governor of this fort in 1775, he was taken prisoner by the French under La Pérouse in 1782. He returned to England in 1787 and died there in 1792.

See his posthumous *Journey from Prince of Wales Fort in Hudson's Bay to the Northern Ocean* (London, 1795).

HEARNE, THOMAS (1678–1735), English antiquary, was born in July 1678 at Littlefield Green, White Waltham, Berk-

shire, son of the parish clerk. Educated at St. Edmund Hall, Oxford, he became in 1699 assistant keeper of the Bodleian Library, where he worked on the catalogue of books, and in 1712 he was appointed second keeper. As a nonjuror he refused to take the oaths of allegiance to King George I, and early in 1716 he was deprived of his librarianship He continued to reside in Oxford, and occupied himself in editing the English chroniclers. He died on June 10, 1735.

Hearne's most important work was done as editor of many of the English chroniclers, and until the appearance of the "Rolls" series his editions were in many cases the only ones extant. Very carefully prepared, they are still of the greatest value to historical students. Perhaps the most important of a long list are Benedict of Peterborough's (Benedictus Abbas) *De vita et gesta Henrici II. et Ricardi I.* (1735); John of Fordun's *Scotichronicon* (1722); the monk of Evesham's *Historia vitae et regni Ricardi* (1729); Robert of Gloucester's *Chronicle* (1724); the *Vita et gesta Henrici V*, wrongly attributed to Thomas Elmham (1727); Titus Livy's *Vita Henrici V.* (1716); Walter of Hemingburgh's *Chronicon* (1731); and William of Newburgh's *Historia rerum Anglicarum* (1719). He also edited John Leland's *Itinerary* (1710–12) and the same author's *Collectanea* (1715); W. Camden's *Annales rerum Anglicarum et Hibernicarum regnante Elizabetha* (1717); Sir John Spelman's *Life of Alfred* (1709); and W. Roper's *Life of Sir Thomas More* (1716). Among his other compilations may be mentioned *Reliquiae Bodleianae* (1703).

Hearne left his mss. to William Bedford, who sold them to Dr. Richard Rawlinson, who in his turn bequeathed them to the Bodleian. Two volumes of extracts from his voluminous diary were published by Philip Bliss (Oxford, 1857), and afterwards an enlarged edition in three volumes appeared (1869). A large part of his diary entitled *Remarks and Collections, 1705–1714*, edited by C. E. Doble and D. W. Rannie, has been published by the Oxford Historical Society (1885–98). *Bibliotheca Hearniana*, excerpts from the catalogue of Hearne's library, has been edited by B. Botfield (1848).

See *Impartial Memorials of the Life and Writings of Thomas Hearne by several hands* (1736); and W. D Macray, *Annals of the Bodleian Library* (1890). Hearne's autobiography is published in W. Huddesford's *Lives of Leland, Hearne and Wood* (1772). T. Ouvry's *Letters addressed to Thomas Hearne* has been privately printed (1874).

HEARSAY, a legal term signifying facts given in evidence derived from indirect information, the circumstances under which such evidence is admitted being subject to considerable limitations. *See* EVIDENCE.

HEARSE, a vehicle for the conveyance of a dead body at a funeral (Fr. *herse*, a harrow), usually a four-wheeled car, with a roofed and enclosed body, which contains the coffin. This is the only current use of the word. Its earlier form was "herse," and meant, as the French word did, a harrow (*q.v.*). It was then used of a portcullis, and thus becomes a heraldic term, the "herse" being frequently borne as a "charge," as in the arms of the City of Westminster. In funeral ceremonies a "herse" or "hearse" seems first to have been a harrow-shaped framework of wood, to hold lighted tapers and decorations placed on a coffin; this developed into a pagoda-shaped erection of woodwork or metal for the funerals of royal or other distinguished persons. This held banners, candles, armorial bearings and other heraldic devices. An elaborate "hearse" was designed by Inigo Jones for the funeral of James I. The "hearse" is also found as a permanent erection, of iron or other metal, over tombs. There is a brass "hearse" in the Beauchamp chapel at Warwick castle, and one over the tomb of Robert Marmion and his wife at Tanfield church near Ripon.

HEARST, WILLIAM RANDOLPH (1863–), American publisher, was born in San Francisco in April 1863, the son of George Hearst, a California pioneer who amassed a large fortune in ranch and mining lands, and who served as U.S. senator from 1886 to 1893. He entered Harvard in 1882 and remained two years. Becoming interested in journalism, he visited Boston newspaper offices, studied newspapers from all parts of the country, and paid special attention to the success of the New York *World* under Joseph Pulitzer. On his return to California he took first, partial and in 1887 complete control of the San Francisco *Examiner*, which the elder Hearst had bought for political objects. Within two years he made this journal pay, and with an efficient staff used it for many newspaper experiments.

Hearst invaded New York journalism in Sept. 1895 by buying the unsuccessful *Morning Journal*, which he made a one-cent newspaper of highly popular type. To it he brought many able workers, including Julian Hawthorne, E. W. Townsend, Stephen Crane, Julian Ralph, and the cartoonist Homer Davenport, while he immediately raided the New York *World* for the best members of Pulitzer's Sunday staff, including R. F. Outcault, the inventor of the modern coloured comic pictures. By the use of numerous illustrations, coloured magazine sections and glaring headlines, by sensational articles on crime and pseudo-scientific topics, and by a jingo policy in foreign affairs, the *Journal* (an evening edition was started in 1896) was shortly given an unprecedented circulation. On the day after the election in 1896 it printed 1,506,000 copies of its several editions. Under Hearst's control the *Journal* attacked England in the Venezuela affairs, supported Bryan in 1896, demanded war with Spain in 1897–98, launched a series of attacks against municipal "franchise grabs" and supported Bryan again in 1900, bitterly assailing McKinley and Mark Hanna as tools of the trusts. An editorial statement in April 1901 that "if bad institutions and bad men can be got rid of only by killing, then the killing must be done," led Roosevelt in his first message after McKinley's assassination to denounce "exploiters of sensationalism" in words which he later (1906) declared he meant for Hearst.

The success of the *Journal* led Hearst to establish the Chicago *American* in 1900, the Chicago *Examiner* in 1902, and the Boston *American* in 1904 Other newspapers were purchased in 1912, and in 1917 he launched an energetic policy of expansion, so that by 1925 he owned 25 newspapers in 17 cities, including every section of the United States. After 1904, when he supported Parker, he paid decreasing attention to editorial leadership, declaring in 1924 that "newspapers do not form the opinion of the public, but if they are to be successful they must express the opinion of the public." But he supported Wilson in 1912 and 1916; he opposed American entrance into the World War; he waged unremitting warfare against the League of Nations, and demanded payment of the war debts in full. Late in 1916 the British and French governments denied Hearst the use of their mails and cables. But in 1927 he suddenly emerged as the champion of a bond of close friendship and practical co-operation among all English-speaking countries, and vigorously pushed the proposal. In the 1928 campaign he favoured the Republican national ticket. All his newspapers made use of common features and articles, all showed a modified sensationalism, and with wide variations in State politics, all expressed the same national views. Meanwhile, he embarked in other publishing enterprises. He purchased the *Cosmopolitan* monthly in 1905, the *World To-day* in 1911, and *Harper's Bazaar* and other magazines, including *Nash's Magazine* in England, at later dates. He published books, chiefly fiction, and later in his career produced motion pictures on a large scale.

Hearst's rôle in politics was ambitious but unsuccessful. While serving two inactive terms in the national House (1903–07), he ran in 1905 for mayor of New York on an anti-Tammany municipal ownership ticket, and came within 3,000 votes of winning; and the following year, as Democratic nominee for governor of New York he was defeated by Charles E. Hughes. A heavier defeat for mayor of New York followed in 1909, and though he was later frequently suggested for mayor or governor till his quarrel with Alfred E. Smith in 1924 destroyed his Democratic following, he was never again nominated. His importance has lain in the huge scale of his newspaper operations, and though he hardly ranks as a great innovator—his sensationalism imitated Pulitzer's, while E W. Scripps preceded him in forming a newspaper chain—the Hearst methods have profoundly influenced American journalism.

See John K. Winkler, *W. R. Hearst, An American Phenomenon* (1928). (A. N.)

HEART, ANATOMY OF. The heart in man is a four-chambered muscular bag, which lies in the cavity of the thorax between the two lungs. It is surrounded by another bag, the pericardium, for protective and lubricating purposes (*see* COELOM AND SEROUS MEMBRANES). Externally the heart is somewhat conical, its base being directed upward, backward, and to the right, its apex downward, forward, and to the left. In transverse

section the cone is flattened, so that there is an anterior and a posterior surface and a superior and inferior border. The superior border runs obliquely downward and to the left, the inferior border is horizontal (*see* fig. 1). The divisions between the four chambers of the heart (namely, the two auricles and two ventricles) are indicated on the surface by grooves, and when these are followed it will be seen that the right auricle and ventricle

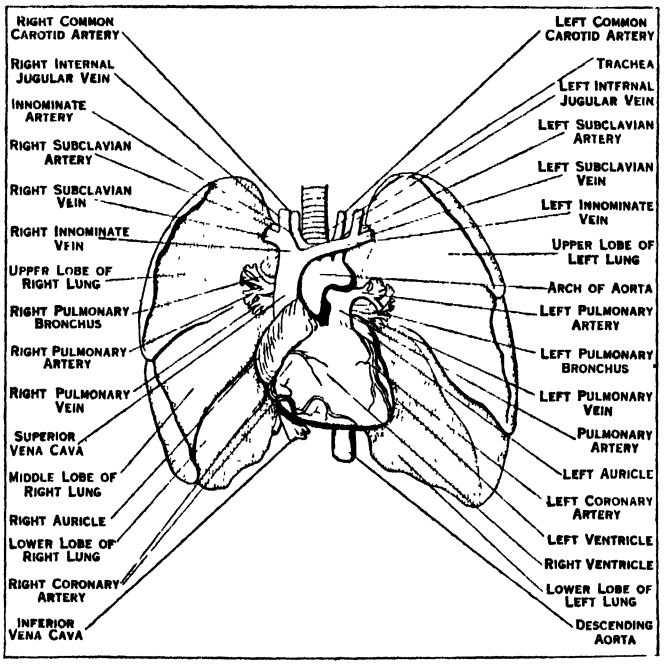

FIG. 1.—THE THORACIC VISCERA IN THIS DIAGRAM THE LUNGS ARE TURNED TO THE SIDE, AND THE PERICARDIUM IS REMOVED TO DISPLAY THE HEART

lie on the front and right side, while the left auricle and ventricle are behind and on the left.

The *right auricle* is situated at the base of the heart, and its outline is seen on looking at the organ from in front. Into the posterior part of it open the two venae cavae (*see* fig. 2). In front and to the left of the superior vena cava is the right auricular appendage which overlaps the front of the root of the aorta, while running obliquely from the front of one vena cava to the other is a shallow groove, which indicates the original separation between the true auricle in front and the sinus venosus behind. When the auricle is opened by turning the front wall to the right as a flap the following structures are exposed:

1. A series of ridges on the anterior wall and in the appendage, running downward from the last and at right angles to it, like the teeth of a comb; these are known as *musculi pectinati.*

2. The orifices of the superior and inferior vena cava.

3. The remains of the *Eustachian valve* (*see* fig. 2), which in the foetus directs the blood from the inferior vena cava, through the *foramen ovale,* into the left auricle.

4. On the posterior or septal wall, between the two auricles, is an oval depression, called the *fossa ovalis* (*see* fig. 2), the remains of the original communication between the two auricles. In about a quarter of all normal hearts there is a small valvular communication between the two auricles in the left margin of this depression.

5. On the left side, opening into the right ventricle, is the right *auriculo-ventricular opening.*

The *right ventricle* is a triangular cavity (*see* fig. 2) the base of which is largely formed by the auriculo-ventricular orifice. To the left of this it is continued up into the root of the pulmonary artery. Its anterior wall forms part of the anterior surface of the heart, while its posterior wall is chiefly formed by the septum ventriculorum, between it and the left ventricle. In transverse section it is crescentic, since the septal wall bulges into its cavity. In its interior the following structures are seen:

1. The *tricuspid valve* (*see* fig. 2) which guards against reflux of blood into the right auricle. This consists of a short cylindrical curtain of fibrous tissue, which projects into the ventricle from the margin of the auriculo-ventricular aperture, while from its free edge three triangular flaps hang down, the bases of which touch one another.

2. The *chordae tendineae* are fine fibrous cords, which fasten the cusps to the musculi papillares and ventricular wall, and prevent the valve being turned inside out when the ventricle contracts.

3. The *columnae carneae* are fleshy columns, and are of three kinds. The first are attached to the wall of the ventricle in their whole length and are merely sculptured in relief, as it were; the second are attached by both ends and are free in the middle; while the third are known as the *musculi papillares* and are attached by one end to the ventricular wall, the other end giving attachment to the chordae tendineae. These musculi papillares are grouped into three bundles (fig. 2).

4. The *pulmonary valve* (*see* fig. 2) at the opening of the pulmonary artery has three crescentic, pocket-like cusps, which, when the ventricle is filling, completely close the aperture, but during the contraction of the ventricle fit into three small niches known as the *sinuses of Valsalva,* and so are quite out of the way of the escaping blood. In the middle of the free margin of each is a small knob called the *corpus Arantii* (*see* fig. 2), and on each side of this a thin crescent-shaped flap, the lunula (*see* fig. 2), which is only made of two layers of endocardium, whereas in the rest of the cusp there is a fibrous backing between these two layers.

The *left auricle* is situated at the back of the base of the heart, behind and to the left of the right auricle. Behind it are the oesophagus and the thoracic aorta. Internally, it is much lighter in colour than the other cavities, owing to the greater thickness of its endocardium. There are no musculi pectinati except in the auricular appendage. The openings of the four pulmonary veins, usually, are placed two on each side of the posterior wall. On the septal wall is a small depression which corresponds to the anterior part of the fossa ovalis and often forms a valvular communication with the right auricle. The auriculo-ventricular orifice is large and oval, and is directed downward and to the left.

Lying in the left auriculo-ventricular furrow, is the coronary sinus, which receives most of the veins returning the blood from the heart substance; these are the right and left coronary veins at each extremity and the posterior and left cardiac veins from below.

The *left ventricle* is conical, the base being above, behind and to the right, while the apex corresponds to the apex of the heart

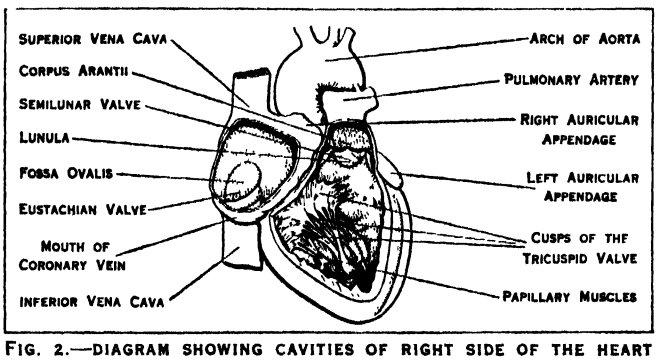

FIG. 2.—DIAGRAM SHOWING CAVITIES OF RIGHT SIDE OF THE HEART

and lies opposite the fifth intercostal space, 3½in. from the mid line. The following structures are seen inside it:—

1. The *mitral valve* guarding the auriculo-ventricular opening has the same arrangement as the tricuspid, already described, save that there are only two cusps, named marginal and aortic, the latter of which is the larger.

2. The *chordae tendineae* and *columnae carneae* resemble those of the right ventricle, though there are only two bundles of musculi papillares instead of three. These are very large.

3. The *aortic valve* has the same structure as the pulmonary, but the cusps are more massive. From the anterior and left

posterior sinuses of Valsalva the coronary arteries arise.

The walls of the left ventricle are three times as thick as those of the right, except at the apex, where they are thinner. The septum ventriculorum is concave towards the left ventricle, so that a transverse section of that cavity is nearly circular. The greater part of it has nearly the same thickness as the rest of the left ventricular wall and is muscular, but a small portion of the upper part is membranous and thin; it lies between the aortic and pulmonary orifices.

Structure of the Heart.—The arrangement of the muscular fibres of the heart is very complicated and only imperfectly known. For details one of the larger manuals, such as Cunningham's *Anatomy* (1922), or Gray's *Anatomy* (1926), should be consulted. The general scheme is that there are superficial fibres common to the two auricles and two ventricles and deeper fibres for each cavity. Passing from auricle to ventricle is a muscular bundle (best seen in the heart of young Ruminants) through which the wave of contraction passes from the auricles to the ventricles.

The *central fibrous body* is a triangular mass of fibro-cartilage, situated between the two auriculo-ventricular and the aortic orifices. The upper part of the septum ventriculorum blends with it. The endocardium is a delicate layer of endothelial cells backed by a very thin layer of fibro-elastic tissue; it is continuous with the endothelium of the great vessels and lines the whole of the cavities of the heart.

The heart is roughly as large as the closed fist and weighs from 8 to 12oz.; it continues to increase in size up to about 50 years of age, but the increase is more marked in the male than in the female. Each ventricle holds about 4 f. oz. of blood, and each auricle rather less. The nerves of the heart are derived from the vagus, spinal accessory and sympathetic, through the superficial and deep cardiac plexuses.

EMBRYOLOGY

In the article on the arteries (*q.v.*) the formation and coalescence of the two *primitive ventral aortae* to form the heart are noticed, so that we may here start with a straight median tube lying ventral to the pharynx and prolonged headwards into the ventral aortae and tailwards into the vitelline veins. This soon shows four dilations, which, from the tail towards the head end, are called the sinus venosus, the auricle, the ventricle and the truncus arteriosus. (This is often called bulbus arteriosus, but it will be seen that the term is used rather differently in comparative anatomy.) As the tubular heart grows more rapidly than the pericardium which contains it, it becomes bent into the form of an S laid on its side (S), the ventral convexity being the ventricle and the dorsal the auricle. The passage from the auricle to the ventricle is known as the *auricular canal*, and in the dorsal and ventral parts of this appear two thickenings known as *endocardial cushions*, which approach one another and leave a transverse slit between them (*see* fig. 3). Eventually these two cushions fuse in the middle, obliterating the central part of the slit, while the lateral parts remain as the two auriculo-ventricular orifices; this fusion is known as the *septum intermedium*. From the bottom (ventral convexity) of the ventricle an antero-posterior median septum grows up, which is the *septum inferius* or *septum ventriculorum* (*see* fig. 3). Posteriorly (caudally) this septum fuses with the septum intermedium, but anteriorly it is free at the lower part of the truncus arteriosus. On referring to the development of the arteries (*see* ARTERIES) it will be seen that another septum starts between the last two pairs of aortic arches and grows tailwards until it reaches and joins with the septum inferius just mentioned. This septum aorticum (formed by two ingrowths from the wall of the vessel which fuse later) becomes twisted in such a way that the right ventricle is continuous with the last pair of aortic arches (pulmonary artery), while the left ventricle communicates with the other arches (the permanent ventral aorta and its branches); it joins the septum ventriculorum in the upper part of the ventricular cavity and so forms the *pars membranacea septi* (fig. 3).

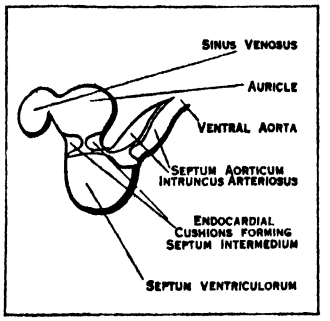

FIG. 3.—DIAGRAM OF THE FORMATION OF SOME OF THE SEPTA OF THE HEART, VIEWED FROM THE RIGHT SIDE

The fate of the sinus venosus and auricle must now be followed. Into the former, at first, only the two vitelline veins open, but later, as they develop, the *ducts of Cuvier* and the *umbilical veins* join in (*see* VEINS). As the ducts of Cuvier come from each side the sinus spreads out to meet them and becomes transversely elongated The slight constriction, which at first is the only separation between the sinus and the auricle, becomes more marked, and later the opening is into the right part of the auricle. Later the right side of the sinus and the right part of the aperture enlarge until the back part of the right side of the auricle and the right part of the sinus venosus are thrown into one. The left part of the sinus venosus, which does not enlarge at the same rate as the right part, remains as the coronary sinus It will now be seen why, in the adult heart, all the veins which open into the right auricle open into its posterior part. The permanent division between the two auricles occurs at a later date than that between the ventricles. It is formed by two partitions, the first of which, grows down from the auricular roof and ultimately reaches the endocardial cushions in the auricular canal. The other partition grows down on the right of the former and is never complete; it grows round and largely overlaps the foramen ovale and its edges form the annulus ovalis, so that, in the later months of foetal life, the foramen ovale is a valvular opening, the floor of which is formed by the first partition and the margins by the second. The closure of the foramen is brought about by adhesion of the two septa.

The pulmonary veins of the two sides at first join one another, dorsal to the left auricle, and open into that cavity by a single median trunk, but, as the auricle grows, this trunk and part of the right and left veins are absorbed into its cavity.

The mitral and tricuspid valves are formed by the shortening of the auricular canal which becomes telescoped into the ventricle, and the cusps are the remnants of this telescoping process.

The columnae carneae and chordae tendineae are the remains of a spongy network which originally filled the cavity of the primary ventricle.

The aortic and pulmonary valves are laid down in the ventral aorta, before it is divided into aorta and pulmonary artery, as four endocardial cushions; anterior, posterior, and two lateral. The septum aorticum cuts the latter two into two, so that each artery has the rudiments of three cusps.

Abnormalities of the heart are very numerous, and can usually be explained by a knowledge of its development. They may cause grave clinical symptoms. A clear and well illustrated review of the most important of them will be found in the chapter on congenital disease of the heart in *Clinical Applied Anatomy*, by C. R. Box and W. McAdam Eccles (1906).

BIBLIOGRAPHY.—For further details of the embryology of the heart *see* Oscar Hertwig's *Entwickelungslehre der Wirbeltiere* (1902); G. Born, "Entwicklung des Säugetierherzens," *Archiv f. mik. Anat.* Bd. 33 (1889); W. His, *Anatomie menschlicher Embryonen* (1881, 1885); Quain's *Anatomy*, vol. i. (1908); C. S. Minot, *Human Embryology* (1892); and A. Keith, *Human Embryology and Morphology* (1905).

COMPARATIVE ANATOMY

In the Acrania (*e.g.*, lancelet) there is no heart, though the vessels are specially contractile in the ventral part of the pharynx.

In the Cyclostomata (lamprey and hag), and Fishes, the heart has the arrangement which has been noticed in the human embryo. There is a smooth, thin-walled sinus venosus, a thin reticulate-walled auricle, produced laterally into two appendages, a thick-walled ventricle, and a *conus arteriosus* containing valves. In addition to these the beginning of the ventral aorta is often thickened and expanded to form a *bulbus arteriosus*, which is non-contractile, and, strictly speaking, should rather be described with the arteries than with the heart. Between the auricle and ventricle

is the auriculo-ventricular valve, which primarily consists of two cusps, comparable to the two endocardial cushions of the human embryo, though in some forms they may be subdivided. In the interior of the ventricle is a network of muscular trabeculae. The conus arteriosus in the Elasmobranchs (sharks and rays) and Ganoids (sturgeon) is large and provided with several rows of semilunar valves, but in the Cyclostomes (lamprey) and Teleosts (bony fishes) the conus is reduced and only the anterior (cephalic) row of valves retained. With the reduction of the conus the bulbus arteriosus is enlarged. So far the heart is a single tubular organ expanded into various cavities and having the characteristic S-shaped form seen in the human embryo; it contains only venous blood which is forced through the gills to be oxidized on its way to the tissues. In the Dipnoi (mud fish), in which rudimentary lungs, as well as gills, are developed, the auricle is divided into two, and the sinus venosus opens into the right auricle. The conus arteriosus too begins to be divided into two chambers, and in Protopterus this division is complete. This division of the heart is one instance in which the sequence of mammalian embryonic changes is not an epitome of evolutionary development—*i.e.*, mammalian ontogeny does not repeat the processes of phylogeny, because in the human embryo the ventricular septum appears before the auricular.

In the Amphibia there are also two auricles and one ventricle, though in the Urodela (tailed amphibians) the auricular septum is often fenestrated. The sinus venosus is still a separate chamber, and the conus arteriosus, which may contain many or few valves, is usually divided into two by a spiral fold. Structurally the amphibian heart closely resembles the dipnoan, though the increased size of the left auricle is an advance. In the Anura (frogs and toads) the whole ventricle is filled with a spongy network which prevents the arterial and venous blood from the two auricles mixing to any great extent (For the anatomy and physiology of the frog's heart, see *The Frog*, by Milnes Marshall.)

In the Reptiles the ventricular septum begins to appear; this in the lizards is quite incomplete, but in the crocodiles, which are usually regarded as the highest order of living reptiles, the partition has nearly reached the top of the ventricle, and the condition resembles that of the human embryo before the pars membranacea septi is formed. The conus arteriosus becomes included in the ventricular cavity, but the sinus venosus still remains distinct, and its opening into the right ventricle is guarded by two valves which closely resemble two venous valves in the auricle of the human embryo.

In the Birds the auricular and ventricular septa are complete; the right ventricle is thin-walled and crescentic in section, as in Man, and the musculi papillares are developed. The left auriculo-ventricular valve has three membranous cusps with chordae tendineae attached to them, but the right auriculo-ventricular valve has a large fleshy cusp without chordae tendineae. The sinus venosus is largely included in the right auricle, but remains of the two venous valves are seen on each side of the orifice of the inferior vena cava.

In the Mammals the structure of the heart corresponds closely with the description of that of Man already given. In the Ornithorynchus, among the Monotremes, the right auriculo-ventricular valve has two fleshy and two membranous cusps, thus showing a resemblance to that of the bird. In the Echidna, the other member of the order, however, both auriculo-ventricular valves are membranous. In the Edentates the remains of the venous valves at the opening of the inferior vena cava are better marked than in other orders. In the Ungulates the moderator band in the right ventricle is especially well developed, and the central fibrous body at the base of the heart is often ossified, forming the os cordis so well known in the heart of the ox.

The position of the heart in the lower mammals is not so oblique as it is in Man.

BIBLIOGRAPHY.—For further details, *see* C. Rose, *Beitr. z. vergl. Anat. des Herzens der Wirbelthiere Morph. Jahrb.*, Bd. xvi. (1890); R. Wiedersheim, *Vergleichende Anatomie der Wirbelthiere* (Jena, 1902) (for literature). (F. G. P.; X.)

HEART, COMPARATIVE PHYSIOLOGY OF. Mechanisms for the circulation of fluids through the body are found in all except the simplest forms of animals, and such mechanisms appear to be a necessity for all animals which have specialised organs for respiration, digestion or excretion. Some of the chief functions of the circulation are as follows: (1) To carry oxygen from the organs of respiration to the rest of the body; (2) To carry food materials from the organs of digestion to the rest of the body; and (3) to remove from the tissues their waste products and to carry these to the organs of excretion. The transport of oxygen is the most urgent of these functions of the circulation because all animal tissues use oxygen continuously but are unable to store significant quantities. Hence the activity of all animal tissues is dependent on the circulation delivering to them a continuous supply of oxygen. The importance of the oxygen carrying function of the blood is indicated by the fact that the blood of nearly all animals contains some form of pigment that can combine with and transport to the tissues considerable quantities of oxygen. The haemoglobin of vertebrate blood is the best known of these pigments. The muscles that move the body use oxygen freely and the chief factor limiting continued muscular activity is the efficiency of the circulation; hence animals of an active habit of life require a much more efficient circulation than do animals which perform few movements Animals do not develop complex mechanisms for which they have no need and hence the degree of development of the circulation varies to an extraordinary degree, because the complexity of circulatory apparatus needed depends on the mode of life of the animal and this often varies greatly in closely related animals. For example, of two Crustacea one may swim vigorously and the other may be sedentary, and in such a case the former will have a far better developed circulation than the latter. Generalisations concerning the circulation are therefore difficult, because in a single order of animals very wide variations in the development of circulatory mechanisms may exist. In this article examples will be chosen from those species which have a relatively well developed circulation, and the species with rudimentary or vestigial circulatory mechanisms will not be considered.

Tubular Hearts.—The common earth worm provides an excellent example of a primitive type of circulation. Down the back runs a tube filled with blood and down this tube from the tail to the head pass regular waves of contraction moving at a rate of about half an inch a second. These waves of contraction squeeze the blood forward just as a thin rubber tube can be emptied by drawing a finger and thumb down it. Waves of contraction of this nature which pass along a structure are termed peristaltic waves. The blood is squeezed from the dorsal artery into arterioles, these connect with small veins and the veins empty into a ventral vein which returns the blood to the dorsal artery. Tubular hearts of this character may be regarded as the primitive type from which the more complex hearts have been developed. Hearts of this type are found in the worms and also in the ascidia. These last are a primitive group, which form a link between invertebrates and vertebrates. Moreover, the heart of the embryo vertebrate commences as a tubular structure.

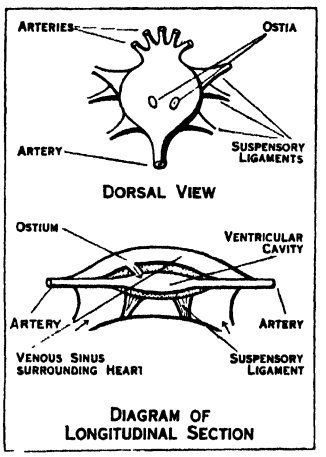

FIG. 1.—HEART OF A CRAYFISH
The blood enters the heart through the ostia and is driven by the heart's contraction through the arteries

The Arthropod Heart.—The vast majority of living animals belong to the arthropod phylum which contains such classes as Crustacea, Arachnida and Insecta. This phylum may be divided into two great groups: firstly the Crustacea which breathe by gills, and secondly the spiders, scorpions and insects which are mostly land animals and which breathe partly or entirely by tracheae.

In the whole class of arthropods the circulatory apparatus has certain features in common. The heart is surrounded by a venous

sinus and the blood passes into the heart by means of holes or ostia provided with valves. When the heart contracts the contraction closes the ostia and drives the blood out through arteries. In most forms there is no proper system of capillaries and veins but the organs are surrounded by venous sinuses.

The gill breathing forms have fairly powerful hearts and fig. 1 shows the heart of the crayfish. The king-crab *Limulus* is noteworthy because it has a better developed circulatory system than any other arthropod. This form is a survival of a primitive type of arthropod and is intermediate between Crustacea and spiders. It possesses a closed circulatory system of arteries, capillaries and veins, and an exceptionally powerful heart. On the other hand, some of the smaller Crustacea have only very rudimentary circulatory mechanisms, without any true heart. The hearts of Crustacea are superior to those of other arthropods but are distinctly inferior to those of the mollusca; for example, it is fair to compare a crab and an octopus of similar size for both are cold-blooded, sea-living, gill-breathing animals of about equal activity, but the heart of the crab is a far simpler and weaker form of pump than is the heart of the octopus.

The tracheated arthropods include the spiders, scorpions and insects and all of these have extremely simple and inefficient hearts. The typical heart is a tubular structure running along the dorsum and is divided into segments by valves Waves of contraction pass from behind forward driving the blood either forward or out through lateral arteries. The reason for the imperfect development of the heart in these forms is that they are not dependent on the circulation for their supply of oxygen, but breathe through minute branching tubes or tracheae which carry air from the surface of the body direct to the cells This is a very efficient and economical respiratory mechanism for animals up to a certain size, as is indicated by the success of the class Insecta which contains more than half of the known species of animals, but in which the vast majority of species are less than one gram in weight.

Molluscan Hearts.—The molluscan circulation is arranged as follows: The blood returning from the body is collected in auricles and these contract and squeeze the blood into the ventricle which expels it into arteries. This arrangement forms a striking contrast to the arthropod heart in which the ventricle is suspended in a venous sinus. The contractile auricle ensures the proper filling of the ventricle, and represents an important advance in the efficiency of the heart as a pump. The vertebrate heart is of course constructed on the same principle.

In the highest molluscs, namely, the cephalopods (*e.g.*, octopus) the circulatory mechanism is complex, for in addition to the chief heart accessory hearts are provided to pump the blood through the gills. This arrangement is shown in fig. 2. The difference between the efficiency of the arthropod and molluscan hearts is indicated by the fact that in the lobster, which is a particularly active crustacean, the arterial pressure is only 12cm. of water, whereas in the octopus the arterial pressure may rise as high as 115cm. of water

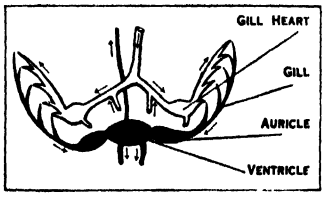

FIG. 2.—A MOLLUSCAN HEART
The accessory gill heart is shown. The veins are shown white, and heart and arteries black

The Development of the Vertebrate Heart.—A comparison of the circulation in the different classes of vertebrates reveals a series of arrangements of increasing complexity and efficiency. The vertebrates are descended from sea living forms and the hearts of the fishes may be compared as regards efficiency and complexity with the hearts of the higher molluscs. The change from water to land involved the substitution of lungs for gills, and this necessitated a considerable increase in circulatory efficiency. The heart of a frog, for example, is larger, more complex and much more efficient than the heart of a fish of the same size. The acquirement by vertebrates of the power to maintain a constant body temperature considerably above the temperature of their surroundings was a further change that involved even greater demands on the circulation, because the rate of oxygen consumption is far higher in warm blooded than in cold blooded animals, and in fact the circulatory mechanisms of the birds and mammals are far more powerful and efficient than those of any invertebrates or cold blooded vertebrates.

Fish's Heart.—The heart of an elasmobranch such as the dog-fish is a good example of a primitive vertebrate heart. It consists of four divisions, the sinus venosus, the auricle, the ventricle and the bulbus arteriosus. Each of these chambers is divided by valves from its neighbours and the heart functions by a wave of contraction which passes down from the sinus to the bulbus arteriosus, and drives the blood before it from one chamber to another. This wave of contraction passes at a rate of about 4in. a second. When one chamber contracts, a certain interval is necessary to allow the blood to pass into and distend the next chamber and this time is provided by the wave of contraction being delayed for a fraction of a second between each of the chambers. The muscles forming all the chambers have the power to contract rhythmically without any stimulus being applied, but the natural rhythm of the sinus muscle is the highest and hence the sinus acts as a pacemaker to the rest of the heart On the whole the hearts of the different classes of fishes do not differ in any important respect The lampreys are the most primitive group of vertebrates and their hearts are slightly more primitive than the dog-fish heart, but the general arrangement and properties are the same In the teleosts there is no true bulbus arteriosus, but otherwise there is no important difference from the elasmobranch heart. The dipnoi of lung fishes, however, show an important variation. This order is only represented by a few scattered species, but these show the first primitive attempt of a water-living vertebrate to acquire the power of air breathing. They possess lungs, and the veins from the lungs open into a portion of the auricle, which is separated from the rest by an incomplete septum. The oxygenated blood coming from the lungs is thus separated in the heart from the reduced blood that comes from the rest of the body.

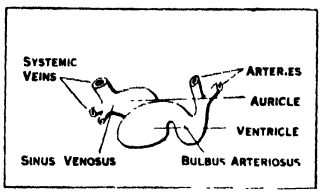

FIG. 3-A.—HEART OF A TADPOLE

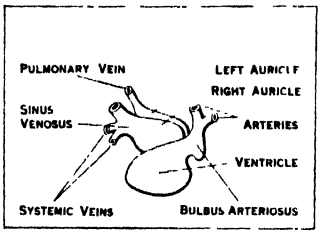

FIG 3-B.—HEART OF A TADPOLE SHORTLY BEFORE METAMORPHOSIS
The heart is developed by the differentiation of the simple tubular structure shown in fig. 3-A.

Amphibian Heart.—The frog is a good example of this group and its heart shows special arrangements necessitated by air breathing A special auricle has developed on the left and in this the aerated blood from the lungs is collected. The ventricle is not divided, but a complex system of valves in the bulbus arteriosus ensures that a large proportion of the aerated blood from the lungs shall pass to the head whilst a large proportion of the oxygen-poor venous blood from the rest of the body shall pass to the pulmonary arteries. Fig. 3-C shows the manner in which the frog's heart is developed by the convolution and differentiation of a simple tubular structure. The mechanism of the frog's heart is one of the simplest examples of a double circulation, that is to say, of an arrangement by which the blood is alternately passed through the lungs to be oxygenated and then through the body to provide oxygen to the tissues The actual mechanism for the separation of exhausted and oxygenated blood appears to be very imperfect in the case of the amphibian heart, and this may be one reason why the amphibia are a relatively unimportant group of animals.

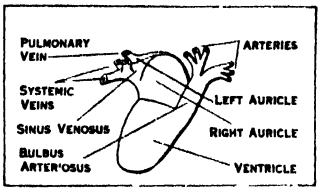

FIG. 3-C —HEART OF ADULT FROG
The mechanism for the separation of exhausted and oxygenated blood is very imperfect in amphibia

Reptilian Hearts.—The process of division of the circulation into two distinct circuits is carried to completion in the reptiles.

In all reptiles there are two distinct auricles; in most genera the ventricle is only partly divided, but in the crocodiles the ventricle is divided into two separate chambers and thus the pulmonary or lung circulation is completely separated from the systemic or body circulation.

Birds and Mammals.—The hearts of the birds and mammals are more complex and far more powerful pumps than are those of the cold blooded vertebrates. The heart consists of four cham-

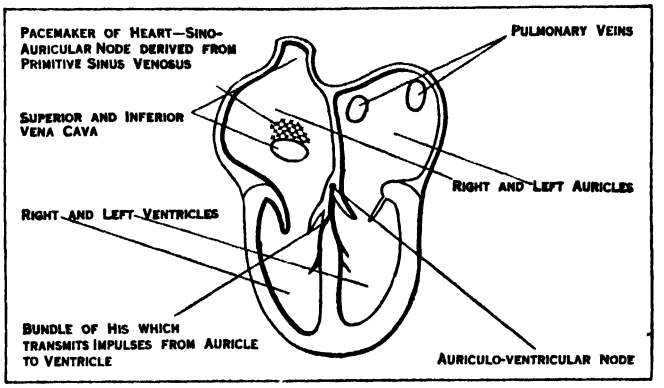

FIG. 4.—THE MAMMALIAN HEART, CONSISTING OF FOUR CHAMBERS
Venous blood passes into the right auricle through the vena cava, and is pumped by the right ventricle to the lungs, where it is oxygenated. It then returns to the left auricle by the pulmonary veins, and is pumped by the left ventricle to the systemic arteries

bers, two auricles and two ventricles. The right auricle which receives the blood from the body represents the sinus venosus and the right portion of the auricle of the fish. The sinus venosus is reduced to a small but very important piece of tissue around the superior vena cava, an area known as the pace-maker of the heart (*cf.* fig. 4). The left auricle, which receives the blood from the lungs, represents the left half of the fish's auricle. The two ventricles have been derived by division of the single ventricle seen in the fish, whilst the bulbus arteriosus of the fish has disappeared. In this type of heart the venous blood returning from the body is collected in the right auricle and passes to the right ventricle which pumps it through the lungs. The lung veins return the blood to the left auricle and the left ventricle pumps the blood to the body tissues.

Conduction System.—The hearts of warm blooded animals have to work at a far greater pace than the hearts of cold blooded animals; *e.g.*, the frog's heart beats about 20 times a minute, whilst the mouse's heart beats from 500–1,000 times a minute. These high speeds obviously necessitate a very careful timing of the contractions of the different portions of the heart. This is achieved by the specialisation of certain tissues which conduct the impulses from chamber to chamber. These are shown in fig. 4. The remnant of the sinus venosus situated in the right auricle around the great veins is the pace-maker of the mammalian heart, and from here the impulse spreads all over the two auricles at a rate of about 40in. a second, which is 10 times the rate of the conduction in the frog's heart. The auricles are of course firmly attached to the ventricles, but there is only one small bridge of tissue that is capable of carrying the wave of excitation from the auricles to the ventricle. This bridge is called the Bundle of His and consists of specialised muscle fibres called Purkinje fibres. The exact arrangement of the Bundle of His in birds is not well known, but in mammals it is a well defined bundle that first splits into two divisions which pass to the two ventricles and then branches out into a network of fibres covering the interior of the ventricles. At the commencement of the Purkinje system is a mass of small muscle cells called the auriculo-ventricular node and here the wave of excitation is checked for a fraction of a second (in man for about one-twentieth of a second), and then the contraction wave is carried rapidly down the Purkinje system so that it reaches all portions of the ventricle at almost the same instant.

This is an arrangement which allows sufficient time for the blood to move from auricle to ventricle when the auricle contracts and at the same time ensures that the whole ventricle shall contract simultaneously. The high efficiency of the mammalian heart probably depends very largely on this peculiar timing mechanism. The remarkable adaptability of the heart as a pump is illustrated by the fact that all mammalian hearts are built on the same type, but the heart of a small mouse weighs about 0·15 grams whereas the hearts of the largest whales weigh about 200 kilos. Moreover there are huge variations in speed for the heart of the mouse can beat 1,000 times a minute whilst the heart of the horse beats only 30 times a minute. These examples show over what an extraordinary range of size and speed the mammalian heart is capable of functioning efficiently.

The Capacity of the Vertebrate Heart for Work.—An outstanding feature of the heart as a machine is its capacity to perform continuous work, for it beats continuously during the life of the body. In the case of the human heart, this contracts 100,000 times a day and the left ventricle daily expels some 10,000 litres of blood working against a resistance of 120mm. of mercury. Another remarkable feature is the reserve power of the heart. The work that the heart does during bodily rest is only a fraction of the work it can do. The power of the body to perform long continued muscular exercise is limited by the amount of oxygen per minute that can be supplied to the muscles, and this again depends on the quantity of blood that the heart can expel per minute. The heart of a human athlete during violent exercise can expel three times as much blood per minute as it expels during bodily rest, but to perform this work the heart itself requires about one quarter of the blood it expels, for the heart's oxygen consumption during such violent exercise is nearly equal to the oxygen usage of the whole body when at rest. Athletic animals capable of feats of endurance such as the dog, the horse, the hare or man are characterized by having large hearts with great reserve powers. On the other hand animals which never need to perform continuous exertion have relatively small hearts with low reserve powers. The rabbit and hare form a striking contrast. The rabbit's heart weighs 2·7 parts per 1,000 parts of body weight, whilst the hare's heart weighs 7·5 parts per 1,000. Corresponding to this difference in weight the rabbit's pulse rate at rest is 205 which is about two-thirds of the maximum rate at which it can work, whereas the hare's pulse rate at rest is only 64 which is less than one quarter of its maximum rate.

Since the maximum output of the heart is greatly in excess of its normal output, it obviously requires some controlling mechanism to adjust its work to the bodily needs. This adjustment is partly effected by variations in the venous filling of the heart, for the heart muscle is so adjusted that the more complete the filling the more powerful the contraction. In addition the heart is controlled by two nerves, the vagus nerve which reduces the heart's frequency, and the sympathetic nerve which augments the frequency and the force of the beat. Augmentor and depressor nerves of this type are present in most invertebrate hearts and in all vertebrate hearts, but their activity is most marked in the case of athletic animals. For example cutting the vagus nerves increases the frequency of the hare's heart from 64 to 264 beats per minute, whereas cutting the vagus nerves in the rabbit only increases the frequency from 205 to 321 beats per minute.

Although the mammalian heart is a very efficient pump, yet there is a limit to the amount of work that can be done per minute by a given weight of muscle. The actual limiting fact is probably the maximum amount of blood, and consequently the maximum amount of oxygen, that can be supplied to the heart muscle per minute by the arteries of the heart (the coronary arteries). The oxygen required per unit weight by warm blooded animals varies inversely as the cube root of their body weight, and hence small animals require much more oxygen per unit weight than do large animals. For example the ox needs about 3·5cc. of oxygen per minute per kilo. of body weight, whilst the mouse needs 17 times this quantity.

It is a striking fact that a very large number of species of birds and mammals weigh between 10 and 30 grams but very few weigh less than 10 grams. A probable reason for this fact is that the oxygen requirements per unit weight in the case of animals of 10 grams is so great that the heart has to do work at a rate

that approaches the maximum possible capacity of heart muscle.

See A. J. Clark, *Comparative Physiology of the Heart* (1927), also VASCULAR SYSTEM. (A. J. C.)

HEART, DISEASES OF THE. Diseases of the heart may be classified in two main groups: (1) Disease of the valves; and (2) Disease of the walls of the heart.

(1.) Valvular Disease.—Inflammation of the valves of the heart, or *endocarditis,* is the most common complication of rheumatism in children and young adults. More severe types, which are apt to prove fatal from a form of blood poisoning, may result when the valves are attacked by pneumococci, pyogenic streptococci and staphylococci, gonococci, or influenza bacilli. As a result of endocarditis, one or more of the valves may be damaged, so that it leaks, the aortic and mitral valves being affected far more commonly than those of the right side. In the process of healing, scar tissue is formed which has a tendency to contract, so that in some cases the orifice of the valve becomes narrowed. We may thus have incompetence or stenosis of a valve or both combined.

Valvular lesions are detected on auscultation by the blowing sounds or murmurs to which they give rise. Thus, lesions of the mitral valve give rise to murmurs heard at the apex beat, and lesions of the aortic valves to murmurs heard in the second right inter-costal space. Accurate timing of the murmurs in relation to the heart sounds indicates whether the murmur is due to stenosis or incompetence. If the valvular lesion is severe, changes must take place in the heart cavities and muscle to compensate for the effects of the regurgitation or obstruction, as the case may be, or the circulation would fail. In affections of the aortic valve, the extra work falls on the left ventricle, which dilates and hypertrophies. In affections of the mitral valve the effect is felt primarily by the left auricle, a thin walled structure incapable of undergoing the requisite increase in power to resist the backward flow through the mitral orifice in case of leakage, or to overcome the effects of obstruction in case of stenosis. The back pressure is therefore transmitted to the pulmonary circulation, and as the right ventricle is responsible for maintaining the flow of blood through the lungs, the strain and extra work fall on the right ventricle, which in turn dilates and hypertrophies. The degree of hypertrophy of the left or right ventricle is thus, up to a point, a measure of the extent of the lesion of the aortic or mitral valve respectively. When the effects of the valvular lesion are so neutralized by these structural changes in the heart that the circulation is equably maintained, "compensation" is said to be efficient.

When the heart gives way under the strain, compensation is said to break down, and dropsy, shortness of breath, cough and cyanosis are among the distressing symptoms which may set in. The mere existence of a valvular lesion is unimportant if compensation is efficient, and many persons with slight valvular lesions are living lives indistinguishable from those of their neighbours. But with more serious lesions certain precautions should be observed in regard to over-exertion, excitement, over-indulgence in tobacco or alcohol, etc., as additional strain on the heart may cause a breakdown of compensation. When this occurs treatment is required. Rest in bed may be sufficient or may need to be supplemented by drugs such as digitalis, convallaria or strychnine.

(2.) Affections of the Muscular Wall of the Heart.—Dilatation of the heart is an incident in the earlier stages of valvular disease antecedent to hypertrophy. Temporary dilatation of the heart occurs in violent exertion, but rapidly subsides and is not harmful to the sound and vigorous heart of the young. But if the heart muscle is weak and flabby from a too sedentary life or from degenerative changes, or during convalescence from a severe illness, circumstances which will not injure a healthy heart, may give rise to serious dilatation from which recovery may be protracted. Influenza is a common cause of cardiac dilatation after the acute illness has subsided, if the patient resumes his ordinary life too soon. Fatty or fibroid degeneration of the heart wall may occur in later life if the nutrient blood-vessels are the seat of arterio-sclerosis or atheroma. The affection known as *angina pectoris* (*q.v.*) may be a further consequence of this defective blood-supply.

The treatment varies according to the nature of the case. In serious cases of dilatation, rest in bed, purgatives and cardiac tonics will be required.

In commencing degenerative change the Oertel treatment, consisting of graduated exercise up a gentle slope, limitation of fluids and a special diet, may be indicated. In cases of slight dilatation after influenza or recent illness, the Schott treatment by baths and exercises as carried out at Nauheim is sometimes beneficial.

Disorders of Rhythm of the Heart's Action.—Under this heading may be grouped a number of conditions concerning which much has been learned during the past 20 years by the researches of the late Sir James Mackenzie and Sir Thomas Lewis. By means of Mackenzie's ink polygraph or Lewis's modification a prolonged simultaneous record of the arterial and venous pulses can be obtained.

Electrical Records.—Electrical records of the heart beat have given even more accurate results. It has long been known that a minute electrical current is generated when the heart, or any other muscle, contracts. In 1903 Einthoven, of Leyden, invented his string galvanometer (*q v*) an instrument capable of detecting a current of less than $\frac{1}{60000}$ millionth of an ampère. By putting the human heart in electrical connection with the instrument, either by means of contacts from the chest wall in front of the heart, or, more conveniently, by three electrodes in which the two hands and one foot are immersed, a graphic curve is obtained of the electrical variations associated with each heart beat together with appropriate time marks. On such a curve the variations due to auricular and ventricular contraction respectively are differentiated, the wave representing auricular contraction being designated arbitrarily as "P," and that representing the commencement of ventricular contraction "R." The time interval between these two components of each normal heart beat can be measured accurately.

Heart Block.—In health this time interval is between 0·18 to 0·20 sec.; if the junctional tissues between auricle and ventricle are injured, either by disease or by cardiac poisons, conduction between auricle and ventricle is delayed and the "P.R." interval may become 0·24 sec , or even more. This state of affairs is known as heart block, and in its minor stages can be recognized only by means of graphic records. With more severe damage of the junctional tissues, higher grades of auriculo-ventricular block ensue; thus the ventricle may respond only to every alternate, or to every third or fourth auricular beat. In complete heart block no stimuli reach ventricle from auricle and there is complete dissociation between the upper and lower chambers of the heart, the former beating at their usual rate of 60–80 per min. while the ventricles take on a rhythm of their own, usually at a rate of about 35–40. The presence of these more serious grades of heart block can often be surmised on clinical grounds, but graphic records are essential for their certain recognition. Heart block is one of the rarer causes of irregular heart action.

Other Features.—There are some other causes of cardiac arrhythmia, some of which are unimportant, others serious. Quite early in the century it was impossible to differentiate with certainty between the two types. Now differentiation can be made with confidence, and often without the necessity for taking polygraphic or electro-cardiographic tracings. For instance, "intermissions" of the pulse and "premature beats" were considered to be serious. Nowadays it is recognized that, in themselves, they are not serious but are almost invariably present from time to time in most elderly subjects.

Auricular Fibrillation.—But there is another common type of cardiac arrhythmia known as auricular fibrillation which is undoubtedly serious. Here, as a result of pathological changes in the heart muscle, the auricles cease to contract rhythmically as a whole in a series of orderly beats; but the auricular musculature is in a constant state of inco-ordinate and futile twitchings. In consequence, the ventricles, instead of being stimulated from above rhythmically at the rate of about 70 per min. are overwhelmed by a series of stimuli which pour down on them like an avalanche. They do their best to respond, and contract rapidly and irregularly at a rate of 120–180 per minute. This condition is

very constantly associated with cardiac failure, usually ending in dropsy, shortness of breath and eventually, if progressive, in death. It is a dangerous condition, but when recognized (and about its recognition there is now seldom any difficulty) it may be controlled by the administration of digitalis. This drug depresses the conductivity between auricle and ventricle, and consequently only the more powerful auricular stimuli reach the ventricle after its use; the ventricle now beats, still irregularly, but more slowly, and consequently, having time for a longer rest between each beat, more powerfully. The auricles may fibrillate in paroxysms lasting a few minutes, hours or days; but more commonly the condition is a permanent one. It brings about great disability, but, if controlled by the use of digitalis and if the patient is content to live within his limits, it is often compatible with 10, 15 or even 20 years of very fair health.

The Circus Movement.—Lewis has recently demonstrated by means of the string galvanometer that in auricular fibrillation, as in its sister condition, auricular flutter, instead of each auricular beat arising in the sinu-auricular node and radiating thence throughout the auricles, a "circus movement" takes place in the auricular muscle, often around the mouths of the great veins entering the right auricle. We have to conceive of an irregular wave of contraction whirling around, usually in an irregular circle. From this contractile path are projected into the surrounding auricular muscle countless stimulating impulses, very much as sparks are thrown out from a catherine wheel, and, as a result, the whole of the auricular musculature is thrown into incessant, shimmering contractions. So soon as this explanation of auricular fibrillation was put forward and accepted, it was manifest that, if we could bridge the gap between the advancing crest, and the retreating wake of the contracting wave in its "circus," the heart might revert to normal rhythm. It has been found that quinine and its allied alkaloids, of which quinidine is the one usually employed, have such an effect. In rather more than 50% of cases of auricular fibrillation it is possible to bring about a reversion to normal rhythm by the use of quinidine. Unfortunately the process is not devoid of risk, and many cases relapse into fibrillation when quinidine is withdrawn.

Paroxysmal Tachycardia.—Here the heart beats with great rapidity (rates of 150–200 per min.), but regularly. There is an abrupt transition from the normal and slow, to the abnormal and rapid rhythm; the attack may last for a few seconds, or for a few days, and ends as abruptly as it began. Such attacks may be associated with great respiratory and mental distress, and may lead to cardiac failure. Their differentiation from a purely nervous form of rapid heart action may be impossible without an electrocardiogram taken during both normal and abnormal periods.

Bradycardia.—In some healthy persons the rate of heart beat is unusually slow. In jaundice a slow pulse rate is the rule.

X-rays in Cardiology.—Of recent years X-rays have been used extensively in the investigation of cardiac disease. By their help alone can accurate information be obtained of the size of the heart and aorta. Percussion and location of the apex beat by the finger are often misleading.

Vital Capacity.—The vital capacity is the maximal amount of air which an individual can expire from the lungs after taking the deepest possible inspiration. Disease of either heart or lungs may very materially diminish this quantity which falls or rises according as the disease advances or tends to recovery. Estimation of the vital capacity, therefore, is a means of recording numerically a functional disability and its progress. The trend of recent instrumental investigation of the heart's action has been to stress the importance of the heart's muscle in cardiac pathology and to minimise the effect of valvular lesions, to which so much attention was formerly paid. Possibly the pendulum has swung a little too far in this direction but it is certain that many cardiac murmurs heard through the stethoscope are not necessarily indicative of valvular or of any other disease. The innocuous nature of these "exo-cardial," "cardio-respiratory," or "haemic" murmurs, had long been known to the more experienced physicians, but it required the mass experiment of the World War to teach the lesson to the rank and file of the profession.

In Dec. 1925 Yandel Henderson, of Yale university, published a comparatively simple method of determining the output of the heart per beat. From this it is easy to calculate the actual work done by the heart, and to recognize departures from normal efficiency. Thus we now appear to have a simple method of ascertaining with accuracy whether a heart is functioning normally or not, and whether a defect previously discovered is stationary, improving or deteriorating.

HEART AND LUNG, SURGERY OF. Surgery of the heart itself is of quite recent origin and has been mainly devoted to three subjects.

I. SURGERY OF THE HEART

Removal of Foreign Bodies Retained in the Heart Wall.—The safety of the methods of surgical approach to the heart has been demonstrated. Surgeons in many countries have removed war missiles from the wall of the heart and from the pericardium with a surprisingly small mortality. R. le Fort (*Bull. et Mém. Acad. de Méd.*, vol. 80, p. 147, 1918) removed 11 foreign bodies from nine patients, with one death. Roberts successfully removed a bullet from the posterior wall of the left ventricle, which had been present for seven years and was causing cardiac disturbance. The approach by resection of one rib and traversing the pleura was excellent. He had also removed four fragments of shell from the pericardium in four patients by the same route, with no mortality.

Operations for Stenosis of the Valvular Orifices of the Heart.—A new field for surgery in the treatment of what has for long been a purely medical subject is being opened up by work which has hitherto been largely experimental. The subject is still in its infancy, but enough has been done to show that with further experience certain selected cases of mitral stenosis, in which the musculature of the heart has not been too much damaged, may be submitted to operation with a fair prospect of improvement. Duff S. Allen and E. A. Graham (*Jour. Amer. Med. Assoc.*, Sept. 23, 1922, and *Arch. of Surg.*, Jan. 1924) have invented an instrument which they call a cardioscope. This is a tube, closed at one end by a lens, which is introduced into the heart through a small incision. When the lens is pressed against the heart wall so that no blood intervenes, the endocardium, illuminated by a small electric bulb, is clearly visible. In the wall of the tube is fitted a rod ending in a small knife, with which a stenosed valve may be incised under direct vision. In dogs, when the incision to introduce the cardioscope was made in the auricular appendix, all the dogs recovered. E. C. Cutler and S. A. L. Levine (*The Boston Med. and Surg. Jour.*, June 28, 1923), believing that a mere incision in the stenosed ring will heal without relief of the stenosis, invented an instrument which punches out a piece of tissue.

They have used this successfully in the case of a girl, aged 12, suffering from mitral stenosis. She was alive 10 months later and was still improving. H. S. Souttar (*Brit. Med. Jour.*, Oct. 3, 1925) reports a brilliant operation on a girl of 15 with mitral stenosis and regurgitation. He exposed the heart by a flap operation, and placed a light clamp on the base of the auricular appendix. After two guide sutures had been inserted, the appendix was incised and drawn over the finger like a glove, haemorrhage being thus obviated. The interior of the auricle was easily explored by the finger, no effect on the pulse being noted. The blood pressure instantly fell to zero as the passage of blood through the orifice was abolished. Souttar intended to divide the stenosed orifice with a knife passed along the finger, but as the stenosis was found to be of moderate degree with little thickening of the valve, he contented himself with stretching the orifice with the finger. The appendage was ligated at its base and the wound of the chest wall closed. The patient's condition was improved and she was well three months later, though still somewhat breathless on exertion.

Cervical Sympathectomy for Angina Pectoris.—The cause of this very distressing disease is not settled with certainty. But as changes in the cardiac muscle, coronary arteries and aorta are usually present it may be considered.

Jonnesco, of Bucharest, in 1916 first performed the removal of the left cervical sympathetic chain, including the upper and middle cervical ganglia and the first thoracic ganglion. The result, followed for four years, was complete relief from symptons. T. Jonnesco operates under spinal anaesthesia (*La Presse Méd.*, April 26, 1922). W. B. Coffey and P. K. Brown (*Arch. Int. Med.*, vol. 31, p. 200, 1923) report six cases with one death and great improvement in the other five, H. Lilienthal (*Arch. of Surg.*, vol. 10, p. 531, 1925) three cases. In one, the cervical sympathetic was removed on both sides. All were cured. H. H. Kerr (*Ann. of Surg.*, vol. 82, p. 354, 1925) reports five cases. He removes the superior cervical ganglion only, under local infiltration anaesthesia by novocain, and obtains the same results as the others by the more formidable operation performed by Jonnesco.

II. SURGERY OF THE LUNG

Since the World War the surgery of the lung has made great strides, and in all countries is engaging the attention of active workers. While differential pressure anaesthesia of some kind is still advisable, the introduction of intra-tracheal insufflation has enabled the elaborate and costly pressure chambers to be dispensed with. For many types of operation ordinary inhalation anaesthesia, especially by nitrous oxide and oxygen, suffices. Local infiltration anaesthesia, combined with nerve blocking by novocain or some similar drug, is largely used, and for some operations is essential. It is being combined with light analgesia by nitrous oxide and oxygen, or even ether by some surgeons in the case of nervous patients, for whom deep general anaesthesia is inadvisable (*see* ANAESTHESIA AND ANAESTHETICS).

Surgical Treatment of Pulmonary Tuberculosis.—Direct operations on the tuberculous lung, either by drainage of tuberculous cavities or the resection of one or more lobes of the lung, have been abandoned by the majority of thoracic surgeons. The great advance in latter years has been in devising methods of collapsing the affected lung either temporarily or permanently.

Principles of Collapse Therapy.—In all other parts of the body it is found that rest of the affected part is beneficial, but in the case of the lung the respiratory movements, exaggerated by coughing, continue unless the lung is compressed. By collapse, stasis in the lymphatic vessels occurs, preventing spread of tubercle bacilli to other parts of the lung and diminishing the entrance of toxins into the general circulation with consequent improvement of the general resistance of the body. Congestion of the collapsed lung with blood appears to occur, favouring the formation of fibrous tissue and healing of the lesions. Mechanically, the effect is to allow the retraction of the new formed fibrous tissue and to collapse cavities and dilated bronchi. This prevents the retention of secretions, which often become secondarily infected with other organisms, and allows the walls of the cavities to come in contact and so to heal. This retraction occurs normally to a limited extent by the pulling up of the diaphragm, the pulling over of the mediastinum, and the assumption of the expiratory position by the ribs, but falls far short of that necessary for complete obliteration of the cavities.

Methods of Producing Collapse.—Artificial pneumothorax was first proposed by James Carson, of Liverpool, in 1821, but was introduced into practice by Forlanini, of Pavia, in 1882 (*Gazz. d. Osp.*, 1882). It is now extensively practised by physicians all over the world. By the introduction of air, oxygen or nitrogen through a hollow needle into the pleural cavity the lung may be more completely collapsed than by any other method. As this method is simple and satisfactory it is the method of choice, and other operations are only undertaken when this is impossible, through the presence of adhesions binding the two layers of the pleura together (*see* PNEUMOTHORAX).

Division of Adhesions.—Where the adhesions are few and bandlike, so that a partial collapse only can be obtained, it is necessary to divide them. The operation of thoracotomy and division of the bands by direct vision is unnecessarily severe. Jacobaeus, of Stockholm, in 1913 devised an instrument similar to a cystoscope, which he calls a thoracoscope. After the induction of a pneumothorax this is introduced under novocain anaesthesia through a canula. Through a smaller canula a galvanocautery is introduced. Thus the adhesions may be burnt through under the vision of the operator without opening the chest cavity (H. C. Jacobaeus, *Proc. Roy. Soc. Med*, 1922–23, vol. 16, p 45) By using the cautery at a red heat only, haemorrhage is avoided. The adhesions often pull out a cone of lung substance in which may be a prolongation of a lung cavity, so that it is important to burn the adhesions through as near the chest wall as possible.

Paralysis of the Diaphragm.—Stuertz first proposed this operation by division of the phrenic nerve in the neck, which was independently devised by Sauerbruch. The result of depriving the diaphragm on one side of its motor innervation is that it rises in the thorax as much as 2½ to 3in., thus allowing the lower lobe partially to collapse and putting it at rest. The operation is easily done in a few minutes under local anaesthesia by novocain, the nerve being found running obliquely across the scalenus anticus muscle in the neck. At first the nerve was simply divided, but it was found that accessory fibres joined it below the point of section in 20–30% of individuals. W. Felix's operation of "Exairesis" (*Deutsch. Ztsch. f. Chir.*, No. 171, p. 283, 1922) has gained favour. In this modification the lower end of the divided nerve is seized in forceps and gradually drawn out of the thorax. Sometimes the whole length of the nerve as far as the diaphragm is successfully extracted, but in any case the collaterals which join it in its upper part are also severed so that the paralysis is complete. The operation is used where basal adhesions are preventing full collapse in pneumothorax, as an addition to thoracoplasty, in some cases of early tuberculosis of the lower lobe only and for the relief of pain in the region of the diaphragm on coughing.

Extrapleural Pneumolysis.—The operation consists in separating the parietal layer of the pleura from the chest wall over a limited area and filling the space thus formed with some material which is not absorbed, thereby compressing the lung beneath. A portion of one rib is resected and the posterior periosteum and endothoracic fascia are carefully incised. The gloved finger then separates the outer surface of the parietal pleura from the inner surface of the endothoracic fascia. As the air which enters the cavity thus formed is rapidly absorbed it is necessary to provide some filling. Tuffier, in 1910, first used fat obtained from omentum or a lipoma. This has become one of the favourite methods, the fat being obtained from the patient's thigh (Tuffier, *Bull, et. mém. Soc. de Chir. de Paris*, vol. 40, 1240, 1923). If a very careful aseptic technique is not followed the fat may be extruded. Owing to the difficulty of obtaining enough fat, Baer, in 1913, used a paraffin filling (H. Baer, *Munch. med. Wochenschr.*, vol. 68, 1921). This is readily available but is heavy, and tends to be extruded later in many cases. E. W. Archibald, of Montreal (*Am. Rev. of Tuberc.*, vol. 4, p. 828, 1921), has used a pedicled muscle graft obtained by detaching the pectoral muscle.

The operation is almost confined to apical lesions and is used either alone, or following thoracoplasty, in cases where the apex of the lung is incompletely collapsed. It may also be of service where the apex alone is adherent and a satisfactory pneumothorax has collapsed the lower part of the lung.

Extrapleural Thoracoplasty.—Collapsing operations on the chest wall were suggested as long ago as 1888 (Quincke) and 1890 (Spengler). In 1907 Brauer and Friedreich removed large portions of the ribs in their lateral portions. Wilms, in 1911, removed portions both posteriorly and anteriorly. The modern operation of paravertebral thoracoplasty is due to Sauerbruch and the Scandinavians: Bull, of Oslo; Saugman, of Veilefiord; Jacobaeus and Key, of Stockholm. The operation may be done in one, two or more stages and consists essentially in resecting a portion of the first to the 10th or 11th ribs posteriorly through a long incision posterior to the scapula and turning forwards along the 10th rib The muscles attached to the scapula are divided and the scapula is turned forwards. It is essential that the ribs should be resected as far back as the tips of the transverse processes of the vertebrae. The length of rib removed varies from ½in. of the first rib to 7 or 8in. of the middle and lower ones The operation is a severe one, but the mortality, which was at first about 8%, has been reduced by proper selection of cases to

about 2% in the hands of experienced operators. Many operators still prefer a local anaesthesia by novocain, but the tendency now, except in cases with profuse sputum, is to operate under general anaesthesia by nitrous oxide and oxygen preceded by an injection of morphine and hyoscine. The results of these operations have shown that in cases of unilateral or mainly unilateral pulmonary tuberculosis which are not improving under sanatorium treatment a new field of hope is opening out. F. Sauerbruch (*Chir. der Brustorgane*, 1920), H. C. Jacobaeus and E. Key (*Acta. Chir. Scand.*, 1923); P. Bull (*Proc. Roy. Soc. Med.*, 1924, vol. 17, p. 1); J. Alexander (*Surg. of Pulmon. Tub.*, 1925); J. Gravesen (*Surg. Treat. of Pulmon. and Pleur. Tub.*, 1925).

Bronchiectasis.—Three types of operation are used in the treatment of this distressing condition: (1) Drainage operations, (2) operations to collapse the lungs, (3) radical excision of the affected part of the lung. (1) Drainage operations are palliative only and aim either at drainage of abscess cavities or, by making a permanent bronchial fistula, at reducing the amount of sputum. (2) All the forms of collapsing operations which are in use for pulmonary tuberculosis have their place in the treatment of bronchiectasis. They are phrenicotomy, pneumothorax, extrapleural pneumolysis and extrapleural thoracoplasty. The principles involved are, firstly, that the spaces in which secretions collect and decompose are obliterated by the collapse of the lung, and secondly that the new formed fibrous tissue in its contraction no longer pulls open the walls of the bronchi softened by inflammation, but can now pull inward the mobilised walls of the thorax. (3) In certain types of bronchiectasis the results of collapsing operations are not satisfactory, and in consequence amputation of the affected lobe or lobes of the lung has been performed. This procedure has produced real cures but the mortality of the operation is high. The longest series of cases is that published by H. Lilienthal, of New York (*Arch. of Surg.*, vol. 8, 1924), whose mortality is nearly 50%. Many of his patients were, however, desperately ill. Evarts A. Graham (*Arch. of Surg.*, vol. 10, p. 392, 1925) has practised pneumectomy by the actual cautery, in one or several stages, on 20 patients. Of these, 50% were cured, 30% improved and 20% died.

Intrathoracic Tumours.—Innocent intrathoracic tumours are being diagnosed with greater frequency owing to the increasing use of X-rays. H. C. Jacobaeus and E. Key (*Acta Chir. Scand.*, vol. 53, p. 575, 1921) have successfully removed four fibromata by the transpleural route. T. P. Dunhill (*Br. Jour. of Surg.*, 1922) removed a fibroma by Gask's modified sternum splitting operation. J. E. H. Roberts (*Tr. Roy. Soc. Med.*, 1926) has removed four innocent tumours, two fibromas, an encapsuled endothelioma and a dermoid cyst, three by the transpleural route and one by sternum splitting.

Malignant Tumours of the Lung.—Radical operations for the removal of carcinomata of the lung are rarely possible owing to the later stage at which patients come under observation. F. Sauerbruch (*Chir. der Brustorgane*) has operated in five cases: One with a carcinoma of the lower lobe the size of a small fist, was alive five years later; another was alive after three years. Sauerbruch advises a two-stage operation or three-stage operation, ligature of the branch of the pulmonary artery to the affected lobe being done as a preliminary followed by thoracoplasty and resection of lung.

Palliative operations often give great relief from distressing symptoms and prolong life for many months; they are (1) drainage of a secondary lung abscess or empyema, (2) drainage of a sterile abscess due to necrosis of growth, (3) exposure of the growth for the insertion of radium, (4) treatment by X-rays.

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HEART-BURIAL, the burial of the heart apart from the body. The practice began very early in ancient Egypt and in mediaeval Europe heart-burial was fairly common. Some of the more notable cases are those of Richard I., whose heart, preserved in a casket, was placed in Rouen cathedral; of Henry III., buried in Normandy; and of Edward I., at Jerusalem. Since the 17th century the hearts of deceased members of the house of Habsburg have been buried apart from the body in the Loretto chapel in the Augustiner Kirche, Vienna. The most romantic story of heart-burial is that of Robert Bruce. He wished his heart to rest at Jerusalem in the Church of the Holy Sepulchre, and on his death-bed entrusted the fulfilment of his wish to Douglas. The latter broke his journey to join the Spaniards in their war with the Moorish king of Granada, and was killed in battle, the heart of Bruce enclosed in a silver casket hanging round his neck. Subsequently the heart was buried at Melrose abbey. Of notable 17th century cases there is that of James II., whose heart was buried in the church of the Convent of the Visitation at Chaillot near Paris, and that of Sir William Temple, at Moor Park, Farnham. The last ceremonial burial of a heart in England was that of Paul Whitehead, secretary to the Monks of Medmenham club, in 1775, the interment taking place in Le Despenser mausoleum at High Wycombe, Bucks. Of later cases the most notable are those of Daniel O'Connell, whose heart is at Rome, Shelley's at Bournemouth, Kosciusko's at the Polish museum at Rapperschwyll, Lake Zurich, and the marquess of Bute, taken by his widow to Jerusalem for burial in 1900; Thomas Hardy's heart was buried in his first wife's grave at Stinsford, Dorset, in Jan. 1928. The viscera of the popes from Sixtus V. (1590) onward have been preserved in the parish church of the Quirinal.

See Pettigrew, *Chronicles of the Tombs* (1857).

HEARTH, the part of a room where a fire is made, also the fire and cooking apparatus on board ship; the floor of a smith's forge, or of a reverberatory furnace on which the ore is exposed to the flame; the lower part of a blast furnace through which the metal goes down into the crucible; in soldering, a portable brazier or chafing dish, and an iron box sunk in the middle of a flat iron plate or table. An "open-hearth furnace" is a regenerative furnace of the reverberatory type used in making steel, hence "open-hearth steel" (*see* IRON and STEEL).

HEARTH TAX. This impost, also known as hearth-money or chimney-money, was a tax imposed in England at a rate of 2s. for each hearth; it was levied upon all houses except cottages. It was first levied in 1662, but owing to its unpopularity, chiefly caused by the domiciliary visits of the collectors, it was repealed in 1689, although it was producing £170,000 a year. The principle of the tax was not new in the history of taxation, for in Anglo-Saxon times the king derived a part of his revenue from a *fumage*, or tax of smoke, levied on all hearths except those of the poor. It appears also in the hearth-penny or tax of a penny on every hearth, which as early as the 10th century was paid annually to the pope. (*See* PETER'S PENCE.)

HEARTS, a game of cards of recent origin, though founded upon the same principle as many old games, such as *Slobberhannes, Four Jacks* and *Enflé*, namely, that of losing instead of winning as many tricks as possible. Hearts is played with a full pack, ace counting highest and deuce lowest. In the four-handed game, which is usually played, the entire pack is dealt out as at whist (but without turning up the last card, since there are no trumps), and the player at the dealer's left begins by leading any card he chooses, the trick being taken by the highest card of the suit led. Each player must follow suit if he can; if he has no cards of the suit led he is privileged to throw away any card he likes, thus having an opportunity of getting rid of his hearts, which is the object of the game. When all thirteen tricks have been played each player counts the hearts he has taken in and pays into the pool a certain number of counters for them, according to an arrangement made before beginning play. In the four-handed, or sweep-stake, game the method of settling called "Howell's," from the name of the inventor, has been generally adopted, according to which each player begins with an equal number of chips, say 100, and after the hand has been played pays into the pool as

many chips for each heart he has taken as there are players besides himself. Then each player takes out of the pool one chip for every heart he did not win. The pool is thus exhausted with every deal. Hearts may be played by two, three, four or even more players, each playing for himself.

Spot Hearts.—In this variation the hearts count according to the number of spots on the cards, excepting that the ace counts 14, the king 13, queen 12 and knave 11, the combined score of the thirteen hearts being thus 104.

Auction Hearts.—In this the eldest hand examines his hand and bids a certain number of counters for the privilege of naming the suit to be got rid of, but without naming the suit. The other players in succession have the privilege of outbidding him, and whoever bids most declares the suit and pays the amount of his bid into the pool, the winner taking it.

Joker Hearts.—Here the deuce of hearts is discarded, and an extra card, called the joker, takes its place, ranking in value between ten and knave. It cannot be thrown away, excepting when hearts are led and an ace or court card is played, though if an opponent discards the ace or a court card of hearts then the holder of the joker may discard it. The joker is usually considered worth five chips, which are either paid into the pool or to the player who succeeds in discarding the joker.

Heartsette.—In this variation the deuce of spades is deleted and the three cards left after dealing twelve cards to each player are called the *widow* (or *kitty*), and are left face downward on the table. The winner of the first trick must take the widow without showing it to his opponents.

Slobberhannes.—The object of this older form of Hearts is to avoid taking either the first or last trick or a trick containing the queen of clubs. A euchre pack (thirty-two cards, lacking all below the 7) is used, and each player is given ten counters, one being forfeited to the pool if a player takes the first or last trick, or that containing the club queen. If he takes all three he forfeits four points.

Four Jacks (Polignac or Quatre-Valets) is usually played with a piquet pack, the cards ranking in France as at écarté, but in Great Britain and America as at piquet. There is no trump suit. Counters are used, and the object of the game is to avoid taking any trick containing a knave, especially the knave of spades, called *Polignac*. The player taking such a trick forfeits one counter to the pool.

Enflé (or Schwellen) is usually played by four persons with a piquet pack and for a pool. The cards rank as at Hearts, and there is no trump suit. A player must follow suit if he can, but if he cannot he may not discard, but must take up all tricks already won and add them to his hand. Play is continued until one player gets rid of all his cards and thus wins.

HEARTS OF OAK BENEFIT SOCIETY: *see* FRIENDLY SOCIETIES.

HEAT, a general term applied to that branch of physical science which deals with the effects produced by heat on material bodies, with the laws of transference of heat, and with the transformations of heat into other kinds of energy. The object of the present article is to give a brief sketch of the historical development of the science of heat, and to indicate the relation of the different branches of the subject, which are discussed in greater detail with reference to the latest progress in separate articles.

1. The term heat is employed in ordinary language in a number of different senses. This makes it a convenient term to employ for the general title of the science, but the different meanings must be carefully distinguished in scientific reasoning. For the present purpose, omitting metaphorical significations, we may distinguish four principal uses of the term:—(*a*) sensation of heat; (*b*) temperature, or degree of hotness; (*c*) quantity of thermal energy; (*d*) radiant heat, or energy of radiation.

(*a*) From the sense of heat, aided in the case of very hot bodies by the sense of sight, we obtain our first rough notions of heat as a physical entity, which alters the state of a body and its condition in respect of warmth, and is capable of passing from one body to another. By touching a body we can tell whether it is warmer or colder than the hand, and, by touching two similar bodies in succession, we can form a rough estimate, by the acuteness of the sensation experienced, of their difference in hotness or coldness over a limited range. If a hot iron is placed on a cold iron plate, we may observe that the plate is heated and the iron cooled until both attain appreciably the same degree of warmth; and we infer from similar cases that something which we call "heat" tends to pass from hot to cold bodies, and to attain finally a state of equable diffusion when all the bodies concerned are equally warm or cold Ideas such as these derived entirely from the sense of heat, are, so to speak, embedded in the language of every nation from the earliest times.

(*b*) From the sense of heat, again, we naturally derive the idea of a continuous scale or order, expressed by such terms as summer heat, blood heat, fever heat, red heat, white heat, in which all bodies may be placed with regard to their degrees of hotness, and we speak of the *temperature* of a body as denoting its place in the scale, in contradistinction to the quantity of heat it may contain.

(*c*) The quantity of heat contained in a body obviously depends on the size of the body considered. Thus a large kettleful of boiling water will evidently contain more heat than a teacupful, though both may be at the same temperature. The temperature does not depend on the size of the body, but on the degree of concentration of the heat in it, *i.e.*, on the quantity of heat per unit mass, other things being equal.

It may be taken as axiomatic that a given body in a given state under given conditions (*e.g.*, a pound of water in the liquid state at freezing point under atmospheric pressure) must always contain the same quantity of heat, and that different quantities of the same substance in the same state under the same conditions must contain quantities of heat proportional to their several masses. But it is for experiment to determine how the heat-content varies for any given substance in different states, or for different substances in similar states, and how it is affected by variations of temperature and pressure in each case

(*d*) It is a matter of common observation that rays of the sun or of a fire falling on a body warm it, and it was in the first instance natural to suppose that heat itself somehow travelled across the intervening space from the sun or fire to the body warmed, in much the same way as heat may be carried by a current of hot air or water. But we now know that energy of radiation is not the same thing as heat, though it is converted into heat when the rays strike an absorbing substance. The term "radiant heat," however, is generally retained, because radiation is commonly measured in terms of the heat it produces, and because the transference of energy by radiation and absorption is the most important agency in the diffusion of heat.

TEMPERATURE

2. **Evolution of the Thermometer.**—The first step in the development of the science of heat was necessarily the invention of a thermometer, an instrument for indicating temperature and measuring its changes The first requisite in the case of such an instrument is that it should always give, at least aproximately the same indication at the same temperature The air-thermoscope of Galileo, illustrated in fig. 1, which consisted of a glass bulb containing air, connected to a glass tube of small bore dipping into a coloured liquid, though very sensitive to variations of temperature, was not satisfactory as a measuring instrument, because it was also affected by variations of atmospheric pressure. The French doctor Rey describes in a letter dated 1631 a thermometer in which the expansion of water itself was used to indicate temperature, but it is not clear from his description whether the thermometer tube was left open or closed.

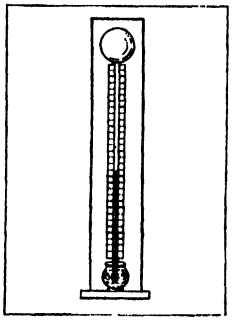

FIG. 1.—GALILEO'S AIR THERMOSCOPE

The type of thermometer familiar at the present time, containing a liquid hermetically sealed in a glass bulb with a fine tube attached, was first brought into general use by the Grand Duke

Ferdinand II. of Tuscany, and he is said to have possessed such instruments as early as 1654. They were much employed by the members of the *Accademia del Cimento* founded under his protection at Florence, and were long known as Florentine thermometers. Alcohol was the liquid first employed, and the degrees, intended to represent thousandths of the volume of the bulb, were marked with small beads of enamel fused on the stem, as shown in fig. 2, which represents two thermometers as depicted in the *Saggi di Naturali Esperienze* published by the Accademia del Cimento in 1666.

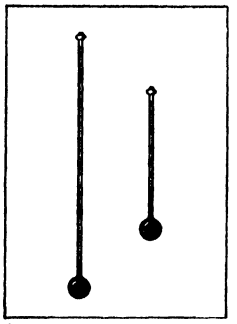

FIG 2.—EARLY FLORENTINE THERMOMETERS, 1666
Alcohol in glass, graduated with enamel beads on stem

In order to render the readings of such instruments comparable with each other, it was necessary to select a fixed point or standard temperature as the zero or starting point of the graduations. Instead of making each degree a given fraction of the volume of the bulb, which would be difficult in practice, and would give different values for the degree with different liquids, it was soon found to be preferable to take *two fixed points*, and to divide the interval between them into the same number of degrees. It was natural in the first instance to take the temperature of the human body as one of the fixed points. In 1701 Sir Isaac Newton proposed a scale in which the freezing-point of water was taken as zero, and the temperature of the human body as 12°. About the same date (1714) Gabriel Daniel Fahrenheit proposed to take as zero the lowest temperature obtainable with a freezing mixture of ice and salt, and to divide the interval between this temperature and that of the human body into 12°. To obtain finer graduations the number was subsequently increased to 96°.

The freezing-point of water was at that time supposed to be somewhat variable, because as a matter of fact it is possible to cool water several degrees below its freezing-point in the absence of ice. Fahrenheit showed, however, that as soon as ice began to form the temperature always rose to the same point, and that a mixture of ice or snow with pure water always gave the same temperature. At a later period he also showed that the temperature of boiling water varied with the barometric pressure, but that it was always the same at the same pressure, and might therefore be used as the second fixed point (as Edmund Halley and others had suggested) provided that a definite pressure, such as the average atmospheric pressure, were specified. The freezing and boiling-points on one of his thermometers, graduated as already explained, with the temperature of the body as 96°, came out in the neighbourhood of 32° and 212° respectively, giving an interval of 180° between these points. Shortly after Fahrenheit's death (1736) the freezing and boiling-points of water were generally recognized as the most convenient fixed points to adopt, but different systems of subdivision were employed. Fahrenheit's scale, with its small degrees and its zero below the freezing-point, possesses undoubted advantages for meteorological work, and is still retained in most English-speaking countries. For general scientific purposes, however, the centigrade system, in which the freezing-point is marked 0° and the boiling-point 100°, is now almost universally employed, on account of its greater simplicity from an arithmetical point of view. For work of precision the fixed points have been more exactly defined (*see* THERMOMETRY), but no change has been made in the fundamental principle of graduation.

3. **Comparison of Scales Based on Expansion.**—Thermometers constructed in the manner already described will give strictly comparable readings, provided that the tubes be of uniform bore, and that the same liquid and glass be employed in their construction; but they possess one obvious defect from a theoretical point of view, namely, that the subdivision of the temperature scale depends on the expansion of the particular liquid selected as the standard. A liquid such as water, which, when continuously heated at a uniform rate from its freezing-point, first contracts and then expands, at a rapidly increasing rate, would obviously be unsuitable; but there is no a priori reason why other liquids should not behave to some extent in a similar way. As a matter of fact, it was soon observed that thermometers carefully constructed with different liquids, such as alcohol, oil and mercury, did not agree precisely in their indications at points of the scale intermediate between the fixed points, and diverged even more widely outside these limits. Another possible method, proposed in 1694 by Carlo Renaldeni (1615–1698), professor of mathematics and philosophy at Pisa, would be to determine the intermediate points of the scale by observing the temperatures of mixtures of ice-cold and boiling water in varying proportions. By this method, the temperature of 50° C would be defined as that obtained by mixing equal weights of water at 0° C and 100° C; 20° C, that obtained by mixing 80 parts of water at 0° C with 20 parts of water at 100° C and so on. Each degree rise of temperature in a mass of water would then represent the addition of the same quantity of heat. The scale thus obtained would, as a matter of fact, agree very closely with that of a mercury thermometer, but the method would be very difficult to put in practice, and would still have the disadvantage of depending on the properties of a particular liquid, namely, water, which is known to behave in an anomalous manner in other respects.

At a later date, the researches of Gay-Lussac (1802) and Regnault (1847) showed that the laws of the expansion of gases are much simpler than those of liquids. Whereas the expansion of alcohol between 0° C and 100° C is nearly seven times as great as that of mercury, all gases (excluding easily condensible vapours) expand equally, or so nearly equally that the differences between them cannot be detected without the most refined observations. This equality of expansion affords a strong a priori argument for selecting the scale given by the expansion of a gas as the standard scale of temperature, but there are still stronger theoretical grounds for this choice, which will be indicated in discussing the absolute scale (§ 23). Among liquids mercury is found to agree most nearly with the gas scale, and is generally employed in thermometers for scientific purposes on account of its high boiling-point and for other reasons. The differences of the mercurial scale from the gas scale having been carefully determined, the mercury thermometer can be used as a secondary standard to replace the gas thermometer within certain limits, as the gas thermometer would be very troublesome to employ directly in ordinary investigations. For certain purposes, and especially at temperatures beyond the range of mercury thermometers, electrical thermometers, also standardized by reference to the gas thermometer, have been very generally employed in recent years, while for still higher temperatures beyond the range of the gas thermometer, thermometers based on the recently established laws of radiation are the only instruments available. For a further discussion of the theory and practice of the measurement of temperature, the reader is referred to the article THERMOMETRY.

CHANGE OF STATE

4. Among the most important effects of heat is that of changing the state of a substance from solid to liquid, or from liquid to vapour. All substances, with the exception of some unstable compounds, are known to be capable of existing in each of the three states under suitable conditions of temperature and pressure. The transition of any substance, from the state of liquid to that of solid or vapour under the ordinary atmospheric pressure, takes place at fixed temperatures, the freezing and boiling-points, which are very sharply defined for pure crystalline substances, and serve in fact as fixed points of the thermometric scale. A change of state cannot, however, be effected in any case without the addition or subtraction of a certain definite quantity of heat. If a piece of ice below the freezing-point is gradually heated at a uniform rate, its temperature may be observed to rise regularly till the freezing-point is reached. At this point it begins to melt, and its temperature ceases to rise. The melting takes a considerable time, during the whole of which heat is being continuously supplied without producing any rise of temperature, although if the same quantity of heat were supplied to an equal mass of water, the

temperature of the water would be raised to the extent of nearly 80° C.

Heat thus absorbed in producing a change of state without rise of temperature is called *latent heat*, a term introduced by Joseph Black, who was one of the first to study the subject of change of state from the point of view of heat absorbed, and who in many cases actually adopted the comparatively rough method described above of estimating quantities of heat by observing the time required to produce a given change when the substance was receiving heat at a steady rate from its surroundings. For every change of state a definite quantity of heat is required, without which the change cannot take place. Heat must be added to melt a solid, or to vaporize a solid or a liquid, and conversely, heat must be subtracted to reverse the change, *i.e.*, to condense a vapour or freeze a liquid. The quantity required for any given change depends on the nature of the substance and the change considered, and varies to some extent with the conditions under which the change is made, but is always the same for the same change under the same conditions. A rough measurement of the latent heat of steam was made as early as 1764 by James Watt, who found that steam at 212° F, when passed from a kettle into a jar of cold water, was capable of raising nearly six times its weight of water to the boiling point. He gives the volume of the steam as being approximately 1,800 times that of an equal weight of water.

5. **General Phenomena of Fusion.**—There are two chief varieties of the process of fusion, namely, crystalline and amorphous, which are in many ways distinct, although it is possible to find intermediate cases which partake of the characteristics of both. The melting of ice may be taken as a typical case of crystalline fusion. The passage from rigid solid to mobile liquid occurs at a definite surface without any intermediate stage or plastic condition. The change takes place at a definite temperature, the fusing or freezing point (abbreviated F.P.), and requires the addition of a definite quantity of heat to the solid, which is called the latent heat of fusion. There is also in general a considerable change of volume during fusion, which amounts in the case of ice to a contraction of 9%.

Some typical cases of amorphous solidification are those of silica, glass, plastic sulphur, pitch, alcohol and many organic liquids. In this type the liquid gradually becomes more and more viscous as the temperature falls, and ultimately attains the rigidity characteristic of a solid, without any definite freezing point or latent heat. The condition of the substance remains uniform throughout, if its temperature is uniform; there is no separation into the two distinct phases of solid and liquid, and there is no sudden change of volume at any temperature.

The melting or freezing of a pure crystalline solid is characterized most clearly by the perfect constancy of temperature during the process. In fact, the law of constant temperature, which is generally stated as the first of the so-called "laws of fusion," does not strictly apply except to this case The constancy of the F.P. of a pure substance is so characteristic that change of the F.P. is often one of the most convenient tests of the presence of foreign material. In the case of substances like ice, which melt at a low temperature and are easily obtained in large quantities in a state of purity, the point of fusion may be very accurately determined by observing the temperature of an intimate mixture of the solid and liquid while slowly melting as it absorbs heat from surrounding bodies. In the majority of cases, however, it is more convenient to observe the freezing point as the liquid is cooled. By this method it is possible to ensure perfect uniformity of temperature throughout the mass by stirring the liquid continuously during the process of freezing, whereas it is difficult to ensure uniformity of temperature in melting a solid, however gradually the heat is supplied, unless the solid can be mixed with the liquid. It is also possible to observe the F.P. in other ways, as by noting the temperature at the moment of the breaking of a wire, of the stoppage of a stirrer, or of the maximum rate of change of volume, but these methods are generally less certain in their indications than the point of greatest constancy of temperature in the case of homogeneous crystalline solids.

Fusing Points of Common Metals in ° C

Mercury	−38·8	Antimony	630
Potassium	62·5	Aluminium	655
Sodium	97·6	Silver	962
Tin	231·9	Gold	1064
Bismuth	269·2	Copper	1082
Cadmium	320·7	Nickel	1452
Lead	327·7	Palladium	1556
Zinc	419·0	Platinum	1756

The table contains some of the most recent values of fusing points of metals determined (except the last three) with platinum thermometers. These points are often utilized as fixed points on the thermometric scale, especially for the calibration of thermocouples.

6. **Superfusion, Supersaturation.**—It is generally possible to cool a liquid several degrees below its normal freezing point without a separation of crystals, especially if it is protected from agitation, which would assist the molecules to rearrange themselves. A liquid in this state is said to be "undercooled" or "superfused." The phenomenon is even more familiar in the case of solutions (*e.g.*, sodium sulphate or acetate) which may remain in the "metastable" condition for an indefinite time if protected from dust. The introduction into the liquid under this condition of the smallest fragment of the crystal, with respect to which the solution is supersaturated, will produce immediate crystallization, which will continue until the temperature is raised to the saturation point by the liberation of the latent heat of fusion. The constancy of temperature at the normal freezing point is due to the equilibrium of exchange existing between the liquid and solid Unless both solid and liquid are present, there is no condition of equilibrium, and the temperature is indeterminate.

It has been shown by H. A. Miers (*Jour Chem Soc*, 1906) that for a supersaturated solution in metastable equilibrium there is an inferior limit of temperature, at which it passes into the "labile" state, *i.e.* spontaneous crystallization occurs throughout the mass in a fine shower. This seems to be analogous to the fine misty condensation which occurs in a supersaturated vapour in the absence of nuclei (*see* VAPORIZATION) when the supersaturation exceeds a certain limit.

7. **Freezing of Solutions and Alloys.**—The phenomena of freezing of crystalline mixtures may be illustrated by the case of aqueous solutions and of metallic solutions or alloys, which have been most widely studied The usual effect of an impurity, such as salt or sugar in solution in water, is to lower the freezing point, so that no crystallization occurs until the temperature has fallen below the normal F.P. of the pure solvent, the depression of F.P. being nearly proportional to the concentration of the solution. When freezing begins, the solvent generally separates out from the solution in the pure state. This separation of the solvent involves an increase in the strength of the remaining solution, so that the temperature does not remain constant during the freezing, but continues to fall as more of the solvent is separated. There is a perfectly definite relation between temperature and concentration at each stage of the process, which may be represented in the form of a curve as *AC* in fig. 3, called the freezing point curve.

The equilibrium temperature, at the surface of contact between the solid and liquid, depends only on the composition of the liquid phase and not at all on the quantity of solid present. The abscissa of the F.P. curve represents the composition of that portion of the original solution which remains liquid at any temperature. If instead of starting with a dilute solution we start with a strong solution represented by a point *N*, and cool it as shown by the vertical line *ND*, a point *D* is generally reached at which the solution becomes "saturated." The dissolved substance or "solute" then separates out as the solution is further cooled, and the concentration diminishes with fall of temperature in a definite relation, as indicated by the curve *CB*, which is called the solubility curve. Though often called by different names, the two curves *AC* and *CB* are essentially of a similar nature. To take the case of an aqueous solution of salt as an example, along *CB* the solution is saturated with respect to salt, along *AC* the solution is saturated with respect to ice. When the point *C* is reached along either

curve, the solution is saturated with respect to both salt and ice. The concentration cannot vary further, and the temperature remains constant, while the salt and ice crystallize out together, maintaining the exact proportions in which they exist in the solution. The resulting solid was termed a cryohydrate by F. Guthrie, but it is really an intimate mixture of two kinds of crystals, and not a chemical compound or hydrate containing the constituents in chemically equivalent proportions The lowest temperature attainable by means of a freezing mixture is the temperature of the F.P. of the corresponding cryohydrate. In a mixture of salt and ice with the least trace of water a saturated brine is quickly formed, which dissolves the ice and falls rapidly in temperature, owing to the absorption of the latent heat of fusion. So long as both ice and salt are present, if the mixture is well stirred, the solution must necessarily become saturated with respect to both ice and salt, and this can only occur at the cryohydric temperature, at which the two curves of solubility intersect.

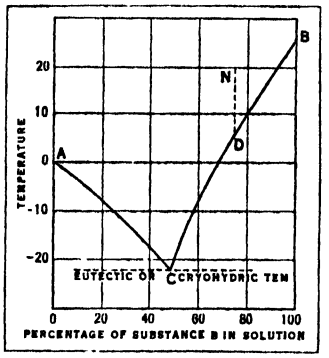

FIG. 3.—F.P., OR SOLUBILITY CURVE: SIMPLE CASE

The curves in fig. 3 also illustrate the simplest type of freezing point curve in the case of alloys of two metals *A* and *B* which do not form mixed crystals or chemical compounds. The alloy corresponding to the cryohydrate, possessing the lowest melting point, is called the eutectic alloy, as it is most easily cast and worked. It generally possesses a very fine-grained structure, and is not a chemical compound. (*See* ALLOYS.)

8. **Calorimetry by Latent Heat.**—In principle, the simplest and most direct method of measuring quantities of heat consists in observing the effects produced in melting a solid or vaporizing a liquid. It was, in fact, by the fusion of ice that quantities of heat were first measured. If a hot body is placed in a cavity in a block of ice at 0° C, and is covered by a closely fitting slab of ice, the quantity of ice melted will be directly proportional to the quantity of heat lost by the body in cooling to 0° C. None of the heat can possibly escape through the ice, and conversely no heat can possibly get in from outside. The body must cool exactly to 0° C, and every fraction of the heat it loses must melt an equivalent quantity of ice. Apart from heat lost in transferring the heated body to the ice block, the method is theoretically perfect. The only difficulty consists in the practical measurement of the quantity of ice melted. Black estimated this quantity by mopping out the cavity with a sponge which was weighed before and after the operation. But there is a variable film of water adhering to the walls of the cavity, which gives trouble in accurate work.

In 1780 Laplace and Lavoisier used a double-walled metallic vessel containing broken ice, which was in many respects more convenient than the block, but aggravated the difficulty of the film of water adhering to the ice. In spite of this practical difficulty, the quantity of heat required to melt unit weight of ice was for a long time taken as the unit of heat. This unit possesses the great advantage that it is independent of the scale of temperature adopted. At a much later date R. Bunsen (*Phil. Mag.*, 1871), adopting a suggestion of Sir John Herschel's, devised an ice-calorimeter suitable for measuring small quantities of heat, in which the difficulty of the water film was overcome by measuring the change in volume due to the melting of the ice. The volume of unit mass of ice is approximately 1·0920 times that of unit mass of water, so that the diminution of volume is 0·092 of a cubic centimetre for each gramme of ice melted. The method requires careful attention to details of manipulation, which are more fully discussed in the article on CALORIMETRY.

For measuring large quantities of heat, such as those produced by the combustion of fuel in a boiler, the most convenient method is the evaporation of water, which is commonly employed by engineers for the purpose. The natural unit in this case is the quantity of heat required to evaporate unit mass of water at the boiling point under atmospheric pressure. In boilers working at a higher pressure, or supplied with water at a lower temperature, appropriate corrections are applied to deduce the quantity evaporated in terms of this unit.

For laboratory work on a small scale the converse method of condensation has been successfully applied by John Joly, in whose steam-calorimeter the quantity of heat required to raise the temperature of a body from the atmospheric temperature to that of steam condensing at atmospheric pressure is observed by weighing the mass of steam condensed on it. (*See* CALORIMETRY.)

9. **Thermometric Calorimetry.**—For the majority of purposes the most convenient and the most readily applicable method of measuring quantities of heat, is to observe the rise of temperature produced in a known mass of water contained in a suitable vessel or calorimeter. This method was employed from a very early date by Count Rumford and other investigators, and was brought to a high pitch of perfection by Regnault in his extensive calorimetric researches (*Mémoires de l'Institut de Paris*, 1847); but it is only within comparatively recent years that it has really been placed on a satisfactory basis by the accurate definition of the units involved. The theoretical objections to the method, as compared with latent heat calorimetry, are that some heat is necessarily lost by the calorimeter when its temperature is raised above that of the surroundings, and that some heat is used in heating the vessel containing the water. These are small corrections, which can be estimated with considerable accuracy in practice. A more serious difficulty, which has impaired the value of much careful work by this method, is that the quantity of heat required to raise the temperature of a given mass of water 1° C depends on the temperature at which the water is taken, and also on the scale of the thermometer employed. It is for this reason, in many cases, impossible to say, at the present time, what was the precise value of the heat unit, in terms of which many of the older results, such as those of Regnault, were expressed. These difficulties are discussed in the articles CALORIMETRY and THERMOMETRY. The unit generally adopted for scientific purposes is the quantity of heat required to raise 1 gramme of water 1° C, and is called the gramme-calorie. English engineers usually state results in terms of the British Thermal Unit (B.Th U.), which is the quantity of heat required to raise 1lb. of water 1° F. (*See* CALORIE.)

10. **Watt's Indicator Diagram; Work of Expansion.**—The rapid development of the steam-engine (*q.v.*) in England during the latter part of the 18th century had a marked effect on the progress of the science of heat. In the first steam-engines the working cylinder served both as boiler and condenser, a very wasteful method, as most of the heat was transferred directly from the fire to the condensing water without useful effect. The first improvement (about 1700) was to use a separate boiler, but the greater part of the steam supplied was still wasted in reheating the cylinder, which had been cooled by the injection of cold water to condense the steam after the previous stroke. In 1769 James Watt showed how to avoid this waste by using a separate condenser and keeping the cylinder as hot as possible. In his earlier engines the steam at full boiler pressure was allowed to raise the piston through nearly the whole of its stroke. Connection with the boiler was then cut off, and the steam at full pressure was discharged into the condenser. Here again there was unnecessary waste, as the steam was still capable of doing useful work. He subsequently introduced "expansive working," which effected still further economy. The connection with the boiler was cut off when a fraction only, say ¼, of the stroke had been completed, the remainder of the stroke being effected by the expansion of the steam already in the cylinder with continually diminishing pressure. By the end of the stroke, when connection was made to the condenser, the pressure was so reduced that there was comparatively little waste from this cause. Watt also devised an instrument called an *indicator* (*see* STEAM ENGINE), in which a pencil, moved up and down vertically by the steam pressure, recorded the pressure in the cylinder at every point of the stroke on a sheet of paper moving horizontally in time with the stroke of the piston. The diagram thus obtained made it possible to study what was happening inside the cylinder, and to deduce the work done by the steam in each

stroke. The method of the indicator diagram has since proved of great utility in physics in studying the properties of gases and vapours.

Fig. 4 represents an imaginary indicator diagram for a steam-engine, taken from one of Watt's patents. Steam is admitted to the cylinder when the piston is at the beginning of its stroke at S, ST represents the length of the stroke or the limit of horizontal movement of the paper on which the diagram is drawn. The indicating pencil rises to the point A, representing the absolute pressure of 60lb. per sq.in. As the piston moves outwards the pencil traces the horizontal line AB, the pressure remaining constant till the point B is reached, at which connection to the boiler is cut off. After cut-off at B the steam expands under diminishing pressure, and the pencil falls gradually from B to C, folowing the steam pressure until the exhaust valve opens at the end of the stroke. The pressure then falls rapidly to that of the condenser, which for an ideal case may be taken as zero, following Watt. The work done during expansion is found by dividing up, as shown, into a number of small rectangles. The whole work done in the forward stroke is represented by the area ABCTSA, or by the average value of the pressure p over the whole stroke multiplied by the stroke l. This area must be multiplied by the area of the piston a in square inches to get the work done per stroke in foot-pounds.

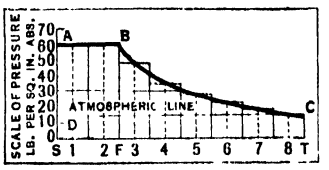

FIG. 4.—WATT'S INDICATOR DIAGRAM. PATENT OF 1782

11. **Thermal Efficiency.**—The thermal efficiency of an engine is the ratio of the work done by the engine to the heat supplied to it. According to Watt's observations, confirmed later by Clément and Desormes, the total heat required to produce 1lb. of saturated steam at any temperature from water at 0° C was approximately 650 times the quantity of heat required to raise 1lb. of water 1° C. Since 1lb. of steam represented on this assumption a certain quantity of heat, the efficiency could be measured naturally in foot-pounds of work obtainable per lb. of steam, or conversely in the pounds of steam which are consumed per horse-power-hour.

In his patent of 1782 Watt gives the following example of the improvement in thermal efficiency obtained by expansive working. Taking the diagram already given, if the quantity of steam represented by AB, or 300 cu.in. at 60lb. pressure, were employed without expansion, the work realized, represented by the area ABSF, would be $6{,}000/4=1{,}500$ foot-pounds. With expansion to 4 times its original volume, as shown in the diagram by the whole area ABCTSA, the mean pressure (as calculated by Watt, assuming Boyle's law) would be 0·58 of the original pressure, and the work done would be $6{,}000\times0{\cdot}58=3{,}480$ foot-pounds for the same quantity of steam, or the thermal efficiency would be 2·32 times greater. The advantage actually obtained would not be so great as this, on account of losses by condensation, back-pressure, etc., which are neglected in Watt's calculation, but the margin would still be very considerable. Three hundred cu.in. of steam at 60lb. pressure would represent about ·0245 of 1lb. of steam, or 28·7 B.Th.U., so that, neglecting all losses, the possible thermal efficiency attainable with steam at this pressure and four expansions (¼ cut-off) would be 3480/28·7, or 121 foot-pounds per B.Th U.

About 1820, it was usual to include the efficiency of the boiler with that of the engine, and to reckon the efficiency or "duty" in foot-pounds per bushel or cwt. of coal. The best Cornish pumping-engines of that date achieved about 70 million foot-pounds per cwt., or consumed about 3·2lb. per horse-power-hour, which is roughly equivalent to 43 foot-pounds per B.Th.U. The efficiency gradually increased as higher pressures were used, with more complete expansion, but the conditions upon which the efficiency depended were not fully worked out till a much later date. Much additional knowledge with regard to the nature of heat, and the properties of gases and vapours, was required before the problem could be attacked theoretically.

THE NATURE OF HEAT

12. In the early days of the science it was natural to ascribe the manifestations of heat to the action of a subtle imponderable fluid called "caloric," with the power of penetrating, expanding and dissolving bodies, or dissipating them in vapour. The fluid was imponderable, because the most careful experiments failed to show that heat produced any increase in weight. The opposite property of levitation was often ascribed to heat, but it was shown by more cautious investigators that the apparent loss of weight due to heating was to be attributed to evaporation or to upward air currents. The fundamental idea of an imaginary fluid to represent heat was useful as helping the mind to a conception of something remaining invariable in quantity through many transformations, but in some respects the analogy was misleading, and tended greatly to retard the progress of science. The caloric theory was very simple in its application to the majority of calorimetric experiments, and gave a fair account of the elementary phenomena of change of state, but it encountered serious difficulties in explaining the production of heat by friction, or the changes of temperature accompanying the compression or expansion of a gas.

The explanation which the calorists offered of the production of heat by friction or compression was that some of the latent caloric was squeezed or ground out of the bodies concerned and became "sensible." In the case of heat developed by friction, they supposed that the abraded portions of the material were capable of holding a smaller quantity of heat, or had less "capacity for heat," than the original material. From a logical point of view, this was a perfectly tenable hypothesis, and one difficult to refute. It was easy to account in this way for the heat produced in boring cannon and similar operations, where the amount of abraded material was large. To refute this explanation, Rumford (*Phil. Trans.*, 1798) made his celebrated experiments with a blunt borer in one of which he succeeded in boiling by friction 26·5lb. of cold water in 2½ hours, with the production of only 4,145 grains of metallic powder. He then showed by experiment that the metallic powder required the same amount of heat to raise its temperature 1°, as an equal weight of the original metal, or that its "capacity for heat" (in this sense) was unaltered by reducing it to powder; and he argued that "in any case so small a quantity of powder could not possibly account for all the heat generated, that the supply of heat appeared to be inexhaustible, and that heat could not be a material substance, but must be something of the nature of motion."

Unfortunately Rumford's argument was not quite conclusive. The supporters of the caloric theory appear, whether consciously or unconsciously, to have used the phrase "capacity for heat" in two entirely distinct senses without any clear definition of the difference. The phrase "capacity for heat" might very naturally denote the total quantity of heat contained in a body, which we have no means of measuring, but it was generally used to signify the quantity of heat required to raise the temperature of a body one degree, which is quite a different thing, and has no necessary relation to the total heat. In proving that the powder and the solid metal required the same quantity of heat to raise the temperature of equal masses of either one degree, Rumford did not prove that they contained equal quantities of heat, which was the real point at issue in this instance. The metal tin actually changes into powder below a certain temperature, and in so doing evolves a measurable quantity of heat. A mixture of the gases oxygen and hydrogen, in the proportions in which they combine to form water, evolves when burnt sufficient heat to raise more than 30 times its weight of water from the freezing to the boiling point; and the mixture of gases may, in this sense, be said to contain so much more heat than the water, although its capacity for heat in the ordinary sense is only about half that of the water produced. To complete the refutation of the calorists' explanation of the heat produced by friction, it would have been necessary for Rumford to show that the powder when reconverted into the same state as the solid metal did not absorb a quantity of heat equivalent to that evolved in the grinding; in other words that the heat produced by friction was not simply that due to the change

of state of the metal from solid to powder.

Shortly afterwards, in 1799, Davy (*see* Sir H. Davy's *Collected Works*, 1839) described an experiment in which he melted ice by rubbing two blocks together. This experiment afforded a very direct refutation of the calorists' view, because it was a well-known fact that ice required to have a quantity of heat added to it to convert it into water, so that the water produced by the friction contained more heat than the ice. In stating as the conclusion to be drawn from this experiment that "friction consequently does not diminish the capacity of bodies for heat," Davy apparently uses the phrase capacity for heat in the sense of total heat contained in a body, because in a later section of the same essay he definitely gives the phrase this meaning, and uses the term "capability of temperature" to denote what we now term capacity for heat

The delay in the overthrow of the caloric theory, and in the acceptance of the view that heat is a mode of motion, was no doubt partly due to some fundamental confusion of ideas in the use of the term "capacity for heat" and similar phrases. A still greater obstacle lay in the comparative vagueness of the motion or vibration theory. Davy speaks of heat as being "repulsive motion," and distinguishes it from light, which is "projective motion"; though heat is certainly not a substance—according to Davy in the essay under discussion—and may not even be treated as an imponderable fluid, light as certainly *is* a material substance, and is capable of forming chemical compounds with ordinary matter, such as oxygen gas, which is not a simple substance, but a compound, termed phosoxygen, of light and oxygen

Accepting the conclusions of Davy and Rumford that heat is not a material substance but a mode of motion, there still remains the question, what definite conception is to be attached to a quantity of heat? What do we mean by a quantity of vibratory motion, how is the quantity of motion to be estimated, and why should it remain invariable in many transformations? The idea that heat was a "mode of motion" was applicable as a qualitative explanation of many of the effects of heat, but it lacked the quantitative precision of a scientific statement, and could not be applied to the calculation and prediction of definite results. The state of science at the time of Rumford's and Davy's experiments did not admit of a more exact generalization The way was paved in the first instance by a more complete study of the laws of gases, to which Laplace, Dalton, Gay-Lussac, Dulong and many others contributed both on the experimental and theoretical side. Although the development proceeded simultaneously along many parallel lines, it is interesting and instructive to take the investigation of the properties of gases, and to endeavour to trace the steps by which the true theory was finally attained.

THERMAL PROPERTIES OF GASES

13. The most characteristic property of a gaseous or elastic fluid, namely, the elasticity, or resistance to compression, was first investigated scientifically by Robert Boyle (1662), who showed that the pressure p of a given mass of gas varied inversely as the volume v, provided that the temperature remained constant. This is generally expressed by the formula $pv=C$, where C is a constant for any given temperature, and v is taken to represent the specific volume, or the volume of unit mass, of the gas at the given pressure and temperature. Boyle was well aware of the effect of heat in expanding a gas, but he was unable to investigate this properly as no thermometric scale had been defined at that date. According to Boyle's law, when a mass of gas is compressed by a small amount at constant temperature, the percentage increase of pressure is equal to the percentage diminution of volume (if the compression is $v/100$, the increase of pressure is very nearly $p/100$). Adopting this law, Newton showed, by a most ingenious piece of reasoning (*Principia*, ii., sect. 8), that the velocity of sound in air should be equal to the velocity acquired by a body falling under gravity through a distance equal to half the height of the atmosphere, considered as being of uniform density equal to that at the surface of the earth. This gave the result 918ft per sec. (280 metres per sec.) for the velocity at the freezing point. Newton was aware that the actual velocity of sound was somewhat greater than this, but supposed that the difference might be due in some way to the size of the air particles, of which no account could be taken in the calculation. The first accurate measurement of the velocity of sound by the French Académie des Sciences in 1738 gave the value 332 metres per sec. as the velocity at 0° C. The true explanation of the discrepancy was not discovered till nearly 100 years later.

The law of expansion of gases with change of temperature was investigated by Dalton and later by Gay-Lussac (1802), who found that the volume of a gas under constant pressure increased by $\frac{1}{267}$ of its volume at 0° C for each 1° C rise in temperature. This value was generally assumed in all calculations for nearly 50 years. More exact researches, especially those of Regnault, at a later date, showed that the law was very nearly correct for all permanent gases, but that the value of the coefficient should be $\frac{1}{273}$. According to this law the volume of a gas at any temperature t° C should be proportional to $273+t$, *i.e.*, to the temperature reckoned from a zero 273° below that of the Centigrade scale, which was called the absolute zero of the gas thermometer. If $T=273+t$, denotes the temperature measured from this zero, the law of expansion of a gas may be combined with Boyle's law in the simple formula

$$pv=RT \qquad (1)$$

which is generally taken as the expression of the gaseous laws. If equal volumes of different gases are taken at the same temperature and pressure, it follows that the constant R is the same for all gases If equal masses are taken, the value of the constant R for different gases varies inversely as the molecular weight or as the density relative to hydrogen

Dalton also investigated the laws of vapours, and of mixtures of gases and vapours. He found that condensible vapours approximately followed Boyle's law when compressed, until the condensation pressure was reached, at which the vapour liquefied without further increase of pressure. He found that when a liquid was introduced into a closed space, and allowed to evaporate until the space was saturated with the vapour and evaporation ceased, the increase of pressure in the space was equal to the condensation pressure of the vapour, and did not depend on the volume of the space or the presence of any other gas or vapour provided that there was no solution or chemical action He showed that the condensation or saturation-pressure of a vapour depended only on the temperature, and increased by nearly the same fraction of itself per degree rise of temperature, and that the pressures of different vapours were nearly the same at equal distances from their boiling points. The increase of pressure per degree C at the boiling point was about $\frac{1}{26}$ of 760mm. or 27·2mm., but increased in geometrical progression with rise of temperature. These results of Dalton's were confirmed, and in part corrected, as regards increase of vapour-pressure, by Gay-Lussac, Dulong, Regnault and other investigators, but were found to be as close an approximation to the truth as could be obtained with such simple expressions. More accurate empirical expressions for the increase of vapour-pressure of a liquid with temperature were soon obtained by Thomas Young, J. P. L. A. Roche and others, but the explanation of the relation was not arrived at until a much later date (*see* VAPORIZATION).

14. **Specific Heats of Gases.**—In order to estimate the quantities of heat concerned in experiments with gases, it was necessary in the first instance to measure their specific heats, which presented formidable difficulties. The earlier attempts by Lavoisier and others, employing the ordinary methods of calorimetry, gave very uncertain and discordant results, which were not regarded with any confidence even by the experimentalists themselves. Gay-Lussac (*Mémoires d'Arcueil*, 1807) devised an ingenious experiment, which, though misinterpreted at the time, is very interesting and instructive. With the object of comparing the specific heats of different gases, he took two equal globes A and B connected by a tube with a stop-cock. The globe B was exhausted, the other A being filled with gas. On opening the tap between the vessels, the gas flowed from A to B and the pressure was rapidly equalized. He observed that the fall of temperature in A was

nearly equal to the rise of temperature in *B*, and that for the same initial pressure the change of temperature was very nearly the same for all the gases he tried, except hydrogen, which showed greater changes of temperature than other gases. He concluded from this experiment that equal volumes of gases had the same capacity for heat, except hydrogen, which he supposed to have a larger capacity, because it showed a greater effect. The method does not in reality afford any direct information with regard to the specific heats, and the conclusion with regard to hydrogen is evidently wrong.

At a later date (*Ann. de Chim.*, 1812) Gay-Lussac adopted A. Crawford's method of mixture, allowing two equal streams of different gases, one heated and the other cooled about 20° C, to mix in a tube containing a thermometer. The resulting temperature was in all cases nearly the mean of the two, from which he concluded that equal volumes of all the gases tried, namely, hydrogen, carbon dioxide, air, oxygen and nitrogen, had the same thermal capacity. This was correct, except as regards carbon dioxide, but did not give any information as to the actual specific heats referred to water or any known substance. About the same time, F. Delaroche and J. E. Bérard (*Ann de Chim.*, 1813) made direct determinations of the specific heats of air, oxygen, hydrogen, carbon monoxide, carbon dioxide, nitrous oxide and ethylene, by passing a stream of gas heated to nearly 100° C through a spiral tube in a calorimeter containing water. Their work was a great advance on previous attempts, and gave the first trustworthy results With the exception of hydrogen, which presents peculiar difficulties, they found that equal volumes of the permanent gases, air, oxygen and carbon monoxide, had nearly the same thermal capacity, but that the compound condensible gases, carbon dioxide, nitrous oxide and ethylene, had larger thermal capacities in the order given. They were unable to state whether the specific heats of the gases increased or diminished with temperature, but from experiments on air at pressures of 740mm and 1,000mm., they found the specific heats to be ·269 and ·245 respectively, and concluded that the specific heat diminished with increase of pressure The difference they observed was really due to errors of experiment, but they regarded it as proving beyond doubt the truth of the calorists' contention that the heat disengaged on the compression of a gas was due to the diminution of its thermal capacity.

Dalton and others had endeavoured to measure directly the rise of temperature produced by the compression of a gas Dalton had observed a rise of 50° F in a gas when suddenly compressed to half its volume, but no thermometers at that time were sufficiently sensitive to indicate more than a fraction of the change of temperature. Laplace was the first to see in this phenomenon the probable explanation of the discrepancy between Newton's calculation of the velocity of sound and the observed value. The increase of pressure due to a sudden compression, in which no heat was allowed to escape, or as we now call it an *adiabatic* compression, would necessarily be greater than the increase of pressure in a slow isothermal compression, on account of the rise of temperature. As the rapid compressions and rarefactions occurring in the propagation of a sound wave were perfectly adiabatic, it was necessary to take account of the rise of temperature due to compression in calculating the velocity. To reconcile the observed and calculated values of the velocity, the increase of pressure in adiabatic compression must be 1·410 times greater than in isothermal compression. This is the ratio of the adiabatic elasticity of air to the isothermal elasticity. It was a long time, however, before Laplace saw his way to any direct experimental verification of the value of this ratio. At a later date (*Ann. de chim.*, 1816) he stated that he had succeeded in proving that the ratio in question must be the same as the ratio of the specific heat of air at constant pressure to the specific heat at constant volume.

15. **Experimental Verification of the Ratio of Specific Heats.**—This was a most interesting and important theoretical relation to discover, but unfortunately it did not help much in the determination of the ratio required, because it was not practically possible at that time to measure the specific heat of air at constant volume in a closed vessel. Attempts had been made to do this, but they had signally failed, on account of the small heat capacity of the gas as compared with the containing vessel. Laplace endeavoured to extract some confirmation of his views from the values given by Delaroche and Bérard for the specific heat of air at 1,000 and 740mm. pressure. On the assumption that the quantities of heat contained in a given mass of air increased in direct proportion to its volume when heated at constant pressure, he deduced, by some rather obscure reasoning, that the ratio of the specific heats S and s should be about 1·5 to 1, which he regarded as a fairly satisfactory agreement with the value $\gamma = 1{\cdot}41$ deduced from the velocity of sound.

The ratio of the specific heats could not be directly measured, but a few years later, N. Clément–Desormes (*Journ. de Phys.*, 1819) succeeded in making a direct measurement of the ratio of the elasticities in a very simple manner. He took a large globe containing air at atmospheric pressure and temperature, and removed a small quantity of air. He then observed the defect of pressure p_0 when the air had regained its original temperature. By suddenly opening the globe, and immediately closing it, the pressure was restored almost instantaneously to the atmospheric, the rise of pressure p_0 corresponding to the sudden compression produced. The air, having been heated by the compression, was allowed to regain its original temperature, the tap remaining closed, and the final defect of pressure p_1 was noted. The change of pressure for the same compression performed isothermally is then $p_0 - p_1$. The ratio $p_0/(p_0 - p_1)$ is the ratio of the adiabatic and isothermal elasticities, provided that p_0 is small compared with the whole atmospheric pressure In this way he found the ratio 1·354, which is not much smaller than the value 1·410 required to reconcile the observed and calculated values of the velocity of sound. Gay-Lussac and J J. Welter (*Ann. de chim.*, 1822) repeated the experiment with slight improvements, using expansion instead of compression, and found the ratio 1·375. The experiment has often been repeated since that time, and there is no doubt that the value of the ratio deduced from the velocity of sound is correct, the defect of the value obtained by direct experiment being due to the fact that the compression or expansion is not perfectly adiabatic. Gay-Lussac and Welter found the ratio practically constant for a range of pressure 144 to 1,460mm , and for a range of temperature from −20° to +40° C. The velocity of sound at Quito, at a pressure of 544mm was found to be the same as at Paris at 760mm at the same temperature Assuming on this evidence the constancy of the ratio of the specific heats of air, Laplace (*Mécanique céleste*, v) showed that, if the specific heat at constant pressure was independent of the temperature, the specific heat per unit volume at a pressure p must vary as $p^{1/\gamma}$ according to the caloric theory The specific heat per unit mass must then vary as $p^{1/\gamma - 1}$ which he found agreed precisely with the experiment of Delaroche and Bérard already cited This was undoubtedly a strong confirmation of the caloric theory. Poisson by the same assumptions (*Ann. de chim.*, 1823) obtained the same results, and also showed that the relation between the pressure and the volume of a gas in adiabatic compression or expansion must be of the form $pv^\gamma = \text{constant}$.

P. L. Dulong (*Ann. de chim* , 1829), adopting a method due to E F. F Chladni, compared the velocities of sound in different gases by observing the pitch of the note given by the same tube when filled with the gases in question He thus obtained the values of the ratios of the elasticities or of the specific heats for the gases employed For oxygen, hydrogen and carbonic oxide, these ratios were the same as for air. But for carbonic acid, nitrous oxide and olefiant gas, the values were much smaller, showing that these gases experienced a smaller change of temperature in compression On comparing his results with the values of the specific heats for the same gases found by Delaroche and Bérard, Dulong observed that the changes of temperature for the same compression were in the inverse ratio of the specific heats at constant volume, and deduced the important conclusion that "*Equal volumes of all gases under the same conditions evolve on compression the same quantity of heat.*" This is equivalent to the statement that the difference of the specific heats, or the latent heat of expansion R' per 1°, is the same for all gases if equal

volumes are taken. Assuming the ratio $\gamma = 1.410$, and taking Delaroche and Bérard's value for the specific heat of air at constant pressure $S = .267$, we have $s = S/1.41 = .189$, and the difference of the specific heats per unit mass of air $S - s = R' = .078$. Adopting Regnault's value of the specific heat of air, namely, $S = .238$, we should have $S - s = .069$. This quantity represents the heat absorbed by unit mass of air in expanding at constant temperature T by a fraction $1/T$ of its volume v, or by $\frac{1}{273}$ of its volume at 0° C.

If, instead of taking unit mass, we take a volume $v_0 = 22.30$ litres at 0° C and 760mm. being the volume of the molecular weight of the gas in grammes, the quantity of heat evolved by a compression equal to v/T will be approximately 2 calories, and is the same for all gases. The work done in this compression is $pv/T = R$, and is also the same for all gases, namely, 8·3 joules. Dulong's experimental result, therefore, shows that the heat evolved in the compression of a gas is proportional to the work done. This result had previously been deduced theoretically by Carnot (1824) At a later date it was assumed by Mayer, Clausius and others, on the evidence of these experiments, that the heat evolved was not merely proportional to the work done, but was equivalent to it. The further experimental evidence required to justify this assumption was first supplied by Joule.

CARNOT: ON THE MOTIVE POWER OF HEAT

16. A practical and theoretical question of the greatest importance was first answered by Sadi Carnot about this time in his *Réflexions sur la puissance motrice du feu* (1824). How much motive power (defined by Carnot as weight lifted through a certain height) can be obtained from heat alone by means of an engine repeating a regular succession or "cycle" of operations continuously? Is the efficiency limited, and, if so, how is it limited? Are other agents preferable to steam for developing motive power from heat? In discussing this problem, we cannot do better than follow Carnot's reasoning which, in its main features, could hardly be improved at the present day. Carnot points out that in order to obtain an answer to this question, it is necessary to consider the essential conditions of the process, apart from the mechanism of the engine and the working substance or agent employed. Work cannot be said to be produced *from heat alone* unless nothing but heat is supplied, and the working substance and all parts of the engine are at the end of the process in precisely the same state as at the beginning.

For instance a mass of compressed air, if allowed to expand in a cylinder at constant temperature, will do work, and will at the same time absorb a quantity of heat which, as we now know, is the thermal equivalent of the work done. But this work cannot be said to have been produced solely from the heat absorbed in the process, because the air at the end of the process is in a changed condition, and could not be restored to its original state at the same temperature without having work done upon it precisely equal to that obtained by its expansion. The process could not be repeated indefinitely without a continual supply of compressed air. The source of the work in this case is work previously done in compressing the air, and no part of the work is really generated at the expense of heat alone, unless the compression is effected at a lower temperature than the expansion.

Carnot's Axiom. Carnot here, and throughout his reasoning, makes a fundamental assumption, which he states as follows: "When a body has undergone any changes and after a certain number of transformations is brought back identically to its original state, considered relatively to density, temperature and mode of aggregation, it must contain the same quantity of heat as it contained originally." Clausius (*Pogg. Ann.* 79, p. 369) and others have misinterpreted this assumption, and have taken it to mean that the quantity of heat required to produce any given change of state is independent of the manner in which the change is effected, which Carnot does not here assume.

Heat, according to Carnot, in the type of engine we are considering, can evidently be a cause of motive power only by virtue of changes of volume or form produced by alternate heating and cooling. This involves the existence of hot and cold bodies to act as boiler and condenser, or source and sink of heat, respectively. Wherever there exists a difference of temperature, it is possible to have the production of motive power from heat; and conversely, production of motive power, from heat alone, is impossible without difference of temperature. In other words the production of motive power from heat is not merely a question of the consumption of heat, but always requires transference of heat from hot to cold. What then are the conditions which enable the difference of temperature to be most advantageously employed in the production of motive power, and how much motive power can be obtained with a given difference of temperature from a given quantity of heat?

Carnot's Rule for Maximum Effect.—In order to realize the maximum effect, it is necessary that, in the process employed, there should not be any direct interchange of heat between bodies at different temperatures. Direct transference of heat by conduction or radiation between bodies at different temperatures is equivalent to wasting a difference of temperature which might have been utilized to produce motive power. The working substance must throughout every stage of the process be in equilibrium with itself (*i.e.*, at uniform temperature and pressure) and also with external bodies, such as the boiler and condenser, at such times as it is put in communication with them. In the actual engine there is always some interchange of heat between the steam and the cylinder, and some loss of heat to external bodies. There may also be some difference of temperature between the boiler steam and the cylinder on admission, or between the waste steam and the condenser at release. These differences represent losses of efficiency which may be reduced indefinitely, at least in imagination, by suitable means, and designers had even at that date been very successful in reducing them. All such losses are supposed to be absent in deducing the ideal limit of efficiency, beyond which it would be impossible to go.

17. **Carnot's Description of His Ideal Cycle.**—Carnot first gives a rough illustration of an incomplete cycle, using steam much in the same way as it is employed in an ordinary steam-engine. After expansion down to condenser pressure the steam is completely condensed to water, and is then returned as cold water to the hot boiler. He points out that the last step does not conform exactly to the condition he laid down, because although the water is restored to its initial state, there is direct passage of heat from a hot body to a cold body in the last process. He points out that this difficulty might be overcome by supposing the difference of temperature small, and by employing a series of engines, each working through a small range, to cover a finite interval of temperature. Having established the general notions of a perfect cycle, he proceeds to give a more exact illustration, employing a gas as the working substance. He takes as the basis of his demonstration the well-established experimental fact that a gas is heated by rapid compression and cooled by rapid expansion, and that if compressed or expanded slowly in contact with conducting bodies, the gas will give out heat in compression or absorb heat in expansion while its temperature remains constant. He then goes on to say:—

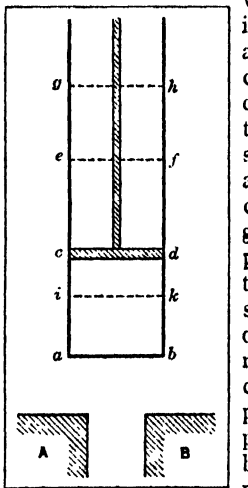

FIG. 5.—CARNOT'S CYLINDER

"This preliminary notion being settled, let us imagine an elastic fluid, atmospheric air for example, enclosed in a cylinder *abcd* (fig. 5) fitted with a movable diaphragm or piston *cd*. Let there also be two bodies A, B, each maintained at a constant temperature, that of A being more elevated than that of B. Let us now suppose the following series of operations to be performed:

"1. Contact of the body A with the air contained in the space *abcd*, or with the bottom of the cylinder, which we will suppose to transmit heat easily. The air is now at the temperature of the body A, and *cd* is the actual position of the piston.

"2. The piston is gradually raised, and takes the position *ef*. The air remains in contact with the body A, and is thereby maintained at a constant temperature during the expansion. The body A furnishes the heat necessary to maintain the constancy of temperature.

"3. The body A is removed, and the air no longer being in contact with any body capable of giving it heat, the piston continues nevertheless to rise, and passes from the position *ef* to *gh*. The air expands without receiving heat and its temperature falls. Let us imagine that it falls until it is just equal to that of the body B. At this moment the piston is stopped and occupies the position *gh*.

"4. The air is placed in contact with the body B; it is compressed by the return of the piston, which is brought from the position *gh* to the position *cd*. The air remains meanwhile at a constant temperature, because of its contact with the body B to which it gives up its heat.

"5. The body B is removed, and the compression of the air is continued. The air being now isolated, rises in temperature. The compression is continued until the air has acquired the temperature of the body A. The piston passes meanwhile from the position *cd* to the position *ik*.

"6. The air is replaced in contact with the body A, and the piston returns from the position *ik* to the position *ef*, the temperature remaining invariable.

"7. The period described under (3) is repeated, then successively the periods (4), (5), (6); (3), (4), (5), (6); (3), (4), (5), (6); and so on.

"During these operations the air enclosed in the cylinder exerts an effort more or less great on the piston. The pressure of the air varies both on account of changes of volume and on account of changes of temperature; but it should be observed that for equal volumes, that is to say, for like positions of the piston, the temperature is higher during the dilatation than during the compression. Since the pressure is greater during the expansion, the quantity of motive power produced by the dilatation is greater than that consumed by the compression. We shall thus obtain a balance of motive power, which may be employed for any purpose. The air has served as working substance in a heat-engine; it has also been employed in the most advantageous manner possible, since no useless re-establishment of the equilibrium of heat has been allowed to occur.

"All the operations above described may be executed in the reverse order and direction. Let us imagine that after the sixth period, that is to say, when the piston has reached the position *ef*, we make it return to the position *ik*, and that at the same time we keep the air in contact with the hot body A; the heat furnished by this body during the sixth period will return to its source, that is, to the body A, and everything will be as it was at the end of the fifth period. If now we remove the body A, and if we make the piston move from *ik* to *cd*, the temperature of the air will decrease by just as many degrees as it increased during the fifth period, and will become that of the body B. We can evidently continue in this way a series of operations the exact reverse of those which were previously described; it suffices to place oneself in the same circumstances and to execute for each period a movement of expansion in place of a movement of compression, and vice versa.

"The result of the first series of operations was the production of a certain quantity of motive power, and the transport of heat from the body A to the body B; the result of the reverse operations is the consumption of the motive power produced in the first case, and the return of heat from the body B to the body A, in such sort that these two series of operations annul and neutralize each other.

"The impossibility of producing by the agency of heat alone a quantity of motive power greater than that which we have obtained in our first series of operations is now easy to prove. It is demonstrated by reasoning exactly similar to that which we have already given. The reasoning will have in this case a greater degree of exactitude; the air of which we made use to develop the motive power is brought back at the end of each cycle of operations precisely to its initial state, whereas this was not quite exactly the case for the vapour of water, as we have already remarked."

18. **Proof of Carnot's Principle.**—Carnot considered the proof too obvious to be worth repeating, but, unfortunately, his previous demonstration, referring to an incomplete cycle, is not so exactly worded that exception cannot be taken to it. We will therefore repeat his proof in a slightly more definite and exact form. Suppose that a reversible engine R, working in the cycle above described, takes a quantity of heat Q from the source in each cycle, and performs a quantity of useful work W. If it were possible for any other engine S, working with the same two bodies A and B as source and refrigerator, to perform a greater amount of useful work W_1 per cycle for the same quantity of heat Q taken from the source, it would suffice to take a portion W'_1 of this motive power (since W_1 is by hypothesis greater than W'_1) to drive the engine R backwards, and return a quantity of heat Q to the source in each cycle. The process might be repeated indefinitely, and we should obtain at each repetition a balance of useful work W_1-W_1, *without taking any heat from the source*, which is contrary to experience. Whether the quantity of heat taken from the condenser by R is equal to that given to the condenser by S is immaterial. The hot body A might be a comparatively small boiler, since no heat is taken from it. The cold body B might be the ocean, or the whole earth. We might thus obtain without any consumption of fuel a practically unlimited supply of motive power. Which is absurd.

Carnot's Statement of his Principle.—If the foregoing reasoning be admitted, we must conclude with Carnot that *the motive power obtainable from heat is independent of the agents employed to realize it. The efficiency is fixed solely by the temperatures of the bodies between which, in the last resort, the transfer of heat is effected.* "We must understand here that each of the methods of developing motive power attains the perfection of which it is susceptible. This condition is fulfilled if, according to our rule, there is produced in the body no change of temperature that is not due to change of volume, or in other words, if there is no direct interchange of heat between bodies of sensibly different temperatures"

It is characteristic of a state of frictionless mechanical equilibrium that an indefinitely small difference of pressure suffices to upset the equilibrium and reverse the motion. Similarly in thermal equilibrium between bodies at the same temperature, an indefinitely small difference of temperature suffices to reverse the transfer of heat. Carnot's rule is therefore the criterion of the reversibility of a cycle of operations as regards transfer of heat. It is assumed that the ideal engine is mechanically reversible, that there is not, for instance, any communication between reservoirs of gas or vapour at sensibly different pressures, and that there is no waste of power in friction. If there is equilibrium both mechanical and thermal at every stage of the cycle, the ideal engine will be perfectly reversible. That is to say, all its operations will be exactly reversed as regards transfer of heat and work, when the operations are performed in the reverse order and direction. On this understanding Carnot's principle may be put in a different way, which is often adopted, but is really only the same thing put in different words: *The efficiency of a perfectly reversible engine is the maximum possible, and is a function solely of the limits of temperature between which it works.* This result depends essentially on the existence of a state of thermal equilibrium defined by equality of temperature, and independent, in the majority of cases, of the state of a body in other respects. In order to apply the principle to the calculation and prediction of results, it is sufficient to determine the manner in which the efficiency depends on the temperature for one particular case, since the efficiency must be the same for all reversible engines.

19. Carnot endeavoured to test his results by calculating the amount of work obtainable from an engine on his cycle, using steam as a working substance, and comparing the result with an engine performing a similar cycle, using air as the working substance. He found, using the experimental data available at that time, that the work to be obtained from 1,000 gram-calories of heat was

roughly independent of the working substance, being about 1·13 kilogrammetre per kilo-calorie per 1° fall at 100° C, *i.e.*, when the limits of temperature of the cycle are 101° C and 100° C. He was able to show that the efficiency per degree fall probably diminished with rise of temperature, but the experimental data at that time were too inconsistent to suggest the true relation. He took as the analytical expression of his principle that the efficiency W/Q of a perfect engine taking in heat Q at a temperature $t°$ C, and rejecting heat at the temperature 0° C, must be some function Ft of the temperature t, which would be the same for all substances. The efficiency per degree fall at a temperature t he represented by $F't$, the derived function of Ft. The function $F't$ would be the same for all substances at the same temperature, but would have different values at different temperatures. In terms of this function, which is generally known as Carnot's function, the results obtained in the previous section might be expressed as follows:—

"The increase of volume of a mixture of liquid and vapour per unit-mass vaporized at any temperature, multiplied by the increase of vapour-pressure per degree, is equal to the product of the function $F't$ by the latent heat of vaporization.

"The difference of the specific heats, or the latent heat of expansion for any substance, multiplied by the function $F't$, is equal to the product of the expansion per degree at constant pressure by the increase of pressure per degree at constant volume."

Since the last two coefficients are the same for all gases if equal volumes are taken, Carnot concluded that: "The difference of the specific heats at constant pressure and volume is the same for equal volumes of all gases at the same temperature and pressure."

Taking the expression $W=RT \log_e r$ for the whole work done by a gas obeying the gaseous laws $pv=RT$ in expanding at a temperature T from a volume 1 (unity) to a volume r, or for a ratio of expansion r, and putting $W''=R \log_e r$ for the work done in a cycle of range 1°, Carnot obtained the expression for the heat absorbed by a gas in isothermal expansion.

$$Q=R \log_e r/F'(t) \qquad (2)$$

He gives several important deductions which follow from this formula, which is the analytical expression of the experimental result already quoted as having been discovered subsequently by Dulong. Employing the above expression for the latent heat of expansion, Carnot deduced a general expression for the specific heat of a gas at constant volume on the basis of the caloric theory. He showed that if the specific heat was independent of the temperature (the hypothesis already adopted by Laplace and Poisson) the function $F'(t)$ must be of the form

$$F'(t)=R/C\ (t+t_0) \qquad (3)$$

where C and t_0 are unknown constants. A similar result follows from his expression for the difference of the specific heats. If this is assumed to be constant and equal to C, the expression for $F'(t)$ becomes R/CT, which is the same as the above if $t_0=273$. Assuming the specific heat to be also independent of the volume, he shows that the function $F'(t)$ should be constant. But this assumption is inconsistent with the caloric theory of latent heat of expansion, which requires the specific heat to be a function of the volume. It appears in fact impossible to reconcile Carnot's principle with the caloric theory on any simple assumptions. As Carnot remarks: "The main principles on which the theory of heat rests require most careful examination. Many experimental facts appear almost inexplicable in the present state of this theory."

Carnot's work was subsequently put in a more complete analytical form by B. P. E. Clapeyron (*Journ. de l'éc. polytechn.*, 1832), who also made use of Watt's indicator diagram for the first time in discussing physical problems. Clapeyron gave the general expressions for the latent heat of a vapour, and for the latent heat of isothermal expansion of any substance, in terms of Carnot's function, employing the notation of the calculus. The expressions he gave are the same in form as those in use at the present time. He also gave the general expression for Carnot's function, and endeavoured to find its variation with temperature; but having no better data, he succeeded no better than Carnot. Unfortunately, in describing Carnot's cycle, he assumed the caloric theory of heat, and made some unnecessary mistakes, which Carnot (who, we now know, was a believer in the mechanical theory) had been very careful to avoid. Clapeyron directs one to compress the gas at the lower temperature in contact with the body B *until the heat disengaged is equal to that which has been absorbed at the higher temperature.* He assumes that the gas at this point contains the same quantity of heat as it contained in its original state at the higher temperature, and that, when the body B is removed, the gas will be restored to its original temperature, when compressed to its initial volume. This mistake is still attributed to Carnot, and regarded as a fatal objection to his reasoning by many writers.

Prof. W. Thomson (Lord Kelvin) stated (*Phil. Mag.*, 1852) that "Carnot's original demonstration utterly fails," and he introduced the "corrections" attributed to James Thomson and Clerk Maxwell respectively. In reality Carnot's original demonstration requires no correction.

MECHANICAL THEORY OF HEAT

26. According to the caloric theory, the heat absorbed in the expansion of a gas became latent, like the latent heat of vaporization of a liquid, but remained in the gas and was again evolved on compressing the gas. This theory gave no explanation of the source of the motive power produced by expansion. The mechanical theory had explained the production of heat by friction as being due to transformation of visible motion into a brisk agitation of the ultimate molecules, but it had not so far given any definite explanation of the converse production of motive power at the expense of heat. The theory could not be regarded as complete until it had been shown that in the production of work from heat, a certain quantity of heat disappeared, and ceased to exist as heat; and that this quantity was the same as that which could be generated by the expenditure of the work produced. The earliest complete statement of the mechanical theory from this point of view is contained in some notes written by Carnot, about 1830, but published by his brother (*Life of Sadi Carnot*, Paris, 1878). Taking the difference of the specific heats to be ·078, he estimated the mechanical equivalent at 370 kilogrammetres. But he fully recognized that there were no experimental data at that time available for a quantitative test of the theory, although it appeared to afford a good qualitative explanation of the phenomena. He therefore planned a number of crucial experiments such as the *porous plug* experiment, to test the equivalence of heat and motive power. His early death in 1836 put a stop to these experiments, but many of them have since been independently carried out by other observers.

The most obvious case of the production of work from heat is in the expansion of a gas or vapour, which served in the first instance as a means of calculating the ratio of equivalence, on the assumption that all the heat which disappeared had been transformed into work and had not merely become latent. Marc Séguin, in his *De l'influence des chemins de fer* (1839), made a rough estimate in this manner of the mechanical equivalent of heat, assuming that the loss of heat represented by the fall of temperature of steam on expanding was equivalent to the mechanical effect produced by the expansion. He also remarks (*loc. cit.*) that it was absurd to suppose that "a finite quantity of heat could produce an indefinite quantity of mechanical action, and that it was more natural to assume that a certain quantity of heat disappeared in the very act of producing motive power." J. R. Mayer (*Liebig's Annalen*, 1842) stated the equivalence of heat and work more definitely, deducing it from the old principle, *causa aequat effectum.* Assuming that the sinking of a mercury column by which a gas was compressed was equivalent to the heat set free by the compression, he deduced that the warming of a kilogramme of water 1° C would correspond to the fall of a weight of one kilogramme from a height of about 365 metres. But Mayer did not adduce any fresh experimental evidence, and made no attempt to apply his theory to the fundamental equations of thermodynamics. It has since been urged that the experiment of Gay-

Lussac (1807), on the expansion of gas from one globe to another (*see* § 14), was sufficient justification for the assumption tacitly involved in Mayer's calculation. But Joule was the first to supply the correct interpretation of this experiment, and to repeat it on an adequate scale with suitable precautions. Joule was also the first to measure directly the amount of heat liberated by the compression of a gas, and to prove that heat was not merely rendered latent, but disappeared altogether as heat, when a gas did work in expansion.

21. **Joule's Determinations of the Mechanical Equivalent.**—The honour of placing the mechanical theory of heat on a sound *experimental* basis belongs almost exclusively to J. P. Joule, who showed by direct experiment that in all the most important cases in which heat was generated by the expenditure of mechanical work, or mechanical work was produced at the expense of heat, there was a constant ratio of equivalence between the heat generated and the work expended and vice versa. His first experiments were on the relation of the chemical and electric energy expended to the heat produced in metallic conductors and voltaic and electrolytic cells; these experiments were described in a series of papers published in the *Phil. Mag.*, 1840–43. He first proved the relation, known as Joule's law, that the heat produced in a conductor of resistance R by a current C is proportional to C^2R per second. He went on to show that the total heat produced in any voltaic circuit was proportional to the electromotive force E of the battery and to the number of equivalents electrolysed in it. Faraday had shown that electromotive force depends on chemical affinity. Joule measured the corresponding heats of combustion, and showed that the electromotive force corresponding to a chemical reaction is proportional to the heat of combustion of the electro-chemical equivalent. He also measured the E.M.F. required to decompose water, and showed that when part of the electric energy EC is thus expended in a voltameter, the heat generated is less than the heat of combustion corresponding to EC by a quantity representing the heat of combustion of the decomposed gases.

Joule's papers so far had been concerned with the relations between electrical energy, chemical energy and heat which he showed to be mutually equivalent. The first paper in which he discussed the relation of heat to mechanical power was entitled "On the Calorific Effects of Magneto-Electricity, and on the Mechanical Value of Heat" (*Brit. Assoc.*, 1843; *Phil. Mag.*, 1887). In this paper he showed that the heat produced by currents generated by magneto-electric induction followed the same law as voltaic currents. By a simple and ingenious arrangement he succeeded in measuring the mechanical power expended in producing the currents, and deduced the mechanical equivalent of heat and of electrical energy. The amount of mechanical work required to raise 1lb. of water 1° F (1 B.Th.U.), as found by this method, was 838 foot-pounds. In a note added to the paper he states that he found the value 770 ft.lb. by the more direct method of forcing water through fine tubes. In a paper "On the Changes of Temperature produced by the Rarefaction and Condensation of Air" (*Phil. Mag.*, 1845), he made the first direct measurements of the quantity of heat disengaged by compressing air, and also of the heat absorbed when the air was allowed to expand against atmospheric pressure; as the result he deduced the value 798 ft.lb. for the mechanical equivalent of 1 B.Th.U. He also showed that there was no appreciable absorption of heat when air was allowed to expand in such a manner as not to develop mechanical power, and he pointed out that the mechanical equivalent of heat could not be satisfactorily deduced from the relations of the specific heats, because the knowledge of the specific heats of gases at that time was of so uncertain a character.

He attributed most weight to his later determinations of the mechanical equivalent made by the direct method of friction of liquids. He showed that the results obtained with different liquids, water, mercury and sperm oil, were the same, namely, 782 ft.lb.; and finally repeating the method with water, using all the precautions and improvements which his experience had suggested, he obtained the value 772 ft.lb., which was accepted universally for many years, and has only recently required alteration on account of the more exact definition of the heat unit, and the standard scale of temperature (*see* CALORIMETRY). The great value of Joule's work for the general establishment of the principle of the conservation of energy lay in the variety and completeness of the experimental evidence he adduced. It was not sufficient to find the relation between heat and mechanical work or other forms of energy in one particular case. It was necessary to show that the same relation held in all cases which could be examined experimentally, and that the ratio of equivalence of the different forms of energy, measured in different ways, was independent of the manner in which the conversion was effected and of the material or working substance employed.

As the result of Joule's experiments, we are justified in concluding that heat is a form of energy, and that all its transformations are subject to the general principle of the conservation of energy. As applied to heat, the principle is called the first law of thermodynamics, and may be stated as follows: *When heat is transformed into any other kind of energy, or vice versa, the total quantity of energy remains invariable; that is to say, the quantity of heat which disappears is equivalent to the quantity of the other kind of energy produced and vice versa.*

The number of units of mechanical work equivalent to one unit of heat is generally called the mechanical equivalent of heat, or Joule's equivalent, and is denoted by the letter *J*. Its numerical value depends on the units employed for heat and mechanical energy respectively. The values of the equivalent in terms of the units most commonly employed at the present time are as follows:—

777 foot-pounds (Lat. 45°)	= 1 B.Th.U. (lb. deg. Fahr.)
1·399 foot-pounds (Lat. 45°)	= 1 lb. deg. C (lb.-calorie)
426·3 kilogrammetres	= 1 kilogram-deg. C or kilo-calorie.
426·3 grammetres 4·180 joules or watt-seconds	= 1 gram-deg. C or gramme-calorie.
1·161 watt-hours	= 1 kg. calorie.
1·161 kilowatt-hours	= 1 tonne calorie.

The water for the heat units is supposed to be taken at 20° C or 68° F, and the degree of temperature is supposed to be measured by the hydrogen thermometer. The acceleration of gravity in latitude 45° is taken as 980·6 C.G.S. For details of more recent and accurate methods of determination, the reader should refer to the article CALORIMETRY, where tables of the variation of the specific heat of water with temperature are also given.

The *second law of thermodynamics* is a title often used to denote Carnot's principle or some equivalent mathematical expression. In some cases this title is not conferred on Carnot's principle itself, but on some axiom from which the principle may be indirectly deduced. These axioms, however, cannot as a rule be directly applied, so that it would appear preferable to take Carnot's principle itself as the second law. It may be observed that, as a matter of history, Carnot's principle was established and generally admitted before the principle of the conservation of energy as applied to heat, and that from this point of view the titles, first and second laws, are not particularly appropriate.

22. **Combination of Carnot's Principle with the Mechanical Theory.**—A very instructive paper, showing the state of the science of heat about this time, is that of C. H. A. Holtzmann, "On the Heat and Elasticity of Gases and Vapours" (Mannheim, 1845; Taylor's *Scientific Memoirs*, iv.) who points out that the theory of Laplace and Poisson does not agree with facts when applied to vapours, and that Clapeyron's formulae, though probably correct, contain an undetermined function (Carnot's $F't$, Clapeyron's $1/C$) of the temperature. He determines the value of this function to be J/T by assuming, with Séguin and Mayer, that the work done in the isothermal expansion of a gas is a measure of the heat absorbed. From the then accepted value ·078 of the difference of the specific heats of air, he finds the numerical value of J to be 374 kilogrammetres per kilo-calorie. *Assuming the heat equivalent of the work to remain in the gas,* he obtains expressions similar to Clapeyron's for the total heat and the specific heats. In consequence of this assumption, the formulae he obtained for adiabatic expansion were necessarily wrong, but no data existed at that time for testing them. In applying his

formulae to vapours, he obtained an expression for the saturation-pressure of steam, which agreed with the empirical formula of Roche, and satisfied other experimental data on the supposition that the coefficient of expansion of steam was ·00423, and its specific heat 1·69—values which are now known to be impossible, but which appeared at the time to give a very satisfactory explanation of the phenomena.

The essay of Hermann Helmholtz, *On the Conservation of Force* (Berlin, 1847), discussed all the known cases of the transformation of energy, and is justly regarded as one of the chief landmarks in the establishment of the energy-principle. Helmholtz gives an admirable statement of the fundamental principle as applied to heat, but makes no attempt to formulate the correct equations of thermodynamics on the mechanical theory. He points out the fallacy of Holtzmann's (and Mayer's) calculation of the equivalent, but admits that it is supported by Joule's experiments, though he does not seem to appreciate the true value of Joule's work. He considers that Holtzmann's formulae are well supported by experiment, and are much preferable to Clapeyron's, because the value of the undetermined function $F't$ is found. But he fails to notice that Holtzmann's equations are fundamentally inconsistent with the conservation of energy, because the heat equivalent of the external work done is supposed to remain in the gas.

That a quantity of heat equivalent to the work performed actually disappears when a gas does work in expansion, was first shown by Joule in the paper on condensation and rarefaction of air (1845) already referred to. At the conclusion of this paper he felt justified by direct experimental evidence in reasserting definitely the hypothesis of Ségiun (*loc. cit*) that "the steam while expanding in the cylinder loses heat in quantity exactly proportional to the mechanical force developed, and that on the condensation of the steam the heat thus converted into power is not given back." He did not see his way to reconcile this conclusion with Clapeyron's description of Carnot's cycle. At a later date, in a letter to Prof. W. Thomson (Lord Kelvin) (1848), he pointed out that, since, according to his own experiments, the work done in the expansion of a gas at constant temperature is equivalent to the heat absorbed, by equating Carnot's expressions (given in § 19) for the work done and the heat absorbed, the value of Carnot's function $F't$ must be equal to J/T, in order to reconcile his principle with the mechanical theory.

Prof. W. Thomson gave an account of Carnot's theory (*Trans. Roy. Soc. Edin.*, 1849), in which he recognized the discrepancy between Clapeyron's statement and Joule's experiments, but did not see his way out of the difficulty. He therefore adopted Carnot's principle provisionally, and proceeded to calculate a table of values of Carnot's function $F't$, from the values of the total-heat and vapour-pressure of steam then recently determined by Regnault (*Mémoires de l'Institut de Paris*, 1847). In making the calculation, he assumed that the specific volume v of saturated steam at any temperature T and pressure p is that given by the gaseous laws, $pv=RT$. The results are otherwise correct so far as Regnault's data are accurate, because the values of the efficiency per degree $F't$ are not affected by any assumption with regard to the nature of heat. He obtained the values of the efficiency over a finite range from t to 0° C, by adding up the values of $F't$ for the separate degrees. This latter proceeding is inconsistent with the mechanical theory, but is the correct method on the assumption that the heat given up to the condenser is equal to that taken from the source. The values he obtained for $F't$ agreed very well with those previously given by Carnot and Clapeyron, and showed that this function diminishes with rise of temperature roughly in the inverse ratio of T, as suggested by Joule.

R. J. E. Clausius (*Pogg. Ann.*, 1850) and W. J. M. Rankine (*Trans. Roy. Soc. Edin.*, 1850) were the first to develop the correct equations of thermodynamics on the mechanical theory. When heat was supplied to a body to change its temperature or state, part remained in the body as intrinsic heat energy E, but part was converted into external work of expansion W and ceased to exist as heat. The part remaining in the body was always the same for the same change of state, however performed, as required by Carnot's fundamental axiom, but the part corresponding to the external work was necessarily different for different values of the work done. Thus in any cycle in which the body was exactly restored to its initial state, the heat remaining in the body would always be the same, or as Carnot puts it, the quantities of heat absorbed and given out in its diverse transformations are exactly "compensated," so far as the body is concerned. But the quantities of heat absorbed and given out are not necessarily equal On the contrary, they differ by the equivalent of the external work done in the cycle. Applying this principle to the case of steam, Clausius deduced a fact previously unknown, that the specific heat of steam maintained in a state of saturation is negative, which was also deduced by Rankine (*loc. cit.*) about the same time. In applying the principle to gases Clausius assumes (with Mayer and Holtzmann) that the heat absorbed by a gas in isothermal expansion is equivalent to the work done, but he does not appear to be acquainted with Joule's experiment, and the reasons he adduces in support of this assumption are not conclusive. This being admitted, he deduces from the energy principle alone the propositions already given by Carnot with reference to gases, and shows in addition that the specific heat of a perfect gas must be independent of the density.

In the second part of his paper Clausius introduces Carnot's principle, which he quotes as follows: "The performance of work is equivalent to a transference of heat from a hot to a cold body without the quantity of heat being thereby diminished." This is quite different from Carnot's way of stating his principle (*see* § 18), and has the effect of exaggerating the importance of Clapeyron's unnecessary assumption. By equating the expressions given by Carnot for the work done and the heat absorbed in the expansion of a gas, he deduces (following Holtzmann) the value J/T for Carnot's function $F't$ (which Clapeyron denotes by $1/C$). He shows that this assumption gives values of Carnot's function which agree fairly well with those calculated by Clapeyron and Thomson, and that it leads to values of the mechanical equivalent not differing greatly from those of Joule. Substituting the value J/T for C in the analytical expressions given by Clapeyron for the latent heat of expansion and vaporization, these relations are immediately reduced to their modern form (*see* THERMODYNAMICS). Being unacquainted with Carnot's original work, but recognizing the invalidity of Clapeyron's description of Carnot's cycle, Clausius substituted a proof consistent with the mechanical theory, which he based on the axiom that "heat cannot of itself pass from cold to hot." The proof on this basis involves the application of the energy principle, which does not appear to be necessary, and the axiom to which final appeal is made does not appear more convincing than Carnot's. Strange to say, Clausius did not in this paper give the expression for the efficiency in a Carnot cycle of finite range (Carnot's Ft) which follows immediately from the value J/T assumed for the efficiency $F't$ of a cycle of infinitesimal range at the temperature t° C or T° A.

Rankine did not make the same assumption as Clausius explicitly, but applied the mechanical theory of heat to the development of his hypothesis of molecular vortices, and deduced from it a number of results similar to those obtained by Clausius. Unfortunately the paper (*loc. cit.*) was not published till some time later, but in a summary given in the *Phil. Mag.* (1851) the principal results were detailed. Assuming the value of Joule's equivalent, Rankine deduced the value 0·2404 for the specific heat of air at constant pressure, in place of 0·267 as found by Delaroche and Bérard. The subsequent verification of this value by Regnault (*Comptes rendus*, 1853) afforded strong confirmation of the accuracy of Joule's work. In a note appended to the abstract in the *Phil. Mag.* Rankine states that he has succeeded in proving that the maximum efficiency of an engine working in a Carnot cycle of finite range t_1 to t_0 is of the form $(t_1-t_0)/(t_1-k)$, where k is a constant, the same for all substances. This is correct if t represents temperature Centigrade, and $k=-273$.

Prof. W. Thomson (Lord Kelvin) in a paper "On the Dynamical Theory of Heat" (*Trans. Roy. Soc. Edin.*, 1851, first published in the *Phil. Mag.*, 1852) gave a very clear statement of the position of the theory at that time. He showed that the value

$F't=J/T$, assumed for Carnot's function by Clausius without any experimental justification, rested solely on the evidence of Joule's experiment, and might possibly not be true at all temperatures. Assuming the value J/T with this reservation, he gave as the expression for the efficiency over a finite range $t_1°$ to $t_0°$ C, or $T_1°$ to $T_0°$A, the result,

$$W/Q=(t_1-t_0)/(t_1+273)=(T_1-T_0)/T_1 \qquad (4)$$

which, he observed, agrees in form with that found by Rankine.

23. **The Absolute Scale of Temperature.**—Since Carnot's function is the same for all substances at the same temperature, and is a function of the temperature only, it supplies a means of measuring temperature independently of the properties of any particular substance. This proposal was first made by Lord Kelvin (*Phil. Mag.*, 1848), who suggested that the degree of temperature should be chosen so that the efficiency of a perfect engine at any point of the scale should be the same, or that Carnot's function $F't$ should be constant. This would give the simplest expression for the efficiency of the caloric theory, but the scale so obtained, when the values of Carnot's function were calculated from Regnault's observations on steam, was found to differ considerably from the scale of the mercury or air-thermometer. At a later date, when it became clear that the value of Carnot's function was very nearly proportional to the reciprocal of the temperature T measured from the absolute zero of the gas thermometer, he proposed a simpler method (*Phil. Trans.*, 1854), namely, to define absolute temperature T as proportional to the reciprocal of Carnot's function. On this definition of absolute temperature, the expression $(T-T_0)/T$ for the efficiency of a Carnot cycle with limits T and T_0 would be exact, and it became a most important problem to determine how far the temperature by gas thermometer differed from the absolute temperature. With this object he devised a very delicate method, known as the *porous plug experiment* (*see* THERMODYNAMICS), of testing the deviation of the gas thermometer from the absolute scale. The experiments were carried out in conjunction with Joule, and finally resulted in showing ("On the Thermal Effects of Fluids in Motion," *Phil. Trans.*, 1862) that the deviations of the air thermometer from the absolute scale as above defined are almost negligible, and that in the case of the gas hydrogen the deviations are so small that a thermometer containing this gas may be taken for all practical purposes as agreeing exactly with the absolute scale at all ordinary temperatures. For this reason the hydrogen thermometer has since been generally adopted as the standard.

AVAILABILITY OF HEAT OF COMBUSTION

24. Taking the value of 1·13 kilogrammetres per kilo-calorie for 1° C fall of temperature at 100° C, Carnot attempted to estimate the possible performance of a steam-engine receiving heat at 160° C and rejecting it at 40° C. Assuming the performance to be simply proportional to the temperature fall, the work done for 120° fall would be 134 kilogrammetres per kilo-calorie. To make an accurate calculation required a knowledge of the variation of the function $F't$ with temperature. Taking the accurate formula of § 22, the work obtainable is 118 kilogrammetres per kilo-calorie, which is 28% of 426, the mechanical equivalent of the kilo-calorie in kilogrammetres. Carnot pointed out that the fall of 120° C utilized in the steam-engine was only a small fraction of the whole temperature fall obtainable by combustion, and made an estimate of the total power available if the whole fall could be utilized, allowing for the probable diminution of the function $F't$ with rise of temperature. His estimate was 3·9 million kilogrammetres per kilogramme of coal. This was certainly an over-estimate, but was surprisingly close, considering the scanty data at his disposal.

In reality the fraction of the heat of combustion available, even in an ideal engine and apart from practical limitations, is much less than might be inferred from the efficiency formula of the Carnot cycle, by taking the temperature obtainable by the combustion of the fuel as the upper limit of temperature in the formula. For carbon burnt *in air* at constant pressure without any loss of heat, the products of combustion might be raised 2,300° C in temperature, assuming that the specific heats of the products were constant and that there was no dissociation. If all the heat could be supplied to the working fluid at this temperature, that of the condenser being 40° C, the possible efficiency by the formula of § 22 would be 89%. But it is obvious that this could not be done even under the most ideal conditions. The heat given up by the products of combustion in cooling to atmospheric temperature could not be received by the boiler at 2,300° but at intermediate temperatures from 2,300°, to 40°, which would reduce the mean effective temperature of heat reception from 2,300° to 1,640°, and the ideal efficiency from 89 to 62%. This, however, assumes a perfect regenerative boiler in which the working fluid leaves the boiler at a temperature of 2,300°, although the mean temperature of heat reception cannot exceed 1,640°. Carnot foresaw that there would be further limitations in the case of the steam-engine owing to the properties of the working fluid.

The greater part of the heat required for generating steam in a boiler is the latent heat of vaporization, which is necessarily received by the steam at the saturation temperature corresponding to the pressure at which the boiler is designed to work. Thus at a pressure of 680lb. per sq.in., which is about the highest at present utilized on a large scale, the latent heat of vaporization, amounting to about 400 calories, would be received at a temperature of only 260° C (500° F) permitting an ideal efficiency of 41% for the conversion of this part of the heat. But if the feed-water from the condenser at 40° is pumped directly into the boiler, to heat it to 260°, the heat required, amounting to about 230 cals., would be received by the feed-water at intermediate temperatures, and could not be so efficiently utilized. Rankine (*Phil. Trans.* 1854) was the first to show how the work obtainable from this part of the heat could be calculated. His formula gives an ideal efficiency of conversion of 25% for heat supplied in equal instalments between 40° and 260°. This would reduce the efficiency of an engine using the Rankine cycle with saturated steam at 680lb. pressure to 35% as compared with 41% for the Carnot cycle, in terms of the heat actually received by the steam. If the temperature of the boiler were further raised to 360° C, corresponding to a pressure of 2,700lb. (nearly four times as great as at 260°), the ideal efficiency of the Carnot cycle would be just over 50%, or half the latent heat could be utilized by a perfect engine. But the latent heat at 360° is only 177 calories, and is less than half the heat required for feed-heating, which amounts to 400 calories, so that the corresponding efficiency of the Rankine cycle is only 38%, which is very near the limit theoretically attainable in this cycle with saturated steam.

25. **Advantages of Internal Combustion.**—As Carnot pointed out, the chief advantage of using atmospheric air as a working fluid in a heat-engine lies in the possibility of imparting heat to it directly by internal combustion. Even with internal combustion, however, the full range of temperature is not available, because the heat cannot in practice be communicated to the working fluid at constant temperature, owing to the large range of expansion at constant temperature required for the absorption of a sufficient quantity of heat. Air-engines of this type, such as Stirling's or Ericsson's, taking in heat at constant temperature, though theoretically the most perfect, are bulky and mechanically inefficient.

In practical engines the heat is generated by the combustion of an explosive mixture at constant volume or at constant pressure. The heat is not all communicated at the highest temperature, but over a range of temperature from that of the mixture at the beginning of combustion to the maximum temperature. The earliest instance of this type of engine is the lycopodium engine of M. M. Niepce, discussed by Carnot, in which a combustible mixture of air and lycopodium powder at atmospheric pressure was ignited in a cylinder, and did work on a piston. The early gas-engines of E. Lenoir (1860) and N. Otto and E. Langen (1866), operated in a similar manner with illuminating gas in place of lycopodium. Combustion in this case is effected practically at constant volume, and the maximum efficiency theoretically obtainable is $1-\log_e r/(r-1)$, where r is the ratio of the maximum temperature T to the initial temperature T_0. In order to obtain this efficiency it would be necessary to follow Carnot's rule, and expand the gas after ignition without loss or gain of heat from T

down to T_0, and then to compress it at T_0 to its initial volume. If the rise of temperature in combustion were 2,300°C, and the initial temperature were 0° C or 273°A, the theoretical efficiency would be 73·3%, which is much greater than that obtainable with a boiler. But in order to reach this value, it would be necessary to expand the mixture to about 270 times its initial volume, which is obviously impracticable. Owing to incomplete expansion and rapid cooling of the heated gases by the large surface exposed, the actual efficiency of the Lenoir engine was less than 5%, and of the Otto and Langen, with more rapid expansion, about 10%.

Carnot foresaw that in order to render an engine of this type practically efficient, it would be necessary to *compress* the mixture *before* ignition. Compression is beneficial in three ways: (1) it permits a greater range of expansion after ignition; (2) it raises the mean effective pressure, and thus improves the mechanical efficiency and the power in proportion to size and weight; (3) it reduces the loss of heat during ignition by reducing the surface exposed to the hot gases. In the modern gas or petrol motor, compression is employed as in Carnot's cycle, but the efficiency attainable is limited not so much by considerations of temperature as by limitations of volume. It is impracticable before combustion at constant volume to compress a rich mixture to much less than one-fifth of its initial volume, and, for mechanical simplicity, the range of expansion is made equal to that of compression. The cycle employed was patented in 1862 by Beau de Rochas, but was first successfully carried out by Otto (1876). It differs from the Carnot cycle in employing reception and rejection of heat at constant volume instead of at constant temperature. This cycle is not so efficient as the Carnot cycle for given limits of temperature, but, *for the given limits of volume imposed*, it gives a much higher efficiency than the Carnot cycle. The efficiency depends only on the range of temperature in expansion and compression, and is given by the formula $(T_1-T_2)/T_1$, where T_1 is the maximum temperature, and T_2 the temperature at the end of expansion. The formula is the same as that for the Carnot cycle with the same range of temperature in expansion. The ratio T_1/T_2 is $r^{\gamma-1}$ where r is the given ratio of expansion or compression, and γ is the ratio of the specific heats of the working fluid. Assuming the working fluid to be a perfect gas with the same properties as air, we should have $\gamma=1{\cdot}41$. Taking $r=5$, the formula gives 48% for the maximum possible efficiency. The actual products of combustion vary with the nature of the fuel employed, and have different properties from air, but the efficiency is found to vary with compression in the same manner as for air. For this reason a committee of the Institution of Civil Engineers in 1905 recommended the adoption of the air-standard for estimating the effects of varying the compression ratio, and defined the relative efficiency of an internal combustion engine as the ratio of its observed efficiency to that of a perfect air-engine with the same compression.

26. **Effect of Dissociation, and Increase of Specific Heat.** —One of the most important effects of heat is the decomposition or dissociation of compound molecules. Just as the molecules of a vapour combine with evolution of heat to form the more complicated molecules of the liquid, and as the liquid molecules require the addition of heat to effect their separation into molecules of vapour; so in the case of molecules of different kinds which combine with evolution of heat, the reversal of the process can be effected either by the agency of heat, or indirectly by supplying the requisite amount of energy by electrical or other methods. Just as the latent heat of vaporization diminishes with rise of temperature, and the pressure of the dissociated vapour molecules increases, so in the case of compound molecules in general the heat of combination diminishes with rise of temperature, and the pressure of the products of dissociation increases. There is evidence that the compound carbon dioxide, CO_2, is partly dissociated into carbon monoxide and oxygen at high temperatures, and that the proportion dissociated increases with rise of temperature. There is a very close analogy between these phenomena and the vaporization of a liquid. The laws which govern dissociation are the same fundamental laws of thermodynamics, but the relations involved are necessarily more complex on account of the presence of different kinds of molecules, and present special difficulties for accurate investigation in the case where dissociation does not begin to be appreciable until a high temperature is reached.

It is easy, however, to see that the general effect of dissociation must be to diminish the available temperature of combustion, and all experiments go to show that in ordinary combustible mixtures the rise of temperature actually attained is much less than that calculated as in § 24, on the assumption that the whole heat of combustion is developed and communicated to products of constant specific heat. The defect of temperature observed can be represented by supposing that the specific heat of the products of combustion increases with rise of temperature. This is the case for CO_2 even at ordinary temperatures, according to Regnault, and probably also for air and steam at higher temperatures. Increase of specific heat is a necessary accompaniment of dissociation, and from some points of view may be regarded as merely another way of stating the facts. It is the most convenient method to adopt in the case of products of combustion consisting of a mixture of CO_2 and steam with a large excess of inert gases, because the relations of equilibrium of dissociated molecules of so many different kinds would be too complex to permit of any other method of expression.

It appears from the researches of Dugald Clerk, H. le Chateller and others that the apparent specific heat of the products of combustion in a gas-engine may be taken as approximately ·34 to ·33 in place of ·24 at working temperatures between 1,000°C and 1,700° C, and that the ratio of the specific heats is about 1·29 in place of 1·41. This limits the availability of the heat of combustion by reducing the rise of temperature actually obtainable in combustion at constant volume by 30 or 40%, and also by reducing the range of temperature T_1/T_2 for a given ratio of expansion r from $r^{\cdot41}$ to $r^{\cdot29}$. The formula given in § 23 is no longer quite exact, because the ratio of the specific heats of the mixture during compression is not the same as that of the products of combustion during expansion. But since the work done depends principally on the expansion curve, the ratio of the range of temperature in expansion (T_1-T_2) to the maximum temperature T_1 will still give a very good approximation to the possible efficiency. Taking $r=5$, as before, for the compression ratio, the possible efficiency is reduced from 48% to 38%, if $\gamma=1{\cdot}29$ instead of 1·41. A large gas-engine of the present time with $r=5$ may actually realize as much as 34% indicated efficiency, which is 90% of the maximum possible, showing how perfectly all avoidable heat losses have been minimized.

It is often urged that the gas-engine is relatively less efficient than the steam-engine, because, although it has a much higher absolute efficiency, it does not utilize so large a fraction of its temperature range, reckoning that of the steam-engine from the temperature of the boiler to that of the condenser, and that of the gas-engine from the maximum temperature of combustion to that of the air. This is not quite fair, and has given rise to the mistaken notion that "there is an immense margin for improvement in the gas-engine," which is not the case if the practical limitations of volume are rightly considered. If expansion could be carried out in accordance with Carnot's principle of maximum efficiency, down to the lower limit of temperature T_0, with rejection of heat at T_0 during compression to the original volume v_0, it would no doubt be possible to obtain an ideal efficiency of nearly 80%. But this would be quite impracticable, as it would require expansion to about 100 times v_0, or 500 times the compression volume. Some advantage no doubt might be obtained by carrying the expansion beyond the original volume. This has been done, but is not found to be worth the extra complication. A more practical method, which has been applied by Diesel for liquid fuel, is to introduce the fuel at the end of compression, and adjust the supply in such a manner as to give combustion at nearly constant pressure. This makes it possible to employ higher compression, with a corresponding increase in the ratio of expansion and the theoretical efficiency. With a compression ratio of 14, an indicated efficiency of 40% has been obtained in this way, but owing to additional complications the

brake efficiency was only 31%, which is hardly any improvement on the brake efficiency of 30% obtained with the ordinary type of gas-engine.

Although Carnot's principle makes it possible to calculate in every case what the limiting possible efficiency would be for any kind of cycle if all heat losses were abolished, it is very necessary, in applying the principle to practical cases, to take account of the possibility of avoiding the heat losses which are supposed to be absent, and of other practical limitations in the working of the actual engine. An immense amount of time and ingenuity has been wasted in striving to realize impossible margins of ideal efficiency, which a close study of the practical conditions would have shown to be illusory. As Carnot remarks at the conclusion of his essay: "Economy of fuel is only one of the conditions a heat-engine must satisfy; in many cases it is only secondary, and must often give way to considerations of safety, strength and wearing qualities of the machine, of smallness of space occupied, or of expense in erecting. To know how to appreciate justly in each case the considerations of convenience and economy, to be able to distinguish the essential from the accessory, to balance all fairly, and finally to arrive at the best result by the simplest means, such must be the principal talent of the man called on to direct and co-ordinate the work of his fellows for the attainment of a useful object of any kind"

TRANSFERENCE OF HEAT

27. There are three principal modes of transference of heat, namely (1) convection, (2) conduction and (3) radiation:

(1) In convection, heat is carried or conveyed by the motion of heated masses of matter. The most familiar illustrations of this method of transference are the heating of buildings by the circulation of steam or hot water, or the equalization of temperature of a mass of unequally heated liquid or gas by convection currents, produced by natural changes of density or by artificial stirring. (2) In conduction, heat is transferred by contact between contiguous particles of matter and is passed on from one particle to the next without visible relative motion of the parts of the body. A familiar illustration of conduction is the passage of heat through the metal plates of a boiler from the fire to the water inside, or the transference of heat from a soldering bolt to the solder and the metal with which it is placed in contact. (3) In radiation, the heated body gives rise to a motion of vibration in the aether, which is propagated equally in all directions, and is reconverted into heat when it encounters any obstacle capable of absorbing it. Thus radiation differs from conduction and convection in taking place most perfectly in the absence of matter, whereas conduction and convection require material communication between the bodies concerned.

In the majority of cases of transference of heat all three modes of transference are simultaneously operative in a greater or less degree, and the combined effect is generally of great complexity. The different modes of transference are subject to widely different laws, and the difficulty of disentangling their effects and subjecting them to calculation is often one of the most serious obstacles in the experimental investigation of heat. In space void of matter, we should have pure radiation, but it is difficult to obtain so perfect a vacuum that the effects of the residual gas in transferring heat by conduction or convection are inappreciable. In the interior of an opaque solid we should have pure conduction, but if the solid is sensibly transparent in thin layers there must also be an internal radiation, while in a liquid or a gas it is very difficult to eliminate the effects of convection. These difficulties are well illustrated in the historical development of the subject by the experimental investigations which have been made to determine the laws of heat-transference, such as the laws of cooling, of radiation and of conduction.

28. **Newton's Law of Cooling.**—There is one essential condition common to all three modes of heat-transference, namely, that they depend on difference of temperature, that the direction of the transfer of heat is always from hot to cold, and that the rate of transference is, for small differences, directly proportional to the difference of temperature. Without difference of temperature there is no transfer of heat. When two bodies have been brought to the same temperature by conduction, they are also in equilibrium as regards radiation, and vice versa. If this were not the case, there could be no equilibrium of heat defined by equality of temperature. A hot body placed in an enclosure of lower temperature, *e.g.*, a calorimeter in its containing vessel, generally loses heat by all three modes simultaneously in different degrees. The loss by each mode will depend in different ways on the form, extent and nature of its surface and on that of the enclosure, on the manner in which it is supported, on its relative position and distance from the enclosure, and on the nature of the intervening medium. But provided that the difference of temperature is small, the rate of loss of heat by all modes will be approximately proportional to the difference of temperature, the other conditions remaining constant The rate of cooling or the rate of fall of temperature will also be nearly proportional to the rate of loss of heat, if the specific heat of the cooling body is constant, or the rate of cooling at any moment will be proportional to the difference of temperature.

This simple relation is commonly known as Newton's law of cooling, but is limited in its application to comparatively simple cases such as the foregoing. Newton himself applied it to estimate the temperature of a red-hot iron ball, by observing the time which it took to cool from a red heat to a known temperature, and comparing this with the time taken to cool through a known range at ordinary temperatures. According to this law if the excess of temperature of the body above its surroundings is observed at equal intervals of time, the observed values will form a geometrical progression with a common ratio. Supposing, for instance, that the surrounding temperature were 0° C, that the red-hot ball took 25 minutes to cool from its original temperature to 20° C, and 5 minutes to cool from 20° C to 10° C, the original temperature is easily calculated on the assumption that the excess of temperature above 0° C falls to half its value in each interval of 5 minutes. Doubling the value 20° at 25 minutes five times, we arrive at 640° C as the original temperature. No other method of estimation of such temperaures was available in the time of Newton, but, as we now know, the simple law of proportionality to the temperature difference is inapplicable over such large ranges of temperature. The rate of loss of heat by radiation, and also by convection and conduction to the surrounding air, increases much more rapidly than in simple proportion to the temperature difference, and the rate of increase of each follows a different law. At a later date Sir John Herschel measured the intensity of the solar radiation at the surface of the earth, and endeavoured to form an estimate of the temperature of the sun by comparison with terrestrial sources on the assumption that the intensity of radiation was simply proportional to the temperature difference. He thus arrived at an estimate of several million degrees, which we now know would be about a thousand times too great. The application of Newton's law necessarily leads to absurd results when the difference of temperature is very large, but the error will not in general exceed 2% to 3% if the temperature difference does not exceed 10° C, and the percentage error is proportionately much smaller for smaller differences.

29. **Surface Emissivity.**—Similar considerations apply to many attempts which have been made to determine the general value of the constant termed by Fourier and early writers the "exterior conductibility," but now called the surface emissivity. This coefficient represents the rate of loss of heat from a body per unit area of surface per degree excess of temperature, and includes the effects of radiation, convection and conduction. As already pointed out, the combined effect will be nearly proportional to the excess of temperature in any given case provided that the excess is small, but it is not necessarily proportional to the extent of surface exposed except in the case of pure radiation. The rate of loss of heat by convection and conduction varies with the form of the surface, and, unless the enclosure is very large compared with the cooling body, the effect depends also on the size and form of the enclosure. The effects of conduction and radiation may be approximately estimated if the conductivity of the gas and the nature and forms of the surfaces of the body and enclosure

are known, but the effect of convection in any case can be determined only by experiment. It has been found that the rate of cooling by a current of air is approximately proportional to the velocity of the current, other things being equal. It is obvious that this should be the case, but the result cannot generally be applied to convection currents. Values which are commonly given for the surface emissivity must therefore be accepted with great reserve. They can be regarded only as approximate, and as applicable only to cases precisely similar to those for which they were experimentally obtained. There cannot be said to be any general law of convection. The loss of heat is not necessarily proportional to the area of the surface, and no general value of the coefficient can be given to suit all cases. The laws of conduction and radiation admit of being more precisely formulated, and their effects predicted, except in so far as they are complicated by convection.

CONDUCTION OF HEAT IN SOLIDS

30. The transference of heat in the interior of a solid body formed one of the earliest subjects of mathematical and experimental treatment in the theory of heat. The law assumed by Fourier was of the simplest possible type, but the mathematical application, except in the simplest cases, was so difficult as to require the development of a new mathematical method. Fourier succeeded in showing how, by his method of analysis, the solution of any given problem with regard to the flow of heat by conduction in any material could be obtained in terms of a physical constant, the thermal conductivity of the material, and that the results obtained by experiment agreed in a qualitative manner with those predicted by his theory. But the experimental determination of the actual values of these constants presented formidable difficulties which were not surmounted till a later date.

The law of conduction, which forms the basis of the mathematical theory, although seldom explicitly stated as an experimental law, should really be regarded in this light, and may be briefly worded as follows: *"The rate of transmission of heat by conduction is proportional to the temperature gradient."* The rate of transmission of heat is here understood to mean the quantity of heat transferred in unit time through unit area of cross-section of the substance, the unit area being taken perpendicular to the lines of flow. It is clear that the quantity transferred in any case must be jointly proportional to the area and the time. The "gradient of temperature" is the fall of temperature in degrees per unit length along the lines of flow.

The *thermal conductivity* of the substance is the constant ratio of the rate of transmission to the temperature gradient. To take the simple case of the "wall" or flat plate considered by Fourier for the definition of thermal conductivity, suppose that a quantity of heat Q passes per second through an area A of a plate of conductivity k and thickness x, the sides of which are constantly maintained at temperatures t_1 and t_2. The rate of transmission of heat is Q/A, and the temperature gradient, supposed uniform, is $(t_1-t_2)/x$, so that the law of conduction leads at once to the equation

$$Q/A = k(t_1-t_2)/x \qquad (5)$$

This relation applies accurately to the case of the steady flow of heat in parallel straight lines through a homogeneous and isotropic solid, the isothermal surfaces, or surfaces of equal temperature, being planes perpendicular to the lines of flow. If the flow is steady, and the temperature of each point of the body invariable, the rate of transmission must be everywhere the same. One of the simplest illustrations of the rectilinear flow of heat is the steady outflow through the upper strata of the earth's crust, which may be considered practically plane in this connection. This outflow of heat necessitates a rise of temperature with increase of depth. The corresponding gradient is of the order of 1° C in 100ft., but varies inversely with the conductivity of the strata at different depths.

A different type of problem is presented in those cases in which the temperature at each point varies with the time, as is the case near the surface of the soil with variations in the external conditions between day and night or summer and winter. The flow of heat may still be linear if the horizontal layers of the soil are of uniform composition, but the quantity flowing through each layer is no longer the same. Part of the heat is used up in changing the temperature of the successive layers. In this case it is generally more convenient to consider as unit of heat the thermal capacity c of unit volume, or that quantity which would produce a rise of one degree of temperature in unit volume of the soil or substance considered. If Q is expressed in terms of this unit in equation (5), it is necessary to divide by c, or to replace k on the right-hand side by the ratio k/c. This ratio determines the rate of diffusion of temperature, and is called the *thermometric conductivity* or, more shortly, the *diffusivity*. The velocity of propagation of temperature waves will be the same under similar conditions in two substances which possess the same diffusivity, although they may differ in conductivity.

31. **Variable-flow Methods.**—In these methods the flow of heat is deduced from observations of the rate of change of temperature with time in a body exposed to known external or boundary conditions. No calorimetric observations are required, but the results are obtained in terms of the thermal capacity of unit volume c, and the measurements give the diffusivity k/c, instead of the calorimetric conductivity k. Since both k and c are generally variable with the temperature, and the mode of variation of either is often unknown, the results of these methods are generally less certain with regard to the actual flow of heat. As in the case of steady-flow methods, by far the simplest example to consider is that of the linear flow of heat in an infinite solid, which is most nearly realized in nature in the propagation of temperature waves in the surface of the soil. One of the best methods of studying the flow of heat in this case is to draw a series of curves showing the variations of temperature with depth in the soil for a series of consecutive days. The curves given in fig. 6 were obtained from the readings of a number of platinum thermometers buried in undisturbed soil in horizontal positions at M'Gill College, Montreal.

The method of deducing the diffusivity from these curves is as follows:—The total quantity of heat absorbed by the soil per unit area of surface between any two dates, and any two depths, x' and x'', is equal to c times the area included between the corresponding curves. This can be measured graphically without any knowledge of the law of variation of the surface temperature, or of the laws of propagation of heat waves. The quantity of heat absorbed by the stratum $(x'\,x'')$ in the interval considered can also be expressed in terms of calorimetric conductivity k. The heat transmitted through the plane x is equal per unit area of surface to the product

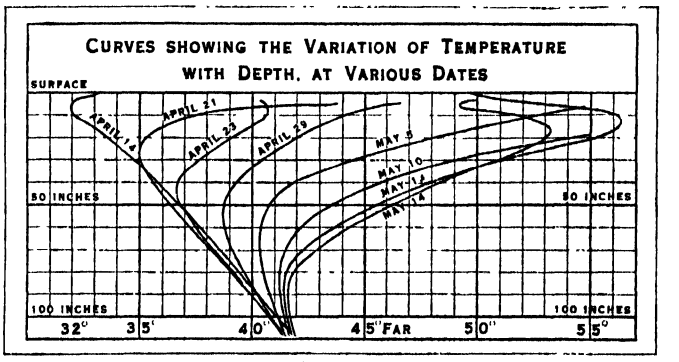

FIG. 6

of k by the mean temperature gradient (dt/dx) and the interval of time in secs. The mean temperature gradient is found by plotting the curves for each day from the daily observations. The heat absorbed is the difference of the quantities transmitted through the bounding planes of the stratum. We thus obtain the simple equation

$$k'\,(dt'/dx') - k''(dt''/dx'') = c \text{ (area between curves)/time in sec.,} \qquad (6)$$

by means of which the average value of the diffusivity k/c can be found for any convenient interval of time, at different seasons of the year, in different states of the soil.

For the particular soil in question it was found that the diffusivity varied enormously with the degree of moisture, falling as low as ·0010 C.G.S. in the winter for the surface layers, which became extremely dry under the protection of the frozen ice and snow from December to March, but rising to an average of ·0060 to ·0070 in the spring and autumn. The greater part of the diffusion of heat was certainly due to the percolation of water. On some occasions, owing to the sudden melting of a surface layer of ice and snow, a large quantity of cold water, percolating rapidly, gave for a short time values of the diffusivity as high as ·0300. Excluding these exceptional cases, however, the variations of the diffusivity appeared to follow the variations of the seasons with considerable regularity in successive years. The presence of water in the soil always increased the value of k/c, and as it necessarily increased c, the increase of k must have been greater than that of k/c.

32. **Periodic Flow of Heat.**—The foregoing method is perfectly general, and can be applied in any case in which the requisite observations can be taken. A case of special interest and importance is that in which the flow is *periodic*. The general characteristics of such a flow are illustrated in fig. 7, showing the propagation of temperature waves due to diurnal variations in the temperature of the surface. The daily range of temperature of the air and of the surface of the soil was about 20° F. On a sunny day, the temperature reached a maximum about 2 P.M. and a minimum about 5 A.M. As the waves were propagated downwards through the soil the amplitude rapidly diminished, so that at a depth of only 4in it was already reduced to about 6° F, and to less than 2° at 10in. At the same time, the epoch of maximum or minimum was retarded, about 4 hours at 4in., and nearly 12 hours at 10in, where the maximum temperature was reached between 1 and 2 A.M. The form of the wave was also changed At 4in. the rise was steeper than the fall, at 10in. the reverse was the case. This is due to the fact that the components of shorter period are more rapidly propagated For instance, the velocity of propagation of a wave having a period of a day is nearly twenty times as great as that of a wave with a period of one year; but on the other hand the penetration of the diurnal wave is nearly 20 times less, and the shorter waves die out more rapidly.

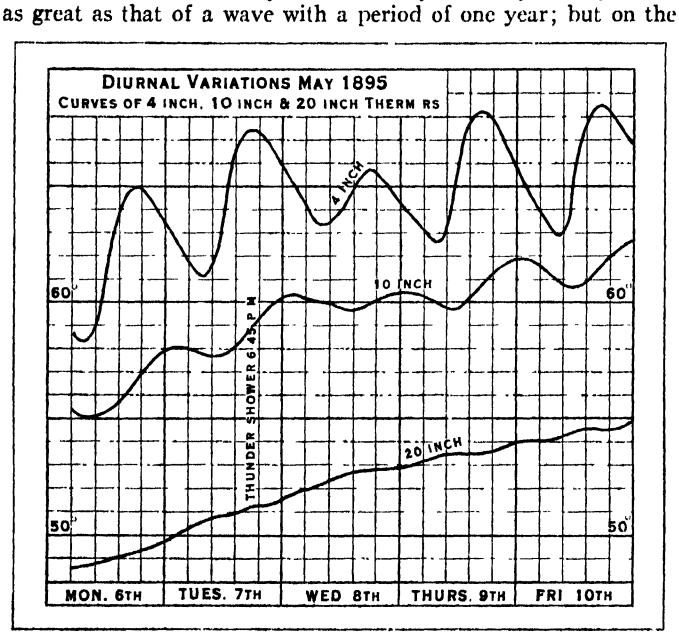

FIG. 7

Annual Variation.—A similar method has frequently been applied to the study of variations of soil-temperatures by harmonic analysis of the annual waves. But the theory is not strictly applicable, as the phenomena are not accurately periodic, and the state of the soil is continually varying, and differs at different depths, particularly in regard to its degree of wetness. An additional difficulty arises in the case of observations made with long mercury thermometers buried in vertical holes, that the correction for the expansion of the liquid in the long stems is uncertain, and that the holes may serve as channels for percolation, and thus lead to exceptionally high values. The last error is best avoided by employing platinum thermometers buried horizontally. In any case results deduced from the annual wave must be expected to vary in different years according to the distribution of the rainfall, as the values represent averages depending chiefly on the diffusion of heat by percolating water For this reason observations at different depths in the same locality often give very concordant results for the same period, as the total percolation and the average rate are necessarily nearly the same for the various strata, although the actual degree of wetness of each may vary considerably. The following are a few typical values for sand or gravel deduced from the annual wave in different localities:—

TABLE I.—*Diffusivity of Sandy Soils. C.G.S. Units*

Observer	Soil	Locality	Thermometer	Diffusivity
Kelvin, 1800	Garden sand	Edinburgh	Mercury	·0087
Neumann, 1863	Sandy loam		,,	·0136
Everett, 1800	Gravel	Greenwich	,,	·0125
Ångström, 1861	Sandy clay	Upsala	,,	·0057
Ångstrom 1861	,, ,,	,,	,,	·0045
Ångstrom	Coarse sand	,,	,,	·0094
Rudberg, Quetelet	The same soil, place and instruments reduced for different years			·0061, ·0074
Callendar, 1895	Garden sand	Montreal	Platinum	·0036
Rambaut, 1900	Gravel	Oxford	,,	·0074

The low value at Montreal is chiefly due to the absence of percolation during the winter. A. A. Rambaut's results were obtained with similar instruments similarly located, but he did not investigate the seasonal variations of diffusivity, or the effect of percolation. It is probable that the coarser soils, permitting more rapid percolation, would generally give higher results. In any case, it is evident that the transmission of heat by percolation would be much greater in porous soils and in the upper layers of the earth's crust than in the lower strata or in solid rocks. It is probable for this reason that the average conductivity of the earth's crust, as deduced from surface observations, is too large; and that estimates of the age of the earth based on such measurements are too low, and require to be raised; they would thereby be brought into better agreement with the conclusions of geologists derived from other lines of argument.

33. **Laboratory Methods.**—Measurements of thermal conductivity present peculiar difficulties on account of the variety of quantities to be observed, the slowness of the process of conduction, the impossibility of isolating a quantity of heat, and the difficulty of exactly realizing the theoretical conditions of the problem. The following are some of the special cases which have been utilized experimentally:—

The "wall" or plate method endeavours to realize the conditions of equation (5), namely, uniform rectilinear flow. Theoretically this requires an infinite plate, or a perfect heat insulator, so that the lateral flow can be prevented or rendered negligible. This condition can generally be satisfied with sufficient approximation with plates of reasonable dimensions. To find the conductivity, it is necessary to measure all the quantities which occur in equation (5) to a similar order of accuracy. The measurement of the temperature gradient in the plate generally presents the greatest difficulties. If the plate is thin, it is necessary to measure the thickness with great care, and it is necessary to assume that the temperatures of the surfaces are the same as those of the media with which they are in contact, since there is no room to insert thermometers in the plate itself. This assumption does not present serious errors in the case of bad conductors, such as glass or wood, but has given rise to large mistakes in the case of metals. The conductivities of thin slices of crystals have been measured by C. H. Lees (*Phil. Trans.*, 1892) by pressing them between plane

amalgamated surfaces of metal. This gives very good contact, and the conductivity of the metal being many times that of the crystal, the temperature of the surface is determinate.

Fig. 8 illustrates a modern example of the plate method, and shows how nearly the theoretical conditions can be realized with the aid of thermocouples and electric heating. To make the conditions of heat-flow and heat-loss symmetrical, it is desirable to

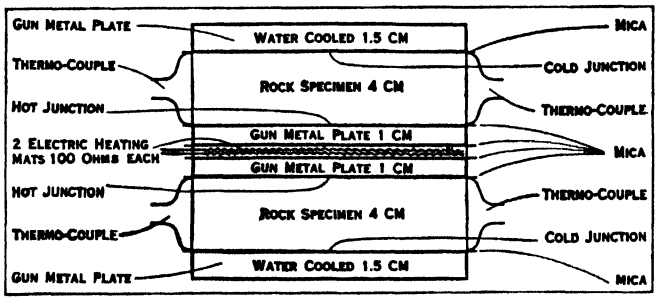

FIG. 8.—WALL OR PLATE METHOD OF MEASURING THERMAL CONDUCTIVITY OF ROCK SPECIMEN WITH AID OF THERMO-COUPLES AND ELECTRIC HEATING

employ a pair of similar plates of the material to be tested, which in this case consist of quartzite of comparatively high conductivity, 15cm. square and 4cm. thick. The plates specimens are mounted on either side of an electric heater constructed of a pair of nichrome-asbestos mats of 100 ohms each, separated by a pad of asbestos paper, and sandwiched between a pair of gunmetal plates, from which they are insulated by thin sheets of cabinet mica. Thus the heat generated by the electric current is evenly distributed in both directions over the surfaces of the specimens and is fully utilized for maintaining the heat-flow. The outer surfaces of the specimens are cooled by a pair of gunmetal plates, channelled for water circulation, and provided with a steady flow of cooling water at a constant temperature. When the electric current is turned on, a steady flow of heat through the specimens is rapidly established, and is readily determined by observing the volts on the heating mats. Thus with 70 volts on each mat, the total flow through each specimen is 49 watts, equivalent to 0·0522 gm cal per sq. cm. per sec for the value of Q/A in equation (5).

The temperature difference between the hot and cold surfaces of each specimen is measured by a copper-constantan thermocouple with its junctions at the centre of each surface. The wires are rolled to a thinness of 0·02mm. and are in direct contact with the surfaces of the rock specimens, being insulated from the gunmetal plates by thin sheets of cabinet mica. With 70 volts on each heating mat, the mean of the temperature differences for the two specimens was found to be 14·60° C in a thickness of 4cm., giving 3·65° C for the temperature gradient. Neglecting any correction for heat-loss the value of the thermal conductivity k comes out 0·0522/3·65 or 0·0143 C.G.S.

In order to stabilize the external loss of heat, the apparatus is enclosed in a double-walled jacket maintained at a constant temperature by the circulating water which also flows through the gunmetal coolers on either side of the specimens. Thus there is no heat-loss from the exposed surface of the coolers. The heat-loss from the exposed sides of the heaters is proportional per sq.cm. to the excess temperature $d\theta$ shown by the hot junction. That from the sides of the rock specimens is proportional to $d\theta/2$ per sq.cm. Since the exposed areas in each case are known, the heat loss from the sides of the heaters and rock specimens can be found if the surface emissivity can be determined. This is easily done by cutting off the circulation of cooling water from the cooling plates, without altering the circulation through the external jacket. A small current then suffices to raise the whole block to a nearly uniform excess of temperature above the jacket, if sufficient time is allowed for the attainment of equilibrium. The assumption of uniform surface emissivity is sufficiently approximate for estimating the small correction for heat-loss provided that the exposed surfaces are all varnished. Thus with 6 watts on each heater it is found that the central plates are raised to an excess temperature $\theta = 14{\cdot}6°$ above the jacket as in the original experiment. The end plates are raised to $\theta = 13{\cdot}4°$ in the absence of the water cooling. The sides of the rock specimens are raised to a mean temperature $\theta = 14{\cdot}0°$. The loss from each heater comes out 0·71 watt at 14·6°, that from each rock specimen, 2·34 watts at 14·0° and that from the end plates 2·95 watts at 13·4°. In the original experiment, the mean temperature of the sides of the rock specimens being only 7·3° above the jacket, the loss would be reduced in the ratio 7·3 to 14·0 and would be 1·22 watt only. The loss from each heater at 14·6° being 0·71 watt, the actual flow of heat through the hot surface of each specimen would be reduced from 70 watts to 69·3, and that through the cold surface of each would be further reduced to 68·1 by the loss from the sides of the specimens. Thus the *mean* flow through each would be 68·7 watts, the correction for heat-loss amounting to less than 2 per cent of the whole. The corrected value of the conductivity is also reduced by 2 per cent, giving 0·0140 C.G.S. in place of the original value 0·0143 in which heat-loss was neglected.

The most essential precaution in this method of experiment is to use accurately worked specimens with plane surfaces, and to exclude air films which might interfere with the uniform distribution of the heat-flow, since the conductivity of air is about 250 times smaller than that of quartzite, so that a thousandth of an inch of air would be equivalent in resistance to nearly a quarter of an inch of quartzite. A viscous liquid like glycerine is often employed for the purpose of excluding air films, but is apt to give trouble by absorbing moisture and creeping on to the heating mats.

A more satisfactory method is to drop about 1cu.cm of paraffin wax on the centre of each plate before building up the block. The block is then built up in a light wooden frame with four uprights grooved to fit the corners of the plates, and a small current is passed through the heaters to melt the wax and allow the plates to settle into contact. After removing the small excess of wax, the current is turned off and the block allowed to cool. This gives a solid block which is easily handled without shifting the plates, and which can be unbuilt in a similar manner when it is desired to use other specimens. Other materials, such as pitch, may be employed for building up the block, when it is desired to work at higher temperatures, such as 100° C with steam in the jacket. The plate method as above described may be employed with suitable modifications for a considerable variety of materials, but is most accurate and convenient in the case of substances of moderate conductivity, such as compact rocks. For good conductors like the metals the temperature gradients are too small and difficult to measure unless either the heat-flow or the heat-loss is excessive. For bad conductors, such as ebonite or cork, it is necessary to use thinner plates. The effective thickness cannot be measured with the same percentage of accuracy, but the results are probably as good as can be obtained by any other method.

Tube Method.—If the inside of a glass tube is exposed to steam, and the outside to a rapid current of water, or *vice versa*, the temperatures of the surfaces of the glass may be taken to be approximately equal to those of the water and steam, which may easily be observed. If the thickness of the glass is small compared with the diameter of the tube, say one-tenth, equation (5) may be applied with sufficient approximation, the area A being taken as the mean between the internal and external surfaces. It is necessary that the thickness x should be approximately uniform. Its mean value may be determined most satisfactorily from the weight and the density. The heat Q transmitted in a given time T may be deduced from an observation of the rise of temperature of the water, and the amount which passes in the interval. This is one of the simplest of all methods in practice, but it involves the measurement of several different quantities, some of which are difficult to observe accurately. Unfortunately the method cannot be applied to good conductors, like the metals, because the difference of temperature between the surfaces may be many times less than that between the water and steam in contact with them, even if the water is energetically stirred. Owing to the error involved in this assumption the values given by some of the early observers for the conductivity of copper were nearly 200 times too small.

Cylinder Method.—A variation of the tube method, which can be applied to metals and good conductors, depends on the employment of a thick cylinder with a small axial hole in place of a thin tube. The actual temperature of the metal itself can then be observed by inserting thermometers or thermo-couples at measured distances from the centre as indicated in the annexed fig. 9. This method has been applied by H. L. Callendar and J. T. Nicolson (*Brit. Assoc. Report*, 1897) to cylinders of cast-iron and mild steel, 5in. in diam. and 2ft. long, with 1in. axial holes. The surface of the central hole was heated by steam under pressure, and the total flow of heat was determined by observing the amount of steam condensed in a given time. The outside of the cylinder was cooled by water circulating round a spiral screw thread in a narrow space with high velocity driven by a pressure of 120lb. per sq.in. A very uniform surface temperature was thus obtained. The lines of flow in this method are radial. The isothermal surfaces are coaxial cylinders. The areas of successive surfaces vary as their radii, hence the rate of transmission Q/A varies inversely as the radius r, and is $Q/2\pi rl$, if l is the length of the cylinder, and Q the heat flow per sec. calculated from the condensation of steam. The outward gradient is dt/dr, and is negative if the central hole is heated. We have therefore the simple equation

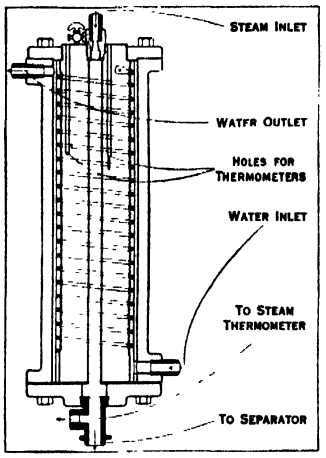

FIG. 9.—CYLINDER METHOD FOR CONDUCTIVITY OF METALS, WITH HOLES BORED FOR THERMOMETERS PARALLEL TO THE AXIS

$$-kdt/dr=Q/2\pi rl \qquad (7)$$

If k is constant the solution is evidently $t=a \log r+b$, where $a=-Q/2\pi kl$, and b and k are determined from the known values of the temperatures observed at any two distances from the axis. This gives an average value of the conductivity over the range, but it is better to observe the temperatures at three distances, and to assume k to be a linear function of the temperature, in which case the solution of the equation is still very simple, namely,

$$t+\tfrac{1}{2}et^2=a \log r\times b, \qquad (8)$$

where e is the temperature-coefficient of the conductivity. The chief difficulty in this method lay in determining the effective distances of the bulbs of the thermometers from the axis of the cylinder, and in ensuring uniformity of flow of heat along different radii. For these reasons the temperature-coefficient of the conductivity could not be determined satisfactorily on this particular form of apparatus, but the mean results were probably trustworthy to 1 or 2%. They refer to a temperature of about 60° C, and were—

Cast-iron, 0·109; mild steel, 0·119, C.G.S.

34. *Forbes's Bar Method.*—Observation of the steady distribution of temperature along a bar heated at one end was very early employed by Fourier, Despretz and others for the comparison of conductivities. It is the most convenient method, in the case of good conductors, on account of the great facilities which it permits for the measurement of the temperature gradient at different points; but it has the disadvantage that the results depend almost entirely on a knowledge of the external heat loss or emissivity, or, in comparative experiments, on the assumption that it is the same in different cases. The method of Forbes (in which the conductivity is deduced from the steady distribution of temperature on the assumption that the rate of loss of heat at each point of the bar is the same as that observed in an auxiliary experiment in which a short bar of the same kind is set to cool under conditions which are supposed to be identical) is well known, but a consideration of its weak points is very instructive, and the results have been most remarkably misunderstood and misquoted. The method gives directly, not k, but k/c. P. G. Tait repeated Forbes's experiments, using one of the same iron bars, and endeavoured to correct his results for the variation of the specific heat c. J. C Mitchell, under Tait's direction, repeated the experiments with the same bar nickel-plated, correcting the thermometers for stem-exposure, and also varying the conditions by cooling one end, so as to obtain a steeper gradient. The results of Forbes, Tait and Mitchell, on the same bar, and Mitchell's two results with the end of the bar "free" and "cooled," have been quoted as if they referred to different metals. This is not very surprising, if the values in the following table are compared:—

TABLE II.—*Thermal Conductivity of Forbes's Iron Bar D (1·25 inches square). C.G.S. Units*

Temp. Cent.	Uncorrected for variation of c				Corrected for variation of c			
	Forbes	Tait	Mitchell		Forbes	Tait	Mitchell	
			Free	Cooled			Free	Cooled
0°	·207	·231	·197	·178	·213	·238	·203	·184
100°	·157	·198	·178	·190	·168	·212	·190	·197
200°	·136	·176	·160	·181	·152	·196	·178	·210

The variation of c is uncertain. The values credited to Forbes are those given by J. D. Everett on Balfour Stewart's authority. Tait gives different figures. The values given in the column headed "cooled" are those found by Mitchell with one end of the bar cooled. The discrepancies are chiefly due to the error of the fundamental assumption that the rate of cooling is the same at the same temperature under the very different conditions existing in the two parts of the experiment. They are also partly caused by the large uncertainties of the corrections, especially those of the mercury thermometers under the peculiar conditions of the experiment. The results of Forbes are interesting historically as having been the first approximately correct determinations of conductivity in absolute value. The same method was applied by R. W. Stewart (*Phil Trans*, 1892), with the substitution of thermo-couples (following Wiedemann) for mercury thermometers. This avoids the very uncertain correction for stem-exposure, but it is doubtful how far an insulated couple, inserted in a hole in the bar, may be trusted to attain the true temperature The other uncertainties of the method remain. R W. Stewart found for pure iron, $k=\cdot175\ (1-\cdot0015\ t)$C.G S. E. H. Hall using a similar method found for cast-iron at 50° C the value ·105, but considers the method very uncertain as ordinarily practised.

Calorimetric Bar Method.—To avoid the uncertainties of surface loss of heat, it is necessary to reduce it to the rank of a small correction by employing a large bar and protecting it from loss of heat. The heat transmitted should be measured calorimetrically, and not in terms of the uncertain emissivity. The apparatus shown in fig. 10 was constructed by Callendar and Nicolson with this object. The bar was a special sample of cast-iron, the conductivity of which was required for some experiments on the condensation of steam (*Proc. Inst. C.E.*, 1898). It had a diameter of 4in., and a length of 4ft. between the heater and the calorimeter. The emissivity was reduced to one-quarter by lagging the bar like a steam-pipe to a thickness of 1in. The heating vessel could be maintained at a steady temperature by high-pressure steam. The other end was maintained at a temperature near that

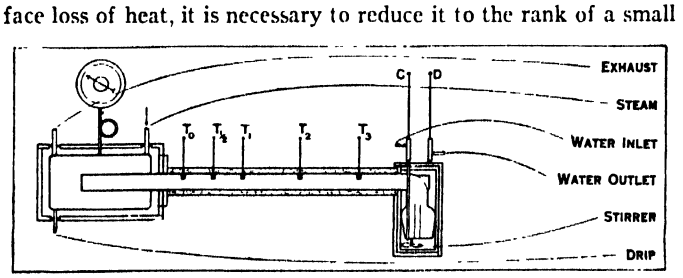

FIG. 10.—CALORIMETRIC BAR METHOD, IN WHICH HEAT-FLOW IS MEASURED BY RISE OF TEMPERATURE OF COOLING WATER, GRADIENT BY MERCURY THERMOMETERS· APPARATUS ALSO USED FOR ÅNGSTRÖM'S PERIODIC-FLOW METHOD

of the air by a steady stream of water flowing through a well-lagged vessel surrounding the bar. The heat transmitted was measured by observing the difference of temperature between the inflow and the outflow, and the weight of water which passed in a given time. The gradient near the entrance to the calorimeter was deduced from observations with five thermometers at suitable intervals along the bar. The results obtained by this method at a temperature of 40° C varied from ·116 to ·118 C.G.S. from observations on different days, and were probably more accurate than those obtained by the cylinder method. The same apparatus was employed in another series of experiments by the periodic flow method, but this involves a knowledge of c, and is very laborious.

35. **Electrical Methods.**—There are two electrical methods which have been recently applied to the measurement of the conductivity of metals, (a) the resistance method, devised by Callendar, and applied by him, and also by R. O. King and J. D. Duncan, (b) the thermo-electric method, devised by Kohlrausch, and applied by W. Jaeger and H. Dieselhorst. Both methods depend on the observation of the steady distribution of temperature in a bar or wire heated by an electric current. The advantage is that the quantities of heat are measured directly in absolute measure, in terms of the current, and that the results are independent of a knowledge of the specific heat. Incidentally it is possible to regulate the heat supply more perfectly than in non-electric methods.

(a) In the practice of the resistance method, both ends of a short bar are kept at a steady temperature by means of solid copper blocks provided with a water circulation, and the whole is surrounded by a jacket at the same temperature, which is taken as the zero of reference. The bar is heated by a steady electric current, which may be adjusted so that the external loss of heat from the surface of the bar is compensated by the increase of resistance of the bar with rise of temperature. In this case the curve representing the distribution of temperature is a parabola, and the conductivity k is deduced from the mean rise of temperature $(R-R_0)/aR_0$ by observing the increase of resistance $R-R_0$ of the bar, and the current C. It is also necessary to measure the cross-section q, the length l, and the temperature-coefficient a for the range of the experiment.

In the general case the distribution of temperature is observed by means of a number of potential leads. The differential equation for the distribution of temperature in this case includes the majority of the methods already considered, and may be stated as follows. The heat generated by the current C at a point x, where θ=excess temperature, is equal per unit length and time (t) to that lost by conduction $-d(qkd\theta/dx)/dx$, and by radiation $hp\theta$ (emissivity h, perimeter p), together with that employed in raising the temperature $qcd\theta/dt$, and absorbed by the Thomson effect $Cd\theta/dx$. We thus obtain the equation

$$C^2R_0(1+a\theta)/l = -d(qkd\theta/dx)/dx+hp\theta+qcd\theta/dt+sCd\theta/dx. \quad (9)$$

If $C=0$, this is the equation of Ångström's method. If h also is zero, it becomes the equation of variable flow in the soil. If $d\theta/dt=0$, the equation represents the corresponding cases of steady flow. In the electrical method, observations of the variable flow are useful for finding the value of c for the specimen, but are not otherwise required. The last term, representing the Thomson effect, is eliminated in the case of a bar cooled at *both* ends, since it is opposite in the two halves, but may be determined by observing the resistance of each half separately. If the current C is chosen so that $C^2R_0a=hpl$, the external heat-loss is compensated by the variation of resistance with temperature. In this case the solution of the equation reduces to the form

$$\theta=x(l-x)C^2R_0/2lqk. \quad (10)$$

By a property of the parabola, the mean temperature is two-thirds of the maximum temperature; we have therefore

$$(R-R_0)/aR_0=lC^2R_0/12qk, \quad (11)$$

which gives the conductivity directly in terms of the quantities actually observed. If the dimensions of the bar are suitably chosen, the distribution of temperature is always very nearly parabolic, so that it is not necessary to determine the value of the critical current $C^2=hpl/aR_0$ very accurately, as the correction for external loss is a small percentage in any case. The chief difficulty is that of measuring the small change of resistance accurately, and of avoiding errors from accidental thermo-electric effects. In addition to the simple measurements of the conductivity (M'Gill College, 1895–1896), some very elaborate experiments were made by King (*Proc. Amer. Acad.*, June 1898) on the temperature distribution in the case of long bars with a view to measuring the Thomson effect. Duncan (*M'Gill College Reports*, 1899), using the simple method under King's supervision, found the conductivity of very pure copper to be 1·007 for a temperature of 33° C.

(b) The method of Kohlrausch, as carried out by Jaeger and Dieselhorst (*Berlin Acad.*, July 1899), consists in observing the difference of temperature between the centre and the ends of the bar by means of insulated thermo-couples. Neglecting the external heat-loss, and the variation of the thermal and electric conductivities k and k', we obtain, as before, for the difference of temperature between the centre and ends, the equation

$$\theta_{max}-\theta_0=C^2Rl/8qk=ECl/8qk=E^2k'/8k, \quad (12)$$

where E is the difference of electric potential between the ends. Lorenz, assuming that the ratio $k/k'=a\theta$, had previously given

$$\theta^2_{max}-\theta_0^2=E^2/4a, \quad (13)$$

which is practically identical with the preceding for small differences of temperature. The last expression in terms of k/k' is very simple, but the first is more useful in practice, as the quantities actually measured are E, C, l, q, and the difference of temperature. The current C was measured in the usual way by the difference of potential on a standard resistance. The external heat-loss was estimated by varying the temperature of the jacket surrounding the bar, and applying a suitable correction to the observed difference of temperature. But the method (a) previously described appears to be preferable in this respect, since it is better to keep the jacket at the same temperature as the end-blocks. Moreover, the variation of thermal conductivity with temperature is small and uncertain, whereas the variation of electrical conductivity is large and can be accurately determined, and may therefore be legitimately utilized for eliminating the external heat-loss.

One of the chief objects of these experiments was to test the combined hypotheses of G. Wiedemann (1853) and L. Lorenz (1872), that the ratio of the thermal to the electrical conductivity was the same for all metals, and varied directly as the absolute temperature. This relation was strongly supported as a result of the development of the electron theory of conduction in metals by Drude (1900) and H. A. Lorentz (1905), and was approximately verified for some of the pure metals by Jaeger and Dieselhorst between 0° and 100° C. But the ratio appears to be affected in a marked degree by the presence of impurities which reduce the electric conductivity, and the majority of alloys give much higher values than the pure metals. It has since been shown by the experiments of Lees (1908), Onnes (1914) and Meissner (1920), that the remarkable increase of electric conductivity of some pure metals at very low temperatures does not extend to the thermal conductivity. Sir J. J. Thomson in his *Corpuscular Theory of Matter* (1907) had already pointed out that there were serious difficulties in the electron theory of Drude and Lorentz, and proposed an alternative theory which did not require the presence of a large number of free electrons in the metal. This was further developed (*Proc. Phys. Soc.* 1915) and appears to supply a reasonable explanation of the increase of electric conductivity at very low temperatures without requiring a similar increase of thermal conductivity. There is no doubt a general parallelism between thermal and electric conductivity in the case of pure metals, but the conditions are so different in many ways that one could not expect any simple and exact relation to hold generally.

CONDUCTION IN GASES AND LIQUIDS

36. The theory of conduction of heat by diffusion in gases has a particular interest, since it is possible to predict the value of the

conductivity on certain assumptions, if the viscosity is known. On the kinetic theory the molecules of a gas are relatively far apart and there is nothing exactly analogous to friction between two adjacent layers A and B in relative motion. There is, however, a continual interchange of molecules between A and B, which produces the same effect as viscosity in a liquid. Faster-moving particles diffusing from A to B carry their momentum with them, and tend to accelerate B; an equal number of slower particles diffusing from B to A act as a drag on A. This action and reaction between layers in relative motion is equivalent to a frictional stress tending to equalize the velocities of adjacent layers. The magnitude of the stress per unit area parallel to the direction of flow is evidently proportional to the velocity gradient, or the rate of change of velocity per cm. in passing from one layer to the next. It must also depend on the rate of interchange of molecules, that is to say, (1) on the number passing through each square centimetre per second in either direction, (2) on the average distance to which each can travel before collision (*i.e.* on the "mean free path"), and (3) on the average velocity of translation of the molecules, which varies as the square root of the temperature. Similarly if A is hotter than B, or if there is a gradient of temperature between adjacent layers, the diffusion of molecules from A to B tends to equalize the temperatures, or to conduct heat through the gas at a rate proportional to the temperature gradient, and depending also on the rate of interchange of molecules in the same way as the viscosity effect.

Conductivity and viscosity in a gas should vary in a similar manner since each depends on diffusion in a similar way. The mechanism is the same, but in one case we have diffusion of momentum, in the other case diffusion of heat. Viscosity in a gas was first studied theoretically from this point of view by J. Clerk Maxwell, who predicted that the effect should be independent of the density within wide limits. This, at first sight, paradoxical result is explained by the fact that the mean free path of each molecule increases in the same proportion as the density is diminished, so that as the number of molecules crossing each square centimetre decreases, the distance to which each carries its momentum increases, and the total transfer of momentum is unaffected by variation of density. Maxwell himself verified this prediction experimentally for viscosity over a wide range of pressure. By similar reasoning the thermal conductivity of a gas should be independent of the density. Maxwell predicted a value 0·000055 C.G.S. for the conductivity of air, and a value seven times greater for hydrogen on account of the greater velocity and range of its molecules. A. Kundt and E. Warburg (*Jour. Phys.*, v. 118) found that the rate of cooling of a thermometer in air between 150 mm. and 1mm. pressure remained constant as the pressure was varied. At higher pressures the effect of conduction was masked by convection currents.

The question of the variation of conductivity with temperature is more difficult. If the effects depended merely on the velocity of translation of the molecules, both conductivity and viscosity should increase directly as the square root of the absolute temperature; but the mean free path also varies in a manner which cannot be predicted by theory and which appears to be different for different gases (Rayleigh, *Proc. R.S.*, January 1896). Experiments by the capillary tube method have shown that the viscosity varies more nearly as θ^1, but indicate that the rate of increase diminishes at high temperatures. The conductivity probably changes with temperature in the same way, being proportional to the product of the viscosity and the specific heat; but the experimental investigation presents difficulties on account of the necessity of eliminating the effects of radiation and convection, and the results of different observers often differ considerably from theory and from each other. The values found for the conductivity of air at 0° C range from ·000048 to ·000057, and the temperature-coefficient from ·0015 to ·0028.

Experimental determinations of the thermal conductivities of gases are still somewhat scarce and discordant owing to the great practical difficulties, but are of special interest for the elucidation of the law of action between molecules. The hot-wire method of T. Andrews (*Phil. Trans.*, 1840) offers special facilities for relative measurements, such as the comparison of conductivities of different gases, or of the same gas at different temperatures, and has frequently been applied with this object in recent years. It has also been improved by introducing the usual compensation for end-effects, and employing more accurate methods of electrical measurement, but it remains liable to the difficulties depending on the small dimensions of the wire and the elimination of the corrections for radiation. The determination of the thermal conductivities of gases gives a means of testing the value of the numerical coefficient f in the relation, $k = f\eta s$, between the conductivity k, the viscosity η, and the specific heat s at constant volume. According to the theoretical investigations of S. Chapman (*Phil. Trans.*, A, 211, p. 433, 1911) the value of the coefficient f should be 2·5 for a gas constituted of spherically symmetrical molecules, which agrees with Maxwell's theory based on the inverse fifth-power law of force, and also with experiment for monatomic molecules. Unfortunately the variation of viscosity with temperature does not satisfy the fifth-power law, which requires that the viscosity should be directly proportional to T. The conclusion is that monatomic gases may have spherically symmetrical molecules, but that the law of force is different. Theory gives no clear indication with regard to the appropriate value of f for other types of molecules. Experiment gives approximately a linear relation, $f = 2{\cdot}816\gamma - 2{\cdot}2$, between f and the ratio γ of the specific heats. This gives $f = 7/4$ for diatomic gases, which show fair agreement with each other. The experimental values for polyatomic gases are much less certain.

The thermal conductivity of liquids shows in one respect a remarkable contrast to that of gases, in that it has little or no relation to the viscosity. Excluding liquid metals, different liquids, such as water and glycerine, may vary widely in viscosity and yet differ little in conductivity. Most liquids show a very rapid diminution of viscosity with rise of temperature, without any corresponding change of similar magnitude in conductivity. But the experimental evidence is very discordant, as in the case of gases. The conductivity of liquids has been investigated by similar methods, generally variations of the thin plate or guard-ring method. A critical account of the subject is contained in a paper by C. Chree (*Phil. Mag.*, July 1887). Many of the experiments were made by comparative methods, taking a standard liquid such as water for reference. A determination of the conductivity of water by S. R. Milner and A. P. Chattock, employing an electrical method, deserves mention on account of the careful elimination of various errors (*Phil. Mag.*, July 1899). Their final result was $k = {\cdot}001433$ at 20° C, which may be compared with the results of other observers, G. Lundquist (1869), ·00155 at 40° C; A. Winkelmann (1874), ·00104 at 15° C; H. F. Weber (corrected by H. Lorberg), ·00138 at 4° C, and ·00152 at 23·6° C; C. H. Lees (*Phil. Trans.*, 1898), ·00136 at 25° C, and ·00120 at 47° C; C. Chree, ·00124 at 18° C, and ·00136 at 19·5° C. The variations of these results illustrate the experimental difficulties. It appears probable that the conductivity of a liquid increases with rise of temperature, although the contrary would appear from the work of Lees.

RADIATION

37. It was at one time supposed that there were three distinct kinds of radiation—thermal, luminous and actinic, combined in the radiation from a luminous source such as the sun or a flame. The first gave rise to heat, the second to light and the third to chemical action. The three kinds were partially separated by a prism, the actinic rays being generally more refracted, and the thermal rays less refracted than the luminous. This conception arose very naturally from the observation that the feebly luminous blue and violet rays produced the greatest photographic effects, which also showed the existence of dark rays beyond the violet, whereas the brilliant yellow and red were practically without action on the photographic plate. A thermometer placed in the blue or violet showed no appreciable rise of temperature, and even in the yellow the effect was hardly discernible. The effect increased rapidly as the light faded towards the extreme red, and reached a maximum beyond the extreme limits of the spectrum (Herschel), showing that the greater part of the thermal radiation

was altogether non-luminous.

It is now a commonplace that chemical action, colour sensation and heat are merely different effects of one and the same kind of radiation, the particular effect produced in each case depending on the frequency and intensity of the vibration, and on the nature of the substance on which it falls. When radiation is completely absorbed by a black substance, it is converted into heat, the quantity of heat produced being equivalent to the total energy of the radiation absorbed, irrespective of the colour or frequency of the different rays. The actinic or chemical effects, on the other hand, depend essentially on some relation between the period of the vibration and the properties of the substance acted on. The rays producing such effects are generally those which are most strongly absorbed. The spectrum of chlorophyll, the green colouring matter of plants, shows two very strong absorption bands in the red The red rays of corresponding period are found to be the most active in promoting the growth of the plant. The chemically active rays are not necessarily the shortest. Even photographic plates may be made to respond to the red rays by staining them with pinachrome or some other suitable dye. The action of light rays on the retina is closely analogous to the action on a photographic plate. The retina, like the plate, is sensitive only to rays within certain restricted limits of frequency. The limits of sensitiveness of each colour sensation are not exactly defined, but vary slightly from one individual to another, especially in cases of partial colour-blindness, and are modified by conditions of fatigue. We are not here concerned with these important physiological and chemical effects of radiation, but rather with the question of the conversion of energy of radiation into heat, and with the laws of emission and absorption of radiation in relation to temperature. We may here also assume the identity of visible and invisible radiations from a heated body in all their physical properties.

It has been abundantly proved that the invisible rays, like the visible, (1) are propagated in straight lines in homogeneous media; (2) are reflected and diffused from the surface of bodies according to the same law; (3) travel with the same velocity in free space, but with slightly different velocities in denser media, being subject to the same law of refraction; (4) exhibit all the phenomena of diffraction and interference which are characteristic of wave-motion in general; (5) are capable of polarization and double refraction; (6) exhibit similar effects of selective absorption. These properties are more easily demonstrated in the case of visible rays on account of the great sensitiveness of the eye. But with the aid of the thermopile or other sensitive radiometer, they may be shown to belong equally to all the radiations from a heated body, even such as are 30 to 50 times slower in frequency than the longest visible rays. The same physical properties have also been shown to belong to electromagnetic waves excited by an electric discharge, whatever the frequency, thus including all kinds of aethereal radiation in the same category as light.

38. **Theory of Exchanges.**—The apparent concentration of cold by a concave mirror, observed by G. Baptista Porta and rediscovered by M. A. Pictet, led to the enunciation of the theory of exchanges by Pierre Prevost in 1791. Prevost's leading idea was that all bodies, whether cold or hot, are constantly radiating heat. Heat equilibrium, he says, consists in an equality of exchange. When equilibrium is interfered with, it is re-established by inequalities of exchange. If into a locality at uniform temperature a refracting or reflecting body is introduced, it has no effect in the way of changing the temperature at any point of that locality. A reflecting body, heated or cooled in the interior of such an enclosure, will acquire the surrounding temperature more slowly than would a non-reflector, and will less affect another body placed at a little distance, but will not affect the final equality of temperature. Apparent radiation of cold, as from a block of ice to a thermometer placed near it, is due to the fact that the thermometer being at a higher temperature sends more heat to the ice than it receives back from it. Although Prevost does not make the statement in so many words, it is clear that he regards the radiation from a body as depending only on its own nature and temperature, and as independent of the nature and presence of any adjacent body.

Heat equilibrium in an enclosure of constant temperature such as that postulated by Prevost, has often been regarded as a consequence of Carnot's principle. Since difference of temperature is required for transforming heat into work, no work could be obtained from heat in such a system, and no spontaneous changes of temperature can take place, as any such changes might be utilized for the production of work. This line of reasoning does not appear quite satisfactory, because it is tacitly assumed, in the reasoning by which Carnot's principle was established, as a result of universal experience, that a number of bodies within the same impervious enclosure, which contains no source of heat, will ultimately acquire the same temperature, and that difference of temperature is required to produce flow of heat. Thus although we may regard the equilibrium in such an enclosure as being due to equal exchanges of heat in all directions, the equal and opposite streams of radiation annul and neutralize each other in such a way that no actual transfer of energy in any direction takes place. The state of the medium is everywhere the same in such an enclosure, but its energy of agitation per unit volume is a function of the temperature, and is such that it would not be in equilibrium with any body at a different temperature.

39. **"Full" and Selective Radiation.**—*Correspondence of Emission and Absorption.* The most obvious difficulties in the way of this theory arise from the fact that nearly all radiation is more or less selective in character, as regards the quality and frequency of the rays emitted and absorbed. It was shown by J. Leslie, M Melloni and other experimentalists that many substances such as glass and water, which are very transparent to visible rays, are extremely opaque to much of the invisible radiation of lower frequency; and that polished metals, which are perfect reflectors, are very feeble radiators as compared with dull or black bodies at the same temperature. If two bodies emit rays of different periods in different proportions, it is not at first sight easy to see how their radiations can balance each other at the same temperature.

The key to all such difficulties lies in the fundamental conception, so strongly insisted on by Balfour Stewart, of the absolute uniformity (qualitative as well as quantitative) of the full or complete radiation stream inside an impervious enclosure of uniform temperature. It follows from this conception that the proportion of the full radiation stream absorbed by any body in such an enclosure must be exactly compensated in quality as well as quantity by the proportion emitted, or that the emissive and absorptive powers of any body at a given temperature must be precisely equal. A good reflector, like a polished metal, must also be a feeble radiator and absorber. Of the incident radiation it absorbs a small fraction and reflects the remainder, which together with the radiation emitted (being precisely equal to that absorbed) makes up the full radiation stream. A partly transparent material, like glass, absorbs part of the full radiation and transmits part. But it emits rays precisely equal in quality and intensity to those which it absorbs, which together with the transmitted portion make up the full stream.

A thin platinum tube heated by an electric current appears feebly luminous as compared with a blackened tube at the same temperature. But if a small hole is made in the side of the polished tube, the light proceeding through the hole appears brighter than the blackened tube, as though the inside of the tube were much hotter than the outside, which is not the case to any appreciable extent if the tube is thin. The radiation proceeding through the hole is nearly that of a perfectly black body if the hole is small. If there were no hole the internal stream of radiation would be exactly that of a black body at the same temperature however perfect the reflecting power, or however low the emissive power of the walls, because the defect in emissive power would be exactly compensated by the internal reflection.

Balfour Stewart gave a number of striking illustrations of the qualitative identity of emission and absorption of a substance. Pieces of coloured glass placed in a fire appear to lose their colour when at the same temperature as the coals behind them, because

they compensate exactly for their selective absorption by radiating chiefly those colours which they absorb. Rocksalt is remarkably transparent to thermal radiation of nearly all kinds, but it is extremely opaque to radiation from a heated plate of rocksalt, because it emits when heated precisely those rays which it absorbs. A plate of tourmaline cut parallel to the axis absorbs almost completely light polarized in a plane parallel to the axis, but transmits freely light polarized in a perpendicular plane. When heated its radiation is polarized in the same plane as the radiation which it absorbs. In the case of incandescent vapours, the exact correspondence of emission and absorption as regards wave-length or frequency of the light emitted and absorbed forms the foundation of the science of spectrum analysis. Fraunhofer had noticed the coincidence of a pair of bright yellow lines seen in the spectrum of a candle flame with the dark D lines in the solar spectrum, a coincidence which was afterwards more exactly verified by W. A. Miller. Foucault found that the flame of the electric arc showed the same lines bright in its spectrum, and proved that they appeared as dark lines in the otherwise continuous spectrum when the light from the carbon poles was transmitted through the arc. Stokes gave a dynamical explanation of the phenomenon and illustrated it by the analogous case of resonance in sound. Kirchhoff completed the explanation (*Phil. Mag.*, 1860) of the dark lines in the solar spectrum by showing that the reversal of the spectral lines depended on the fact that the body of the sun giving the continuous spectrum was at a higher temperature than the absorbing layer of gases surrounding it.

Whatever be the nature of the selective radiation from a body, the radiation of light of any particular wave-length cannot be greater than a certain fraction E of the radiation R of the same wave-length from a black body at the same temperature The fraction E measures the emissive power of the body for that particular wave-length, and cannot be greater than unity. The same fraction, by the principle of equality of emissive and absorptive powers, will measure the proportion absorbed of incident radiation R'. If the black body emitting the radiation R' is at the same temperature as the absorbing layer, $R=R'$, the emission balances the absorption, and the line will appear neither bright nor dark. If the source and the absorbing layer are at different temperatures, the radiation absorbed will be ER', and that transmitted will be $R'-ER'$. To this must be added the radiation emitted by the absorbing layer, namely ER, giving $R'-E(R'-R)$. The lines will appear darker than the background R' if R' is greater than R, but bright if the reverse is the case. The D lines are dark in the sun because the photosphere is much hotter than the reversing layer. They appear bright in the candle-flame because the outside mantel of the flame, in which the sodium burns and combustion is complete, is hotter than the inner reducing flame containing the incandescent particles of carbon which give rise to the continuous spectrum. This qualitative identity of emission and absorption as regards wave-length can be most exactly and easily verified for luminous rays, and we are justified in assuming that the relation holds with the same exactitude for non-luminous rays, although in many cases the experimental proof is less complete and exact.

40. **Relation Between Radiation and Temperature.**—Assuming, in accordance with the reasoning of Balfour Stewart and Kirchhoff, that the radiation stream inside an impervious enclosure at a uniform temperature is independent of the nature of the walls of the enclosure, and is the same for all substances at the same temperature, it follows that the full stream of radiation in such an enclosure, or the radiation emitted by an ideal black body or full radiator, is a function of the temperature only. The form of this function may be determined experimentally by observing the radiation between two black bodies at different temperatures, which will be proportional to the difference of the full radiation streams corresponding to their several temperatures. The law now generally accepted was first proposed by Stefan as an empirical relation.

Tyndall had found that the radiation from a white hot platinum wire at 1,200° C was 11·7 times its radiation when dull red at 525° C. Stefan (*Wien. Akad. Ber.*, 1879, 79, p. 421) noticed that the ratio 11·7 is nearly that of the fourth powers of the absolute temperatures as estimated by Tyndall. On making the somewhat different assumption that the radiation between two bodies varied as the difference of the fourth powers of their absolute temperatures, he found that it satisfied approximately the experiments of Dulong and Petit and other observers. According to this law the radiation between a black body at a temperature T and a black enclosure or a black radiometer at a temperature T_0 should be proportional to $(T^4-T_0^4)$. The law was very simple and convenient in form, but it rested so far on very insecure foundations. The temperatures given by Tyndall were merely estimated from the colour of the light emitted, and might have been some hundred degrees in error. We now know that the radiation from polished platinum is of a highly selective character, and varies more nearly as the fifth power of the absolute temperature. The agreement of the fourth power law with Tyndall's experiment appears therefore to be due to a purely accidental error in estimating the temperatures of the wire. Stefan also found a very fair agreement with Draper's observations of the intensity of radiation from a platinum wire, in which the temperature of the wire was deduced from the expansion. Here again the apparent agreement was largely due to errors in estimating the temperature, arising from the fact that the coefficient of expansion of platinum increases considerably with rise of temperature.

So far as the experimental results available at that time were concerned, Stefan's law could be regarded only as an empirical expression of doubtful significance. But it received a much greater importance from theoretical investigations which were even then in progress. James Clerk Maxwell (*Electricity and Magnetism*, 1873) had shown that a directed beam of electromagnetic radiation or light incident normally on an absorbing surface should produce a mechanical pressure equal to the energy of the radiation per unit volume. A. G. Bartoli (1875) took up this idea and made it the basis of a thermodynamic treatment of radiation. P. N. Lebedew in 1900, and E. F. Nichols and G. F. Hull in 1901, proved the existence of this pressure by direct experiments. L. Boltzmann (1884) employing radiation as the working substance in a Carnot cycle, showed that the energy of full radiation at any temperature per unit volume should be proportional to the fourth power of the absolute temperature.

The proof given by Boltzmann may be somewhat simplified if we observe that full radiation in an enclosure at constant temperature behaves exactly like a saturated vapour, and must therefore obey Carnot's or Clapeyron's equation (*see* THERMODYNAMICS). The radiation-pressure at any temperature is a function of the temperature only, like the pressure of a saturated vapour. If the volume of the enclosure is increased by any finite amount, the temperature remaining the same, radiation is given off from the walls so as to fill the space to the same pressure as before. The heat absorbed when the volume is increased corresponds with the latent heat of vaporization. In the case of radiation, as in the case of a vapour, the latent heat consists partly of internal energy of formation and partly of external work of expansion at constant pressure. Since in the case of full or undirected radiation the pressure is one-third of the energy per unit volume, the external work for any expansion is one-third of the internal energy added. The latent heat absorbed is, therefore, four times the external work of expansion. Since the external work is the product of the pressure P and the increase of volume V, the latent heat per unit increase of volume is four times the pressure. But by Carnot's equation the latent heat of a saturated vapour per unit increase of volume is equal to the rate of increase of saturation-pressure per degree divided by Carnot's function or multiplied by the absolute temperature. Expressed in symbols we have,

$$T(dP/dT)=L/V=4P, \qquad (14)$$

where (dP/dT) represents the rate of increase of pressure. This equation shows that the percentage rate of increase of pressure is four times the percentage rate of increase of temperature, or that if the temperature is increased by 1%, the pressure is increased by 4%. This is equivalent to the statement that the pressure varies as the fourth power of the temperature, a result which is

mathematically deduced by integrating the equation.

41. **Experimental Verification of the Fourth Power Law.**—The verification of this law requires (1) a black body or bodies capable of emitting full radiation at a series of different temperatures over an extended range, (2) a thermometer or thermometers capable of measuring these temperatures on the absolute scale, (3) a bolometer or thermopile capable of giving accurate relative values of the intensity of the radiation emitted in each case. These conditions were approximately satisfied by the experiments of Schneebeli (*Wied. Ann.*, 1884), who employed an air thermometer heated to various temperatures in a furnace, and observed the radiation from the bulb through a small aperture in the walls of the furnace With this arrangement the radiation observed would be nearly that of a black body, but the verification was rather rough in some respects. Measurements by J. T. Bottomley, A. Schleiermacher, L. C. H. F. Paschen and others, of the radiation from electrically heated platinum, failed to give results in agreement with the fourth power law on account of variations in the quality of the radiation, but greatly extended and improved methods of measuring radiation in other respects.

The most complete series of experiments, covering the range of the gas thermometer at the time available, were those of O. R. Lummer and E. Pringsheim (*Ann. Phys.*, 1897). They used a black body heated by steam at 100° C, for standardizing their bolometer, and, as their radiator, a black body consisting of a copper sphere heated in a salt bath for the range 200° to 600° C, and an iron cylinder heated in a gas muffle for the range 600° to 1,250° C. The temperatures were taken with a high range mercury thermometer, and with thermocouples, corrected to the gas-scale by direct comparison with a gas thermometer up to 1,150° C. One of the chief experimental difficulties of this investigation is the wide range of variation of the intensity of the radiation to be measured, which is nearly 450 times as great at 1,250° C as at 100° C. They employed a very sensitive form of bolometer (*see* § 42), and a galvanometer capable of giving a deflection of 336mm. under standard conditions, with a beam of radiation 16mm. square at a distance of 633mm. from the black body at 100° C. For the higher intensities it was necessary to reduce the sensitivity in a known ratio by varying the distance of the bolometer from the source, and the current in the bolometer circuit. The results for the relative intensities agreed on the average to about 1% with the fourth power law over the whole range of the observations. The law has since been verified up to 1,500° C by extending the range of the gas thermometer and the calibration of the thermocouples.

42. **Sensitive Radiometers.**—The term radiometer may be applied to any instrument adapted for measuring radiation, but we are here concerned chiefly with those types which are equally sensitive to radiant energy of all the wavelengths present in the radiation from a hot body. We may therefore omit the selenium cell which is very sensitive to luminous radiation, and the photo-electric cell for actinic rays, since these are comparatively insensitive to the infra-red rays, and do not satisfy the condition of measuring total energy irrespective of wavelength. The instruments chiefly employed at the present time for measurements of heat radiation, are the *thermopile* and the *bolometer*, the action of which depends on the same principles as those involved in the construction and operation of the corresponding types of electrical thermometers, namely the thermocouple and the electrical resistance thermometer, the theory of which is more fully discussed in the article THERMOMETRY. The thermopile and bolometer are in fact essentially electrical thermometers, with sensitive receiving surfaces for the absorption of radiation, and especially designed for measuring the small differences of temperature thereby produced. The sensitivity and accuracy of these instruments depend to a great extent on the galvanometer and electrical measuring apparatus with which they are employed.

One of the oldest and most sensitive radiometers is the *Melloni thermopile*, the invention of which led to so many advances in the theory and measurement of radiation. Sensitivity is secured by using antimony and bismuth alloys (A and B), a single couple of which may give as much as 120 microvolts for a difference of temperature of 1° C between the hot and cold junctions. With 100 couples connected in a continuous series A–B–A–B–A and so on, packed as usual in the form of a cube with alternate junctions on opposite faces, an electromotive force of 12 millivolts would be obtainable per 1° C difference of temperature between the receiving surfaces of the pile. The chief defect of this type of instrument in practice is that it has a large thermal capacity owing to its massive construction, and takes a long time to reach its maximum temperature. For many purposes quickness of action is quite as important as sensitivity in millivolts per degree, and the accuracy obtainable depends to a great extent on constancy of zero. In such cases the Melloni pile will be a most unsuitable instrument to employ, though it is still often used for demonstration purposes.

The conditions affecting quickness and constancy were first clearly elucidated by C. V. Boys (*Phil. Trans.* 1888) in the construction of his *radiomicrometer*, in which the thermopile and galvanometer were combined in a single instrument. This was effected by attaching a very light A–B couple to a loop of copper wire suspended between the poles of a powerful magnet by means of a fine quartz fibre, which made it possible to combine the advantage of maximum deflection for weak sources of radiation with quickness of action and constancy of zero. A similar arrangement was adopted some years later by W. Duddell in his *thermo-galvanometer*, for measuring small alternating currents. The current to be measured is passed through a small heater fixed close below the suspended thermocouple, the deflections of which are approximately proportional to the square of the current. The radio-micrometer is essentially the same instrument except that the suspended thermocouple is heated by radiation incident on a blackened disc of copper or silver foil, and that its constant is determined by exposure to a known source of radiation, such as a standard candle at a considerable distance. The instrument must be set up like a sensitive galvanometer and carefully levelled on a good foundation in a permanent position, and the radiation to be measured must be brought to the receiver in a horizontal direction. In this respect the combination of the thermopile and sensitive galvanometer in a single instrument is less convenient in practice than the use of a separate thermopile in conjunction with a fixed galvanometer, since in the latter case the thermopile can be adjusted in any desired position independently of the galvanometer, and the sensitivity may easily be altered in a known ratio according to requirements by varying the resistance in the circuit without changing the position of either source or receiver.

The *bolometer* invented by S. P. Langley (*Proc. Amer. Acad.*, 1881) depends for its action on change of electrical resistance, and consists essentially of a pair of grids of thin blackened foil of nearly equal resistance balanced one against the other in a Wheatstone bridge. Both are equally affected by changes in the temperature of the instrument, but if one grid is exposed to radiation while the other is screened, the resulting difference of temperature between them produces a current through the galvanometer approximately proportional to the intensity of the radiation. The whole exposed area of the grid constitutes the receiving surface, and extreme quickness of action can be secured by using very thin foil. The bolometer permits a wide range of variation of sensitivity since (in addition to other methods available with the thermopile) the current through the grids may be increased with a proportional increase in the deflection of the galvanometer. For this reason the sensitivity of a bolometer may considerably exceed that of a thermopile under otherwise similar conditions. There is, however, a practical limit to the increase of sensitivity thus obtainable, owing to the heating effect of the current which produces a rise of temperature in the grids proportional to the square of the current. When this becomes excessive, the zero is liable to wander and no further improvement in accuracy of measurement can be gained. The effect is most marked with a *"linear" bolometer*, consisting of a single strip of high resistance, as employed by Langley for measuring the intensity of the absorption lines in the infra-red spectrum. The rise of temperature due to a given current will be many times greater in a single strip than in a grid of many strips

with the same resistance but a much larger surface for dissipating the heat generated.

A *linear thermopile,* in which all the sensitive junctions are arranged in a vertical line, is entirely free from this source of trouble and is generally superior to the bolometer in point of stability of zero. Fig. 11 illustrates the construction of the Moll linear thermopile which is probably the most perfect instrument of this type in respect to constancy of zero as well as quickness of action. There are 20 couples arranged with their hot junctions in a vertical line behind the centre of the slit. The metals employed are the alloys constantan and manganin, both of which possess the property that their resistance does not vary appreciably with temperature. These alloys have the required mechanical properties and can be rolled into very thin strips, which afford excellent receiving surfaces and respond with extreme quickness. One half of each strip consists of constantan and the other half of manganin as indicated in the figure by the shading. The strips are connected in a continuous series, C–M–C–M–C and so on, the cold junctions on either side being soldered to copper studs fixed in insulating blocks at right angles to the plane of the strips. The function of these studs is to keep the cold junctions at a uniform temperature as nearly as possible the same as that of the enclosing case. Great constancy of zero and steadiness of deflection is thus obtained. Thus although the thermo-electric power of a single constantan-manganin couple is only about 40 microvolts per degree, or less than a third of that obtainable with the antimony-bismuth alloys (which are brittle and difficult to work) the superior quickness and constancy and facility of construction of the Con-Mn pile make the latter a more accurate and convenient instrument in practice.

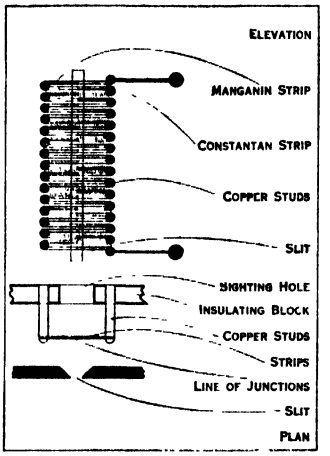

FIG. 11.—MOLL LINEAR THERMOPILE
Thermocouples of manganin and constantan strips with alternate junctions in a vertical line

In measuring the intensity of radiation at a distance from the source, where there is no restriction on the area of the beam received, the bolometer has the advantage that it can easily be made of any desired area, and that increase of area permits an increase of sensitivity. This condition cannot be satisfied easily in practice with a thermopile since the multiplication of couples involves a corresponding increase of resistance; but in dealing with *images,* such as spectral lines, of limited area, the thermocouple has the advantage that its sensitive receiving surface can be made to coincide with that of the image to be measured, as in the coronal pile (*Proc. Roy. Soc.,* 1905) for observing the sun's corona. Thus in the extreme case of a point image, such as that of a star, the single couple has a great advantage over the bolometer, which could not easily be made of the required size. By using very small single couples enclosed in a vacuum to reduce external loss of heat, W. W. Coblentz (Lick Observatory, 1915) succeeded in obtaining remarkably accurate measurements of the relative thermal intensities of star images in a large reflecting telescope. The vacuum thermopile recently devised by Moll, with a differential pair of junctions enclosed in a vacuum, would probably be well suited for this kind of work, as the effect of sky radiation would be compensated very accurately.

The *Crookes' radiometer,* with a delicately suspended vane in a vacuum of about 0·02mm., as improved by Nichols, can be made nearly equal in sensitivity to the radiomicrometer of Boys, but has the disadvantage of requiring the radiation to be introduced through a window, which may in many cases give rise to uncertainty due to selective absorption, in addition to the difficulty of maintaining a constant vacuum.

43. **Absolute Measurement of Radiation.**—The absolute measurement of the constant of radiation σ in the fourth-power law

$$R=\sigma(T^4-T_0^4) \qquad (15)$$

is required for estimating the quantity of radiation R emitted per second per unit area by a black surface at the absolute temperature T. The law having been verified qualitatively, as previously described, by observing relative values at different temperatures, it suffices for the determination of the constant σ to select one particular temperature of the source, and to observe the intensity of the radiation received at a known distance with a receiver capable of giving the result in absolute measure, such as watts per sq.cm., or gm.cals./cm². sec. It is first necessary that the temperature of the emitter should be uniform and accurately known. For this reason a black body enclosure at 100° C or $T=373{\cdot}1$ is commonly selected. The objection to this is that the intensity of the radiation is comparatively feeble and the quantity of heat to be measured inconveniently small as compared with accidental errors. A high temperature such as $T=1273°$ gets over this difficulty, but such temperatures are not known with sufficient accuracy, and are not easily regulated with the necessary uniformity and constancy. It appears best to select an intermediate temperature, such as the boiling point of sulphur (S.B.P) at 444·5° C or $T=817{\cdot}6°$, which has been determined with great care, and is easily maintained constant.

Fig 12 shows the essential points of a black body emitter employed for this purpose. The black body consists of a double walled enclosure constructed of sheet iron with brazed or welded joints, which must be absolutely tight to prevent any escape of the vapour. The sulphur is boiled in an iron boiler located in a fume cupboard at a lower level, and the vapour is brought up to the apparatus through a long iron tube to avoid any possibility of superheating. When the sulphur boils, the heavy brown vapour soon makes its appearance in the glass condenser tube at the top of the apparatus. This tube is open at the top, and is exposed without lagging for a height of two or three feet. The boiler flame is regulated to keep the level of the vapour constant about half way up the tube. The condensed liquid flows back through a small tube to the bottom of the boiler, and the apparatus will work for days with hardly any attention. The actual temperature inside the enclosure is observed occasionally with a long platinum thermometer,

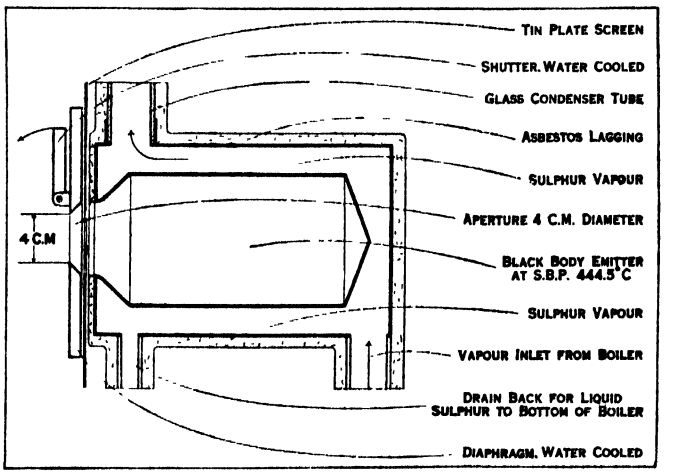

FIG. 12.—BLACK BODY EMITTER HEATED BY SULPHUR VAPOUR, FOR MEASURING INTENSITY OF FULL RADIATION FROM A SOURCE AT A TEMPERATURE OF 444·5° C. THE BOILING-POINT OF SULPHUR

and is always a few tenths of a degree lower than that of the vapour, as deduced from the height of the barometer, owing to loss by radiation. The inside of the enclosure is usually blackened in the first instance with platinum black, but soon becomes coated in any case with a protecting film of black oxide of iron, which is generally black enough for the purpose. The emitted beam is defined by an accurately turned aperture in a blackened diaphragm, cooled by a copious circulation of water at or near the atmospheric temperature.

The method of taking an observation consists in exposing the receiver, at a distance d from the diaphragm along the axis of the

aperture, to the full normal beam of radiation, and taking a reading of the heat received. The aperture is then closed by the water-cooled shutter shown in the figure, and a zero reading is taken. The effect of closing the shutter is to substitute for the beam of full radiation at the temperature T of the enclosure, a beam from an exactly equal area of the shutter at the temperature T_0, which is the same as that of the diaphragm. The observed difference between the two readings gives the value of $\sigma(T^4-T_0^4)$ as required in the equation, and eliminates any accidental stray radiation, which may affect the zero of the receiver, but is not altered by closing the shutter. If $T=717{\cdot}6°$ and $T_0=290°$, the correction for T_0^4 is less than 1·6%, so that a defect of 5% in the effective blackness of the diaphragm or shutter would give an error of less than 1 in 1000 in the result for the constant σ, and it is not necessary to know the value of T_0 with great accuracy. The case is quite different, however, in using a black body at 100° C or 373·1°A in the same manner. The correction for T_0 would then amount to nearly 37%, or 23 times larger, and a defect of 5% in the blackness of the shutter might produce an error of nearly 2% in the result. This fact, in addition to the other difficulties above mentioned, has often led to appreciable errors in the use of a black body at 100° C for purposes of reference, and is one of the chief reasons why it is desirable to use a black body at a reasonably high temperature for the determination of the constant σ. Accidental errors of this kind, due to invisible reflections and stray radiation, are most perfectly avoided by completely enclosing the receiver in a water-cooled aluminium casting (aluminium for lightness and high conductivity) at the same temperature as the diaphragm and shutter. The casting has a removable lid permitting easy access for preliminary measurements and adjustments of distance, etc., but this method is so elaborate that it has seldom been attempted. It is also essential to exclude products of combustion such as CO, CO_2 and SO_2 which are highly absorbent for infra-red radiation.

44. **Absolute Radiometers.**—The measurement of the radiation in absolute units is a more difficult part of the problem than that of securing a good approximation to full radiation at a known temperature. Instruments designed for absolute measurement were first developed for measuring the intensity of solar radiation, and were called *pyrheliometers*. The usual method, as first employed in Pouillet's pyrheliometer, was to receive the solar radiation on a blackened disc of known area and thermal capacity and to observe the rise of temperature produced in a given time. The original apparatus was rather sluggish in action, and the correction for heat-loss somewhat uncertain. The method was improved by Sir G. G. Stokes, J. Violle and A. Crova, by using discs of small thermal capacity and high conductivity, protected from stray radiation, by an enclosure at constant temperature. It is still largely employed for solar radiation, but is much less suitable for weak sources, such as are generally used in laboratory experiments, for which some electrical method of compensation is more convenient and accurate.

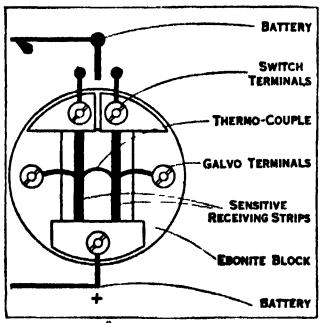

FIG. 13.—ÅNGSTRÖM PYRHELIOMETER, SHOWING FRONT VIEW OF STRIPS
Radiation received by one strip is measured by heating the other with an electric current to same temperature as indicated by a thermo-couple

Ångström Pyrheliometer.—One of the oldest and best of these compensation methods was first devised by K. Ångström (1890) for measuring solar radiation. His pyrheliometer is illustrated in figs. 13 and 14, and depends on balancing the radiation by electric heating. The front view, fig. 13, shows the pair of blackened strips of very thin manganin, 2cm. long and 2mm. wide, one of which is exposed to the radiation to be measured while the other is heated to the same temperature by an electric current. In this case the heat received from the radiation by one strip would evidently be equal to that generated by the current in the other, provided that the two were alike in all respects. Thus if R^1 is the radiant heat absorbed per sq cm., b the breadth of the strip, C the current in amperes and r the resistance in ohms per cm., the value of R^1 in watts per sq.cm. is given by the simple relation, $R^1=C^2r/b$. The ebonite block carrying the strips and their connecting terminals is fitted in a brass tube the front of which is closed by a cap with two slits corresponding in position with the strips. A swivelling shutter behind the cap permits the screening of either strip. The current is turned on the screened strip by the switch at the back and is adjusted by the rheostat until the galvanometer connected to the thermo-couple indicates equality of temperature by absence of deflection. The thermo-couple consists of a loop of fine constantan wire, the ends of which are connected to strips of copper foil attached to the backs of manganin strips as indicated in the diagram of connections (fig. 14). Each copper strip is attached as closely as possible to its manganin strip, but is insulated from it by thin silk paper and shellac. The copper strips provide a reliable attachment for the two junctions of the couple and help to equalize the temperature of the strip. The object of balancing one strip against the other is to make the reading as sensitive as possible, and to eliminate any disturbances depending on changes of temperature of the case, which would affect both strips equally. To eliminate small differences between the strips, the reading is repeated with the second strip screened and heated by the current while the first is exposed to radiation. The mean of the results is free from errors due to want of symmetry, provided that such errors are small. In this balance method of observation the result is practically independent of the accuracy of the galvanometer, but an error of 1% in the current C as measured by the ammeter would give an error of 2% in the result, since it depends on C^2. The result also depends on the breadth of the strip b and on its resistance r per cm., both of which are difficult to measure accurately, more especially when the strip is blackened with smoke, which makes the edge somewhat ill defined. In any case the value of R, representing the heat actually absorbed, will depend on the coefficient of absorption of the smoke film, which is generally taken as 98% but may vary somewhat for different wave-lengths and different smoke films.

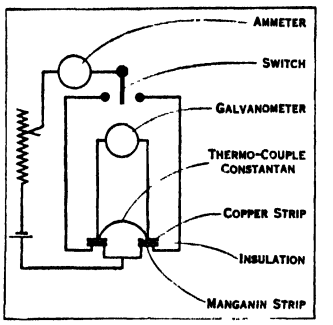

FIG. 14.—DIAGRAM OF CONNECTIONS OF THE ÅNGSTRÖM PYRHELIOMETER
Showing ammeter circuit, and insulated copper strips for attachment of thermo-junctions

Kurlbaum's bolometric method can be applied to any sensitive bolometer of suitable construction, and avoids some of the difficulties of measurement inherent in Ångström's method, but introduces others which make it less convenient for solar radiation. The method consists in observing the deflection D of the galvanometer when the bolometer is exposed to the radiation to be measured and is traversed by the small current c usually employed. The grid is then screened from radiation, and the current is increased to a larger value C such that the galvanometer gives the same deflection D due to the additional heat generated by the current in the grid. The intensity of the radiation R^1 in watts per sq.cm. is given in terms of the resistance r per sq.cm. of the grid by the formula, $R^1=r\ (C^2-c^2)C/c$. The difficulty of measuring the width of the strips may be avoided by using a pair of similar grids, adjusted in such a way that the strips of the second are behind the spaces between the strips of the first. The whole area of the grid may thus be utilized, and r is the whole resistance in ohms divided by the area in sq.cm. The factor C/c is required in the formula to allow for the fact that the deflection D of the galvanometer for a given increase of resistance of the grid is directly proportional to the current. The accuracy of measurement of the currents C and c is rather more important than in Ångström's method, but the bolometric method avoids the measurement of b and makes that of r very easy. On the other hand it is necessary to balance the bolometer against manganin resistances which are not appreciably affected by the current C. This makes it impossible to compensate for changes in the temperature of the surroundings in the usual

way (by balancing the receiving grid against a precisely similar grid) since both would be equally heated by the current C. Kurlbaum employed a black body at 100° C as source, and the actual rise of temperature of the grid due to the incident radiation with the small current c was only about a tenth of 1° C. The rise of temperature due to increasing the current from c to C would be less than this in the ratio c/C. The successive observations of

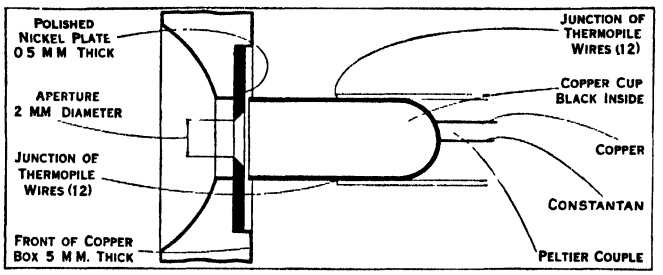

FIG. 15.—BLACK BODY RECEIVER OF RADIO BALANCE
The radiation to be measured is received in a blackened copper cup giving practically complete absorption, and is balanced by heat absorbed in a Peltier thermo-junction

radiation and current-heating would be unequally affected by any change in the surrounding conditions, and the difficulties of the method make it unsuitable for employment except in the laboratory with weak sources under very steady conditions.

Employing this method Kurlbaum (*Wied. Ann.*, 1898) found the value $\sigma = 5{\cdot}32 \times 10^{-5}$ ergs per sq.cm. per sec., or $5{\cdot}32 \times 10^{-12}$ watts per sq.cm , but this rested on a somewhat doubtful estimate of the absorption coefficient of the bolometer employed, and was raised at a later date (1912) from 5·32 to 5·45. Paschen and Gerlach (*Ann. Phys.* 1912) employed a modification of Ångström's method, but with a single strip (in place of a pair of strips) of measured area and resistance, which was alternately exposed to the radiation to be measured and heated by a measured electric current. The rise of temperature of the strip was indicated, and adjusted approximately to the same value in either case, by observing the *deflection* of a galvanometer connected to a linear pile fixed in position close behind the strip but not in contact with it. The method is inferior in some respects to Ångström's, especially in the absence of a balancing strip, and in its dependence on the accurate observation of successive deflections. On the other hand the single strip employed by Paschen and Gerlach is easier to make than the compound strip employed by Ångström, and the measurement of its breadth b and resistance r per cm. should be more accurate. They used a linear thermopile equal in length to the strip, and deduced the value of r per cm. from measurements of the whole length and resistance, whereas Ångström measured r by observing the potential difference between a pair of needle-point potential terminals fixed at a distance of 1cm. apart, and brought into contact with the central portion of the strip while a measured current was passing through it. This was a delicate operation, but was necessitated by the fact that he used a single couple at the centre of the strip, and that there might be some uncertainty about the resistance of the contacts at the end of the strip, since the compound strip could not be soldered satisfactorily to the terminal plates. Gerlach's later measurements (1916), in which corrections were applied for the imperfect blackness of platinum black and for atmospheric absorption, gave a final value $\sigma = 5{\cdot}80 \times 10^{-12}$ watt per sq.cm. which, though appreciably lower than his original uncorrected value, 5·85, was still nearly 7% higher than Kurlbaum's final value 5·45 by the bolometric method. It was suggested that these discrepancies might be due to inequalities of temperature due to loss of heat by conduction from the ends of the strip. Coblentz and Emerson (*Bur. Stds. Bull.*, 1916) endeavoured to avoid this difficulty by attaching potential terminals to the strip at a short distance from the ends. These terminals tend to cool the strip locally, but they estimate the cooling effect as only about 0·3%. Comparing a number of different receivers of this type they found variations amounting in some cases to 2%, with a probable order of 1% for the accuracy of the mean. They gave a final value 5·73 for the constant after applying corrections for imperfect blackness and atmospheric absorption.

The Radiobalance, employed by Callendar (*Proc. Phys. Soc.* 1910), was the first serious attempt to eliminate uncertain coefficients of absorption (which depend on the wave-length of the radiation as well as on the blackness and conductivity of the film) by employing a black-body receiver, designed to give complete absorption with an error of less than 0·1%. The construction of this receiver which can be used in any position, is illustrated in the fig. 15, on an enlarged scale. The radiation to be measured is admitted through an optically worked aperture of 2mm. dia. (which is comparatively easy to measure with the requisite degree of accuracy) and falls on the bottom of a small copper cup, where it is directly compensated by the *absorption* of heat due to the Peltier effect in a thermojunction formed between the cup and a constantan wire through which a suitable current is passed. Any change of temperature of the cup is indicated by a sensitive galvanometer, connected to a thermopile in which the cup is mounted as shown in fig. 16 The junctions of the pile are insulated from the cup by thin silk paper and paraffin wax, which is non-hygroscopic, and are bound firmly round the cup with a lapping of fine silk. The pile wires are iron and constantan each 0·2mm. dia. and are sufficiently stiff to hold the cup securely in place. The cold junctions of the pile are similarly fixed to a copper cylinder screwed to the base of the copper box 5mm thick enclosing the sensitive parts of the apparatus at a uniform temperature, which is indicated by a delicate mercury thermometer with its bulb inserted between the two piles. Since it is always desirable to take observations by a balance method (most especially in measuring strong sources of radiation, such as 1cal. per sq cm. per min., or 0·07 watt per sq cm., which would give unbalanced deflections of the galvanometer of the order of 7,000mm) the cup exposed to radiation is balanced against a similarly mounted cup, as indicated in the diagram of connections fig 17, the piles in which the cups are mounted being connected in opposition in the galvanometer circuit. This method gives very perfect elimination of external disturbances owing to the small size and high conductivity of the copper box in which the two piles are enclosed.

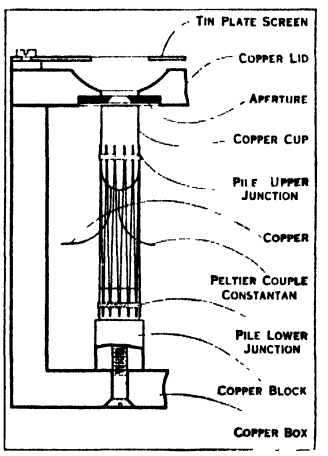

FIG. 16.—CUP AND PILE OF RADIO-BALANCE, SHOWING MOUNTING OF CUP IN SENSITIVE THERMOPILE WITH 12 JUNCTIONS INSIDE COPPER BOX

The advantage of using the Peltier effect for the absolute measurement of radiation, in place of the more familiar Joule effect employed in other instruments such as the Ångström pyrheliometer, is that heat reception can be directly compensated by heat absorption, and that the heat absorbed is proportional to the current C (instead of to C^2) and changes sign when the current is reversed. The value of the Peltier coefficient P for a single copper-constantan junction as here employed is approximately 12 millivolts, which when multiplied by the current C in amperes gives the heat absorption PC in milliwatts. Thus with an aperture of 2mm. dia. the current required to compensate radiation of intensity 0·07 watt per sq.cm , which is near the mean for sunshine, is about 200 milliamps. with a single couple. In actual practice the same current C is passed through the Peltier junctions of both cups so that the exposed cup is cooled while the screened cup is heated. This doubles the effect and requires a current of 100 milliamps. only, in the case above given, and makes it possible to measure strong sources up to 0·4 watt per sq.cm., without changing the 2mm. aperture.

In taking readings by this method, one cup is exposed to radiation while the other is screened, and the current is adjusted to reduce the deflection of the galvanometer to zero. After reading

the current, the radiation is switched over to the other cup (by moving a shutter close in front of the aperture and behind the tin plate screen in fig. 16) and the current is simultaneously reversed without altering its value. This procedure has the effect of exactly eliminating any small heating effect in the wires conveying the current to the cups, and gives the simple formula $R'=2PC/a$, for the intensity R' of the radiation received in terms of the aperture a in sq cm If the radiation is variable, as is usually the case with sunshine even on the clearest day, it is preferable to keep the current constant and to observe the small residual deflections of the galvanometer, which are readily translated into milliamps. by observing the deflection produced by reversing a small current when both cups are screened. If the piles are not accurately balanced, or if the areas of the apertures are not exactly equal, the appropriate value of the balancing current will be different for the two cups. Any small differences of this kind may be treated in the same way by observing galvanometer deflections, but should not exceed a small fraction of 1%.

The value of the coefficient P is most easily determined by observing the thermoelectric power p of a junction made of the same wires, and multiplying by the absolute temperature T. Both factors in the product Tp increase with temperature, so that it is necessary to know the temperature to 0·2° C in order to secure an order of accuracy of 0·1% in R', since the temperature coefficient of P is usually in the neighbourhood of 0·5% per 1° C. A more direct method is to balance the Peltier effect in each cup against the heating effect in a resistance coil fitting the cup. This method affords the most simple and accurate verification of the thermodynamic theory, and measures the effect under working conditions for the actual couples employed. To find the value of σ by observing the radiation emitted from a black body such as that illustrated in fig. 12, with a water cooled aperture of radius b, it is necessary to adjust the aperture a of the receiver to be coaxial with that of the emitter and to measure the distance d between their planes. The normal intensity R' as measured by the receiver is given in terms of the black body intensity R in formula (15) by the simple relation $R'=Rb^2/(d^2+b^2)$, which may be found in most textbooks of geometrical optics.

Observations taken with radiobalance D (one of the instruments described in *Proc. Phys. Soc.* 1910) in conjunction with the black body illustrated in fig. 12, by N. L. Jones gave a mean result $\sigma=5{\cdot}690\times10^{-12}$ watt per sq cm. The observations were taken at night under favourable conditions, but no correction was applied for atmospheric absorption, as the distance (29 to 33cm.) was not varied sufficiently. Later observations made by Callendar using a black body at 100° C with the same instrument, in which the distance d was varied from 6 to 56cm. under similar conditions, gave a result 5·752 when corrected for atmospheric absorption. The Peltier couple in this instrument was tested by the thermoelectric method using samples of the same wires, iron and constantan respectively. Another balance (E), with a copper-constantan couple, tested by both methods with consistent results, and corrected for atmospheric absorption in the same way, gave a slightly higher result, 5·766. The differences between observations taken on different days averaged about 0·2% and appeared to depend mainly on variations of atmospheric absorption, the correction for which doubled the time and labour of taking observations. The percentage absorbed varies to some extent with the quality of the radiation as determined by the temperature of the emitter as well as the state of the atmosphere, and is not simply proportional to the distance traversed as commonly assumed. The observations with the black body at 444·5° C, when corrected by reference to hygrometric records, using the coefficient found at 100° C, were raised from a mean value 5·690 to 5·804, which suggests that the absorption correction should be smaller for radiation at 444·5° C than at 100° C. The mere presence of an observer radiating heat and exhaling variable quantities of CO_2 is a source of uncertainty in absolute measurements. Apart from atmospheric absorption, the instrument appeared to be capable of an order of accuracy of at least 0·1%. It was accordingly decided to enclose the receiver in a water-cooled metal casting from which absorbing gases could be excluded. Unfortunately at this stage the work was interrupted by the World War, and no favourable opportunity has since occurred for making the final corrections for absorption. It appears, however, that the result would probably be intermediate between those of Gerlach and Coblentz by the Ångström method. A number of other highly ingenious methods have been employed for the absolute determination of this important constant, but have generally been inferior to the electric methods in quickness and sensitivity, and do not promise so high a degree of accuracy. Some experienced observers have found values as high as 6·5, but there are many most insidious sources of error in these difficult experiments.

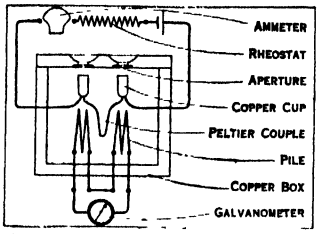

FIG. 17.—DIAGRAM OF CONNECTIONS FOR RADIOBALANCE
Both cups, with circuit of Peltier junction separate from that of piles and galvanometer, are shown

45. **Wien's Displacement Law.**—Assuming that the fourth power law gives the quantity of full radiation at any temperature it remains to determine how the quality of the radiation varies with the temperature, since as we have seen both quantity and quality are determinate. This question may be regarded as consisting of two parts. (1) How is the wave-length or frequency of full or "black" radiation changed when its temperature is altered? (2) What is the form of the curve expressing the distribution of energy between the various wave-lengths in the spectrum of full radiation, or what is the distribution of heat in the spectrum? The researches of Tyndall, Draper, Langley and other investigators had shown that while the energy of radiation of each frequency increased with rise of temperature, the maximum of intensity was shifted or displaced along the spectrum in the direction of shorter wave-lengths or higher frequencies. W. Wien (*Ann. Phys.*, 1898), applying Doppler's principle to the adiabatic compression of radiation in a perfectly reflecting enclosure, deduced that the wave-length of each constituent of the radiation should be shortened in proportion to the rise of temperature produced by the compression, in such a manner that the product λT of the wave-length and the absolute temperature should remain constant. According to this relation, which is known as *Wien's displacement law*, the frequency corresponding to the maximum ordinate of the energy curve of the normal spectrum of full radiation should vary directly (or the wave-length inversely) as the absolute temperature, a result previously obtained by H. F. Weber (1888). Paschen, Lummer and Pringsheim verified this relation by observing with a bolometer the intensity at different points in the spectrum produced by a fluorite prism. The intensities were corrected and reduced to a wave-length scale with the aid of Paschen's results on the dispersion formula of fluorite (*Wied. Ann.*, 1894). The curves in fig. 18 illustrate curves obtained by Lummer and Pringsheim (*Ber. deut. phys. Ges.*, 1899) at three different temperatures, namely 1,377°, 1,087° and 836° absolute, plotted on a wave-length base with a scale of microns μ or millionths of a metre. The wave-lengths Oa, Ob, Oc, corresponding to the maximum ordinates of each curve, vary inversely as the absolute temperatures given. The constant value of the product λT at the maximum point was found to be 2,920. Thus for a temperature of 1,000°A the maximum is at wave-length 2·92μ; at 2,000° the maximum is at 1·46μ.

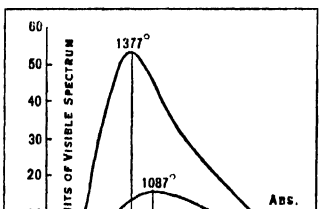

FIG. 18.—DISTRIBUTION OF ENERGY IN THE SPECTRUM OF A BLACK BODY

46. **Distribution of Energy in the Spectrum.**—Assuming Wien's displacement law, it follows that the form of the curve representing the distribution of energy in the spectrum of full radiation should be the same for different temperatures with the maximum displaced in proportion to the absolute temperature, and with the total area increased in proportion to the fourth power

of the absolute temperature. Observations taken with a bolometer along the length of a normal or wave-length spectrum, would give the form of the curve plotted on a wave-length base. The height of the ordinate at each point would represent the energy included between given limits of wave-length, depending on the width of the bolometer strip and the slit. Supposing that the bolometer strip had a width corresponding to $\cdot 01\mu$, and were placed at $1\cdot 0\mu$ in the spectrum of radiation at 2,000°A, it would receive the energy corresponding to wave-lengths between 1·00 and 1·01μ. At a temperature of 1,000°A the corresponding part of the energy, by Wien's displacement law, would lie between the limits 2·00 and 2·02μ, and the total energy between these limits would be 16 times smaller. But the bolometer strip placed at 2·0μ would now receive only half of the energy, or the energy in a band ·01μ wide, and the deflection would be 32 times less. Corresponding ordinates of the curves at different temperatures will therefore vary as the fifth power of the temperature, when the curves are plotted on a wave-length base. The maximum ordinates in the curves already given are found to vary as the fifth powers of the corresponding temperatures.

The equation representing the distribution of energy on a wave-length base must be of the form

$$E = C\lambda^{-5} F(\lambda T) = CT^{5}(\lambda T)^{-5}F(\lambda T) \qquad (16)$$

where $F(\lambda T)$ represents some function of the product of the wave-length and temperature, which remains constant for corresponding wave-lengths when T is changed. If the curves were plotted on a frequency base, owing to the change of scale, the maximum ordinates would vary as the cube of the temperature instead of the fifth power, but the form of the function F would remain unaltered Reasoning on the analogy of the distribution of velocities among the particles of a gas on the kinetic theory, which is a very similar problem, Wien was led to assume that the function F should be of the form $e^{-c/\lambda T}$, where e is the base of Napierian logarithms, and c is a constant having the value 14,600 if the wave-length is measured in microns μ. This expression was found by Paschen to give a very good approximation to the form of the curve obtained experimentally for those portions of the visible and infra-red spectrum where observations could be most accurately made. The formula was tested in two ways: (1) by plotting the curves of distribution of energy in the spectrum for constant temperatures as illustrated in fig. 19: (2) by plotting the energy corresponding to a given wave-length as a function of the temperature. Both methods gave very good agreement with Wien's formula for values of the product λT not much exceeding 3,000.

A method of isolating rays of great wave-length by successive reflection was devised by H. Rubens and E. F. Nichols (*Wied. Ann.*, 1897). They found that quartz and fluorite possessed the property of selective reflection for rays of wave-length 8·8μ and 24μ to 32μ respectively, so that after four to six reflections these rays could be isolated from a source at any temperature in a state of considerable purity. The residual impurity at any stage could be estimated by interposing a thin plate of quartz or fluorite which completely reflected or absorbed the residual rays, but allowed the impurity to pass. H. Beckmann, under the direction of Rubens, investigated the variation with temperature of the residual rays reflected from fluorite employing sources from —80° to 600° C, and found the results could not be represented by Wien's formula unless the constant c were taken as 26,000 in place of 14,600. In their first series of observations extending to 6μ O. R. Lummer and E. Pringsheim (*Deut. phys. Ges.*, 1899) found systematic deviations indicating an increase in the value of the constant c for long waves and high temperatures. In a theoretical discussion of the subject, Lord Rayleigh (*Phil. Mag.*, 1900) pointed out that Wien's law would lead to a limiting value $C\lambda^{-5}$, of the radiation corresponding to any particular wave-length when the temperature increased to infinity, whereas according to his view the radiation of great wave-length should ultimately increase in direct proportion to the temperature. Lummer and Pringsheim (*Deut. phys. Ges.*, 1900) extended the range of their observations to 18μ by employing a prism of sylvine in place of fluorite. They found deviations from Wien's formula increasing to nearly 50% at 18μ, where, however, the observations were very difficult on account of the smallness of the energy to be measured. Rubens and F. Kurlbaum (*Ann. Phys.*, 1901) extended the residual reflection method to a temperature range from -- 190° to 1,500° C, and employed the rays reflected from quartz 8·8μ, and rocksalt 51μ, in addition to those from fluorite.

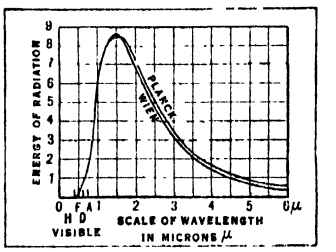

FIG. 19.—DISTRIBUTION OF ENERGY IN THE SPECTRUM OF FULL RADIATION AT 2,000° A. ACCORDING TO FORMULAE OF PLANCK AND WIEN

It appeared from these researches that the rays of great wave-length from a source at a high temperature tended to vary in the limit directly as the absolute temperature of the source, as suggested by Lord Rayleigh, and could not be represented by Wien's formula with any value of the constant c. The formula now generally accepted is that proposed by Max Planck (*Ann. Phys.*, 1901) namely,

$$E = C\lambda^{-5}(e^{c/\lambda T}-1)^{-1}, \qquad (17)$$

which agrees with Wien's formula when T is small, where Wien's formula is known to be satisfactory, but approaches the limiting form $E = C\lambda^{4}T/c$, when T is large, thus satisfying the condition proposed by Lord Rayleigh. The theoretical interpretation of this formula is discussed in the article RADIATION The most recent value of the constant c in Planck's formula is 14,300, as given by Warburg. In order to compare Planck's formula graphically with Wien's, the distribution curves corresponding to both formulae are plotted in fig. 19 for a temperature of 2000° A, with a scale of wave-length in microns μ.

The curves in fig. 20 illustrate the difference between the two formulae for the variation of the intensity of radiation with temperature for a *fixed* wave-length 30μ which is five times as long as the limit 6μ of the curves in fig 20. But at 2,000° A the energy to be measured at 30μ is about ten thousand times less than at the maximum of the curve in fig. 20. Assuming Wien's displacement law, the curves may be applied to find the energy for any other wave-length or temperature, by simply altering the wave-length scale in inverse ratio to the temperature, or vice versa. Thus to find the distribution curve for 1,000° A, it is only necessary to multiply all the numbers in the wave-length scale of fig. 19 by 2; or to find the variation curve for wave-length 60μ the numbers on the temperature scale of fig. 20 should be divided by 2. The ordinate scales must be increased in proportion to the fifth power of the temperature, or inversely as the fifth power of the wave-length respectively in figs. 19 and 20 if comparative results are required for different temperatures or wave-lengths.

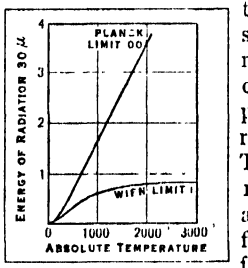

FIG 20 —VARIATION OF ENERGY OF RADIATION CORRESPONDING TO WAVE-LENGTH 30 μ WITH TEMPERATURE OF SOURCE

SPECIFIC HEAT AT LOW TEMPERATURES

47. The early experiments of Sir J. Dewar, Sir W. A. Tilden and others had shown that solids at low temperatures deviated from Dulong and Petit's law of the constancy of atomic heat in the same way as carbon, boron and silicon, at ordinary temperatures, but they failed to show the full extent of the deviation, or to indicate a probable explanation. A. Einstein suggested (*Ann. Phys.*, 1907) that the atom of a solid might be regarded as an electric resonator with three degrees of freedom possessing a particular frequency, independent of the temperature and capable of responding to the same frequency of radiation. Adopting Planck's theory and radiation formula, he showed that the specific heat at constant volume should approach the limit $3R = 5\cdot 94$ calories per gram-atom at high temperatures, as required by Dulong and Petit's law, but that the variation at low temperatures

should be given by the expression

$$s = 3Rz^2e^z/(e^z-1)^2 = 3Rf(z) \qquad (18)$$

where $z = \beta\nu/T = c/\lambda T$, as in Planck's formula. The symbol ν denotes the natural frequency of the atoms, and λ the corresponding wave-length in cm. such that $\nu\lambda = 3\times10^{10}$, the velocity of light. Taking H. F. Weber's observations on the variation of the specific heat of the diamond, extending from $T=222°$ to 1,258° A, Einstein showed that they agreed qualitatively with this formula, if we could assume the diamond atoms to possess a single frequency corresponding to the wave-length 11 microns. Taking the substances, CaFl, NaCl, KCl, $CaCO_3$ and SiO_2, for which the optical frequencies in the infra-red were known, he showed that the frequencies agreed in order of magnitude with those required by his formula, but that the observed wave-lengths were somewhat shorter than those calculated from the specific heats. This could be attributed to the fact that most of the substances showed more than one frequency, and that the frequencies were not strictly monochromatic, as indicated by the width of the corresponding absorption bands. In any case there were other effects, such as work of expansion, included in the specific heats as ordinarily measured, and it might be doubted whether the optical frequencies corresponded exactly with the thermal vibrations of the atoms.

Experiments on Solids.—An important series of experimental measurements, extending down to the temperature of liquid hydrogen, was made by W. Nernst, F. A Lindemann and their collaborators (*Sitz. Akad., Berlin,* 1911), on a number of metals and other solids, including those for which the optical frequencies were known. They found, as already indicated, that Einstein's formula gave too low values for the specific heats at low temperatures, if the optical frequencies were assumed in calculating the value of $f(z)$, and that much better agreement could be obtained by taking the mean of $f(z)$ for the optical frequency, and a similar term, $f(z/2)$ at half the optical frequency:—

$$s = 3R[f(z)+f(z/2)]/2 = 3Rf''(z) \qquad (19)$$

The same function, $f''(z)$, of z was assumed to apply to other substances, such as the metals, but the appropriate values of z were selected to fit the observations on the specific heats. Some substances, such as SiO_2 (in the forms of quartz and quartz-glass) and benzine, C_6H_6, which gave a different type of curve, were represented by formulae with two or three different values of z, each value of $f''(z)$ being multiplied by a fractional coefficient representing the proportion in which the corresponding molecule was supposed to be present. But such cases could not be regarded as a verification of the theory, because it would obviously be possible to represent almost any type of variation in this way.

Einstein objected that even the simplest of these formulae, namely (19), was too empirical to be satisfactory from a theoretical standpoint; that a cubical crystal, such as KCl, or NaCl, could not have two different frequencies; and that there was no evidence in either case of an optical frequency with half the experimental value, since, according to Rubens, the crystals became again transparent before this frequency was reached, and had a value of the refractive index which was nearly normal. He also indicated two other objections to the *quantum theory* on which Planck's formula was based. (1) According to the quantum theory it did not follow, as required by the classical mechanics, that the oscillator with three degrees of freedom would have three times the energy of a linear oscillator. (2) It was very difficult to conceive the distribution of energy among the oscillators at low temperatures required by the theory. Thus for the diamond at $T=73°$A only one molecule in 100 millions would possess a single quantum of energy, all the rest would be absolutely quiescent. It was physically impossible to conceive such a distribution of energy, which moreover would make the thermal conductivity of the diamond at such temperatures entirely negligible, whereas, according to Eucken, it was nearly as great as that of copper at ordinary temperatures. For these reasons Einstein preferred to rely mainly on the expression for the energy of an electric oscillator in equilibrium with radiation as deduced from Maxwell's equations, and to regard Planck's formula for the distribution of energy in full radiation simply as representing the results of experiment.

Debye's Theory of Specific Heat of Solids.—The theory now most commonly accepted is that of P. Debye (*Ann. Phys.*, 1912), who attributes the heat energy to mechanical or acoustic vibrations of the solid with all possible frequencies up to a certain limit ν_m. According to a theorem attributed to the late Lord Rayleigh (*Sound,* i., 1877) the number of possible degrees of freedom of a system of N discontinuous mass-points will be $3N$. According to another theorem by the same author (*Phil. Mag.*, 1900), the number of possible frequencies in a given volume of a *continuous* medium between the limits ν and $\nu+d\nu$ may be represented by $C'\nu^2d\nu$, where C' is a constant depending on the volume and the velocity of propagation. The total number of possible frequencies from 0 up to a limit ν_m is $C'\nu_m^3/3$. If we equate this to $3N$, we find $C'=9N/\nu_m^3$. Adopting Planck's expression for the energy of an electric ascillator with one degree of freedom as applying to each possible frequency of the N atoms in a gram-atom, we obtain the energy $(RT/N)z/(e^z-1)$ for each frequency. Multiplying this by the number of frequencies between ν and $\nu+d\nu$, namely $(9N/\nu_m^3)\nu^2d\nu$, and integrating from 0 to ν_m, we obtain the energy of a gram-atom at T, from which the specific heat at constant volume is obtained by differentiation with regard to T. Unfortunately the integral cannot be expressed in finite terms and is too complicated to reproduce here. It is evident, however, that it will be a function of z_m, or $\beta\nu_m/T$, or T_m/T, where $T_m=\beta\nu_m$.

Thus the *form* of the curve representing the variation of the specific heat (which depends on a single parameter T_m or ν_m) is the same for all substances on Debye's theory, if the temperature scale is altered for each in proportion to ν_m. This point has been very carefully tested by E. H. Griffiths and E. Griffiths (*Phil. Trans.*, A, 1914) for the metals Al, Ag, Cd, Cu, Fe, Na, Pb, Zn. Their results indicate qualitative agreement with the theory, but show characteristic differences, greatly exceeding the limit of experimental error, which may possibly be attributed to other effects not included in the simple theory. Thus the curve for Fe differs from that for Cu by nearly 20% between corresponding temperatures, which may be attributed to the magnetic properties of Fe. The curve for Na shows a rapid rise towards the melting point, reaching an excess of 25% above $3R$, followed by a diminution of specific heat for the liquid, as in the case of water and mercury. Many simple compounds, such as NaCl, show curves of a very similar type to the metals, which has been used as an argument that the specific heat must be attributed entirely to the atoms, and that the free electrons supposed to exist in metals cannot make any appreciable contribution. Thus if there were two free electrons per atom, as required by some theories, the electrons alone would account for the whole specific heat according to the kinetic theory at ordinary temperatures; and it would be necessary to suppose that the number of free electrons diminished to zero at low temperatures, which would make it difficult to account for the enormous increase in electric conductivity of pure metals demonstrated by Kamerlingh Onnes in the neighbourhood of the absolute zero. There can be little doubt that the properties of any substance are intimately related to the natural frequencies of the molecules, but the form of the relation cannot be predicted with certainty; and the quantitative measurements are not yet sufficiently exact to distinguish between many possible hypotheses.

Specific Heat of a Gas.—The experiments of A. Eucken (*Sitz. Akad., Berlin,* 1912) on the specific heat of hydrogen at low temperatures were very instructive in this connection. The gas was electrically heated at various temperatures in a thin steel vessel under considerable pressure at constant volume. The specific heat was found to diminish from nearly $5R/2$ at ordinary temperatures to nearly $3R/2$ at $T=60°$, after which it remained practically constant down to $T=35°$. The experiments were undoubtedly of considerable difficulty, but there seems no reason to doubt their substantial accuracy.

Eucken's results have recently been confirmed with remarkable precision by J. H. Brinkworth (*Proc. Roy. Soc.* [A] 1925) using an entirely independent method of experiment. He observed the

cooling effect in adiabatic expansion with a compensated platinum thermometer at various temperatures between 20° C and −183° C, and deduced the corresponding values of the ratio of the specific heats at constant pressure and at constant volume. The actual specific heats at any temperature could be deduced with certainty from these observations. This method is unaffected by the thermal capacity of the containing vessel, whereas in Eucken's

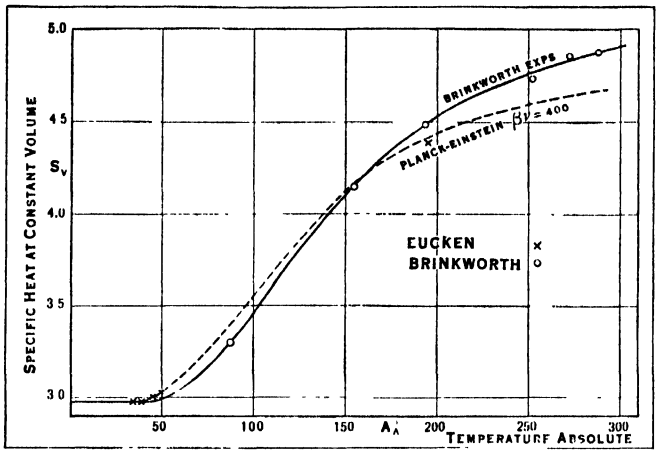

FIG. 21.—MOLECULAR SPECIFIC HEAT OF HYDROGEN AT CONSTANT VOLUME

The curve shows change from 3R/2 (the value appropriate to a monatomic gas like helium) at 50° A to the value 5R/2 at 300° A. The latter is the appropriate value for a diatomic molecule, such as nitrogen, the specific heat of which remains nearly constant over this range

method the thermal capacity of the vessel must be known with considerable accuracy. Brinkworth also showed that the heat-loss could be most satisfactorily eliminated by using vessels of different sizes Assuming that the variation of the specific heat was due to the response of some particular frequency of the molecule to the same frequency in natural radiation at each temperature, he states that Callendar's radiation formula fits the observations better than Planck's but that satisfactory agreement cannot be obtained by assuming a *single* frequency. Reiche's calculations do not seem to improve the agreement

It would appear that the specific heat of the most perfect gas may vary quite independently of the kinetic energy of its molecules, and that the Boltzmann dumbbell model of a diatomic molecule, with five equal degrees of freedom, cannot longer be maintained. The form of the curve representing the variation of the specific heat between 50° and 300°A as shown in fig 21, is similar to that found for the diamond at low temperatures, and suggests that the variation is related to some natural frequency of the hydrogen molecule according to Einstein's theory but the exact nature of the relation remains at present obscure.

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HEATH, BENJAMIN (1704–1766), English classical scholar and bibliophile, was born at Exeter on April 20, 1704, and died on Sept. 13, 1766. He was the son of a wealthy merchant, and was thus able to devote himself mainly to travel and book-collecting. As a classical scholar he made his reputation by his critical and metrical notes on the Greek tragedians. He also left ms. notes on Burmann's and Martyn's editions of Virgil, on Euripides, Catullus, Tibullus and the greater part of Hesiod. His *Revisal of Shakespear's Text* (1765) was an answer to the "insolent dogmatism" of Bishop Warburton. Two of his sons were Benjamin, headmaster of Harrow, and George, headmaster of Eton. His collection of rare classical works formed the nucleus of his son Benjamin's famous library (Bibliotheca Heathiana).

An account of the Heath family will be found in Sir W. R. Drake's *Heathiana* (1882).

HEATH, NICHOLAS (*c.* 1501–78), archbishop of York and lord chancellor, was born in London. He was educated at Oxford and at Christ's college, Cambridge, and after minor preferments he was appointed archdeacon of Stafford in 1534. He then accompanied Edward Fox (*q.v.*), bishop of Hereford, on his mission to promote a theological and political understanding with the Lutheran princes of Germany In 1539, he was made bishop of Rochester, and in 1543 succeeded Latimer at Worcester. He accepted the earlier reforms of Edward VI, and the first book of common prayer after it had been modified by the House of Lords in a Catholic direction. His definite breach with the Reformation occurred on the question of the Ordinal drawn up in 1550. Heath refused to accept it, was imprisoned, and in 1551 deprived of his bishopric On Mary's accession he was restored, made president of the council of the Marches and Wales, and in 1555 was promoted to the archbishopric of York After the death of Gardiner he was appointed lord chancellor. On Mary's death Heath as chancellor at once proclaimed Elizabeth Although the queen did not renew his commission as lord chancellor, he continued to sit in the privy council for two months until the government completed the breach with the Catholic Church; and as late as April 1559 he assisted in the arrangement of the Westminster Conference. He refused to crown Elizabeth because she would not have the coronation service accompanied with the elevation of the Host and resisted her acts of supremacy and uniformity, although he had acquiesced in the acts of 1534 and 1549. He was deprived of his archbishopric in 1559, but he remained loyal to Elizabeth; and after a temporary confinement he passed the remaining 19 years of his life in peace, dying at Chobham, Surrey at the end of 1578

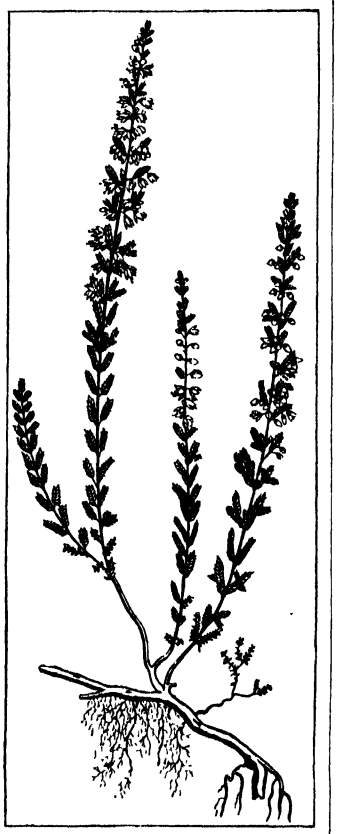
AUTHORITIES.—Letters and Papers of Henry VIII; Acts of the Privy Council; Cal. State Papers, Domestic, Addenda, Spanish and Venetian; Kemp's Loseley mss; Froude's *History;* Burnet, Collier, Dixon and Frere's *Church Histories;* Strype's *Works* (General Index), Parker Soc. Publications (Gough's Index); Birt's *Elizabethan Settlement.*

HEATH, WILLIAM (1737–1814), American soldier, was born in Roxbury, Mass., on March 2, 1737 (old style). He was brought up as a farmer but had a passion for military exercises. In 1765 he entered the Ancient and Honourable Artillery company of Boston, of which he became commander in 1770. In the same year he wrote to the *Boston Gazette* letters signed "A Military Countryman," urging the necessity of military training. He was a member of the Massachusetts general court from 1770 to 1774, of the provincial committee of safety, and from 1774–1775 of the provincial congress He was commissioned a provincial brigadier-general in 1774, directed the pursuit of the British from Concord (April 19, 1775), was promoted to be provincial major-general on June 20, 1775, and two days later was commissioned fourth brigadier-general in the Continental army. He became major-general in 1776, and was in active service around New York until early the next year. In Jan. 1777 he attempted to take Ft. Independence, near Spuyten Duyvil, then garrisoned by about 2,000 Hessians, but at the first sally of the garrison his troops became panic-stricken and a few days later he withdrew Washington reprimanded him. Throughout the war, however, Heath was very efficient in muster service and in the barracks. In May 1779 he was appointed a commissioner of the board of War. He was placed in command of the troops on the east side of the Hudson in June 1779, and of other troops and posts on the Hudson in November of the same year. In July 1780, he met the French allies under Rochambeau on their arrival in Rhode Island; in October of the same year he succeeded Arnold in command of West Point and its dependencies; and in Aug. 1781, when Washington went south to meet Cornwallis, Heath was left in command

of the army of the Hudson to watch Clinton. After the war he retired to his farm at Roxbury, was a member of the State house of representatives in 1788, of the Massachusetts convention which ratified the Federal Constitution in the same year, and of the governor's council in 1789–90. He was a State senator 1791–93. He died at Roxbury Jan. 24, 1814, the last of the major-generals of the Revolutionary War

See *Memoirs of Major-General Heath, containing Anecdotes, Details of Skirmishes, Battles, and other Military Events during the American War, written by Himself* (Boston, 1798; frequently reprinted), particularly valuable for the descriptions of Lexington and Bunker Hill, of the fighting around New York, of the controversies with Burgoyne and his officers during their stay in Boston, and of relations with Rochambeau; and his correspondence, *The Heath Papers*, vols. iv.–v., seventh series, *Massachusetts Historical Society Collections* (Boston, 1904–05).

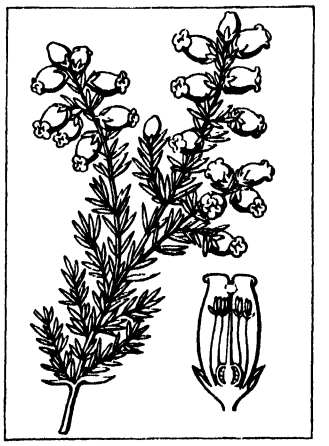
HEATH, the English form of a name given in most Teutonic dialects to the common ling or heather (*Calluna vulgaris*), but now applied to all species of *Erica*, an extensive genus of monopetalous plants, belonging to the family Ericaceae. The heaths are evergreen shrubs, with small narrow leaves, in whorls usually set rather thickly on the shoots; the persistent flowers have 4 sepals, and a 4-cleft campanulate or tubular corolla, in many species more or less ventricose or inflated; the dry capsule is 4-celled, and opens, in the true Ericae, in 4 segments, to the middle of which the partitions adhere, though in the ling the valves separate at the dissepiments. The plants are mostly of low growth, but several African kinds reach the size of large bushes, and a common South European species, *E. arborea*, occasionally attains almost the aspect and dimensions of a tree.



FLOWERING BRANCH OF THE LING OR HEATHER (CALLUNA VULGARIS) In flower, the small corolla is concealed by rose-coloured sepals, at base of which are four small green bracts

One of the best known and most interesting of the family is the common heath, heather or ling, *Calluna vulgaris*, placed by most botanists in a separate genus on account of the peculiar dehiscence of the fruit, and from the coloured calyx, which extends beyond the corolla, having a whorl of sepal-like bracts beneath. This shrub derives some economic importance from its forming the chief vegetation on many of those extensive wastes that occupy so large a portion of the more sterile lands of northern and western Europe, the usually desolate appearance of which is enlivened in the latter part of summer by its abundant pink blossoms. When growing erect to the height of 3 ft. or more, as it often does in sheltered places, its purple stems, close-leaved green shoots and feathery spikes of bell-shaped flowers render it one of the handsomest of the heaths; but on the bleaker elevations and more arid slopes it frequently rises only a few inches above the ground. In all moorland countries the ling is applied to many rural purposes; the larger stems are made into brooms, the shorter tied up into bundles that serve as brushes, while the long trailing shoots are woven into baskets. Pared up with the peat about its roots it forms a good fuel, often the only one obtainable on the drier moors

The shielings of the Scottish Highlanders were formerly constructed of heath stems, cemented together with peat-mud, worked into a kind of mortar with dry grass or straw; hovels and sheds for temporary purposes are still sometimes built in a similar way, and roofed in with ling. Laid on the ground, with the flowers above, it forms a soft springy bed, the luxurious couch of the ancient Gael. The young juicy shoots and the seeds, which remain long in the capsules, furnish the red grouse of Scotland with the larger portion of its sustenance; the ripe seeds are eaten by many birds. The tops of the ling afford a considerable part of the winter fodder of the hill flocks, and are popularly supposed to communicate the fine flavour to Welsh and Highland mutton, but sheep seldom crop heather while the mountain grasses and rushes are sweet and accessible. Ling has been suggested as a material for paper, but the stems are hardly sufficiently fibrous for that purpose. The purple or fine-leaved heath, *E. cinerea*, one of the most beautiful of the genus, abounds on the lower moors and commons of Great Britain and western Europe, in such situations being sometimes more prevalent than the ling. The flowers of both these species yield much honey.



FROM "FLORA DANICA," 1767 FINE-LEAVED HEATH (ERICA CINEREA), ONE OF THE MOST BEAUTIFUL SHRUBS OF THE HEATH FAMILY

The genus contains about 500 known species, by far the greater part being indigenous to the western districts of South Africa, but it is also a characteristic genus of the Mediterranean region, while several species extend into northern Europe No species is native in America, but ling occurs as an introduced plant on the Atlantic side from Newfoundland to New Jersey Five species occur in Britain: *E. cinerea*, *E Tetralix* (cross-leaved heath), both abundant on heaths and commons, *E vagans*, Cornish heath, found only in West Cornwall, *E. ciliaris* in the west of England and Ireland and *E. mediterranea* in Ireland The last three are south-west European species which reach the northern limit of their distribution in the west of England and Ireland. *E. scoparia* is a common heath in the centre of France and elsewhere in the Mediterranean region, forming a spreading bush several feet high. It is known as *bruyère*, and its stout underground rootstocks yield the briarwood used for pipes.

HEATHCOAT, JOHN (1783–1861), English inventor, was born at Duffield near Derby on Aug. 7, 1783, and was apprenticed to a framesmith. In 1808 he constructed an extremely complicated machine, capable of producing an exact imitation of real pillow-lace. A mill at Loughborough for the exploitation of the new process owned by Heathcoat and his partner Lacy was attacked by the Luddites in 1816, and the 55 lace frames destroyed. Heathcoat now constructed new and greatly improved machines in an unoccupied factory at Tiverton, Devon, propelling them by water-power and afterwards by steam. He invented many other useful processes in connection with silk manufacture. He died on Jan. 18, 1861, at Bolham House, near Tiverton.

HEATHCOTE, SIR GILBERT (*c.* 1651–1733), lord mayor of London, was educated at Christ's college, Cambridge, afterwards becoming a merchant in London. He was one of the promoters of the new East India company and emerged victorious from a contest between himself and the old East India company in 1693; he was also one of the founders and first directors of the Bank of England. He died in London on Jan. 25, 1733.

HEATHEN, a term originally applied to all persons or races not holding the Jewish or Christian belief, but now more usually given to polytheistic races. *See* PAGAN.

HEATHER, a plant name properly applied only to *Calluna vulgaris*, also termed ling, but often used loosely to include the heaths (*Erica*) in addition. (*See* ERICACEAE.)

HEATHFIELD, GEORGE AUGUSTUS ELIOTT, BARON (1717–1790), British general, a younger son of Sir Gilbert Eliott, Bart., of Stobs, Roxburghshire, was born on Dec. 25, 1717. As a volunteer he fought with the Prussian army in 1735 and

1736, and then entered the Grenadier Guards. He went through the War of the Austrian Succession, and was wounded at Dettingen. In 1775 he was selected to be governor of Gibraltar (*q.v.*), and his magnificent defence in the great siege of 1779 made his name famous. In 1787 he was created Baron Heathfield of Gibraltar, and died on July 6, 1790.

HEATH HEN (*Tympanuchus cupido*), a North American grouse, allied to the prairie chicken (*q.v.*) but smaller and inhabiting wooded districts. Between 1800 and 1850 the heath hen was found locally in southern New England and throughout the Middle States. It subsequently disappeared from all parts of its range except the island of Martha's Vineyard, Mass., where in 1907 it had decreased to less than 100 living birds. Owing to protective measures then established its numbers soon increased, but this grouse is still restricted to a small area on the island.

HEATING AND VENTILATION. These two subjects are so closely allied that they will be treated together. They deal with the science of maintaining in buildings the proper temperatures and atmospheric conditions for the health and comfort of human beings.

History.—The earliest known method of artificial heating was the open fire of prehistoric days. As mankind gradually learned to build dwellings, the fireplace with its chimney was developed as a means of enclosing the fire and carrying off the products of combustion. Later the stove was invented and steadily improved, and is still an acceptable method of heating under certain conditions. The next development was the warm air furnace which made it possible to remove the heating apparatus from the living quarters. As buildings became larger and requirements more exacting, the steam and hot water systems were developed.

Ventilation was not given much attention until relatively recent times. One of the earliest recorded attempts at artificial ventilating was a study of the ventilation of the Houses of Parliament by Sir Humphry Davy in 1811. Thorough scientific research into the true principles of ventilating was not carried on until the last decade and, although excellent progress has been made, there is still much to be learned about the physiological effects of atmospheric conditions as well as the design and operation of the mechanical apparatus.

The General Problem.—Heat is continually being generated by the physiological processes of the human body and must be continually dissipated to the surrounding atmosphere. Comfort, health and working efficiency require that the atmospheric conditions in occupied buildings be such that the loss of heat from the body will take place at the proper rate. This heat is dissipated in several ways; there is direct radiation and conduction from the skin, a considerable amount passes off with the exhaled breath, and much is removed by the evaporation of moisture from the lungs and of perspiration from the skin. The overall cooling effect of the atmosphere upon the body depends upon three conditions—the temperature of the air, its humidity and its rate of motion. They control the heat conduction from the body surface and the rate of evaporation of the perspiration which is almost constantly, though often imperceptibly, being exuded. The higher the temperature and humidity and the slower the movement of the air currents passing over the body, the greater the feeling of warmth. For comfortable conditions the combination of these factors must be correct although each may vary between certain limits. For example, when the atmosphere in a room is very dry the temperature must be maintained considerably higher for comfort than if the atmosphere contained more moisture. The cooling effect of a fan, especially when the skin is bathed in perspiration, illustrates the effect of air motion. The interrelation of these factors has been quantitatively studied, as will be brought out later.

It is the function of the heating and ventilating apparatus to maintain these correct atmospheric conditions within the building. In the great majority of buildings a simple heating system only is provided, and no attempt is made to maintain a definite air movement or to control the moisture content. But where a large number of people are gathered or when it is desired to maintain the best possible atmospheric conditions, ventilating apparatus, often in combination with the heating apparatus, is provided. The two systems are necessarily parts of the same problem.

The heating system must supply enough heat to replace that which is continually being dissipated from the building in cold weather and must also be adequate to warm up the structure itself after it has been allowed to cool. This heat is lost from the building in several ways. There is direct conduction through the walls, roof and other exposed surfaces, and particularly through the window-glass. There is also a loss due to the infiltration of cold air and a corresponding outward leakage of warm air under the influence of the wind and from other causes. This leakage takes place through the cracks around windows, doors and elsewhere, and even to some extent through the walls themselves. There is a loss of heat occasioned also when windows are left open for ventilation or when ventilating fans discharge air from the building. Besides increasing the infiltration loss, wind movement also increases the heat transmission through the walls and roof, and this fact must be taken into consideration.

The amount of heat required by a building can be computed in advance of its construction, with fair accuracy, by a study of the various sources of heat loss. The heat-conducting properties of all common building materials and types of wall construction are known and are to be found in engineering handbooks. The following are coefficients for some common forms of building construction.

Construction	Coefficient of heat transmission*
Brick wall 4 in. thick	·66
" " 9 in. "	·358
" " 13 in. "	·278
Limestone or sandstone 8 in. thick	·556
" " " 12 in. "	·457
Wood walls:	
Clapboard, 4 in. studs, lath, plaster	·227
Ditto with 1½ in. corkboard insulation	·110
Concrete roof—4 in. thick	·568
Single windows and skylights	1·13
Double " " "	·45

*Expressed in B.T.U. per hr., per sq. ft., per 1° F. difference in temperature between the air on the two sides, with an outside wind of 15 m. per hour.

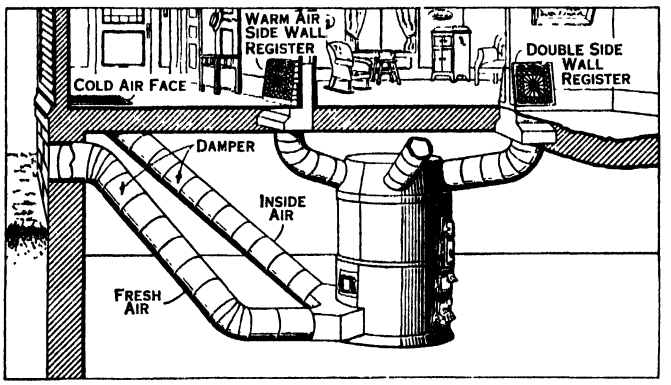
The infiltration loss is computed either by assuming a certain number of air renewals per hour, varying from ½ to 3 for different kinds of rooms, or by computing the length of the cracks around windows and doors and estimating the leakage therefrom, the cracks being the chief source of infiltration. A complete calculation of the heat losses with suitable corrections for exposure on the colder sides of the building thus serves as the basis for the selection of the proper size of the boiler, pipes, radiators and other parts of the heating system. Where the building in question is small or where the heating is not important, such calculations are omitted, but in all modern buildings where the heating is at all important the architect or engineer makes a complete study of the requirements.

HEATING SYSTEMS

The Fireplace or Grate, of which various modifications and improvements have been made from time to time, consists essentially of a basket which holds the fire (or andirons if logs are the fuel), an opening backed by brick which becomes heated by the fire and radiates heat to the room, and a chimney. The grate is an inefficient form of heating because most of the heat imparted to the air which is supplied to the fire passes up the chimney and is lost. In the best designs of open grates only about 20% of the heat in the fuel is actually delivered to the room. Because of this, and because of the impossibility of comfortably heating a building in a severe climate with grates, and also because of the dirt and labour involved, the grate is not used as a primary means of heating in North America. In Great Britain and elsewhere, where the climate is relatively mild the fireplace is still in general use; the psychological effect of the open fire has also caused it to be retained even where more complete means of heating are provided.

The Stove.—The stove is an improvement over the grate from the standpoint of economy. The modern baseburner stove makes use of from 70 to 80% of the heat in the fuel, but it delivers its heat almost entirely by radiation and is, therefore, not a particularly comfortable method of heating. The stove is being rapidly discarded in America, where formerly it was widely used, because of the attention and space it needs, its unsightly appearance and the fact that a separate stove is required in every room for satisfactory results.

The Warm Air Furnace.—The warm air furnace is the natural outgrowth of the stove The furnace consists of a firepot and an extended flue, the whole being surrounded by a sheet metal casing (fig. 1). Air passes through the casing, absorbing heat from the hot surfaces of the firepot and flue, and flows through pipes to the various rooms. In the simplest type, the so-called pipeless furnace, the heated air is delivered only to the room directly over the furnace and passes into the other rooms through open doorways by natural circulation. For any but the smallest houses, a furnace having separate pipes to the individual rooms is necessary for good results. The air supply to the furnace may be taken from outside, but in order to save fuel is usually



BY COURTESY OF THE DETROIT EDISON COMPANY

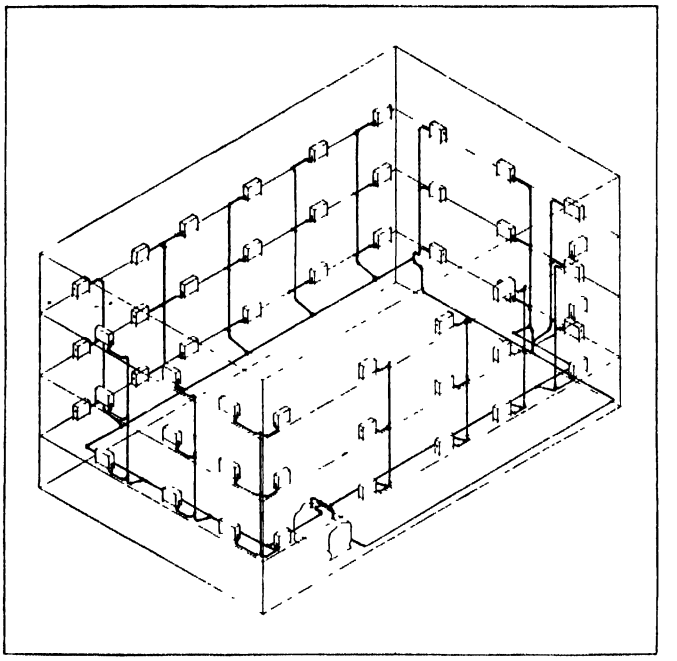
FIG. 1.—DIAGRAM OF WARM AIR FURNACE SHOWING HOW PIPES CONVEY THE HEAT INTO VARIOUS ROOMS

partially or wholly recirculated from the rooms through a system of return ducts.

The warm air furnace, properly installed, is a fairly satisfactory method of heating small homes and is the standard method for such purposes in many parts of America. It is economical in fuel consumption and humidification can be obtained by means of a pan of water placed above the dome of the furnace in the path of the warm air. The fundamental difficulty with the warm air furnace is that since the force which produces the flow of warm air to the rooms depends only upon the difference in temperature between the heated and unheated air, the flow is not always positive and is sometimes affected by the wind. Also the pipes must be short and direct, and rooms distant from the furnace can seldom be satisfactorily heated. The circulation can be augmented by the use of a fan in the air-piping, and this method has found some favour; the fan is needed only in severe weather. Best results are obtained when the air pipes are specially designed for the fan system.

The Steam Heating System.—This type consists of a boiler in which steam is generated, a number of so-called radiators located in the various rooms, and a system of pipes to convey the steam to the radiators and to carry the water of condensation back to the boiler. The heat which has been imparted to the water in the boiler to form the steam is given up as the steam condenses in the radiators and is transmitted to the air of the room. There are several forms of steam heating systems, differing principally in the arrangement of the piping. The simplest is the single-pipe system shown in fig. 2. There is a large horizontal main pipe which leaves the boiler and circles the basement, branches leading to the individual radiators. In large buildings this main is often placed overhead, in the attic. The connection is made to the supply-valve at the bottom of the radiator and the water of condensation trickles back down the steam pipe to the horizontal main and thence back to the boiler. The air which is originally in the system is forced out by the pressure of the steam through air-valves on each radiator and at other points along the system. These air-valves close automatically when the steam reaches them, thus preventing the escape of steam; they are also supposed to prevent the escape of water. A steam pressure of 1 to 5 lb. per sq.in. is used.

The single-pipe system is a simple, fairly satisfactory system for such buildings as factories and warehouses and is also used

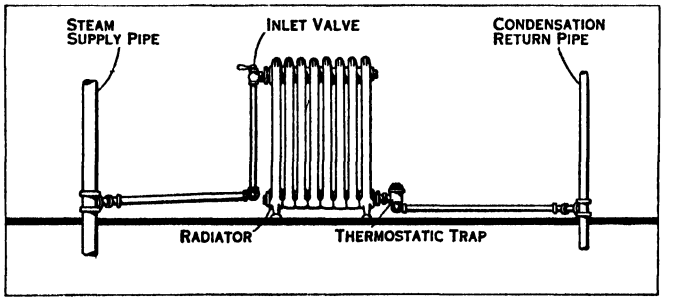


BY COURTESY OF THE DETROIT EDISON COMPANY

FIG. 2.—DIAGRAM OF AN APARTMENT HOUSE EQUIPPED WITH A SINGLE-PIPE STEAM-HEATING SYSTEM, SHOWING THE SIMPLE ARRANGEMENT OF PIPES AND AUTOMATIC AIR-VALVES

in many houses. Its chief disadvantages are the noise, smell and drip which often accompany the action of the automatic air-valve. Also the radiators sometimes fill with water and a violent hammering action takes place.

The Two-pipe System (fig. 3), which is somewhat more costly to install, overcomes these drawbacks. There is a separate system of piping for carrying off the air and condensation, and the air is discharged from the system at a single point in the basement. The supply-valve is placed at the top of one end of the radiator



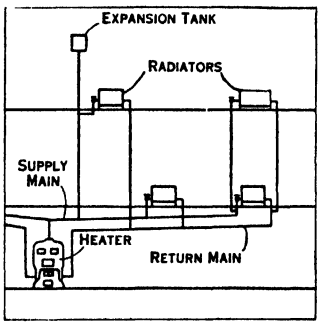
BY COURTESY OF THE DETROIT EDISON COMPANY

FIG. 3.—TWO-PIPE STEAM-HEATING SYSTEM, CALLED A VAPOUR SYSTEM

and the so-called return connection is made at the bottom of the opposite end through a device called a thermostatic trap which permits the air and condensation, but not the steam, to pass into the return pipe. This system when used in a house or small building will circulate with only a few ounces of pressure at the boiler and is, for this reason, often called a *vapour* system. It operates practically without noise and is somewhat more economical in fuel consumption than the single-pipe system.

The Vacuum System is used in large buildings. It is a two-pipe system with a vacuum pump attached to the return piping.

A partial vacuum, equivalent usually to about 10 in. of mercury below atmospheric pressure, is carried, and the circulation is greatly improved thereby. Radiators and piping located below the boiler can be operated successfully, which would not be otherwise possible. The vacuum pump returns the water of condensation to the boiler or to a tank from which it is pumped to the boiler. The vacuum steam system is the standard method of heating blocks of offices, large retail stores, hotels and similar buildings in America.



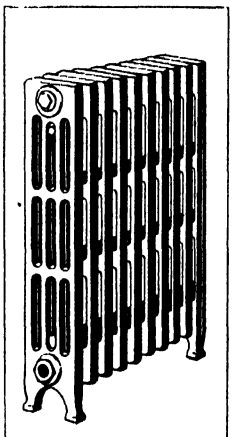
BY COURTESY OF THE DETROIT EDISON CO

FIG 4.—TWO-PIPE HOT WATER SYSTEM, SHOWING THE SEPARATE SUPPLY AND RETURN MAINS

The piping for a steam-heating system must be carefully designed to secure satisfactory operation. The pipe sizes must be so chosen that the required quantities of steam will flow at a low velocity to avoid noise and permit proper drainage of the condensation. The slope of horizontal pipes must be correct so that the pipes will drain correctly; for accumulations of water at low points will often cause the annoying tapping noise called "water hammer." Provision must also be made for the free expansion of the pipes due to changes in temperature. In the vertical risers of tall buildings it is necessary to provide loops which absorb the expansion by their flexibility, or slip joints consisting of one sleeve which slides within another.

The Hot Water Heating System.—In this system heat is conveyed to the various rooms by hot water which circulates through the radiators and returns to the heater for reheating In the simple gravity type the circulation is produced by the difference in density of the hot water in the pipes supplying the radiators and the cooler water in the return pipes which bring the water back to the heater.

There are two different piping arrangements in common use. In the two-pipe system the supply and return pipes are separate as shown in fig. 4. In the single-pipe system the supply for each radiator is taken from the single main pipe and the return connection made at a point farther along the pipe. This system requires less piping but if there are many radiators, the size of those farthest along the main pipe must be increased because they receive cooler water than those near the heater. An expansion tank, usually placed at the top of the system, is required to accommodate the changes in the volume of the water with changing temperatures. Most hot water systems operate at a maximum temperature on leaving the heater, of about 180° F. A higher temperature is practicable only if the water is subjected to pressure to prevent it from boiling.



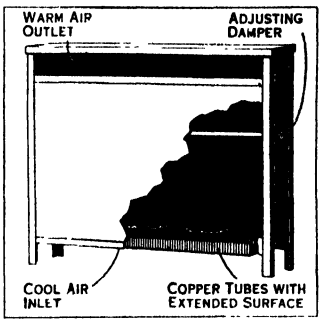
BY COURTESY OF THE DETROIT EDISON CO.

FIG. 5.—IRON RADIATOR

The fundamental difficulty with the gravity type of hot water system is that the force producing circulation, being due only to the slight difference in densities of the water in the different parts of the system, is very small and the circulation is therefore easily hindered by any sort of restriction in the piping. The successful design of a large hot water system therefore requires the selection of the proper pipe sizes and the proper arrangement of the pipes so that the required quantity of water will flow to each radiator. The dynamics of the flow condition are somewhat complicated but, briefly, a condition of equilibrium becomes established in which the flow of water reaches such a magnitude that the force producing circulation is exactly balanced by the frictional resistance. The selection of the proper pipe sizes is thus of considerable importance and the design requires more care than does a steam-heating system.

In large buildings it is not practicable to depend upon the force of gravity to produce the flow, and a pump is installed in the circuit. In such a system of forced circulation the differential pressure through the system is from 20 to 40 lb. and much smaller pipes can be used than in the gravity system, with resulting economy in construction cost.

The hot water system gives a less fluctuating output of heat to the rooms than the steam system because of the thermal capacity of the circulating water, but is for the same reason less readily capable of responding quickly when more or less heat is required. Because of the lower temperature of the radiators it produces more comfortable room conditions than does the steam system. Another advantage is that the heat output of the radiators can be controlled by varying the water temperature, which is an advantage from the standpoint of economy in large buildings.

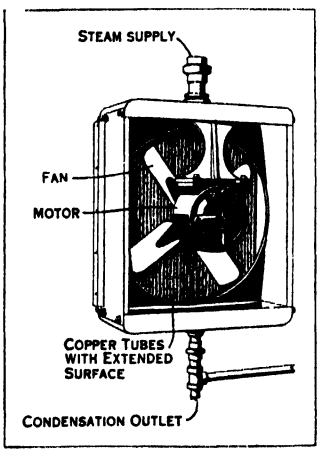


BY COURTESY OF GRANE CO., LA CROSSE, WIS

FIG 6.—HEAT CABINET WITH COPPER TUBES AND FINS ATTACHED

The hot water system is not well adapted to tall buildings because the water pressure in the lowest radiators becomes very high (about 4·3 lb. for each 10 ft of building height). Also it requires more careful design than the steam system. It is much used in homes and is regarded by many as the most desirable method of residential heating, although the cost of installation is from 10 to 20% more than that of the simplest steam system. It is used to some extent in office buildings and hotels in America and is particularly popular in Europe for such buildings. In America there are many hot water systems used to supply groups of buildings such as hospitals and educational institutions.

Radiators.—In both the steam and the hot water heating systems there is placed in each room one or more heating elements which are somewhat improperly called "radiators" and, in Great Britain, "the heating apparatus." They consist of pipe coils or of hollow cast iron sections joined together so as to give a large surface area; the heat is given off partly by radiation and partly by convection, *i.e.*, by currents of air which are heated as they pass through the radiator. It has been demonstrated and is, in fact, a matter of common experience that, from a standpoint of comfort, a room heated by convection currents is more comfortable than one heated by radiant heat, hence the tendency is toward methods by which the heat is delivered by convection rather than by radiation.



BY COURTESY OF THE DETROIT EDISON CO

FIG. 7.—HEAT DIFFUSER WITH A FAN, USED IN LARGE BUILDNGS

Fig. 5 shows the common form of cast iron radiator, which is built in sections of various sizes and assembled as required to give any size desired; the sections are connected at both top and bottom. A slightly different design with connections between the sections at the bottom only was formerly used for steam-heating systems only, but this form, having no particular advantage, has been discontinued by most American manufacturers.

Heating units which deliver their heat almost entirely by convection are in frequent use in America. This design consists of an element having a surface which is greatly extended by means of fins and which is housed in a cabinet giving a flue effect and causing a rapid circulation of air. One form has a copper tube with thin copper fins attached (fig. 6); the cabinet may be concealed in the wall, thus relieving some of the unsightliness of the ordinary radiator.

In large areas, such as in factory buildings, it has been found desirable to use, instead of numerous ordinary radiators, a few heat diffusing units consisting of a fin-type heating element with a fan forcing a large quantity of air through it (fig. 7). This method is quite satisfactory in certain circumstances.

Boilers and Fuels.—The boiler used for heating buildings of moderate size usually has the furnace or firepot incorporated in it; it is usually made of cast iron, which is a suitable material because of the low pressures carried, and is built in sections which are easily handled and assembled. Recently, in America, the steel welded boiler has been introduced, welding being permitted by law for this class of work. In larger buildings where cast iron boilers would be prohibitively large, the riveted steel boiler is used.

The design of the boiler is considerably influenced by the character of the fuel which is to be burned. For anthracite coal or coke a simple firepot with a shaking grate is all that is required. These fuels are ideal from the standpoint of smokelessness. The semi-bituminous coals (called "smokeless" coals), having less volatile matter than the true bituminous coals, can also be burned fairly satisfactorily in the simple firepot, but for bituminous coals special provisions are necessary to avoid excessive smoke. These consist usually of means of introducing heated air at the proper place in the combustion process so that the volatile matter is consumed before striking the relatively cold boiler surfaces.

The efficiency of the usual form of heating boiler is not particularly high The small boilers operated by the average householder probably deliver less than 50% of the heat in the coal to the water in the boiler. In larger installations the results are somewhat better, reaching 75% in the more elaborate plants.

In some sections of America oil is quite commonly used as a fuel. It requires a special burner which can be applied to any style of boiler.

Natural gas is used in certain restricted localities and recently artificial gas has been used in places where its cost is low and where the luxury value of this method of heating is appreciated. Boilers designed particularly for gas are essentially different from those used for coal. Whereas the latter are designed to absorb the large amount of radiant heat from the fuel bed, the gas-fired boiler receives its heat almost entirely from the products of combustion as they pass over the heating surfaces. Also, the gas boiler is designed for good efficiency because of the high cost of gas. Heating with artificial gas is only practicable when the house is well constructed, preferably with insulated walls, and when the advantages of freedom from dirt, ashes and care are of value.

Boilers used for heating with electricity are usually designed with heating elements of the submerged resistance type.

Humidification.—The atmosphere in a building is being more or less frequently renewed through leakage, and the outside air, though it may contain nearly the maximum possible amount of moisture at its original temperature, has its capacity for holding moisture greatly increased as it reaches the indoor temperature and therefore has a drying effect upon the skin and the membranes of the respiratory passages as well as upon furniture, woodwork, etc. Health authorities advocate artificial humidification to alleviate this condition and various devices have been contrived for this purpose.

For hot water and steam systems they usually consist of a wick or pan attached to the radiator. In the warm air furnace system humidification can be quite easily accomplished by means of an evaporating pan located in the air passage of the furnace. That humidifying devices are not always effective is usually due to the lack of appreciation of the quantity of water that must be evaporated. For example, with an outside temperature of 20°, about 1 gal. must be evaporated every 24 hrs. for each 1,000 cu.ft. of room volume to bring the relative humidity to 40%, which is about the proper point. In England and elsewhere, where the outside temperatures are not low and the climate is moist, humidification is rarely needed. Although the temperature required for comfort is somewhat lower when the air is humidified there is no appreciable saving in the amount of fuel required because of the heat which must be used to evaporate the water for humidifying.

Electric Heating.—Electricity is in many respects an excellent heating medium but its use is limited because of its cost. When electricity is generated by means of the combustion of coal the process involves a loss of 75% or more of the heat in the fuel; and further losses in transmission and the cost of the transmission system make the cost of heating excessive as compared with other methods It is therefore used only for small rooms and as an auxiliary to other means of heating. Where the electricity is generated by water power, however, the cost is often very much less and in certain cases may compare favourably with that of coal, if the latter is high priced in that locality. This is true in some districts in western United States and Canada and in some parts of Europe.

Temperature Control.—Since the amount of heat which a building requires varies so greatly with different weather conditions, some means are necessary to control the supply. In the small warm air, steam or hot water systems adjustment of the furnace dampers is the simplest method, but this requires attention and is not wholly satisfactory. A thermostat may be used to control the dampers according to the temperature in the rooms; in its simplest form this consists of a temperature-sensitive element located at a properly selected point and arranged so that it operates a small electric motor, as the temperature rises or falls, to close or open the dampers.

When automatic temperature control is provided in large buildings it must be arranged so as to control the temperature in each room individually. Most systems use compressed air as the motive power for operating the radiator valves, controlled by one or more thermostats located in each room. The radiator valves (or the dampers in the case of a ventilating system) are equipped with rubber or metal diaphragm chambers so designed that, as air pressure is applied, the valve or damper will close. The thermostatic element on the wall opens and closes an air supply valve in the pipe leading to the diaphragm chamber so as to maintain the temperature at which its dial is set. Thermostatic control is frequently used in public buildings, hotels, office buildings, etc. It is almost a necessity in the case of a ventilating system.

Central Heating.—In Great Britain, and in Europe generally, the term *central heating* usually refers to the heating of a building by means of one heating unit instead of fireplaces or stoves in every room. As understood in North America, however, it means the supplying of heat to a number of separate buildings from a central plant. When portions of a city are thus heated the term *district heating* is often synonymously used.

The first central-heating system was installed at Lockport, N.Y., in 1877 by Birdsill Holly. Other systems were built from time to time in various cities and there are at present extensive systems in New York city, Detroit, Pittsburgh, Rochester and St. Louis and in a number of smaller cities and towns in America. The areas covered are sometimes 1 or 2 sq.m. or more in extent and include business districts and high class residential districts. Also many groups of factory and institutional buildings are heated from central plants.

Either steam or hot water may be used as the medium for conveying the heat from the central plant; many of the earlier systems are hot water systems and this method is still in use for small groups of buildings. It makes possible the control of the heat supply from the central plant by adjusting the water temperature and is quite satisfactory in institutional work. A double set of underground pipes composing the supply and return systems is installed and the water is circulated by means of pumps. For commercial district heating, however, hot water has several disadvantages. It is impracticable to meter the amount of heat used by each consumer because of the lack of a suitable meter; and it is not feasible to supply tall buildings because of the high pressures that would be required to serve the topmost radiators. Consequently district heating in all of the larger cities is effected by the steam system.

Most of the first steam systems were designed with the idea of utilizing the exhaust steam from engines driving electrical generators and for steam pressures between 2 and 10 lb. per sq.in.; later it was sometimes found more desirable to use live steam direct from the boilers and distribute it at a higher pressure. The passing of the steam through engines or turbines, which drive electric generators, before distributing it for heating purposes is, from a standpoint of fuel consumption, an economical procedure. The electricity thus generated is produced at a very low fuel cost as compared with the usual method of generation in which a large proportion of the heat of the fuel is carried away by the water circulating through the condensers (*see* POWER GENERATION). On the other hand, a low pressure distribution system requires much larger pipes because of the greater volume of the low pressure steam and the cost of installation is therefore much higher. In fact, in large cities it would be impossible to install pipes large enough to carry, at pressures below 10 lb., the quantities of steam required. This fact, together with the added cost of the electrical generating machinery, has sometimes made it appear more expedient, commercially, not to generate electricity in the heating plant, notwithstanding the apparent economy of this method. There are, however, a number of heating plants in which some electricity is generated and the present development of boilers and turbines for higher steam pressures and higher exhaust pressures will undoubtedly have a considerable effect upon future practice in this respect.

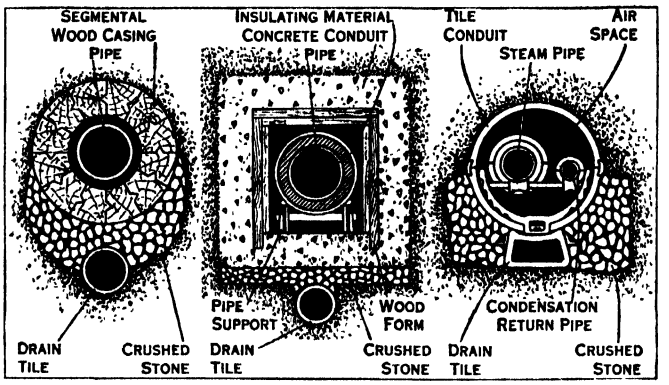


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FIG. 8.—CROSS-SECTIONS OF CONDUITS FOR UNDERGROUND PIPES

The steam-distributing pipes are laid beneath the streets or alleys, either inside a conduit buried in a trench, or in a tunnel large enough for men to walk in. The latter method, while allowing inspection of the pipe and facilitating repairs, is naturally much more costly and is justified only when several pipes are to be laid along the same route or where sub-surface conditions do not permit the use of the conduit construction. Various forms of conduits are shown in fig. 8. They are designed so as to prevent excessive loss of heat and to protect the pipe from water and from earth pressure. They are built of wood, vitrified clay, brick or concrete, and so constructed as to leave a space around the pipe to permit its free linear expansion due to changes in temperature. Heat insulation consisting of magnesia or asbestos 1 or 2 in. in thickness, surrounds the pipe except in the case of the wooden conduit, in which the wood itself is the insulator. Underdrainage of the conduit is very necessary in order to carry off ground water. It is provided by a layer of crushed stone or coarse gravel below the conduit with a drain tile, laid with open joints, which leads to some sewer or other outlet.

The heat loss from well constructed underground pipes in dry soil is less than is generally supposed, owing to the insulating effect of the soil. It varies from 40 to 80 B.T.U. per hour per sq.ft. of pipe surface. Further reduction of the heat loss could be obtained by thicker insulation but would not warrant the increased cost. In well maintained systems the efficiency of distribution, which is the ratio of the steam delivered to the consumer to the steam sent out from the central plant, varies from about 80% to as high as 95%, the latter being possible only for a small system serving a dense load.

The linear expansion and contraction of the pipes due to changes in temperature must be provided for. With a steam pressure of 20 lb. per sq.in., for example, the pipe will increase in length about 1·6 in. in each 100 ft., from its length when cold. To provide for this movement there are two general types of expansion fittings. One of them, the slip joint, consists of a sleeve sliding within another, with suitable packing to prevent steam leakage; others make use of flexible diaphragms or corrugated copper sleeves. Expansion fittings are placed at regular intervals with anchor points midway between to control the direction of the movement.

The life of the underground pipes depends upon the design of the conduit and the nature of the soil. The chief cause of damage is ground water which corrodes the pipe and is difficult to exclude entirely. Pipes installed in well constructed concrete or tile conduit in fairly well drained soil will last for 30 years or more. Wood casing is much shorter lived and is good for only 10 to 20 years as a rule.

The distance over which steam can be transmitted is much greater than is commonly supposed, being limited only by the size of the pipe and by the pressure available. Pipes a mile or two in length are not uncommon and a distance of several miles is quite feasible, though probably not economical. The pressure loss can be closely estimated.

The usual scheme of distribution consists of a central trunk main of large diameter near the plant and decreasing in size, with lateral branches at the intersecting streets. Some systems make use of feeder pipes which radiate to strategic points in the distribution system. Long distance gauges, electrically operated, are used to record, at the plant, the pressure at remote points in the system. The condensation from the consumers' radiators is returned to the plant in most small systems serving only a few buildings, but in large systems it is frequently discharged to the sewer, unless the cost of water is very high, because of the expense of return piping and the difficulty of returning the water without pumping.

In addition to its use for heating buildings the steam is used in small quantities for other purposes. Cooking and laundry apparatus use steam and are satisfactorily served from the central plant if sufficient pressure is available. Cooking equipment is usually designed for steam pressures of 25 lb. or higher. Some steam is used for the heating of water for domestic purposes and, in a few cases, for producing power in steam driven pumps, etc.

Central Heating Costs.—The charge for heat supply is based upon the amount of steam used, which is measured either by a steam flow meter located at the point of supply in each building, or by a meter which measures the amount of condensate drained from the radiators. The latter method is more common and is quite satisfactory. The heat is usually removed from the condensate before it is discharged to the sewer by passing it through an economizer which heats the water supplying lavatories, etc. The water is passed through the economizer, which consists of a cylindrical tank in which a coil or a bundle of tubes, through which the condensation flows, is submerged.

The overall efficiency of the central-heating system compares favourably with that of the individual boiler plant. The better boiler efficiency in the more elaborate and refined central plant balances, to a great extent, the losses in distribution. The efficiency of the modern central plant is from 75 to 85%; the efficiency of distribution is from 80 to 90%; and about 90% of the heat delivered to the consumers' buildings is actually utilized (there being some loss in the condensate). The combination gives an overall efficiency of perhaps 60% in the average case. This is to be compared with an average efficiency of 50% or less for the small coal-fired boiler and perhaps 65% for the large plant; and with 60 to 75% for gas or oil, varying with the size of the plant. The charges for heating service range from about $.60 to $1.25 per 1,000 lb. of steam, varying with the size of the building and local conditions. The cost of service is naturally higher in larger cities and where the cost of fuel is high; it compares favourably

with that of the individual plant, particularly where the space occupied by the latter has a rental value. The service is popular in cities where the luxury value is appreciated. To the large-building owner as well as to the householder the freedom from the dirt and nuisance of operating a boiler plant is attractive. There is also an advantage to the community in the reduction of smoke and of dirt from coal and ash hauling.

There are at present approximately 200 commercial district-heating systems in operation in America with an aggregate annual revenue of about $20,000,000.

VENTILATION

Ventilation is the process and practice of keeping an enclosed place supplied with air proper for human health and comfort and, by analogy, the term is used of exposing any subject to the winds of public criticism [Lat. *ventilare*, from *ventus*, wind]. The air we breathe consists chiefly of two gases, oxygen and nitrogen, with certain small proportions of others, such as carbon dioxide, ozone and argon. Oxygen, which is the active and important constituent, and on which life and combustion depend, forms about one-fifth of the whole, while nitrogen, which is inert and acts as a diluent, forms nearly four-fifths. Of this mixture each adult breathes some 2,600 gal. or 425 cu.ft. in 24 hours In air that has passed through the lungs the proportion of oxygen is reduced and that of carbon dioxide increased. Of the various impurities that are found in the air of inhabited rooms, carbon dioxide forms the best practical index of the efficiency of the ventilation. The open air of London and of large inland towns contains about four parts by volume of the gas in 10,000 of air. In the country, and in towns near the sea, two to three and a half parts in 10,000 is a more usual proportion. Authorities on ventilation usually take four parts in 10,000 as the standard for pure air and use the excess over that quantity in estimating the adequacy of the air supply.

Ventilation Principles.—Since the atmosphere is thought of primarily as the source of oxygen which our lungs require, it is not surprising that the early theories of ventilation considered only the effect of the atmosphere upon the lungs. For many years it was believed that the effects of poor ventilation were due mainly to the presence of carbon dioxide with perhaps other crowd poisons which exerted their harmful effects through the lungs. It was Flugge who, in 1905, first called attention to the inadequacy of this theory. Working at the Institute of Hygiene at Breslau, he placed human subjects in a tight box, in which the atmosphere soon became oppressive. Allowing them to breathe through tubes air from the outside of the box brought little relief, while other subjects outside the box and breathing its atmosphere through tubes felt no ill effects From this he concluded that the effect of the atmosphere upon the skin is an important factor in ventilation. Later experimenters, notably Leonard Hill, confirmed these results and it is now generally recognized that the effect of bad atmospheres is primarily physical rather than chemical, and is on the surface of the body rather than the lungs While it is true that vitiation of the air through the reduction of its oxygen content does take place in crowded rooms, the stuffiness of the atmosphere and the discomfort it produces are mainly due to excessive temperature and humidity and often to bad odours Appreciation of this fact has greatly aided the development of proper methods of ventilation.

In 1913 Sheppard and E. V. Hill, in America, established by tests a comfort zone which showed, for still air, the relation between temperature and humidity necessary for comfort. More recently Houghten, Yaglou and others, in an investigation sponsored by the American Society of Heating and Ventilating Engineers, the U.S. bureau of mines and the U S. public health service made elaborate observations of the relations between temperature, humidity and air motion as they affect comfort.[1]

The experiments consisted in exposing a large number of persons to carefully controlled atmospheric conditions and recording their sensations as to the relative warmth or coolness of the various conditions. Tests were made in still air and in moving air and with the subjects stripped to the waist and normally clothed. The results obtained give the true relationships between temperature, humidity and air motion as they affect human comfort, over a wide range of conditions. For example, with an air movement of 100 ft. per min. and with subjects normally clothed and slightly active, the sensible effect of the atmosphere is the same for the following conditions:—

Relative humidity %	*Dry-bulb temperature* F
20	72·6°
50	70·0°
100	66·7°

Ventilation Requirements.—The various factors entering into ventilation have been given much study. The cooling effect of the atmosphere, which depends upon its temperature, humidity and motion, is the most important factor; but there are other atmospheric conditions which must be considered. Odours play an important part. Body odours, particularly, are objectionable and although no definite harm has been traced to them, modern standards of cleanliness require that they be kept to a minimum. Many complaints of poor ventilation are due to the presence of odours, although all other factors may be correct. The control of odours is an essential element in ventilation. The measurement of odours is very difficult and can only be done in an approximate way by comparison with sample solutions of odours of known strength.

Dust in the atmosphere is another factor that should be at a minimum in a well ventilated room. The dust may be created within the room itself (*e.g.*, by a manufacturing process) or it may enter with the air supplied for ventilation; but it is an element to be considered in arriving at the degree of perfection of the ventilating conditions. The presence of harmful bacteria is undesirable because of the possibility of contagion. Although all bacteria are not harmful the number in the air may generally be taken as indicating the surrounding sanitary condition. The bacteria content of the air is determined by a count of the number of colonies which develop on a culture plate exposed for a short period. Other injurious substances such as gases arising from industrial processes or decaying matter are also elements to be reckoned with.

Dr. E. V. Hill, in America, has suggested a method of ascertaining the degree of perfection of the ventilation in any particular room on the basis of observations made of these several factors, namely, the amount and distribution of the air supply; the cooling effect as indicated by the temperature, humidity and air motion: and the factors of odours, dust, bacteria and other injurious substances. By arbitrarily assigning a scale of penalties for each one of these factors falling short of the ideal condition and combining the results, the degree of perfection of the ventilation as a whole can be computed. This method has been adopted by the American Society of Heating and Ventilating Engineers.

Systems of Ventilation.—To satisfy the requirements it is necessary to provide some means for renewing the atmosphere and it is evident that since the room temperature is a factor in ventilation, the heating and ventilating systems must be considered together. When no special ventilating equipment is provided, acceptable atmospheric conditions are sometimes secured merely through the natural circulation of air through the building, aided by the action of chimneys and open windows, but when many people occupy a room some more positive means must be provided and the air supply must be properly warmed before introduction. There are many kinds of ventilating systems varying from the open window to elaborate fan arrangements, the choice depending upon the type of building and the standard of ventilation it is desired to maintain. The tendency is toward better air conditions in offices, factories and public buildings, steady progress being made in developing improved apparatus and methods. The health and efficiency of office and factory workers is demonstrably improved by a proper atmosphere; and in many manufacturing processes air conditioning is absolutely essential (*see* AIR CONDITIONING).

[1] See *Transactions* of the American Society of Heating and Ventilating Engineers for 1923 *et seq*

A complete system of ventilation for buildings in which the best results are desired consists of apparatus for warming, cleaning and humidifying the air, a fan and a system of supply ducts for distributing it to the various rooms, and a system of exhaust ducts with an exhaust fan for removing the foul air. An additional feature, sometimes included, is the cooling of the air, in summer, by artificial refrigeration.

Air Quantities.—The amount of air which should be supplied by the ventilating system varies according to the type of building. The following quantities represent good practice:

Type of building	Air supply	
	Cubic feet per hour per occupant	Number of renewals of room volume per hour
Theatres and auditoriums	600–900	.
Schools	1800	.
Hospitals	2000–3000	.
Toilet rooms	.	20
Offices—general	1200–1800	.
Offices—private	.	4
Public dining rooms	.	4
Basement restaurants	.	8–12
Restaurant kitchens	.	10–20

Minimum quantities for certain classes of buildings are sometimes fixed by State legislation. In many States it is compulsory to provide ventilation for school rooms to the extent of 1,800 cu ft. per hour per pupil.

Types of Fan Systems.—There are several types of central fan systems in common use The arrangement depends somewhat upon the extent to which the heating requirements are taken care of by the fan system. The various combinations are as follows: (1) fan system takes care of both the heating and ventilation; (2) it provides ventilation and part of heating, remainder supplied by radiators; (3) it provides ventilation, heat supplied by radiators.

In the first type the air must be delivered at a sufficiently high temperature to heat the rooms and, since the heating requirements vary, provision must be made to deliver air at different temperatures to the different rooms. One common arrangement of this system is shown in fig. 9. The air drawn from outside passes through a tempering heater, is heated to about 40°, then goes through the air washer, secondary heater and fan. Leaving the fan, part of the air passes through additional heaters which are adjusted to bring it to a temperature of from 80° to 160°, depending upon weather conditions; the remainder bypasses these heaters and is at a temperature of about 68°. Individual ducts lead to the various rooms and take their supply partly from a hot air chamber and

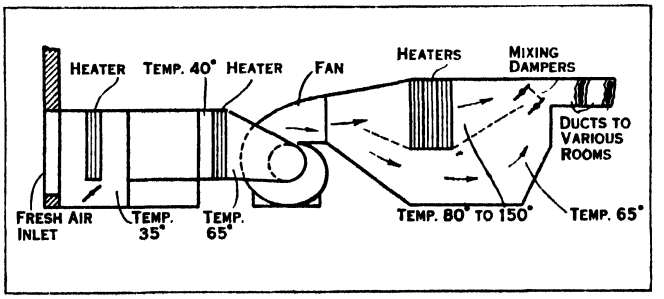

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FIG. 9.—ARRANGEMENT OF VENTILATING SYSTEM WHICH PROVIDES BOTH VENTILATION AND HEAT AT VARIOUS TEMPERATURES FOR DIFFERENT ROOMS

partly from a tempered air chamber, the proportions being regulated by a mixing damper usually controlled by a thermostat located in the room itself. Thus the proper mixture of air is supplied to maintain the room at the desired temperature. In an alternative arrangement the fan system delivers air to a trunk duct with branch ducts to the various rooms and in each branch duct is located a heater, often thermostatically controlled from the room, which adds just the proper amount of heat to the air.

In the second type, when part of the heat is supplied by radiators, the fan system is similarly arranged but the air is delivered at a lower temperature. In severe climates it is desirable to install radiators along the outside walls, particularly under large windows, to avoid local cold spots. This is the justification for this type.

In type 3, since no heating is done by the fan system, the air is supplied to all of the rooms at the same temperature, usually about 70°, and the fan system is therefore simple in arrangement. A trunk duct with branches to the various rooms is used as shown in fig. 10.

It is evident that the first type of fan system must be operated whenever heat is required in the building, while the third type need be used only when ventilation is desired.

Exhaust System.—In modern systems a central exhaust fan is used to withdraw the foul air but in some systems the circulation is produced only by the natural tendency of warm air to

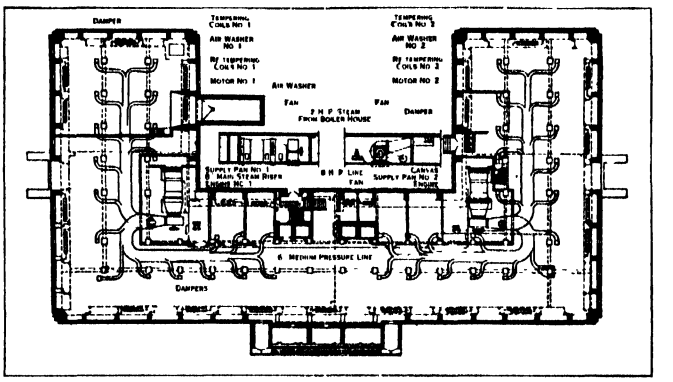

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FIG. 10.—BASEMENT PLAN OF BUILDING SHOWING VENTILATION DUCTS

rise, and by the slight pressure produced by the supply fan Provision is often made for partial recirculation of the air from the exhaust duct to the supply fan so as to avoid the waste of warming unnecessary quantities of fresh air during the heating up period. Also, it is held by some that partial recirculation even in times of full occupancy of the building is permissible, provided the air is passed through an air washer or filter.

The air supply is introduced, in ordinary rooms, usually at points along the inside walls well above head height. Sometimes the inlet grilles are placed in the ceiling, but this requires a much lower air velocity to avoid uncomfortable draughts. An air movement in the occupied zone of the room greater than about 2 ft. per sec. is likely to cause discomfort. In theatres the air is introduced from above and withdrawn through small openings in the floor beneath the seats.

Air-conditioning apparatus (*see* AIR CONDITIONING) used in ventilation comprises the air washer and the air filter, either or both being used, depending upon the standard of ventilation desired. The function of the washer is to remove dirt and bacteria, to increase or reduce the moisture content and to cool the air in cases where artificial cooling is used. The air filter consists of a metal screen so constructed as to cause the air to flow through it in tortuous paths. The surfaces are wet with a viscous oil which traps the dust particles. This apparatus is more efficient in removing certain kinds of dirt than is the air washer and is used in some cases to supplement the latter.

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(J. H. W.)

HEATON, SIR JOHN HENNIKER, 1ST BART. (1848–1914), English postal reformer, was born at Rochester, in Kent, on May 18, 1848, the son of Lt.-Col. Heaton. He spent 20 years in Australia, where he was a well known newspaper proprietor. As M.P. for Canterbury, England, from 1885 to 1910, he advocated penny postage throughout the British empire, and lived to see it achieved and extended to the United States. He died at

Geneva, on Sept. 8, 1914.

See *Life and Letters of Sir John Henniker Heaton, Bart.*, by his daughter, Mrs. Adrian Porter (1916).

HEATSTROKE: *see* SUNSTROKE AND HEATSTROKE.

HEAVEN, the firmament in which the sun, moon, planets and stars seem to be placed; hence also used, generally in the plural, of the atmospheric region (O. Eng *hefen, heofone,* appearing in O.S. *hevan,* is seemingly unconnected with the High Ger. word appearing in Ger. *Himmel,* Dutch *hemel:* its derivation is unknown; it is not connected with "to heave," *i.e.*, "lifted up"). In the cosmogonies of ancient peoples there was a plurality of heavens, varying from three to seven, the higher transcending the lower in glory. Heaven, in the Hebrew *shamayim,* the Greek *οὐρανός,* the Latin *caelum,* is the abode of God, and as such in Christian eschatology is the place of the blessed in the next world (*see* ESCHATOLOGY and PARADISE).

HEAVISIDE, OLIVER (1850–1925), English physicist, was born in London on May 13, 1850. He was employed by the Great Northern Telegraph Company, Newcastle. Increasing deafness forced him to retire in 1874, when he went to live in Devonshire and devoted himself to theoretical investigations on electricity. Heaviside had some difficulty in getting his papers accepted for publication, probably because he made use of unusual methods of his own in solving his problems. Consequently, in 1892 he published his collected papers in two volumes under the title of *Electrical Papers.* In these papers he dealt with the theoretical aspect of a number of practical problems, such as quadruplex and multiplex telegraphy, electrostatic and electromagnetic induction between parallel wires, and the high frequency resistance and inductance of a concentric main. His work on the theory of the telephone has made long distance telephony practicable. The publication of his papers brought him recognition from men of science. His *Electromagnetic Theory* (vol. i. 1893, vol. ii. 1899, and vol. iii. 1912) also dealt with a number of important problems. He worked out the theory of an electric charge moving with uniform velocity, and predicted the change in the mass of such a charge when the velocity is large. He also suggested the presence of a conducting layer in the upper atmosphere which prevents electromagnetic waves spreading out into space. This layer is now called the Heaviside layer. He died at Torquay on Feb 3, 1925.

HEBBEL, CHRISTIAN FRIEDRICH (1813–1863), German poet and dramatist, was born at Wesselburen in Ditmarschen, Holstein, on March 18, 1813. The only son of a poor bricklayer, he was brought up under conditions of extreme hardship, which exercised a permanent influence on his life. As his English translator, L. H. Allen, has justly said, he owed to his early environment "his sharp directness of speech, and to his peasanthood a raw facing of unvarnished things that was to stand him in good stead in his future war on faddists and dilettanti." He owed his first appearance in print, in the Hamburg *Modezeitung,* to Amalie Schoppe (1791–1858), a then popular journalist and author of nursery tales. Through the kindness of this lady, who interested several of her friends on his behalf, he was enabled to go to Hamburg and there prepare himself for the university. A year later he went to Heidelberg to study law, but finding this uncongenial he passed on to the University of Munich, where he devoted himself to philosophy, history and literature. In 1839 Hebbel left Munich and wandered back to Hamburg on foot, where he resumed his relations with Elise Lensing, a poor seamstress, whose self-sacrificing assistance had helped him over the darkest days in Munich. In the same year he wrote his first tragedy *Judith* (published 1841), a drama of poetry and passion, whose performance in Hamburg and Berlin made his name known throughout Germany. In 1840 he wrote the tragedy *Genoveva,* and the following year finished a comedy, *Der Diamant,* which he had begun at Munich. In 1842 he visited Copenhagen, where he obtained from the king of Denmark a small travelling studentship, which enabled him to spend some time in Paris and two years (1844–46) in Italy. In Paris he wrote his fine prose "tragedy of common life," *Maria Magdalena* (1844). The significance of this play in the history of the drama will be realized when it is noted that it was written when Ibsen was still a lad of 16.

On his return from Italy Hebbel met at Vienna two Polish noblemen, the brothers Zerboni di Sposetti, who in their enthusiasm for his genius urged him to remain, and supplied him with the means to mingle in the best intellectual society of the Austrian capital. The unwonted life of ease had its effect. The old precarious existence became a horror to him, he made a deliberate breach with it by marrying (in 1846) the beautiful and wealthy actress Christine Enghaus, who created the principal parts in many of his plays and thus powerfully helped his career. Much of his best work was inspired by her. In marrying Christine Hebbel sacrificed the girl who had given up all for him and who remained faithful till her death, on the ground that "a man's first duty is to the most powerful force within him, that which alone can give him happiness and be of service to the world": in his case the poetical faculty, which would have perished "in the miserable struggle for existence." The marriage brought a measure of peace and serenity to his stormy and passionate nature. Christine invited Elise to Vienna, and made what amends were possible in the case. The relations of these two noble women are a great example of mutual understanding and forbearance. Shortly after Elise's death Hebbel wrote (1855) the little epic *Mutter und Kind,* intended to show that the relation of parent and child is the essential factor which makes the quality of happiness among all classes and under all conditions equal. Long before this Hebbel had become famous; and in foreign capitals he was fêted as the greatest of living German dramatists. He died at Vienna on Dec. 13, 1863.

Hebbel's principal tragedies are *Herodes und Mariamne* (1850); *Julia* (1851); *Michel Angelo* (1851); *Agnes Bernauer* (1855); *Gyges und sein Ring* (1856), and the magnificently conceived trilogy *Die Nibelungen* (1862), his last work (consisting of a prologue, *Der gehörnte Siegfried,* and the tragedies, *Siegfrieds Tod* and *Krienhilds Rache*), which won for the author the Schiller prize. Of his comedies *Der Diamant* (1847), *Der Rubin* (1850), and the tragi-comedy *Ein Trauerspiel in Sizilien* (1845), are the more important, but his genius showed itself at its height in tragedy. All his dramatic productions, however, exhibit skill in characterization, great glow of passion, and a true feeling for dramatic situation; their poetic effect is sometimes marred by extravagances of the kind which marred much of the later Elizabethan tragedy. Hebbel's poems, *Gedichte* (1842) and *Neue Gedichte* (1848), show a great lyrical gift. From the age of 20 onwards he kept a diary, and this autobiography is one of the most moving of literary documents.

The best edition of Hebbel's works is that by R. M. Werner (12 vols., 1901 *seq.*); it includes the "works," the diary and letters. There are many later editions. An English translation *Three Plays by Friedrich Hebbel,* by L. H. Allen, is included in the "Everyman Library." For a full bibliography *see* Wuetschke, *Hebbel-Bibliographie* (1910) For his life *see* his own diaries, published in his *Works;* also E. Kuh, *Biographie Friedrich Hebbels* (2 vols., 1877); R. M. Werner, *Hebbel, ein Lebensbild* (1904); A. Farinelli, *Hebbel e i suoi drammi* (1912), R. Ebhardt, *Hebbel als Novellist* (1916); E. Loose, *Friedrich Hebbels Anschauungen uber die deutsche Literatur bis zum Ausgang der Klassiker* (1918); L. Brun, *Hebbel, sa personnalité et son oeuvre lyrique* (1919); E. Federn, *Friedrich Hebbel* (Munich, 1920); A. Hallmann, *Das Individualitätsproblem bei F. Hebbel* (Leipzig, 1921); J. Bab, *Das Wort F. Hebbels* (Munich, 1923); K. Strecker, *Friedrich Hebbel, sein Wille, Weg und Werk* (1925).

HEBBURN, urban district, Durham, England, on the right bank of the Tyne, 4½ m. below Newcastle, on the L.N.E. railway. Pop. (1921) 24,168. It has extensive shipbuilding and engineering works, rope and sail factories, chemical, colour and cement works, and collieries.

HEBDEN BRIDGE, an urban district of the West Riding of Yorkshire, England, 7 m. W by N. of Halifax by the L.M.S. railway. Pop. (1921), 6,459; area 476 acres. The town is situated in a well-wooded steep-sided valley, at the confluence of Hebden Water and the river Calder, and surrounded by wild moorland country. Cotton factories, dye works, foundries and shuttle manufactories provide occupation.

HEBE [Gr. "young maturity," "bloom of youth"], daughter of Zeus and Hera, *Odyssey* xi. 603. In Homer, this divine princess, in accordance with the simple northern manners of the

Achaean nobles, does housework, much as the human princess, Nausicaa, does the family washing. Therefore she harnesses her mother's horses (*Iliad*, v. 722), bathes her brother Ares (*ibid.*, 905), and pours the wine at table (iv. 2). It is in her capacity as cup-bearer to the gods that she is oftenest mentioned, and is sometimes said to have been superseded by Ganymede (q.v.). As goddess of youth, she is generally worshipped along with her mother, of whom indeed she may be regarded as a sort of emanation or specialized form. She is also combined both in cult and in mythology, with Hercules (q.v.), whose bride she became when he was received into heaven (*Odyssey*, l.c.). The most important seats of her worship were Phlius and Sicyon, where she was called Ganymeda and Dia (Pausanias, ii. 13,3; Strabo, viii., 6,24). (*See* Preller-Robert, I. 489, and the classical dictionaries.)

A Latin deity with whom she is sometimes identified is Iuventas, whom, however, Dionysus of Halicarnassus iv 15,5, calls Neotes, not Hebe. The hellenized cult of Iuventas-Hebe dates from 218 B.C. (Livy, xxi., 62,9).

See Wissowa, *Religion und Kultur der Romer*, p. 135, and the classical dictionaries.

HEBER, REGINALD (1783–1826), English bishop and hymn-writer, was born at Malpas, Cheshire, on April 21, 1783. He studied at Brasenose college, Oxford, where he won prizes for a Latin poem entitled *Carmen seculare*, an English poem on *Palestine*, and a prose essay on *The Sense of Honour*. He was elected a fellow of All Souls' (1804), admitted to holy orders (1807) and presented to the family living of Hodnet in Shropshire. Heber became prebendary of St. Asaph in 1812, was appointed Bampton lecturer for 1815, preacher at Lincoln's Inn in 1822, and bishop of Calcutta in Jan. 1823. His devotion to his work in the trying Indian climate told severely on his health. He died at Trichinopoly on April 3, 1826.

Heber's fame rests mainly on his hymns, such as: "Brightest and Best of the Sons of the Morning"; "God, that Madest Earth and Heaven"; "Holy, Holy, Holy, Lord God Almighty"; "From Greenland's Icy Mountains"; "The Son of God Goes Forth to War." He edited (1822) the works of Jeremy Taylor.

See the *Life of Reginald Heber, D.D.* . . . , by his widow, Amelia Heber (1830), which also contains a number of Heber's miscellaneous writings.

HEBER, RICHARD (1773–1833), English book-collector, the half-brother of Reginald Heber, was born in London on Jan. 5, 1773. He attended continental book-sales, purchasing sometimes single volumes, sometimes whole libraries. He did not confine himself to the purchase of a single copy of a work. "No gentleman," he remarked, "can be without three copies of a book, one for show, one for use, and one for borrowers." He is known to have owned 150,000 volumes and probably many more. He was member of Parliament for Oxford university from 1821–26, and was one of the founders of the Athenaeum Club, London. He died in London, Oct. 4, 1833.

HÉBERT, JACQUES RENÉ (1757–1794), French Revolutionist, called "Père Duchesne," from his newspaper, was born at Alençon, on Nov. 15, 1757. His family was ruined by a lawsuit and Hébert came to Paris, where he endured great hardships. In 1790 he attracted attention by some pamphlets, and became prominent in the club of the Cordeliers in 1791. On Aug. 10, 1792 he was a member of the revolutionary Commune of Paris. His violent attacks on the Girondists led to his arrest on May 24, 1793, but he was released owing to the threats of the mob. Henceforth very popular, Hébert organized with P. G. Chaumette (*q.v.*) the "worship of Reason," in opposition to Robespierre's theistic cult. The failure of this movement brought about the arrest of the Hébertists. Hébert was guillotined on March 24, 1794. His influence was mainly due to his violent articles in his journal *Le Père Duchesne*.

See F. A. Aulard, *Le Culte de la raison et de l'être suprême* (1892).

HEBREW LANGUAGE. In the Old Testament, Hebrew is called *sĕphath Kĕna'an* "the lip of Canaan," or *Yĕhûdhîth*, "Jewish"; the later Jews designated it *lĕshôn haqqôdhesh*, "the sacred tongue"; the term *'ibhrîth*, "Hebrew," was coined by the Rabbis of Palestine. The English name comes from the Greek ἑβραῖος, "Hebrew," whose adverb ἑβραϊστί, "in Hebrew," is applied to Biblical Hebrew in the Prologue to Ecclesiasticus (*c.* 130 B.C); this adjective is derived from the Aramaic *'ibhray*, "Hebrew."

Hebrew is a Semitic language (*see* SEMITIC LANGUAGES), and monuments in it range from the 9th or 10th centuries B.C. to the present day. It was a mixed speech, to whose composition elements from several Semitic languages contributed; further, a few primitive words may have come from a non-Semitic people who, archaeology shows, once inhabited Palestine. Egyptian and Babylonian documents prove that a West-Semitic (Canaanite) language resembling Hebrew was current in Canaan before the coming of the Hebrews. Egyptian documents from the 16th century B.C. onwards reveal over 1,200 Semitic words, some common to various Semitic languages, others peculiar to the Syro-Canaanite branch; *e.g.*, Eg.-Can. *'nb* (Hebr. *'ēnābh*), "grape," occurred in Aramaic and Arabic, but Eg.-Can *brt* (=Hebr *bĕrîth*), "covenant," was confined to Hebrew. The feminine nouns preserved the primitive ending *-t*, which had already become *-h* in the Old Testament; *e.g.*, Eg.-Can. *spt* (=Hebr. *'ashpāh*), "quiver." In the earlier words the plural and dual took *-n*, as in Aramaic, but later *-m*, as in classical Hebrew; thus the Eg.-Can *krmyn* (*c.* 1200 B.C.) gave place to *krmym*, which was closer to the Hebrew *kĕrāmîm*, "vineyards" (*c.* 1100 B.C.). The form in *-n* survived in the North-Palestinian dialect of Hebrew, as *ṣîdōnîn* for *ṣîdōnîm*, "Sidonians"; similarly the Eg.-Can *sh-* corresponded with the dialectical Hebr. *she-* (for the correct *'ăsher*), "who," "which." These texts exhibit many names of places afterwards famous, as well as those of deities like *'shtrt* (=Hebr *'ashtōreth*), "Astarte," and of persons like *'brm* (=Hebr. *'abrām*), "Abram," especially in composition. Many terms describing common objects, either in composition or independently, appear early in the texts; *e.g.*, Eg.-Can *rsh* (=Hebr. *rō'sh*), "head," and Eg.-Can. *kmḥ* (=Hebr. *qemaḥ*), "flour." Others, having changed their meanings or not having survived in Hebrew literature, emphasize the fact that much has disappeared from the Hebrew vocabulary. The cuneiform correspondence found in Egypt, chiefly between the Egyptian kings and their vassals in Syria and Palestine (*c.* 1400 B.C.), also exhibits a language similar to, but older than, biblical Hebrew. These letters were written in a Babylonian exhibiting Western peculiarities closely approximate to Hebrew idiom: the Babylonian permansive tense, expressing properly a state, served also to describe a past action, like the Hebrew perfect with whose form it was identical; the Babylonian preterite, like the Hebrew imperfect with which its form agreed, served to express incomplete action in present time; the first person singular of the permansive (perfect) was closer to Hebrew than to Babylonian; *e.g.*, Bab.-Can. *naṣrâti* (=Hebr. *nāṣartî*, not Bab. *naṣrâku*) "I have kept"; a passive is formed by the internal modification of the vowels; *e.g.*, Bab.-Can. *yudan* (=Hebr. *yuttan*), "is given." This passive type, though unknown in Babylonian, is found sporadically in Hebrew and regularly in Arabic. But the principal evidence lies in the Canaanite glosses which, more than 100 in number, were added to explain Babylonian terms; for they closely resemble pure Hebrew. Thus the Bab. *ina qātihu* is explained by the Can. *badiu* (=Hebr. *bĕyādhô*), "in his hand," Bab *elippu*, by Can. *anaya* (=Hebr. *'ŏnîyāh*), "ship," and so on. Again, the language of these glosses is earlier than Hebrew; *e.g.*, Bab.-Can. *yakwun*, "is," in which the half-vowel *w* is retained, is older than a form like the Hebr. *yāqûm*, "he arises," in which it has been assimilated to the *u* (*cf.* Pun. *ichon*, "he is"); it preserved also the old feminine *-t*, as in *abadat* (*cf.* Hebr. *'ābhĕdhāh*), "is ruined," which rarely appeared in Biblical Hebrew. These texts prove the pronominal suffix *-mô*, which is a late poetical variety of the usual *-m*, "their," to be a genuine archaism; for example, Bab.-Can. *panimu* corresponds with the archaistic Hebr. *pānêmô*, not the classical Hebr. *pĕnêhem*, "their face." Most place-names, many of them afterwards found in the Old Testament, and some personal names exhibit purely Canaanite forms; and divine names like the Bab.-Can. *ba'alu* or *dagan*, contained in various proper names, are identical with the Hebr. *ba'al*, "Baal," and *dāghôn*, "Dagon." Clearly, Canaanite, as reflected in these ancient Egyptian and Babylonian texts, though not merely a form of Hebrew, certainly

contributed much to it.

The central group (Aramaic) made some contribution to Hebrew. This is illustrated by certain differences in the vowels: where old Aramaic prefers *a*, Canaanite and Phoenician prefer *u* (*o*), while the alternations in Hebrew betray its composite origin; for example, *rō'sh*, "head," goes back to the Can. and Phoen. *rush*, but *rā'shim*, "heads," to the Aram. *rā'sh*. Again, in certain weak verbs Hebrew prefers the Aramaic *a* in the active but the Canaanite *u* (*o*) in the reflexive (passive) voice; for example, the active *naḥtî* agrees with the Aram. *nāḥt* against the Can. *nuḥti*, "I rested," while a form like the passive *nākhôn*, "was established," reflects the Canaanite vocalization. The vocabulary, however, exhibits few words which are undoubtedly old Aramaic.

Another element comes from the Eastern (Accadian or Assyro-Babylonian) branch of the Semitic family. Through this it obtained a few Sumerian loan-words, like *hêkhāl*, "temple," through Acc. *ēkallu*, "palace," from Sum. *E Gal*, "great house." Those weak verbs, whose last two consonants are identical, show this Accadian (and Aramaic) element; for example, the alternatives *qaṣaṣ* and *qaṣ* represent the Acc. *qasiṣ* and the Aram. *qaṣ* "cut," respectively. Similarly the alternatives *mishôr* and *mêshār*, "justice," represent the Phoen. *misor* and the Acc. *mishāru*, "justice," respectively.

A number of alternative words confirms this view. The Hebr. *'ānōkhî* and *'ănî* reflect, the first, the Bab.-Can. *anuki* (*cf.* Acc. *anâku*) and the second, the Aram. *'ănâ* (*cf.* vulgar Arab. *'ani*), "I"; the Hebr. *'ēl* and *'ĕlō'àh* reflect the Bab.-Can *ilu* and Phoen. *el* (*cf.* Acc. *ilu*) and the Aram. *'ĕlāhâ* (*cf.* Arab. *'ilâh*), "God," respectively.

There are even occasionally three synonyms each from a different source in current use.

Hebrew, therefore, has drawn upon Assyro-Babylonian, old Aramaean (Amorite) and Canaanite. Now the correspondence from Tallu-'l-'Amarnâ tells of people called *Habiru* pressing into Syria and Palestine from the north-east and the east The name can hardly be dissociated from that of the Hebrews (*cf.* Bab.-Can. *ḫaparu*=Hebr. *'āphār*, "dust," in illustration of the philological equation); but the people are not the biblical Hebrews, if only because of their time and manner of entering Palestine. Cuneiform sources, however, relate that they came from Mesopotamia, through Hittite territory, into Syria and Palestine; so tradition asserts that Abraham came from Babylonia by Haran, through Hittite and Amorite territory, into Palestine. The analysis, too, of the Hebrew language shows that those who spoke it borrowed elements from and therefore in all probability passed through lands whose inhabitants spoke the Babylonian, Amorite (or Aramaean) and Canaanite languages. Thus history and philology confirm the traditional origin of the Hebrew people.

Hebrew retained but few traces of dialect; the reason lies probably in the Masoretic editing of the sacred text, which obliterated all local peculiarities. The Amorites substituted *s* for *sh;* and a trace of this is seen when the Ephraimites said *sibbōleth* and *shibbōleth*. Another mark of dialect was the Gileadite use of *shōmēă'* (*cf.* Ass. *shāmeānu* and Eth. *samā'ī*), "hearer," for *'ēdh*, "witness." Again, the North-Palestinian narratives preferred *'attî* to *'att*, "thou" (fem.), *zōh* to *zō'th*, "this" (fem.), and exhibited a few other Aramaizing peculiarities, notably in certain pronominal suffixes. This explanation probably accounts for certain infinitives, like *hălōkh* for *lekheth*, "to go," used by the Elohist. The use of *mĕlôkhāh* for *molkhāh*, "rule," *'ălaz* for *'ălaṣ*, "exulted," and *'al*, "upon," for *'el*, "unto," may also be dialectical. But certainty on this point, in view of the lack of sufficient evidence, is unattainable.

Hebrew was written in the common Semitic alphabet, used alike by Moabites, Hebrews, Phoenicians (who transmitted it to the Greeks), and Aramaeans. The earliest Hebrew examples occur on the Calendar from Gezer (*c.* 8th century B.C.) and on the inscription in the Pool of Siloam (*c.* 700 B.C.); there are, however, earlier instances in other languages. This character remained longest unaltered in Hebrew and Phoenician. The transition to the "square script" was effected first in Aramaic and later in Hebrew, undoubtedly in consequence of the growing influence of Aramaic immediately before the Christian era. It was called the "Assyrian script" on the assumption that it was the hand of the Eastern Aramaeans, which the Jews adopted about the 5th century B.C. Tradition ascribed this change to Ezra; but inscriptions, *ostraka* and *papyri*, prove that it was a gradual process which was not completed in Hebrew by 400 B.C. Another form of this hand is found in Egyptian Aramaic in the 5th and 4th centuries B.C. From these were developed the "square" characters used in biblical manuscripts, important texts and most printed books; the "Rabbinic" script, used in every kind of treatise, and the "cursive" writing of letters and informal documents, which was not generally printed. Hebrew palaeography is not sufficiently advanced to determine accurately the date of a manuscript, but the country of its origin can be recognized. The clearest distinctions are between Spanish, French, Italian, Maghrebi, Greek, Syrian and Egyptian, Yemenite, Persian and Karaite hands. This alphabet numbered 22 letters, whose order the evidence of certain acrostic poems proves not always to have been precisely that which afterwards prevailed; and there are signs that it was not definitely fixed even when the Greek version of the Old Testament was made. In default of figures the consonants served also as numerals, of which usage the earliest traces are found on Maccabaean coins. On these, too, abbreviations, which are unknown in the Old Testament but are extremely common afterwards, make their first appearance.

This alphabet was purely consonantal, except that *w* and *y* could denote *u* and *i*, while ' (*'āleph*) sometimes marked *a* and more rarely *o*, and *h* supported various final vowels; the first two also indicated the diphthongs *au* (*ô*) and *ai* (*ê*). In inscriptions these helping consonants were rarely written and were inserted in the Scriptures only by later scholars, often wrongly. That this alphabet was imperfect, apart from the absence of vowels, is evident; for, firstly, the versions prove that *h* and ' (*'ayin*) each represented a harder and a softer sound, which Arabic distinguishes by diacritical points; secondly, the Masoretes inserted a point in *b, g, d, k, p* and *t*, to distinguish their unaspirated from their aspirated sounds. Yet it was over-rich in the possession of five sibilants: *z*, a strongly articulated *s*, two forms of *s* which were so alike that one of them almost fell into desuetude, and *sh*.

The writing was from right to left. On the earliest inscriptions the words were divided by a point; but this was not so on gems and coins, and separation of the words was probably irregular in early manuscripts of the Scriptures; for the versions not infrequently imply a different division. It seems, however, to have been completed, like the introduction of special final forms of *k, m, n, p* and *s*, before the time of the Masoretes. As Hebrew became ever more the language solely of the learned, the need of preserving the original pronunciation in the reading of the Scriptures was increasingly felt; for this the vowel-less text was a very imperfect instrument. The insertion of *w* and *y* ' (*'āleph*) and *h* to mark long vowels and diphthongs was the first step; that of ' (*'āleph*) and *h* was very early; but, since the Greek version often implies a reading without such a *w* or *y*, they had probably not been generally introduced even after the 2nd century B.C. The system of vowels found in modern Bibles was a much later invention, having been gradually developed by Jewish grammarians in the 6th and 7th centuries A.D., imitating the Syriac vocalization. Two main systems were invented: the Babylonian with mostly supra-linear signs, and the Palestinian, in which they were chiefly put under the line. The Palestinian, as elaborated by the scholars of Tiberias, is that found in modern Bibles. It was so exact as to show all the vowel-changes occasioned by lengthening, by tone, by gutturals, and so on, which other languages seldom indicate in writing. This vocalization, which was little used except in Bibles, represented the traditional pronunciation observed in reading the Scriptures in synagogues and schools; but doubts have, on good grounds, been raised whether it represents the true pronunciation of ancient Hebrew. This can be shown by the Assyrian writing of Hebrew names and by the Greek and Latin transcription of Hebrew names and words. Thus "Dibon" (Hebr. *Dîbhôn*) should probably be pronounced "Daibon" (Hebr. *Daibhôn*) if the Greek Δαιβων is to be trusted. (*See* GREEK

LANGUAGE.) It is also noteworthy that the punctuation often exhibits a later *i* or *e* where the Septuagint preserves an *a* which comparative philology proves to be original. Yet caution is necessary; for the alphabet into which a word is being transcribed may not possess any means of representing the necessary sound; for example, the Assyrian transcription *Ausi'* and *Usi'* for "Hoshea" (Hebr. *Hôshēă'*) does not imply any different pronunciation, since Assyrian had no signs for *h, o* and *e;* the Greek Ωσηε, as far as it can, here confirms tradition. In fact, although the Masoretic vocalization might sometimes be wrong, internal reasons as well as the analogy of the cognate languages testify to the general faithfulness of the tradition. At the same recension, or soon afterwards, other signs, such as a complicated system of accents, different in the prose-works and the poetical books were added. There are now two pronunciations of Hebrew current, viz., the Polish and German, which partly resembles that of Syriac, and the Spanish and Portuguese, which approaches that of Arabic; Christians, after Reuchlin, generally prefer the latter to the former.

In development Hebrew was later in many respects even than classical Arabic, which hardly began till several centuries after Hebrew had ceased to be spoken. Classical Arabic, like early Babylonian, had case-endings (sing. nom. *-u,* acc. *-a,* gen. *-i*). Of these there are traces of a nom. *-û* (or *-ô*), found only with a following genitive case, in the Calendar found at Gezer in which *yarḥû* stands besides *yeraḥ,* "month," and sporadically in the Old Testament in names like "Methushael" (Hebr. *Mĕthûshā'ēl, cf.* Bab. *mutu shâ ili,* "man of God") and in certain phrases like *ḥayĕthô* (for *ḥayyath*) *'ereṣ,* "beasts of the earth." The acc. *-āh* survived as an adverbial ending, chiefly denoting place and time; otherwise it had no force, as in *laylāh* (for *layil*), "night" (*cf.* ἡ νύκτα for ἡ νύξ in Romaic). No genitive ending is found in Hebrew; for the termination *-i,* sometimes attached to nouns governing the genitive case, was probably a binding vowel, like the *-i* of early Babylonian. The plur. *-îm* and du. *-aim* were properly acc. endings, as Babylonian (plur., nom. *-û* and acc.-gen. *-î;* du. nom. *-ân* and acc.-gen. *-ên*) and Arabic (plur., nom. *-ûna* and acc.-gen. *-îna;* du. nom. *-âna* and acc.-gen. *-aina*) show. The Canaanite glosses *shamuma* and *shamema* (*cf.* Hebr. *shāmaim*), "heaven," show two plural cases; of these the alternative forms of the name "Penuel" (Hebr. *Pĕnû'ēl*) and "Peniel" (Hebr. *Pĕnî'ēl*), "face of God," of which the plur. *pānîm* (*cf.* Bab. Ass. *pânû*), "face," is an element, were the sole surviving trace in Hebrew. The earliest Hebrew, then, was on a level with modern Arabic or Greek; for the accusative had become the only case.

Classical Hebrew construction was almost exclusively paratactic, subordinate conjunctions being extremely rare. In pre-exilic writings many verses and even whole chapters can be found, exhibiting no conjunction other than *û-* or *wĕ-,* "and." Yet there is no monotony; for extraordinary skill is displayed in varying the tenses and the order of the words, often with good effect; *e.g.,* Hebrew says graphically "this do and live" for the ordinary English "if you do this, you will live." Further relief was provided by "*wāw*-consecutive," a construction almost confined to biblical Hebrew; elsewhere it is found only in one Moabite and one Aramaic inscription, and died out before Mishnaic Hebrew arose. This construction was the normal method of connecting each fresh verb in the narration of a series of events with the preceding clause. Hebrew tenses involved no relations to actions as past or future but only as complete or incomplete: by it, therefore, in past time only the first verb stood in the perfect and the narration was continued in the imperfect; in present or future time, the first verb stood in the imperfect and the subsequent verbs in the perfect. This progress in the sequence of time was indicated by a variety of the ordinary conjunction *we-* or *û-* "and," which either had a heavier vocalization or altered the accent of the verb; for example, *hāla'khtā wat-tiqṭōl* meant "thou hast gone and killed"; similarly, *tēlēkh wĕ-qāṭaltā'* meant "thou wilt go and kill." In the first the imperfect represented the action as emergent; accordingly, when combined with a conjunction connecting the event introduced by it with a point already reached by the narrative, it represented it as the development of the part which preceded it; thus, *way-tiqṭōl* meant "and thou wentest on to kill," while *wĕ-tiqṭōl* is simply "and thou wilt kill." In the second the perfect *wĕ-qāṭa'ltā'* meant "so thou hast killed," the possible occurrence of the event being confined to a particular area previously implied or defined, whereas the simple perfect *wĕ-qāṭa'ltā* would mean unconditionally "and thou hast killed." The various uses of this construction afford a relief to the monotony of a long string of clauses co-ordinated rather than subordinated to one another. But this idiom began, under Aramaic influence after the exile, to die out, and the simpler constructions, like *hālakhtā wĕ-qāṭa'ltā,* "thou hast gone and killed," and *tēlēkh wĕ-tiqṭōl,* "thou shalt go and kill," become a mark of later Hebrew. The participle also in all periods was freely used to eke out the inadequacy of these two tenses. Another device was the "circumstantial clause," whereby a clause introduced by "and" served as a secondary predicate; *e.g.,* the Hebrew said "he found him (and) he ploughing" instead of "he found him ploughing," using the participle and not a finite verb in a parallel, in place of a subordinate, clause.

The material for forming a judgment on Hebrew is itself scanty and inadequate. Even so, the smallness of the vocabulary and the paucity of adverbs, adjectives and abstract nouns are noticeable. The first difficulty was obviated by prepositional phrases, auxiliary verbs and similar devices, the second by apposition or a descriptive genitive case. The lack of abstract nouns, which only became frequent after the exile, was circumvented by the feminine singular or plural adjective; thus *rā'āh* (fem. sing.) stands for "wickedness" and *qāshôth* (fem. plur.), "harsh things," for "harshness." Another feature was the expression of the abstract under a concrete form; thus *kābhēdh,* "was heavy," meant also "was honourable," and from it both *kābhēdh,* "liver" (as the "heavy" organ), and *kābhôdh,* "abundance" and "honour," were both derived. It is, on the contrary, a sign of lateness when an abstract noun like *môdha'*, "acquaintance," designated a concrete person.

Hebrew was less suited for the definite expression of studied thought and the treatment of abstract subjects than for poetry. There was a great lack of particles to express the more subtle connection of ideas; there were few words or inflexions to indicate slight modifications of meaning, although possibly Hebrew, like other Semitic languages, formerly distinguished verbal moods in a way now obscured by the Masoretes. The use of the tenses was largely determined, especially in poetry, by the imagination, which regarded things unaccomplished as accomplished, the past as present and the future as fulfilled. It must, however, be remembered that living Hebrew never had to express abstract ideas; Ecclesiastes, which alone grappled with an abstract subject in plain prose, was composed when Hebrew was already dying out.

In prose, especially of the pre-exilic period, considerable differences of form and style can be detected, due partly to the time and place of composition, partly to the individuality and talent of the authors. Through them especially the various documents woven into the text can be disentangled. Yet the structure and, except in isolated cases, the vocabulary and phraseology, were much the same. The post-exilic literature shows a constantly closer approximation of the language to the cognate Western Aramaic idiom. The process was very gradual; for literary Hebrew was still understood, if not spoken, by the people at least in the 2nd century B.C.; and its extensive use in popular religious literature, partly preserved in the liturgy and elsewhere, proves that it was not entirely forgotten even in the 3rd century A.D. The poetical language employed peculiar words and meanings, forms especially of prepositions and pronominal suffixes, inflexions and constructions; but these distinctions were not so marked as in Greek. Many of them, being found in ordinary use in the cognate languages, notably in Aramaic, were often probably archaisms from the common Semitic vocabulary, surviving in Hebrew only in poetry; for example, the late and poetical *kethem,* "gold," has now been found in Canaanite. In other cases, possibly, Hebrew poets deliberately embellished their language with Aramaisms; for there is evidence that Aramaic was known to educated Hebrews in the latter part of the 8th century B.C. Apart from Arama-

isms, there was a definite poetical vocabulary; for example, *'ōraḥ* for *derekh*, "way." There was, particularly, a tendency to substitute adjectives for nouns; for example, *lĕbhānāh*, "the white one," for *yārēăḥ*, "moon." The article and *'ēth*, the sign of the accusative, were frequently omitted; the relative particle was freely dropped; the shortened imperfect was more widely employed; the governing power of prepositions was extended; the greater scope allowed to the imagination in the use of the tenses frequently obscures the sequence of events to a Western reader; and a forceful brevity of expression was affected. Poetry was accentual and was distinguished from prose by rhythm and parallelism. The poetical instinct was seemingly satisfied by lines of approximately the same length, combined normally into groups of two, three or four lines and constituting verses which marked more distinct pauses in the thought than the separate lines. The line normally consisted of seven or eight syllables, but there was apparently no rule on the subject; when it was longer than seven or eight syllables, a caesura commonly divided it into halves, each of so many beats. The fundamental form of the verse was the two-lined couplet, of which the second either repeated or re-enforced or completed the thought of the first. These couplets exemplified the main principle of Hebrew poetry, the parallelism of two roughly equal clauses, of which the second answered or completed the first. This might be synonymous, in which the second repeated the thought of the first line; antithetic, in which the thought of the one was contrasted with that of the other line; constructive, in which the second supplemented the thought of the first line; or climactic, in which the second line took up words from and completed the first line, which was incomplete. The poets sometimes grouped their verses into stanzas, marking the close by a refrain; but the number of verses in a stanza was never, according to the Masoretic text, more than approximately uniform in any poem. The *qînāh*, "elegiac rhythm," in which the line consisted of two members, the first containing one beat more than the second, exhibited the clearest scheme. Rhyme was as accidental as in classical Greek or Latin poetry; but both rhyme and quantitative metre were introduced, after the Arabic model, by mediaeval poets, who combined them with the vocabulary and idiom, as far as possible, of the earlier language.

At first foreign words were rare. There are occasional Egyptian words like *'āḥû* (Eg, *'hw*), "reeds," and *qeseth* (Eg. *gsty*), "inkhorn," and Assyrian words like *sĕ'ôn* (Ass. *shênu*), "boot," learnt probably from invading soldiers. The Babylonian *pûru*, "lot," was introduced in the plural *pûrîm*, "lots," to designate a post-exilic feast. Persian words also, like *dāth* (Pers. *dâta*), "law," came in. But late Aramaic, as closely resembling Hebrew, exerted, especially after the exile, an ever-increasing influence. Aramaic words and forms appeared: the Hebr. *-āh* began to be displaced by the Aram. *-â* in feminine nouns, and the Hebr. *dābhār* to yield to the Aram. *millĕthâ* in the Hebraized form *millāh*, "word," which even has two plur. forms (Hebr. *millîm* and Aram. *millîn*) in the same book. Hebrew words were sometimes Aramaized in form, as when the Hebr. *nāṣar* became *nāṭar* like the Aram. *nĕṭar*, "kept," or in meaning, as when the Hebr. *ṭa'am*, "taste," came to mean "decree" like the Aram. *ṭe'êm* (*cf.* Ass. *têmu*), "command." Abstract nouns in *-ûth*, like *malkhûth*, "kingdom," became common and are even formed from infinitives, like *hashmā'ûth*, "proclaiming," on the Aramaic model. The pronominal suffixes were weakened, so that such an Aramaism as *karmî shellî*, "my vineyard which is to me," tended to oust the simple Hebrew *karmî*, "my vineyard." The classical *'ăsher*, "who, which," lingered chiefly in combinations based on the old literary language, while the dialectical *she-* on the analogy of the Aramaic *dĕ-* displaced it in those derived from the popular Aramaic.

This post-exilic Hebrew showed also great simplicity and uniformity of style, again largely due to Aramaic influence. For some centuries the Jews must have been bilingual, still understanding Hebrew but speaking Aramaic, the official language of the western provinces of the Persian empire; by the time of Christ, however, Aramaic versions of the Scriptures, called *targûmîm*, were becoming necessary. Meanwhile Hebrew, without dying out, became gradually a *lĕshôn ḥăkhāmîm*, "language of scholars," as indeed it had begun to be in the later Scriptures. Roughly from 100 B.C. to A.D. 100 little is known of it; but after that it was greatly developed in the *Mishnāh* (*c.* A.D. 200). It was still a living language, though mainly confined to the schools and clearly distinct from Biblical Hebrew. In the Scriptures the range of subjects was limited; in the *Mishnāh* it was much extended. Matters of daily life were minutely discussed and words and phrases were adopted from the earlier and presumably popular speech; further, since the language was no longer in the same sense familiar, greater definiteness of expression was required in the written style.

The first alteration noticeable was the confusion of consonants, especially of the gutturals, which classical Hebrew had kept distinct. This change shows that the writers were accustomed to the daily use of Aramaic. Greek and Latin words, relating to the affairs of ordinary life, for whose writing the rules of classical orthography were violated, crept in. For example, biblical Hebrew almost universally required that initial *w* should become *y*, as in *yeledh* for the very rare *wālādh* (*cf.* Arab. *waladu*), "boy"; but barbarisms like *wĕthas* (Gr. *εὐθύς*), "at once," and *wîlôn* (Lat. *velum*), "curtain," were admitted, and henceforward the objection to forms like *wa'ad* (B. Hebr. *mô'ēd*), "meeting," was less strongly felt.

Biblical Hebrew, having lost the case-endings, used *'ēth* to mark the definite accusative case; but Mishnaic Hebrew employed *'ēth* not only to introduce the direct object, but also to serve alone as a definite article or, with a pronominal suffix, as a pronoun meaning "that" or "the same." Fresh pronouns, too, were coined by combining those already existing into compound forms or by adopting or adapting many from Aramaic. New adverbs, prepositions and conjunctions, especially subordinating conjunctions, were freely invented or imported from Aramaic.

The vocabulary was greatly enriched. Many biblical words remained, although some nouns changed their meaning; thus B. Hebr. *gōlem*, "embryo," became the M. Hebr. *gôlem*, "lump," "mass." New nouns were coined from biblical roots; so beside the B. Hebr. *ḥemedh*, "desire," there arose the M. Hebr. *ḥimmûdh*, "desire," from *ḥāmadh*, "desired." Especially noticeable are the numerous quadriliteral and quinqueliteral formations, which were rare in biblical Hebrew. Lastly, good Hebrew words appear which, though unknown in the Scriptures, must have belonged to the old spoken language. Beside the numerous Greek and Latin words, a few Persian (or Arabic) words crept in. These generally retained their original appearance, while one Greek word passed over in the genitive case (M. Hebr. *'andrî'antôs* = Gr. *ἀνδριάντος*, from *ἀνδριάς*, "statue"); only rarely were they furnished with Hebrew terminations. The inflection of nouns remained unchanged; but many masculine nouns acquired feminine endings, and the Aramaic masculine plural ending *-în* was much commoner than the Hebrew *-îm*, although the Hebrew feminine ending *-ôth* was regularly retained. Finally, the "construct case," whereby a noun governing a genitive case undergoes phonetic modification, survived sporadically; but a periphrasis with *shel-* ("which is to"), "of," the preposition *lĕ-*, "to," or the Aram. *dĕ-*, "of," tended to displace it. This relative particle *she-*, which belonged to dialect in biblical Hebrew, completely ousted the classical *'ăsher*, "who," "which," from Mishnaic Hebrew.

The supply of verbs also was much enlarged. Foreign verbs, being ill suited to the Hebrew conjugations, were rarely adopted, but a few were formed from nouns; *e.g.*, *sāphagh*, "absorbed," from *sĕphôgh* (Gr. *σπόγγος*), "sponge." The imperatives *kîrî* (written כִּירִי = Gr. *χαῖρε*) "hail!" and *vîvî* (written וִיוִי = Lat. *vive*), "live," are exceptions. But Aramaic verbs, which closely resembled Hebrew verbs, were readily assimilated, while some classical verbs received new meanings; *e.g.*, *zākhāh*, "was innocent," acquired the sense of "succeeded." Others, used originally in the simple theme, afterwards affected a derived theme. Many roots known only from derived nouns or quite unknown in biblical Hebrew, became general. Additional verbs were coined from derivative nouns; *e.g.*, *tāram*, "exacted the heave-offering" (B. Hebr. *tĕrûmāh*) and *mishkēn*, "took a pledge" (M. Hebr. *mishkôn*), "pledge." Quadriliteral and quinqueliteral verbs, rare in biblical

Hebrew, became common. The conjugations remained substantially unchanged; but the third person feminine singular took *-eth* (*-ath*) in place of *-āh* in the reflexive theme. Certain weak verbs also deviated slightly from the classical norm.

The themes underwent some slight changes. Canaanite had marked the active and passive voices by modifying the vowel (*cf.* *laqaḥu*, "they took," but *laqiḥu*, "they were taken") and biblical Hebrew sporadically preserved this difference between transitive and intransitive verbs (*cf.* between *zākhar*, "remembered," and *shākhēn*, "dwelt"). Of an internally formed passive the only certain survival is the participle; *e.g.*, *zākhûr*, "remembered." Other traces are probably concealed under certain forms which the Masoretes obscured In its place, biblical Hebrew used the passives of the derived themes. These (according to the paradigm of *pa'al*, "did") were the reflexive *niph'al*, the intensive and causative *pi'ēl*, the causative *hiph'îl* and the reflexive *hithpa'ēl*. The *niph'al* easily acquired a passive force; the *pu'al*, less often the *hoph'al* (the passives of the *pi'ēl* and *hiph'îl* respectively), were often also so used But in later Hebrew the *niph'al* and even more the *hoph'āl* tended, owing to ambiguity in their meanings, to become less frequent, whereas the *hithpa'ēl* became extremely common, both with a reflexive and less often with a passive force. Simultaneously a new form, the *nithpa'ēl*, of which biblical Hebrew offers but three examples, became extremely common with a purely passive sense. Of the active themes the *pi'ēl* served extensively in forming new verbs from nouns and replacing the simple theme customary with many classical verbs and the *hiph'îl* somewhat extended its usage. An Aramaic causative theme, formed by prefixing *sha-* or *sa-*, instead of *hi-*, was not unknown.

The old tense-system was inadequate, and the loss of "*wāw*-consecutive" made it even more inadequate The perfect expressed only completed action in past time; and more than the old imperfect was required for incomplete action in the past, present and future Various periphrases were therefore devised. Past incomplete action was denoted by the verb *hāyāh*, "was," with the participle; *e.g.*, *hāyāh 'ômēr*, "he was saying," was distinguished from *'āmar*, "he said," while the imperfect *yômēr* was left with a jussive force, meaning "he should say." The present participle alone connoted present time; but a pronominal subject, being no longer implicit or explicit in inflection, had to be expressed; *e.g.*, *'ănî 'ômēr* or *'ômēr 'ănî*, "I say." This gave rise to a completely new Aramaizing tense, formed by combining the participle with the following pronouns; for example, *'ômĕranî*, "I say." The future was expressed by the adjective *'āthîdh*, "ready," or the noun *sôph*, "end," with a pronominal suffix referring to the subject, followed by the infinitive introduced by *lĕ-*, "to"; *e.g.*, *'ănî'āthîdh lômar*, "I am ready to say," or *sôphî lômar*, "my end (is) to say," viz., "I will say"; or by *lĕ-* and the infinitive alone, as sometimes in biblical Hebrew, denoting rather what ought than what will happen; *e.g.*, *'anî lômar*, "I am to say." To express obligation, for which biblical Hebrew had no regular phrases, Mishnaic Hebrew used the adjective *ṣārîkh*, "needed," with the infinitive; *e.g.*, *'ănî ṣārîkh lômar*, "I must say."

Thus Hebrew, with its archaic stiffness, lost also the austere beauty and stately dignity of its prime. In exchange it acquired simplicity and flexibility and adapted itself better to the needs of every day. Though the disappearance of much that is characteristically Hebrew before the invasion of Aramaic cannot but be regretted. Hebrew still lives as the language of Jewish scholars, though coloured in varying degrees with the writer's own speech, whether Persian, Arabic, French, German or whatever it may be. The structure is Hebrew; the vocabulary is often very foreign This must be increasingly so; for ancient Hebrew was ill adapted to modern needs. As mediaeval grammar and philosophy demanded Arabic terms, so modern science requires European terms, often borrowed through Arabic. (*See* YIDDISH.) (G. R. D.)

HEBREW LITERATURE. "Hebrew Literature" denotes works written in the Hebrew language. Frequently, however, the expression is used as synonymous with Jewish literature, including all works written by Jews in Hebrew characters, whether the language be Aramaic, Arabic or even some vernacular not related to Hebrew.

Old Testament Scriptures.—The literature begins with the earliest portions contained in the Old Testament. There were no doubt in the earliest times popular songs orally transmitted and perhaps books of annals and laws, but except in so far as remnants of them are embedded in the biblical books, they have entirely disappeared. The traditional view that Moses was the author of the Pentateuch in its present form, would make this the earliest monument of Hebrew literature Modern inquiry, however, has arrived at other conclusions affecting not only the Pentateuch but the other Old Testament books as well (*see* BIBLE: *Old Testament*).

Apocryphal Literature.—It is not to be supposed that all the contents of the Old Testament were immediately accepted as sacred, or that they were ever all regarded as being on the same level The Torah, the Law delivered to Moses, held among the Jews of the 4th century B.C. as it holds now, a pre-eminent position The inclusion of other books in the Canon was gradual, and was effected only after centuries of debate The Jews have always been, however, an intensely literary people, and the books ultimately accepted as canonical were only a selection from the literature in existence at the beginning of the Christian era. The rejected books receiving little attention have mostly either been altogether lost or have survived only in translations, as in the case of the Apocrypha Hence from the composition of the latest canonical books to the redaction of the Mishnah (*see* below) in the 2nd century A.D., the remains of Hebrew literature are very scanty There was formed during this period a large body of exegetical and legal material, for the most part orally transmitted, which only received its literary form much later

Halakhah.—Not only was translation, and therefore exegesis, cultivated, but even more the amplification of the Law According to Jewish teaching (*e.g.*, Abhoth i. 1) Moses received on Mount Sinai not only the written Law as set down in the Pentateuch, but also the Oral Law, which was transmitted to the 70 elders and through them by a "chain of tradition" to succeeding ages The application of this oral law is called *Halakhah*, the rules by which a man's daily "walk" is regulated. The halakhah was by no means inferior in prestige to the written Law Indeed some even ventured to ascribe a higher value to it, since it comes into closer relation with the details of everyday life. It was not independent of the written Law, still less could it be in opposition to it. Rather it was implicitly contained therein, and the duty of the teacher was to show this. It was therefore important that the chain of tradition should be continuous and trustworthy The line is traced through biblical teachers to Ezra, the first of the Sōpherīm or scribes, who handed on the charge to the "men of the Great Synagogue," a much-discussed term for a body or succession of teachers inaugurated by Ezra. The last member of it, Simon the Just (either Simon I., who died about 300 B.C., or Simon II., who died about 200 B.C.), was the first of the next series, called Elders, represented in the tradition by *pairs* of teachers, ending with Hillel and Shammai about the beginning of the Christian era. Their pupils form the starting-point of the next series, the Tannāim (from Aram *tenā*, to teach), who occupy the first two centuries A.D.

Mishnah.—By this time the collection of halakhic material had become very large and various, and after several attempts had been made to reduce it to uniformity, a code of oral tradition —the Mishnah—was finally drawn up in the 2nd century by Judah ha-Nasī, called Rabbi *par excellence* The name Mishnah is derived from the Hebrew *shanah*, corresponding to the Aramaic *tenā*, and therefore a suitable name for a tannaitic work, meaning the *repetition* or *teaching* of the oral law. Its language differs in many respects from that of the Old Testament (*see* HEBREW LANGUAGE). It is divided into six "orders," according to subject, and each order is subdivided into treatises. In making his selection of halakhōth, Rabbi used the earlier compilations, which are quoted as "words of Rabbi 'Aqība" or of Rabbi Me'ir, but rejected much which was afterwards collected under the title of Tosefta (*addition*) and Baraita (*outside* the Mishnah).

Midrash.—Traditional teaching was, however, not confined to

halakhah. Since the teachers endeavoured to show the connexion of practical rules with the written Law, there arose the Midrash, *exposition,* from *darash* to "investigate" a scriptural passage. Of the halakhic Midrash we possess that on Exodus, called Mekhilta, that on Leviticus, called Sifra, and that on Numbers and Deuteronomy, called Sifrē These were drawn up in the period of the Amorāïm, the order of teachers who succeeded the Tannāïm, from the close of the Mishnah to about A.D. 500. The term Midrash, however, more commonly implies *agada, i.e.,* the homiletical exposition of the text, with illustrations designed to make it more attractive to the readers or hearers. It began with the Sōpherīm and was most developed among the Tannāïm and Amorāïm. As the halakhōth were collected and edited in the Mishnah, so the agadic material was compiled and arranged in the Midrashīm. Most of these collections form a sort of continuous commentary on the books of the Bible, Midrash, *Rabbōth* so called in order to distinguish them from preceding smaller collections. *Bereshīth Rabba,* on Genesis, and *Ēkhah Rabbatī,* on Lamentations, were probably edited in the 7th century. Of the same character and of about the same date are the *Pesīqta,* on the lessons for Sabbaths and feast-days, and *Wayyiqra R.* on Leviticus. A century perhaps later is the *Tanḥūma,* on the sections of the Pentateuch, and later still the *Pesīqta Rabbatī, Shemōth R.* (on Exodus), *Bemidhbar R.* (on Numbers), *Debharīm R.* (on Deuteronomy) There are also Midrashīm on Canticles, Ruth, Ecclesiastes, Esther and the Psalms, belonging to this later period, the *Pirqē R. Eliezer,* of the 8th or 9th century, a sort of history of creation and of the patriarchs, and the *Tanna debē Eliyahū* (an ethical work of the 10th century but containing much that is old), besides a large number of minor compositions. (*See* especially J. D. Eisenstein's *Ozar Midrashīm* [New York, 1915], for these lesser midrashīm) In general, these performed very much the same function as the lives of saints in the early and mediaeval church Very important for the study of Midrashic literature are the *Yalqūṭ* (*gleaning*) *Shim'ōnī,* on the whole Bible, the *Yalqūṭ Mekhīrī,* on the Prophets, Psalms, Proverbs and Job, and the *Midrash ha-gadhōl,* all of which are of uncertain but late date and preserve earlier material. That on Genesis was edited for the first time by Schechter (1902), and that on Exodus by D. Hoffmann (1913). The last, which is preserved in MSS. from Yemen, is especially valuable as representing an independent tradition.

THE TALMUD

Meanwhile, if agadic exegesis was popular in the centuries following the redaction of the Mishnah, the study of halakhah was by no means neglected. As the discussion of the Law led up to the compilation of the Mishnah, so the Mishnah itself became in turn the subject of further discussion. The material thus accumulated, both halakhic and agadic, forming a commentary on and amplification of the Mishnah, was eventually written down under the name of *Gemara* (from *gemar,* to learn completely), the two together are commonly spoken of as the *Talmud* (properly *"instruction"*). There are two distinct works to which the title Talmud is applied. One contains the oral traditions which had grown up in the Palestinian Schools and the other those of the schools of Babylonia. Both were due to the Amoraim and were completed by about A.D. 500, though the date at which they were actually committed to writing is very uncertain. Both are arranged according to the six orders of the Mishnah, but the discussion of the Mishnic text often wanders off into widely different topics. Neither is altogether complete. In the Palestinian Talmud (*Yerushalmī*) the gemara of the 5th order (*Qodashīm*) and of nearly all the 6th (*Ṭohōrōth*) is missing, besides smaller parts. In the Babylonian Talmud (*Babhlī*) there is no gemara to the smaller tractates of Order I, and to parts of ii., iv., v., vi. The language of both is in the main the Aramaic vernacular (western Aramaic in Yerushalmī, eastern in Babhlī), but early halakhic traditions (*e.g.,* of Tannaitic origin) are given in their original form, and the discussion of them is usually also in Hebrew. Babhlī is not only greater in bulk than Yerushalmī, but has also received far greater attention, so that the name Talmud alone is often used for it. As being a constant object of study numerous commentaries have been written on the Talmud from the earliest times till the present. The most important of them for the understanding of the gemara (Babhlī) is that of Rashi (Solomon ben Isaac, d. 1104) with the Tōsafōth (*additions,* not to be confused with the Tosefta) chiefly by the French school of rabbis following Rashi. Since the introduction of printing, the Talmud is always cited by the number of the leaf in the first edition (Venice, 1520, etc.), to which all subsequent editions conform. In order to facilitate the practical study of the Talmud, it was natural that abridgements of it should be made. Two of these may be mentioned: that by Isaac Alfasī (*i.e.,* of Fez) in the 11th century, often cited as *Rif;* and that by Asher ben Yeḥiel (d. 1328) of Toledo, usually cited as *Rabbenū Asher* (Rosh). The object of both was to collect all halakhōth having a practical importance, omitting all those which no longer possess more than an academic interest, and excluding the discussions on them and all agada. Both add notes and explanations of their own, and both have in turn formed the text of commentaries.

With the Talmud, the anonymous period of Hebrew literature may be considered to end. Henceforward important works are produced not by schools but by particular teachers, who, however, no doubt often represent the opinions of a school.

The Geōnīm.—The order of the Amoraim, which ended with the close of the Talmud (A.D. 500), was succeeded by that of the Sabōrāïm, who merely continued and explained the work of their predecessors, and these again were followed by the Geōnīm, the heads of the schools of Sura and Pumbeditha in Babylonia. The office of Gaōn lasted for something over 400 years, beginning about A.D. 600, and varied in power according to the ability of its holders Individual Geōnīm produced valuable works (of which later), but what is perhaps most important from the point of view of the development of Judaism is the literature of their Responsa or answers to questions, chiefly on halakhic matters, addressed to them from various countries. Some of these were actual decisions of particular Geōnīm; others were an official summary of the discussion of the subject by the members of the School. They begin with Mar Rab Sheshna (7th century) and continue to Hai Gaon, who died in 1038, and are full of historical and literary interest (*See* the edition of them in Harkavy, *Studien,* iv. [Berlin, 1885].) The She'iltōth (*questions*) of Rab Aḥai (8th century) also belong probably to the school of Pumbeditha, though their author was not Gaon. Besides the Responsa, but closely related to them, we have the lesser Halakhōth of Yehūdai Gaon of Sura (8th century) and the great Halakhōth of Simeon Qayyara of Sura (not Gaon) in the 9th century. In a different department there is the first Talmud lexicon (*'Arūkh*) now lost, by Ẓemaḥ ben Paltoi, Gaon of Pumbeditha in the 9th century. All these writers, however, are entirely eclipsed by the commanding personality of the most famous of the Geōnīm, Seadiah ben Joseph (*q.v.*) of Sura, often called al-Fayyūmī (of the Fayum in Egypt), one of the greatest representatives of Jewish learning of all times, who died in 942. The last three holders of the office were also distinguished. Sherira of Pumbeditha (d. 998) was the author of the famous "Letter" (in the form of a Responsum to a question addressed to him by residents in Kairawan), an historical document of the highest value and the foundation of our knowledge of the history of tradition. His son Hai, last Gaon of Pumbeditha (d. 1038), a man of wide learning, wrote (partly in Arabic) not only numerous Responsa, but also treatises on law, commentaries on the Mishnah and the Bible, a lexicon called in Arabic *al-Ḥāwī,* and poems such as the *Mūsar Haskel,* but most of them are now lost or known only from translations or quotations. Though his teaching was largely directed against superstition, he seems to have been inclined to mysticism, and perhaps for this reason various kabbalistic works were ascribed to him in later times. His father-in-law Samuel ben Ḥophni, last Gaon of Sura (d. 1034), was a voluminous writer on law, translated the Pentateuch into Arabic, commented on much of the Bible, and composed an Arabic introduction to the Talmud, of which the existing Hebrew introduction (by Samuel the Nagid) is perhaps a translation. Most of the works of this author are now lost.

THE QARAITES AND MEDIAEVAL SCHOLARSHIP

In the Geonic period there came into prominence the sect of the Qaraites (*Benē miqrā*, "followers of the Scripture," the protestants of Judaism) who rejected rabbinical authority, basing their doctrine and practice exclusively on the Bible. The sect was founded by 'Anan in the 8th century, and, after many vicissitudes, still exists. Their literature is largely polemical and to a great extent deals with grammar and exegesis. Of their first important authors, Benjamin al-Nehawendi and Daniel al-Qūmisī (both in the 9th century), little is preserved. In the 10th century Jacob al-Qirqisanī wrote his *Kitāb al-anwār*, on law, Solomon ben Yeruḥam (against Seadiah) and Yefet ben 'Alī wrote exegetical works; in the 11th century Abū'l-faraj Furqān, exegesis, and Yūsuf al-Baṣīr against Samuel ben Ḥophni Most of these wrote in Arabic. In the 12th century and in S. Europe, Judah Hadassi composed his *Eshkol ha-Kōpher*, a great theological compendium in the form of a commentary on the Decalogue Other writers are Aaron (the elder) ben Joseph, 13th century, who wrote the commentary *Sepher ha-mibhḥar;* Aaron (the younger) of Nicomedia (14th century), author of *'Ez Ḥayyim*, on philosophy, *Gan 'Eden*, on law, and the commentary *Kether Tōrah;* in the 15th century Elijah Bashyazī, on law (*Addereth Eliyahū*), and Caleb Efendipoulo, poet and theologian; in the 16th century Moses Bashyazī, theologian. From the 12th century onward the sect gradually declined, being ultimately restricted mainly to the Crimea and Lithuania, learning disappeared and their literature became merely popular and of little interest Much of it in later times was written in a curious Tatar dialect Mention need only be made further of Isaac of Troki, whose anti-Christian polemic *Ḥizzūq Emūnah* (1593) was translated into English by Moses Mocatta under the title of *Faith Strengthened* (1851); Solomon of Troki, whose *Appiryōn*, an account of Qaraism, was written at the request of Pufendorf (about 1700); and Abraham Firkovich, who, in spite of his impostures, did much for the literature of his people about the middle of the 19th century. (*See* also QARAITES.)

To return to the period of the Geōnīm While the schools of Babylonia were flourishing as the religious head of Judaism, the West, and especially Spain under Moorish rule, was becoming the home of Jewish scholarship On the breaking up of the schools many of the fugitives fled to the West and helped to promote rabbinical learning there The communities of Fez, Kairawan and N. Africa were in close relation with those of Spain, and as early as the beginning of the 9th century Judah ben Quraish of Tahort had composed his *Risālah (letter)* to the Jews of Fez on grammatical subjects from a comparative point of view, and a dictionary now lost His work was used in the 10th century by Menahem ben Sarūq, of Cordova, in his *Mahbereth* (dictionary). Menahem's system of bi-literal and uni-literal roots was violently attacked by Dūnash ibn Labrāṭ, and as violently defended by the author's pupils. Among these was Judah Ḥayyūj of Cordova, the father of modern Hebrew grammar, who first established the principle of tri-literal roots. His system was adopted by Abū'l-walīd ibn Jannāḥ, of Saragossa (died early in the 11th century), in his lexicon (*Kitāb al-uṣūl*, in Arabic) and other works. In Italy appeared the invaluable Talmud-lexicon (*'Arūkh*) by Nathan b. Yehiel, of Rome (d. 1106), who was indirectly indebted to Babylonian teaching. He does not strictly follow the system of Ḥayyūj. Other works of a different kind also originated in Italy about this time: the very popular history of the Jews, called *Josippon* (probably of the 10th or even 9th century), ascribed to Joseph ben Gōriōn (Gorionides); two different texts of it exist: (1) in the ed. pr. (Mantua, 1476); (2) ed. by Seb. Münster (Basel, 1541); there is also an early Arabic recension, but its relation to the Hebrew and to the Arabic 2 Maccabees is still obscure; see *J.Q.R.*, xi. 355 *sqq.* The Hebrew text was edited with a Latin translation by Breithaupt (Gotha, 1707); the medical treatises of Shabbethai Donnolo (10th century) and his commentary on the *Sepher Yeẓīrah*, the anonymous and earliest Hebrew kabbalistic work ascribed to the patriarch Abraham. In North Africa, probably in the 9th century, appeared the book known under the name of *Eldad ha-Danī*, giving an account of the ten tribes, from which much mediaeval legend was derived; on the various recensions of the text *see* D. H. Müller in the *Denkschriften* of the Vienna Academy (*Phil.-hist. Cl*, xli. 1, p. 41) and Epstein's ed. (Pressburg, 1891); in Kairawan the medical and philosophical treatises of Isaac Israeli, who died in 932.

Exegesis.—The aim of the grammatical studies of the Spanish school was ultimately exegesis This had already been cultivated in the East. In the 9th century Ḥīvī of Balkh wrote a rationalistic treatise on difficulties in the Bible, which was refuted by Seadiah. A fragment of such a work, probably emanating from the school of Ḥīvī was found by Schechter and published in *J.Q.R.*, xiii. 345 *sqq.* A fragment of Seadiah's polemic against Ḥīvī was edited with an English translation, introduction and notes by Israel Davidson (New York, 1915). The commentaries of the Geonim have been mentioned above. The impulse to similar work in the West came also from Babylonia. In the 10th century Ḥushīel, one of four prisoners, perhaps from Babylonia, though that is doubtful, was ransomed and settled at Kairawan, where he acquired great reputation as a Talmudist. His son Hananeel (d. 1050) wrote a commentary on (probably all) the Talmud, and one now lost on the Pentateuch. Hananeel's contemporary Nissīm ben Jacob, of Kairawan, who corresponded with Hai Gaōn of Pumbeditha as well as with Samuel the Nagīd in Spain, likewise wrote on the Talmud, and is probably the author of a collection of *Ma'asiyyōth* or edifying stories, besides works now lost. The activity in North Africa reacted on Spain. There the most prominent figure was that of Samuel ibn Nagdela (or Nagrela), generally known as Samuel the Nagīd or head of the Jewish settlement, who died in 1055. As vizier to the Moorish king at Granada, he was not only a patron of learning, but himself a man of wide knowledge and a considerable author Some of his poems and an Introduction to the Talmud are extant. In grammar he followed Ḥayyūj, whose pupil he was. Among others he was the patron of Solomon ibn Gabirol (*q v*), the poet and philosopher. To this period belong Ḥafẓ al-Qūtī (the Goth?) who made a version of the Psalms in Arabic rhyme, and Baḥya (more correctly Beḥai) ibn Paqūda, dayyan at Saragossa, whose Arabic ethical treatise has always had great popularity among the Jews in its Hebrew translation, *Ḥōbhōth ha-lebhabhōth*. He also composed liturgical poems. At the end of the 11th century Judah ibn Bal'am wrote grammatical works and commentaries (on the Pentateuch, Isaiah, etc) in Arabic; the liturgist Isaac Gayyath (d. in 1089 at Cordova) wrote on ritual. Moses Giqatilla (11th century), grammarian and exegetist, was the first to suggest that the second half of the Book of Isaiah was the work of a prophet near the end of the Babylonian exile.

Rashi.—The French school of the 11th century was hardly less important. Gershom ben Judah, the "Light of the Exile" (d. in 1040 at Mainz), a famous Talmudist and commentator, his pupil, Jacob ben Yaqar, and Moses ha-Darshan of Narbonne, were the forerunners of the greatest of all Jewish commentators, Solomon ben Isaac (Rashi), who died at Troyes in 1105. Rashi was a pupil of Jacob ben Yaqar, and studied at Worms and Mainz. Unlike his contemporaries in Spain, he seems to have confined himself wholly to Jewish learning, and to have known nothing of Arabic or other languages except his native French. Yet no commentator is more valuable or indeed more voluminous, and for the study of the Talmud he is indispensable. He commented on all the Bible and on nearly all the Talmud, has been himself the text of several super-commentaries, and has exerted much influence on Christian exegesis. Closely connected with Rashi, or of his school, are Joseph Qara, of Troyes (d. about 1130), the commentator, and his teacher Menahem ben Ḥelbō, Jacob ben Me'īr, called Rabbenū Tam (d. 1171), the most important of the Tosaphists (*v. sup.*), and later in the 12th century the liberal and rationalizing Joseph Bekhōr Shōr, and Samuel ben Me'īr (d. about 1174) of Ramerupt, commentator and Talmudist.

In the 12th and 13th centuries literature maintained a high level in Spain. Abraham bar Ḥiyya, known to Christian scholars as Abraham Judaeus (d. about 1136), was a mathematician, astronomer and philosopher much studied in the middle ages.

Moses ibn Ezra, of Granada (d. about 1140), wrote in Arabic a philosophical work based on Greek and Arabic as well as Jewish authorities, known by the name of the Hebrew translation as *'Arūgath ha-bosem,* and the *Kitāb al-Maḥaḍarah,* of great value for literary history. He is even better known as a poet, for his *Diwān* and the *'Anaq*, and as a hymn-writer. His relative, Abraham ibn Ezra, was still more distinguished. He was born at Toledo, spent most of his life in travel, wandering even to England and to the East, and died in 1167. Yet he contrived to write his great commentary on the Pentateuch and other books of the Bible, treatises on philosophy (as the *Yesōdh mōra*), astronomy, mathematics, grammar (translation of Ḥayyūj), besides a Dīwān. The man, however, who shares with Ibn Gabirol the first place in Jewish poetry is Judah Ha-levi, of Toledo, who died in Jerusalem about 1140. His poems, both secular and religious, contained in his Dīwān and scattered in the liturgy, are all in Hebrew, though he employed Arabic metres. In Arabic he wrote his philosophical work, called in the Hebrew translation *Sepher ha-Kūzarī,* a defence of revelation as against non-Jewish philosophy and Qaraite doctrine. It shows considerable knowledge of Greek and Arabic thought (Avicenna). Joseph ibn Mīgāsh (d. 1141 at Lucena), a friend of Judah Ha-levi and of Moses ibn Ezra, wrote Responsa and novelae on parts of the Talmud. In another sphere mention must be made of the travellers Benjamin of Tudela (d. after 1173), whose Massa'ōth are of great value for the history and geography of his time, and (though not belonging to Spain) Pethahiah of Regensburg (d. about 1190), who wrote short notes of his journeys. Abraham ben David, of Toledo (d. about 1180), in philosophy an Aristotelian (through Avicenna) and the precursor of Maimonides, is known for his *Sepher ha-qabbalah*, a polemic against Karaism, but valuable for the history of tradition and for his *Emunah Ramah,* a philosophical work.

Maimonides.—The greatest of all mediaeval Jewish scholars was Moses ben Maimōn (Rambam), called *Maimonides.* He was born at Cordova in 1135, fled with his parents from persecution in 1148, settled at Fez in 1160, passing there for a Muslim, fled again to Jerusalem in 1165, and finally went to Cairo where he died in 1204. He was distinguished in his profession as a physician, and wrote a number of medical works in Arabic (including a commentary on the aphorisms of Hippocrates), all of which were translated into Hebrew, and most of them into Latin, becoming the text-books of Europe in the succeeding centuries. But his fame rests mainly on his theological works. Passing over the less important, these are the *Mōreh Nebhūkhīm* (the Hebrew translation of the Arabic original), an endeavour to show philosophically the reasonableness of the faith, parts of which, translated into Latin, were studied by the Christian schoolmen, and the *Mishneh Tōrah,* also called *Yad haḥazaqah* (יד=14, the number of the parts), a classified compendium of the Law, written in Hebrew and early translated into Arabic. The latter of these, though generally accepted in the East, was much opposed in the West, especially at the time by Abraham ben David of Posquières (d. 1198). Maimonides also wrote an Arabic commentary on the Mishnah, soon afterwards translated into Hebrew, commentaries on parts of the Talmud (now lost), and a treatise on Logic. His breadth of view and his Aristotelianism were a stumbling-block to the orthodox, and subsequent teachers may be mostly classified as Maimonists or anti-Maimonists. Even his friend Joseph ibn 'Aqnīn (d. 1226), author of a philosophical treatise in Arabic and of a commentary on the Song of Solomon, found so much difficulty in the new views that the *Mōreh Nebhūkhīm* was written in order to convince him. Maimonides's son Abraham (d. 1234), also a great Talmudist, wrote in Arabic *Ma'aseh Yerūshalmī,* on oaths, and *Kitāb al-Kifāyah,* theology. His grandson David was also an author.

A very different person was Moses ben Naḥman (Ramban) or Nahmanides (b. at Gerona 1194, d. in Palestine about 1270), who was as conservative as Maimonides was liberal. Much of his life was spent in controversy, not only with Christians (in 1293 before the king of Aragon), but also with his own people and on the views of the time. His greatest work is the commentary on the Pentateuch in opposition to Maimonides and Ibn Ezra. He had a strong inclination to mysticism, but whether certain kabbalistic works are rightly attributed to him is doubtful. It is, however, not a mere coincidence that the two great kabbalistic text-books, the *Bahir* and the *Zohar* (both meaning "brightness"), appear first in the 13th century. If not due to his teaching they are at least in sympathy with it. The *Bahir,* a sort of outline of the *Zohar,* and traditionally ascribed to Neḥunya (1st century), is believed by some to be the work of Isaac the Blind ben Abraham of Posquières (d. early in the 13th century), the founder of the modern Kabbalah and the author of the names for the 10 Sephīrōth The *Zohar,* supposed to be by Simeon ben Yoḥai (2nd century), is now generally attributed to Moses of Leon (d. 1305), who, however, drew his material in part from earlier written or traditional sources, such as the Sepher Yeẓīrah. At any rate the work was immediately accepted by the Kabbalists, and has formed the basis of all subsequent study of the subject. Put into the form of a commentary on the Pentateuch, it is really an exposition of the kabbalistic view of the universe showing considerable acquaintance with the natural science of the time. A pupil, though not a follower of Nahmanides, was Solomon ibn Adreth (not Addereth), of Barcelona (d 1310), a prolific writer of Talmudic and and polemical works (against the Kabbalists and Mohammedans) as well as of responsa. He was opposed by Abraham Abulafia (d. about 1291) and his pupil Joseph Giqatilla (d. about 1305), the author of numerous kabbalistic works. Solomon's pupil Baḥya ben Asher, of Saragossa (d. 1340) was the author of a very popular commentary on the Pentateuch and of religious discourses entitled *Kad ha-qemaḥ,* in both of which, unlike his teacher, he made large use of the Kabbalah. Other studies, however, were not neglected. In the first half of the 13th century, Abraham ibn Ḥasdai, a vigorous supporter of Maimonides, translated (or adapted) a large number of philosophical works from Arabic, among them being the *Sepher ha-tappūaḥ,* based on Aristotle's *de Anima,* and the *Mōzenē Ẓedeq* of Ghazzali on moral philosophy, of both of which the originals are lost. Another Maimonist was Shem Ṭōbh ben Joseph Falaquera (d. after 1290), philosopher (following Averroes), poet and author of a commentary on the Mōreh.

A curious mixture of mysticism and Aristotelianism is seen in Isaac Aboab (about 1300), whose *Menorath ha-Ma'ōr,* a collection of agadōth, attained great popularity and has been frequently printed and translated. Somewhat earlier in the 13th century lived Judah al-Ḥarīzī, who belongs in spirit to the time of Ibn Gabirol and Judah ha-levi. He wrote numerous translations of Galen, Aristotle, Ḥarīrī, Ḥunain ben Isaac and Maimonides, as well as several original works, a *Sepher 'Anaq* in imitation of Moses ben Ezra, and treatises on grammar and medicine (*Rephūath geviyyah*), but he is best known for his *Taḥkemōnī,* a diwan in the style of Ḥarīrī's *Maqāmāt.*

EFFECTS OF JEWISH LITERARY ACTIVITY

Meanwhile the literary activity of the Jews in Spain had its effect on those of France. The fact that many of the most important works were written in Arabic, the vernacular of the Spanish Jews under the Moors, which was not understood in France, gave rise to a number of translations into Hebrew, chiefly by the family of Ibn Tibbōn (or Tabbōn). The first of them, Judah ibn Tibbōn, translated works of Baḥya ibn Paqūdah, Judah ha-levi, Seadiah, Abū'lwalīd and Ibn Gabirol, besides writing works of his own. He was a native of Granada, but migrated to Lunel, where he probably died about 1190. His son Samuel, who died at Marseilles about 1230, was equally prolific. He translated the *Mōreh Nebhūkhīm* during the life of the author, and with some help from him, so that this may be regarded as the authorized version; Maimonides's commentary on the Mishnah tractate *Pirqē Abhōth,* and some minor works; treatises of Averroes and other Arabic authors. His original works are mostly biblical commentaries and some additional matter on the Mōreh. His son Moses, who died about the end of the 13th century, translated the rest of Maimonides, much of Averroes, the lesser Canon of Avicenna, Euclid's *Elements* (from the Arabic version), Ibn al-Jazzār's *Viaticum,* medical works of Ḥunain ben Isaac (Johannitius) and

Razi (Rhazes), besides works of less-known Arabic authors. His original works are commentaries and perhaps a treatise on immortality. His nephew Jacob ben Makhīr, of Montpellier (d. about 1304), translated Arabic scientific works, such as parts of Averroes and Ghazzali, Arabic versions from the Greek, as Euclid's *Data*, Autolycus, Menelaus (מילים) and Theodosius on the Sphere, and Ptolemy's *Almagest*. He also compiled astronomical tables and a treatise on the quadrant. The great importance of these translations is that many of them were afterwards rendered into Latin, thus making Arabic and, through it, Greek learning accessible to mediaeval Europe.

Another important family about this time is that of Qimḥi (or Qamḥi). It also originated in Spain, where Joseph ben Isaac Qimḥi was born, who migrated to Southern France, probably for the same reason which caused the flight of Maimonides, and died there about 1170. He wrote works on grammar, commentaries on Proverbs and the Song of Solomon, an apologetic work, *Sepher ha-berīth*, and a translation of Baḥya's *Ḥōbhōth ha-lebhabhōth*. His son Moses (d. about 1190) also wrote on grammar and some commentaries, wrongly attributed to Ibn Ezra. A younger son, David (Radaq) of Narbonne (d. 1235) is the most famous of the name. His great work, the *Mikhlōl*, consists of a grammar and lexicon; his commentaries on various parts of the Bible are admirably luminous, and, in spite of his anti-Christian remarks, have been widely used by Christian theologians and largely influenced the English authorized version of the Bible. A friend of Joseph Qimḥi, Jacob ben Me'īr, known as Rabbenū Tam of Ramerupt (d. 1171), the grandson of Rashi, wrote the *Sepher hayashar* (novelae and responsa) and was one of the chief Tosaphists. Of the same school were Menahem ben Simeon of Posquières, a commentator, who died about the end of the 12th century, and Moses ben Jacob of Coucy (13th century), author of the *Semag* (book of precepts, positive and negative) a very popular and valuable halakhic work.

A younger contemporary of David Qimḥi was Abraham ben Isaac Bedersi (*i.e.*, of Béziers), the poet, and some time in the 13th century lived Joseph Ezobhi of Perpignan, whose ethical poem, *Qe'arath Yōseph*, was translated by Reuchlin and later by others. Berachiah, the compiler of the "Fox Fables" (which have much in common wth the "Ysopet" of Marie de France), is generally thought to have lived in Provence in the 13th century, but according to others in England in the 12th century. In Germany, Eleazar ben Judah of Worms (d. 1238), besides being a Talmudist, was an earnest promoter of kabbalistic studies. Isaac ben Moses (d. about 1270), who had studied in France, wrote the famous *Or Zarūa'* (from which he is often called), an halakhic work somewhat resembling Maimonides's *Mishneh Tōrah*, but more diffuse. In the course of his wanderings he settled for a time at Würzburg, where he had as a pupil Me'īr of Rothenburg (d. 1293). The latter was a prolific writer of great influence, chiefly known for his Responsa, but also for his halakhic treatises and Talmudic studies. He also composed a number of piyyūṭim. Mei'r's pupil, Mordecai ben Hillel of Nürnberg (d. 1298), had an even greater influence through his halakhic work, usually known as the *Mordekhai*. This is a codification of halakhōth, based on all the authorities then known, some of them now lost. Owing to the fact that the material collected by Mordecai was left to his pupils to arrange, the work was current in two recensions, an Eastern (in Austria) and a Western (in Germany, France, etc.). In the East, Tanḥūm ben Joseph of Jerusalem was the author of commentaries (not to be confounded with the *Midrash Tanḥūmā*) on many books of the Bible, and of an extensive lexicon (*Kitāb al-Murshid*) to the Mishnah, all in Arabic.

Limit of Development.—With the 13th century Hebrew literature may be said to have reached the limit of its development. Later writers to a large extent used over again the materials of their predecessors, while secular works tend to be influenced by the surrounding civilization, or even are composed in the vernacular languages. From the 14th century onward only the most notable names can be mentioned. In Italy Immanuel ben Solomon, of Rome (d. about 1330), perhaps the friend and certainly the imitator of Dante, wrote his diwan, of which the last part, "Topheth ve-'Eden," is suggested by the *Divina Commedia*. In Spain Israel Israeli, of Toledo (d 1326), was a translator and the author of an Arabic work on ritual and a commentary on *Pirqē Abhōth*. About the same time Isaac Israeli wrote his *Yesōdh 'Olam* and other astronomical works which were much studied

Jacob ben Asher of Toledo (d 1340), was the author of the *Tūr* (or the four Ṭūrīm), an important code of Jewish law. His pupil, David Abudrahim, of Seville (d. after 1340), wrote a commentary on the liturgy.

Both the 14th and 15th centuries in Spain were largely taken up with controversy, as by Isaac ibn Pulgar (about 1350), and Shem Ṭōbh ibn Shaprūṭ (about 1380), who translated St Matthew's gospel into Hebrew. In France Jedaiah Bedersi, *i.e.*, of Béziers (d. about 1340), wrote poems (*Behinath ha-'ōlam*), commentaries on agada and a defence of Maimonides against Solomon Adreth. Levi ben Gershom (d. 1344), called Ralbag, the great commentator on the Bible and Talmud, in philosophy a follower of Aristotle and Averroes, wrote also many works on halakhah, mathematics and astronomy. Joseph Kaspī, *i.e.*, of Largentière (d. 1340), wrote a large number of treatises on grammar and philosophy (mystical), besides commentaries and piyyūṭim. In the first half of the 14th century lived the two translators, Qalonymos ben David and Qalonymos ben Qalonymos, the latter of whom translated many works of Galen and Averroes, and various scientific treatises, besides writing original works, *e.g.*, one against Kaspī, and an ethical work entitled *Eben Bōhan*. At the end of the century Isaac ben Moses, called Profiat Duran (Efodi), is chiefly known as an anti-Christian controversialist (letter to Me'īr Alguadez), but also wrote on grammar (*Ma'aseh Efod*) and a commentary on the Mōreh. In philosophy he was an Aristotelian.

About the same time in Spain controversy was very active. Ḥasdai Crescas (d. 1410) wrote against Christianity and in his *Or Adōnai* against the Aristotelianism of the Maimonists. His pupil Joseph Albo in his *'Iqqarīm* had the same two objects. On the side of the Maimonists was Simeon Duran (d at Algiers 1444) in his *Magen Abhōth* and in his numerous commentaries. Shem Ṭōbh ibn Shem Ṭōbh, the kabbalist, was a strong anti-Maimonist, as was his son Joseph of Castile (d. 1480), a commentator with kabbalistic tendencies but versed in Aristotle, Averroes and Christian doctrine Joseph's son Shem Ṭōbh was, on the contrary, a follower of Maimonides and the Aristotelians. In other subjects, Saadyah ibn Danān, of Granada (d at Oran after 1473), is chiefly important for his grammar and lexicon, in Arabic; Judah ibn Verga, of Seville (d. after 1480), was a mathematician and astronomer; Solomon ibn Verga, somewhat later, wrote *Shebeṭ Yehūdah*, of doubtful value historically; Abraham Zakkuth or Zakkuto, of Salamanca (d. after 1510), astronomer, wrote the *Sepher Yuḥasīn*, an historical work of importance. In Italy, Obadiah Bertinoro (d. about 1500) compiled a very useful commentary on the Mishnah. His account of his travels and his letters are of great interest. Isaac Abravanel (d. 1508) wrote commentaries (not of the first rank) on the Pentateuch and Prophets and on the Mōreh, philosophical treatises and apologetics, such as the *Yeshū'oth Meshīḥō*, all of which had considerable influence. Elijah Delmedigo, of Crete (d. 1497), a strong opponent of Kabbalah, was the author of the philosophical treatise *Beḥīnath ha-dath*, but most of his work (on Averroes) was in Latin.

Later Writers.—The introduction of printing (first dated Hebrew printed book, Rashi, Reggio, 1475) gave occasion for a number of scholarly compositors and proof-readers, some of whom were also authors, such as Jacob ben Ḥayyīm of Tunis (d about 1530), proof-reader to Bomberg, chiefly known for his masoretic work in connection with the Rabbinic Bible and his introduction to it; Elias Levita, of Venice (d. 1549), also proof-reader to Bomberg, author of the *Massoreth ha-Massoreth* and other works on grammar and lexicography; and Cornelius Adelkind, who however was not an author. In the East, Joseph Karo (Qārō) wrote his *Bēth Yōseph* (Venice, 1550), a commentary on the *Ṭūr*, and his *Shulḥan 'Arūkh* (Venice, 1564) an halakhic work like the *Ṭūr*,

which is still a standard authority. The influence of non-Jewish methods is seen in the more modern tendency of Azariah dei Rossi, who was opposed by Joseph Karo. In his *Me'ōr 'Enayim* (Mantua, 1573) Dei Rossi endeavoured to investigate Jewish history in a scientific spirit, with the aid of non-Jewish authorities, and even criticizes Talmudic and traditional statements.

Another historian living also in Italy was Joseph ben Joshua, whose *Dibhrē ha-yamīm* (Venice, 1534) is a sort of history of the world, and his *'Emeq ha-bakhah* an account of Jewish troubles to the year 1575 In Germany David Gans wrote on astronomy, and also the historical work *Ẓemah David* (Prag, 1592). The study of Kabbalah was promoted and the practical Kabbalah founded by Isaac Luria in Palestine (d. 1572). Numerous works, representing the extreme of mysticism, were published by his pupils as the result of his teaching Foremost among these was Ḥayyīm Vital, author of the *'Ez ḥayyīm*, and his son Samuel, who wrote an introduction to the Kabbalah, called *Shemonch She'arīm*. To the same school belonged Moses Zakkuto, of Mantua (d. 1697), poet and kabbalist. Contemporary with Luria and also living at Safed, was Moses Cordovero (d. 1570), the Kabbalist, whose chief work was the *Pardes Rimmōnīm* (Cracow, 1591).

In the 17th century Leon of Modena (d. 1648) wrote his *Bēth Yehūdah,* and probably *Qōl Sakhal,* against traditionalism, besides many controversial works and commentaries. Joseph Delmedigo, of Prag (d. 1655), wrote almost entirely on scientific subjects. Also connected with Prag was Yōm Ṭōbh Lipmann Heller, a voluminous author, best known for the *Tōsaphōth Yōm Tōbh* on the Mishnah (Prag, 1614; Cracow, 1643). Another important Talmudist, Shabbethai ben Me'īr, of Wilna (d. 1662), commented on the *Shulḥan 'Arūkh*. In the East, David Conforte (d about 1685) wrote the historical work *Qōrē ha-dōrōth* (Venice, 1746), using Jewish and other sources; Jacob ben Ḥayyīm Zemah, kabbalist and student of Luria, wrote *Qōl be-ramah,* a commentary on the *Zohar* and on the liturgy; Abraham Hayekinī, kabbalist, chiefly remembered as a supporter of the would-be Messiah, Shabbethai Zebhī, wrote *Hōd Malkūth* (Constantinople, 1655) and sermons

In the 18th century the study of the kabbalah was cultivated by Moses Ḥayyīm Luzzatto (d. 1747) and by Elijah ben Solomon, called Gaon, of Wilna (d. 1797), who commented on the whole Bible and on many Talmudic and kabbalistic works. In spite of his own leaning towards mysticism he was a strong opponent of the Ḥasīdīm, a mystical sect founded by Israel Ba'al Shem Ṭōbh (Besht) and promoted by Baer of Meseritz. Elijah's son Abraham (d. 1808), the commentator, is valuable for his work on Midrash. An historical work which makes an attempt to be scientific, is the *Seder ha-dōrōth* of Yeḥiel Heilprin (d. 1746). These, however, belong in spirit to the previous century.

MODERN HEBREW LITERATURE

Modern Hebrew literature is universal in scope and secular in spirit, thus contrasting with the purely legal, ritualistic or homiletic works of earlier times. This literature took its rise in Italy (M. H. Luzzatto, 1707–47), whence it shifted to Germany, showing at first, notably through the influence of Moses Mendelssohn (1729–86), a rationalistic and cosmopolitan tendency.

Russia and Lithuania.—Following a brief period of activity in Galicia dominated by Biblical criticism and historical scholarship (Krochmal, 1785–1840; Rapoport, 1790–1867), Hebrew literature assumed a new character in Russia and Lithuania, where the so-called Haskalah movement developed—a humanistic and humanitarian spirit which set itself against the traditional exclusiveness of the Jew. It found expression in the historical and scientific compendia of Kalman Schulman (1819–99), in the novel (Mapu, 1808–67) and in poetry (Lebensohn, 1828–52; J. L. Gordon [1831–92]). The novelist P. Smolenskin (1842–85) heralded a reaction, hastened by the pogroms against the Jews, towards a Jewish national policy, which culminated in Zionism. Since his day Hebrew literature has been largely dominated by the idea of a national revival. This idea has found its most complete expression in the essays of Asher Ginzberg (Ahad Ha'am) who has resisted the tendency to lay undue stress on the economic and political factors in Zionism and has insisted on the conception of Palestine as the cultural centre of the Hebrew race.

The individualistic and symbolic spirit in Hebrew literature has been greatly influenced by the modern mystic movement among the Jews known as Hassidism. In the sphere of fiction this spirit found its foremost representative in Isaac Loeb Perez (1851–1915), whose stories are distinguished by artistic beauty and tenderness. Humour is the dominant characteristic of S. J. Abramowitsch, a short-story writer (known as "Mendele," 1835–1918). Judah Steinberg (1863–1908), author of many stories, excels in the delineation of character, and in him the individual finds more complete and varied representation than elsewhere in Hebrew literature. This fact, and the clearness and fluency of his style, give him high rank among Hebrew novelists. Another novelist of some distinction is R. A. Brandes (1851–1902), who chose the struggle for religious reform as the theme of his principal novels.

Poetry.—Poetry has made rapid strides in modern Hebrew literature. There is a host of contemporary poets, the most representative of whom is Hayyim Nachman Bialik (1873–). With the exception of Judah ha-Levi (*fl.* 12th century) he is perhaps the leading Jewish national poet, inheriting the idealism and the prophetic seriousness of his people. He is pre-eminently the poet of Jewish woe. To Jewish national hopes and aspirations he seldom gives expression in his verse. None of the Hebrew poets has grasped and represented the spirit of the Ghetto and its poetry with so much sympathy and so much tenderness of feeling as Bialik. The ideas of Ahad Ha'am and the influence of Gordon's style and form are traceable in his poems. Next to Bialik and in strong contrast with him stands Dr Saul Tschernichowski (1875–). He was the first to introduce into Hebrew poetry an admiration for the Greek spirit and the sense of complete enjoyment of life His work is remarkable for its easy gracefulness and its varied rhythms and metrical forms. Dr. Jacob Cahan (1880–), is an idealist, whose poems bear the stamp of a marked individuality. In the poems of Zalman Schneor (1886–) there is at times a gentle pessimistic vein, and his verse is full of life and beauty; the rhythm has harmony and tunefulness, the imagery is rich, varied and striking, and the movement quick and bold. His prose, too, is marked by the same qualities. Among a list of poets of less distinction may be mentioned Jacob Steinberg, Jacob Fichman, Isaac Katzenelson, J. J. Koplewitz, David Schimonwitz, the brothers Simon and Pesach Ginsburg, Hillel Bavli, Judah Karni, A Schlonsky, Uri Zebi Greenburg, Avigdor Feuerstein, Benjamin N. Silkiner and Simon Leo Halkin. Modern Hebrew poetry, like Hebrew poetry in general, has been strongest in lyric.

Fiction.—The various transformations of Jewish life brought about by the Zionist and other Jewish movements and the influence of foreign literatures had their effects upon the shaping of contemporary Hebrew fiction, notably the short story and the novel. There has been created a Hebrew short story, artistic in technique and generally psychological in presentation, delineating the individual in a variety of moods and situations; but at the same time marked by a minute, torturing self-analysis, by an impotence in the will of the heroes and by an outlook upon life that is gloomy and despondent. The creators of these stories are followers of Micah Joseph Berdyczewski (1865–1921), who in his view of life was influenced by the individualistic theories of Nietzsche. Among the most notable story-writers of this group are Isaiah Domoshevitzky (known as J. Bershadsky, 1870–1908), Joseph Hayyim Brenner (1881–1921), Gershon Schofmann, Uri Nisan Gnessin (1880–1913) and Isaac Dob Berkowitz. The melancholy and morbid spirit which some of these writers have introduced into the Hebrew sketch and novel is almost entirely traceable to the influence of the Russian and Scandinavian literatures of the last few decades. A notable exception to this tendency is S. J. Agnon, an original symbolico-mystical writer of short stories and a master of Hebrew style. Other writers of fiction who are free from this pessimistic strain are A. A. Kabak, Moses Smilansky, L. A. Orloff, S. Ben-Zion Guttman, Eliezer Steinman, Asher Barash, A. Reubeni and Abraham Soyer.

Other Works.—The adaptation of the Hebrew language to

the needs of modern life owes much to Eliezer Ben-Yehuda (1858–1923), one of the pioneers of the idea of a Jewish national renascence, whose ten-volume Hebrew dictionary (*Thesaurus totius Hebraitatis*) is a monument of a life's devotion to the revival of Hebrew. The talent of David Frischmann (1863–1922) extended over the domains of the feuilleton, the short story, poetry and criticism. Dr. Joseph Klausner (1874–) is active in many fields—criticism, history, scholarship and journalism. He possesses considerable erudition and historic insight. Hillel Zeitlin, a mystic, has made original contributions to various phases of modern Hebrew literature. The greatest Jewish journalist, writing for Jews in Hebrew and in many other languages, is Nahum Sokolow. Reuben Brainin is a fine stylist and an able critic but his literary ideas and tastes are perhaps too much determined by outside influences. In Dr. Simon Bernfeld (1860–) Hebrew literature has a many-sided and very prolific writer with a gift for presenting the results of scholarly research in attractive literary form. Wolf Jawitz (1847–1924) was a historian and a philosopher of religious romanticism. David Neumark (1866–1924) made original contributions to the study of Jewish philosophy. Jacob Klatzkin, Fishel Lachower, S. B. Maximon, Dr. S. M. Melamed, Joel Blau, Osias Thon, Mordecai Ehrenpreis, S. I. Hurwitz, Dr. M. Waxman and others have contributed much to the development of the essay in Hebrew literature.

Hebrew literature, including its vernacular, is a primary factor responsible for the rejuvenation of the national Jewish spirit and for the emancipation of Jewish life from external influences. Literary activity came to a virtual standstill as a result of the World War and its consequences, which bore with especial severity on eastern Europe, formerly the chief centre of Hebrew literature. During the last few years there has been a revival in eastern Europe, and a certain development in America; but the centre of this activity has shifted to Palestine.

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HEBREW RELIGION. The Hebrews were Western Semites, and from the Semites sprang Judaism, Christianity and Mohammedanism (or Islam). The part these three great monotheistic religions have played in history cannot be understood without taking into account the general characteristics of the SEMITES (*q.v.*), and the capacity for monotheism often ascribed to them. But monotheising tendencies are not so rare, and it is more important to observe what effects they have had.

1. **Introductory.**—By Judaism is meant the religion of the Jews (*i.e.*, properly "Judaeans") based upon the Old Testament. There are, however, striking differences within the Old Testament, *e.g.*, between the piety of the Psalms, the pessimism of Ecclesiastes and the eroticism of Canticles; or between the popular stories in Genesis and the priestly ritual in Leviticus. Moreover, it is instructive to compare and contrast the treatment of the history of the monarchy in Samuel—Kings with the parallel portions in Chronicles. Further, the prophets condemn the polytheistic and degrading cults of the Israelite religion of their day, although the Israelites felt that they stood apart from their neighbours, whether Canaanites within the land, or other peoples without: Edom, Ammon, etc. In fact, "Israel" is a much more restricted term than "Hebrew" (*see* JEWS. 3). Israel (which strictly includes both Judah and the northern tribes (Joseph, Ephraim, etc.), was closely related to Edom (its "brother") Moab and Ammon, the Aramaeans of north Syria and the Arabs of the desert. Hence, while the Old Testament (with the religion of Israel) led to both Judaism and Christianity, one must not ignore the religious beliefs and practices over the larger world of which Israel formed part. The ideas which made the monotheistic religion of Israel unique are best appreciated when it is seen how they developed, now in touch with and now in reaction against, the contemporary religions. By Hebrew religion, therefore, we mean the religion of the Hebraic background upon which Israel grew up and developed its monotheism, and which extends outside the chronological limits of the Old Testament. (*See* BIBLE: *Old Testament.*)

2. **Desert and Other Influences.**—Intercourse over south-west Asia, Egypt and the Levant, regular from a very early date, was at times pronounced. Under varying political and economic circumstances the tide of influence flowed now in one direction, now in another In the age after Alexander the Great (332 B.C., *see* HELLENISM), the Greeks left their mark upon the East; but, later, Christianity belongs to a new Oriental revival and its conquests westwards, together with the activity of Rabbinical Judaism and the vitality of old Oriental pagan or semi-pagan cults and ideas, characterise the ages before the rise of Islam among the Arabs (seventh cent. A.D.). From time to time sweeping movements can be distinctly traced, others only inferred; and there is reason to believe that the history of religion in Palestine and Syria—Hebrew religion—was more complicated and more closely bound up with far-reaching external events than would be supposed from the biblical narrative alone. Yet even there the writers are convinced that the history of the religion of Israel was one of universal significance.

The rise of militant Islam, virile and enthusiastic, with the doctrine of one and only god Allah, is not entirely unique in so far as the influence of desert tribes upon Semitic history and religion can be traced earlier. The Israelites themselves admit their indebtedness to the formative period in the deserts outside Palestine and to Kenites or Midianites The story of the flight from Egypt, the Exodus, and the sweeping invasion of tribes under Joshua, the successor of their law-giver Moses, reflects the belief that the national religion of Israel, with the worship of a one and only god Yahweh (on the name *see* JEHOVAH), was introduced into a land of ancient, though depraved civilization by men who had lived under the simpler conditions of the deserts. On the other hand, the story of the "patriarchs" in Genesis and especially the connections with Ur of the Chaldees and Harran (*see* ABRAHAM), point back to famous ancient centres of culture. Difficult as it is to decide whether the desert (nomadic or semi-nomadic) origin is more significant than the traditions (Gen. xi. *sqq.*) pointing to Babylonia, North Syria and even Armenia (Ararat), there are yet other factors to take into account: excavation and the monuments lead us to look for influences from Egypt, Asia Minor, Cyprus, Crete and the Aegean. Accordingly, the study of Israel's own literature (*viz.*, the Old Testament), together with that of the "external evidence," brings many difficult problems, and scholars take different attitudes in regard to the evidence, and sometimes reach very divergent conclusions. On the line taken in the present article, *see* further JEWS, PALESTINE: *History.*

3. **The Amarna Age.**—The age to which the biblical writers evidently ascribe Abraham and the beginning of Hebrew religion is approximately that of the Middle Egyptian empire and of the first Babylonian Dynasty, the chief of whose monarchs, Hammurabi, extended his power to the west. Its significance for the development of religion in Palestine can hardly as yet be safely calculated. On the other hand, a firm foundation is afforded by the Amarna age (*c.* 1400 B.C.), an international age when the

widespread use of the Akkadian language and script points to the earlier influence of Mesopotamia. But the native language of Palestine (including Phoenicia) was already virtually that of the Hebrew Old Testament; and the phraseology of the letters, although Akkadian, is of great interest. The letters are addressed by the petty kings of the land to their Suzerain, the Egyptian Pharaoh (Amenhotep III. and IV.) who, in accordance with ancient usage, is regarded as a more or less divine representative of the supreme god or gods. A "loyal" king is *suduk* (the Heb. *saddik*, "righteous"), he lays his neck to the yoke, and is more unshakable than a brick. A city forsaken by Egypt "weeps, its tears run down, there is no taking hold of the hand" (*i.e.*, no help). The "name" of the loyal vassal endures for ever, while that of the bad one (disloyalty is "sin") perishes. The king "sets his face" against the disloyal but his breath (or spirit) gives life and rest. He is the breath of men (*cf.* Lam. iv. 20), and without it they cannot live. "If" says one, "we go up into heaven, or if we descend into the earth, yet is our head in thy hands" (*cf.* Ps. cxxxix. 7 seq.). The Pharaoh's name spreads fear, and because he has set his name upon Jerusalem for ever, its king Abdi-khiba is confident that it must not be neglected. He even declares that the Pharaoh has "set his name at the rising of the sun and at the setting of the sun" (*cf.* Mal. i. 11): a recognition of the world-wide power of the human representative of the great Egyptian gods, of one whom his vassals call their god or their gods (a plural used like the Heb. *Elohim*). Language of this sort clearly shows how the people of Palestine could address their own gods (or their human representatives).

Centuries of intercourse had created a common background of life and thought; and the deities of one land were often known to another. In Palestine can be found Dagan or Dagon (probably a food god), Nebo (the messenger god), Sin (moon-deity), Nergal and Ninurta. Certain Asiatic deities were known in Egypt: Resheph, Baal and the warrior mother-goddesses Anath, Kadesh and Astarte (Ishtar). Various Egyptian deities entered Palestine (Amon, Re, Hathor, etc.); and Egyptian colonies, temples and symbols (the *Ankh* or "sign of life," the winged-disc) combine with archaeological evidence for contact with Asia Minor and the Aegean, to prove that then, as always, the land was the meeting-place of beliefs—doubtless there were then, as later, local deities (*Baal*, fem. *Baalath*), closely identified with local districts or possessing specialised functions, differing in name or attribute, but the centre of very similar beliefs and practices (*see* BAAL). Especially significant is the recognition of the supreme monarch, since it involved a tendency towards monotheism (a one and only god), or rather henotheism (one god above all others). The Amarna letters show how under Egyptian supremacy, Egyptian and Palestinian deities were co-ordinated or equated. The vassal princes call the king their Shamash and Addu; the former, the Sun-god, god of right and justice, was already familiar (*cf.* also the place Beth-shemesh near Jerusalem), and Addu (Hadad) god of rain, storm, etc., was known widely under other names (Ramman [Rimmon], Teshub, etc.). He was presumably "the Baal," the prominent god associated with thunder and lightning and, with the bull, often named in Egypt in the XIXth Dynasty. The name Shamshi-Adad, borne by five Assyrian kings (1850–1000 B.C.), definitely united the two pre-eminent deities, and in a cuneiform tablet found at Taanach (in the Plain of Jezreel) a "lord of the gods" is invoked. Both in Egypt and in Babylonia (*viz.*, the Code of Hammurabi) there is the conception of a (or the) "god"—not closely defined, but quite clearly understood—other than the named and recognised deities; and consequently important monotheising tendencies are to be recognised before the rise of the national religion of Israel.

4. **The Religious Significance of the Amarna Age.**—The strenuous reforms associated with the name of Amenhotep IV., Ikhnaton (*c.* 1380 B.C.), made the Sun the source of all power and life; and of his Sun-god (Aton) he was the "beloved son" and emanation, born of his rays, eternal. Ideas of the intimate bond uniting national god and king were not necessarily strange to Palestine; and may have been further developed by the marriage relations between the Amenhoteps and the non-Semitic dynasty in Mitanni (North Mesopotamia). Abdi-khiba of Jerusalem, most devoted of vassals of Egypt, was himself one of several dynasts who can be traced from Mitanni southwards. There, in the north, among various signs of Indo-European (Aryan or Iranian) influence, a treaty between Mitanni and the Hatti (Hittites) actually names Varuna, Mitra (later Mithra) and other Indian or Aryan deities. Indo-European thought in general, is distinguished by the recognition of a reign of law, a rational or natural rather than a supernatural order (Sanskrit *rita*, Iranian *arta*), and to judge from various dynastic and other names, it was already known in Mitannian circles. A certain rationalism and pragmatism mark off Iranian (Persian) religion from Indian mysticism, pantheism and quietism; and accordingly it is probable that there was an Aryan or Iranian influence in Palestinian or Hebrew religion centuries before the age of the Persian (Achaemenid) empire, when Zoroastrianism was an important factor in the history of Judaism (*cf.* 16).

In the Amarna age, which is approximately that of Moses, religion had reached an advanced stage, and ethical ideas frequently recur in ancient Babylonia and Egypt, and were especially associated with Solar deities. But apart from the O.T. no clear trace is to be found of Yahweh, at least as a prominent god, still less of the covenant with Israel at Sinai (Horeb), yet the Aryan Varuna and Mitra were gods of oath and covenant; and the lofty ethical character of the former points to some earlier ethico-spiritual reform outside the Semitic world, to which the rise of Zoroaster's Ahura-Mazda (who corresponds to Varuna) is a later parallel. The Amarna letters refer to a very powerful anti-Egyptian movement. The land was rent by intrigues; and, as always, religion and politics were one. The pro-Egyptian petty princes, both native and (like Abdi-khiba) foreign, would necessarily favour the syncretistic religion that Egyptian supremacy involved, whereas the enemies of Egypt, the Khabiru, the Amorites under Abd-Ashirta, whose name styles him a "servant of Ashirat" (Astarte or Ishtar), their Palestinian allies and their Hittite supporters, would promote the native religion. As often later, Palestine in politics and religion wavered between Egypt and the north (Mesopotamia, etc.). The religion was affected by and reacted against contemporary conditions, and the Amarna age marks the beginning of the decline of Egypt, and the increase of Hittite and Amorite influences. It is perhaps significant that "Baal" now becomes familiar in Egypt, in the XIXth and XXth dynasties. External evidence throws no light upon the rise of Yahwism, as described in the O.T., but a new stage in the history of religion in Palestine can undoubtedly be recognised.

5. **The Hebrew Monarchy.**—During the next few centuries sweeping movements changed the face of the land. Hittite and Amorite elements gravitated southwards, and Ezekiel (xvi. 3) calls Jerusalem the offspring of an Amorite and a Hittite. New states came into being, and the Hebrew monarchy arose (*c.* 1025 B.C.) in a national movement which overcame the recently settled Philistine and other Levantine invaders (*see* JEWS, § 5, *seq.*; PALESTINE, § 4, *seq.*; PHILISTINES). Yahweh has now become "the god of the Hebrews" (*cf.* the designation, Ex. iii. 18, etc.), and the people of Israel are his people. Archaeology and the monuments indicate continued intercommunication over a wide area; and the changes since the Amarna Age are not so extensive as might be expected. But from Sam'al (Zenjirli) in extreme north Syria to Jerusalem and Moab we find an alphabetic script (*see* ALPHABET) with almost identical forms, and an almost identical language (Hebrew, Phoenician, Moabite) with a very similar type of thought. This "North Semitic" alphabet is beginning (*c.* 700 B.C.) to develop along separate paths (Hebrew, etc., and Aramaean), and the Aramaic language in use in North Syria is extending, and is destined to be the *Lingua franca* of the Persian empire. Hence there would seem to have been some great *bloc*—Amorite? Hebrew?—of interrelated states from Sam'al (the name itself means "north") downwards, and to this the traditions of the far reaching sway of David and Solomon (*qq.v.*) might conceivably refer.

In Sam'al the dynasts have non-Semitic names, but the gods include Hadad, El ("god" *par excellence*) and Resheph. In

Hamath are sun and moon deities, and gods of heaven and earth. The Baal of Heaven or Sky-god, found at Hamath and Tyre, and known earlier to Hittites and Amorites, was presumably Addu (Hadad) who, with his Aramaean equal, Ramman, is found in Hadad-rimmon, where excavation at Beth-shan has illustrated the fusion and persistence of Egyptian, Aegean and northern influences. Yahweh of Israel, Chemosh of Moab and Milkom of Ammon are three parallel gods of three closely interrelated peoples, but the name Hadad appears in the dynasties further removed—in Damascus and Edom. It is only to be expected that the Israelite Yahweh took over some of the attributes of the earlier gods, and the name Addu appears in the 10th century in Adoram, the name of a prince of Hamath otherwise called Joram, and of one of Solomon's officers (also spelt Hadoram) otherwise called Adoniram, where Addu interchanges respectively with Yo (Yau, Yahweh) and Adon (as in Adonijah, etc.). Moreover, Yau (Yahweh) may probably be traced in the 8th century names Yaubi'di of Hamath and Azriyan of Yaudi. National and religious movements were one, and when Pharaohs spread the name and cult of their god, and Sargon II. sent skilled men to teach "the fear of god and the king" (Cyl. Inscr. 72–74), successful kings of Palestine would not be behind.

Under the famous Omri dynasty (*c.* 887–841 B.C.) Ahab of (north) Israel was related by marriage to the Sidonian priest-king of Astarte; and was an important constituent of an alliance led by Hamath and Damascus against Assyria. Although Ahab recognised Yahweh, and his family bear the distinctive names Aha*ziah*, *Jeho*ram and Atha*liah*, the age is one of (1) Elijah's firm stand for Yahweh against Baal, (2) separation from the northern alliance and (3) dynastic changes in the course of a revolt in which desert influence can be traced. The middle of the 9th century B.C. is, in fact, another great landmark in the history of Hebrew religion, though it is difficult to determine precisely the changes. (*See* ELIJAH, JEWS.)

6. **The Rise of the Prophets.**—The dynasty of Jehu perished, after a stormy century (*c.* 841–745 B.C.). About 25 years later the northern kingdom fell, and the kingdom of Judah came face to face with Assyria (*see* JEWS, § 8, *sqq.*, PALESTINE, § 7, *seq*.). With this, the Assyrian age, a line of prophets arose, and transformed the old Hebrew religion, giving it its specific Israelite form (*see* PROPHET). To be more accurate, on the ordinary view of the O.T. they merely restated the religion introduced by Moses now many centuries previously, whereas modern critical opinion would hold that they "for the first time unfolded the true character of Yahweh, implicit in the old Mosaic religion." Opinion, however, would differ on how far the old religion could be recovered, or could be inferred from an analysis of the religion after the prophets; and the view here taken is that the prophets are a surer guide than the compiled accounts of the pre-prophetic period.

What the prophets condemn is not the absence of religion, but its quality—the ineffectiveness of the sacrificial and other offerings, the festivals and the priests. Amos proclaims that Yahweh was a universal god of unchangeable righteousness, unfettered by any natural bond between himself and his own people. He attacks the old type of group religion where the god was an integral part of the local or national body, furthering the interests of worshippers who possessed the machinery for gaining his favour or placating his wrath. Such group religion was intensive and cohesive; but although it involved a certain degree of morality within the group, it fostered unethical conceptions of the relation between gods and men.

In the days of Amos and Hosea (*qq.v.*) Israel had entered into world-history. Almost overwhelmed by its former ally Damascus, it had been brilliantly restored by Jeroboam II. These were no mere inter-state rivalries; the great powers of Assyria and of Urartu (Ararat, Armenia) themselves had been behind these vicissitudes. Yahweh's relation to Israel was that of Chemosh to Moab (Judg. xi. 24), and Chemosh had aroused Mesha (as he records on the Moabite Stone) (*c.* 850 B.C.) to recover lost territory; but Israel had now seen Yahweh moving history on behalf of his own people. It remained a characteristic conviction, and some prophets are more nationalistic than others. Amos, however, shifted the emphasis from Israel's god who had restored his people to a universal God whose relation to all peoples alike was based on an eternal moral law, and who required a higher standard of life from an Israel who claimed to stand in a unique relationship to him (Am. iii. 2). The prophets taught that Yahweh was behind history; Egypt, Assyria and Babylonia were tools in his hand—but no more than tools, and must not boast, for Yahweh who threatens Israel, or punishes her by defeat or exile, continued to be the god who sought his own people (*cf.* later Paul in Rom. xi.). The prophets extended the group-conception; Yahweh was the god not merely of the visible or acknowledged body of Israel, but of the poor and needy, and of all who served him and sought his help. The old group-unit of *group+god* was to depend, not upon the nature of the group, but upon what Yahweh demanded of the group that claimed to be his

7. **The Old Religion.**—The prophets treat the cult as secondary, as an accretion (Am. v. 25, Jer. vii. 22). It is saturated with crude ideas and immoral practices that disintegrate society (*cf.* HIGH PLACE). Hebrew religion was anthropomorphic and passionate. Men fed the god, ate with him and saw his face (Hezekiah lays a letter before him, Is. xxxvii. 14). It was necessarily practical, for men depended upon trade (note the naive ideas in Deut. xxviii. 12. 44) and upon the fertility of man, beast and the field. No goddess is openly associated with Yahweh, though female deities abounded, and the numerous plaques of the mother-goddess, models of heads of bulls, and phallic objects unearthed by excavation, illustrate elemental ideas of growth and increase, and supplement the prophet's condemnation of impure rites. Although the old religion included elevated ideas, it involved beliefs in the interconnection of men and nature and it did not exclude the licentious practices (condemned, *e.g.*, by Hosea) which were evidently more than mere immorality. It was a persistent conviction that nature shared man's distress and that man's behaviour might react upon nature. The sensuous and sensual elements in religion proved almost ineradicable; and the fact remains that Hosea (second half of 8th cent. B.C.) in attacking the impure cults, clearly a recognized part of the ordinary religion; has to teach, as though for the first time, that Yahweh, and not the local, or functional, Baals, gave nature's blessings and provided for man's most vital needs.

8. **Jerusalem and the Monarchy.**—The sanctuaries (Bethel, Gilgal, Shechem, etc.) have a bad reputation; Jerusalem was no better. Its religious history is pre-Israelite, and nearby, at Ed-Dra' in Moab, traces have been found of an ancient sacred locality, perhaps a place of pilgrimage, dating back to the Hyksos age. With Anathoth (the Anaths), Nob (Nebo), Tophet and the valley of Hinnom (Gehenna), Jerusalem with its sacred Mount Zion was a religious centre of unknown origin. The temple, the abode of the god and part of the royal buildings, with the pillars Jachin and Boaz, the horses of the sun and the sacred chariot, the cherubim and other belongings, the orgiastic festivals and extravagant sacrifices, was far from being the home of the spiritual religion which the reforming prophets called for, and the reforms of Josiah (*q.v.*) and the allusions of Jeremiah and Ezekiel, show to what slight extent the religious conditions were improved.

Jerusalem was the centre of the monarchical idea. Abdi-Khiba received his legitimation—and perhaps, like another vassal, the anointing oil—from his suzerain in Egypt. Later, the David dynasty has taken root. The royal throne was the throne of Yahweh upon which sat his "anointed" (*māshī'ah*) the representative and embodiment of Yahweh's people (*cf.* 1 Chron. xxix. 23, 2 Chron. lx. 8, etc.). The king, the "lamp" of the people (2 Sam. xxi. 17, *cf.* the "coal" in 2 Sam. xiv. 7) takes a prominent part in the national religion; divinely guided, he carries out the Divine Law (*cf.* Prov. xvi. 10–15); and is responsible for the national welfare. A recollection of priestly kings is preserved in the tradition of Melchizedek (*q.v.*), and of human sacrifice to the king-god in the worship of Moloch (*q.v.*). Traces of a divine kingship may be recognised in the Messiah (*q.v.*), especially as a superhuman being who shall bring peace and plenty. Sovereignty

rests in the people of Israel; so (later) in Deuteronomy; or, as in post-exilic times, the high priest has all the powers and responsibilities of the king of old. The tendency to subordinate the king more deliberately to Yahweh (who appoints him through a prophet) or to the priest (so in Ezekiel's programme) reflects later developments. Characteristic of "biblical" religion is the endeavour to safeguard the supremacy of Yahweh who would have no other gods before him, no intermediary (like the god Marduk in Assyria), no ruler who would set himself upon an equality with the Most High (Is. xiv. 13 *seq.*). Kingship and Yahwism are, none the less, intertwined. The prophet Isaiah, who emphasizes the sterner aspects of Yahweh, develops the idea of Divine Sovereignty; but against the usual arbitrariness of ancient Oriental monarchy is directed the doctrine that "Yahweh is not a man to be capricious" (Num. xxiii. 19). And while, on the one hand, Yahweh's absolute freedom of choice is secured: "I shall be—just what I shall be" (Ex. iii. 14), prophetic teaching centres upon Yahweh's absolute righteousness, and his apparent arbitrariness is due, not to his mood, but to his "righteousness"; Israel's conduct inevitably bringing consequences which, whether beneficial or disastrous are "right." As is only to be expected, the very arbitrariness of the Hebrew autocrat, the representative and vicegerent of his god, brought the problem of Yahweh's character and his treatment of his people.

There are solar, lunar and nature traits in Yahwism explicable in view of the earlier religion in Palestine, and the way in which it had to satisfy elemental needs. The calf-cults (*see* AARON; CALF, THE GOLDEN; JEROBOAM) associate themselves with the old Hadad, and Yahweh as a war-god (*e.g.*, Ex. xv. 3) goes back to the earlier warrior Baal. The human sacrifices and licentious cults which the prophets denounce, the fierceness of Levitical reformers and the barbarities of warfare reflect an intensely emotional religion, characteristic of ancient Oriental peoples, and account for the god fiercely "jealous" of a rival and "zealous" for his people (Ex. xx. 5, Zech. i. 14). Passionate as preachers of a new faith like the prophets, or as priests upholding the holiness of Yahweh, or as kings spreading the kingdom of their god, the Hebrews are distinguished by an intense self-consciousness and confidence which, striking enough in the later stages of the religion, would not be less so before the ethical teaching of the prophets had begun to take effect.

9. **Uniqueness of the Prophets.**—Amos is the first of the "written prophets" and although he and his successors are pre-eminent for their powerful theistic idealism, they are not wholly isolated. "The Hebrew, whether prophet, psalmist or sage, was a thorough-going partisan, identifying himself with his circle, and identifying his interests with the eternal order" (C. C. Toy, *Comment on Proverbs*, p. 27). Israel felt herself to be an essential part of the course of history, and the prophets felt that their deepest personal experiences (*cf.* notably Hosea's tragic marriage) had a universal meaning. But whereas the group and god were united in the social group-unit; the individual prophet found in his consciousness of God eternal principles that must work themselves out in the history of individuals and nations. Conscious of an eternal order he, like the group (tribe or nation) felt himself one with past history and future destiny, and he embodied within himself the people for whom he spake as surely as did the representative of the dynasty (or, later of the priesthood), or the individual member of a corporate Israel.

The great prophets mark, however, an immense advance in ideas of God, Man and the Universe. They attacked an old "undifferentiated" type of thought where there was no clearly drawn distinction between man and "nature" (a relatively modern term) between what is ceremonial or ritual and what is ethical. The step they took corresponds to that from the old Aryan Varuna, the guardian of cosmic (social and natural) order, to the specifically Zoroastrian ethical order, which is under the care of the ethical god Ahura-mazda. The date of Zoroaster (*q.v.*) is disputed, but the rise of Amos and his successors may be associated with the prominence, not only of Assyria and its god Asshur, but also of Urartu (Armenia), and with the imminent rise of the Medes, the forerunner of the Persians. Hebrew religion thus reached another definite stage, and the dawn of authentic prophecy is part of widespread movements as truly as are the Amarna Age of the now distant past, and the better known complex of events in the Persian age (*cf.* § 14).

10. **Jeremiah and Ezekiel.**—If Christianity has always found it easy and natural to pass from the prophets of Israel to its own rise, it is because pregnant ideas do not advance continuously, and many centuries had to pass before there again dawned an age as creative as that of the 8th and 7th century B.C. The first four prophets (Amos, Hosea, Isaiah and Micah) belong to the decline and fall of the northern kingdom and the extension of Assyrian power as far as Judah and the gates of Egypt (*see* JEWS). A century later Judah entered upon its decline and the prophets Jeremiah and Ezekiel form another landmark. How far the books named after them represent schools or tendencies is uncertain; at all events their enunciation of individual responsibility belongs to a day when religious and social organization was rapidly breaking up, and with it the old corporate responsibility of communal life. Jerusalem and the Temple were shortly to be destroyed by the Babylonians (586 B.C.) and religion stripped of its national limitations. Jeremiah is characterized by his indifference to city, temple and cult; Jews in exile could be both loyal to their new home and worshippers of Yahweh (ch. xxix.). Jeremiah hardly anticipated a restoration of the old regime, and Ezekiel is distinctly catastrophic in his expectations of ruin before restoration. But while Jeremiah looks for the New Covenant which Yahweh would write upon men's hearts, Ezekiel demands a purer priesthood (viz., Zadokites of Jerusalem), and these shall safeguard the "holiness" of Yahweh which priests and people had defiled. Yet with all their threats and denunciations the prophets are *Israelite*, in the widest sense: Yahweh, whose mouthpiece they were, could not for ever forsake the people whom they represented.

In obscure circumstances the 6th century B.C., which began with the decline and fall of Jerusalem (586 B.C.) and the exile, closed with the rebuilding of the temple (516 B.C.) and high hopes of a new era under the Davidic Zerubbabel. After another obscure interval Zerubbabel has disappeared and a priestly regime is in control. In the work of Nehemiah (who was probably of royal ancestry) and the priest and scribe, Ezra, the step is taken which may be said to inaugurate post-exilic Judaism (Neh. viii. *sqq.*; 445 B.C.). The old land had been broken up, the disorganization seemed complete, but disintegration gives place to reintegration, a new national consciousness and a new corporate responsibility. The study of the changes from the old monarchies of Israel and Judah to the establishment of what is virtually the Church of Israel at Jerusalem continues to absorb scholars, so vital are the problems. It is, however, generally agreed that the Pentateuch *in its present form* is post-exilic; it is not, as on the traditional view, a Mosaic work of pre-monarchical origin which has been re-introduced. In any event, it is very remarkable that, notwithstanding the immense political and social changes arising out of the Assyrian conquests, and after the fall of Assyria (612 B.C.), a certain continuity can be traced; and the individualism of an age of disintegration is followed by a rebirth or reorganization of Yahwism, amid the decay or death of the surrounding powers. (*See* JEWS, § 13 *sqq.*; PALESTINE, § 10.)

11. **Desert Influences.**—The Israelites who invaded Palestine under Joshua now many centuries ago intermarried with the native population and learnt their ways (*cf.* Judg. iii. 5 *sq.*). In fact the religion which the prophets denounce is Palestinian rather than of desert origin; and it was so inveterate that it is difficult to determine how much of the Pentateuchal legislation was brought in by the immigrants. The sacrificial ritual, for example, can be compared with both Phoenician and Babylonian usage. But movements of semi-Edomitic and other clans from the desert were far from exceptional, and they can be traced or suspected (a) in Elijah's day, (b) after the fall of Samaria, and (c) after the fall of Jerusalem. But whereas desert clans would succumb to the old civilization of Palestine ("Jeshurun waxed fat and kicked" Deut. xxxii. 15), biblical history concentrates upon the Mosaic age, the Covenant at Sinai (Horeb) and the

Invasion, although the several traditions in question belong—though to what extent is disputed—to late monarchical, exilic and post-exilic periods. Moreover, there are even some traces of hostility towards the desert clans. None the less, Israel feels that its inspiration came from outside a land of effete culture, and the entrance of the "children of Israel" (Exodus–Joshua) into the land wherein the "patriarchs" had once actually settled down (Genesis) looks like a fusion of two absolutely distinct groups of tradition. Moreover analysis of the composite narratives reveals various traditions of South Palestinian origin and interest, likely to belong to clans who ultimately became part of a united Israel. They naturally belong to a time when such clans were able to leave their imprint upon the growth of the Old Testament, and, to the present writer, they appear to belong to the age, after the great prophets. That is to say, the desert influences which admit of being traced appear to belong to relatively late rather than to early movements.

12. **The Sixth Century B.C.**—The popular narratives (Genesis-Samuel), which describe early conditions in Palestine are commonly dated by scholars to an age before the prophets, and are commonly used as material for modern descriptions of pre-Mosaic, pre-monarchic and pre-prophetic religion. On the other hand, they do not seem to reflect the religious conditions which the prophets denounced; they represent popular religious traditions, not *before*, but *after* the reforms. The local sanctuaries are regarded leniently, and the religion, as practical as ever with its agricultural festivals (*see* however PASSOVER), appears to have been purged of all nature worship. The religious life of the Israelite is bound up with a canonical history of a Chosen People, sons of Abraham, fugitives from Egypt. In striking contrast to royal inscriptions and the didactic and other compositions of the ancient east, there is a view of history which is of unique interest for its democratic spirit The history of Israel is that of every Israelite and his responsibility for the covenant between Yahweh and his fathers. The Jeremian doctrine of individual responsibility and the teaching of a new covenant relation between Yahweh and the individual—these and other leading ideas appear to have been translated into the story of a united Israel.

The view here maintained, that the popular history is approximately of about the sixth century B C, finds confirmation in Deuteronomy (*q.v.*). This book, which had an independent literary history before it became part of the Pentateuch, is distinguished by its appeal to men of Israel to secure the well-being of the community. Israel has come of age. There is a law, but it is within everyone's reach; and self-conscious covenanters decisively separating themselves from pagan neighbours are united to Yahweh who, while allotting objects of worship to other peoples, is himself Israel's God (*cf.* Deut xii. 8, xiii. 6 *sqq*, xxvi. 16–19, xxx. 14). Apostasy and idolatry are to be mercilessly burnt out; religion and reward are organized, and upon the purity of the religion will depend nature's blessings and all prosperity. Whereas the earlier prophets condemn an errant nation and inculcate new ideas of Divine Holiness and Righteousness, Jeremiah, Ezekiel and Deuteronomy look forward, and a new reorganization is in process. In the archaic ideas of the Pentateuchal legislation is reflected a primitive stage of society, rather than a society with a long and continuous history behind it. There are signs of the inauguration of new conditions: in land laws (*cf.* Lev. xxv. 10), and in Ezekiel's curious, impracticable scheme for the division of the tribes (Ez. xlviii.). Hence, while the Pentateuch has always seemed to point naturally to the beginning of Israelite religion, all the weight of evidence appears to be against dating it in or about the Amarna Age, and in favour of the age at and after the collapse of the old Hebrew kingdoms, when new social and religious conditions were inaugurated, and led up to post-exilic Judaism.

13. **The New Jerusalem.**—The composite sources of the Pentateuch, when analysed, reflect some very important developments. Deuteronomy crystallising the work of the prophets, emphasizes Yahweh's disciplinary love for Israel and inculcates communal benevolence and humanity, to the poor and needy, and also to the *ger* or "client" (*not* "stranger"). Its passionate hatred of false worship becomes concrete in the "Deuteronomic" history of Joshua's wars of conquest and extermination. But while the actual invasion and settlement of Israel seem to have been a more gradual process (Judges i.), the fanaticism which blazed forth in the fierce Maccabaean struggles (§ 20) may well have manifested itself earlier, *e g.*, after the fall of Jerusalem, when the land was exposed to invaders from the desert (*cf.* Ez. xi 15, xxxiii. 24, xxxvi. 2–5, etc). Moreover an Israel, a holy nation and a kingdom of priests (Ez xix. 6), would need legitimate representatives. Yahweh's "holiness" must be preserved, and there is a transition from the prophet's ideas of spiritual and ethical holiness to the more ceremonial and ritual holiness of the later parts of the Pentateuch. A "nation of prophets" (Num. xi 29) is too vague an aspiration, for "prophecy" is in itself a dubious phenomenon, as was frequently recognized. Yahweh's breath or spirit does not rest on all alike and in the story of Eldad and Medad, although 70 of the people's elders receive the spirit *temporarily* while in the Holy Tent, these two who remained behind but "prophesied" none the less, were—as a cautious interpolator explains—already on the register (v. 26). Again the Deutero-Isaiah (of the VIth century) views the return of exiles as a new Exodus and in the new reorganization of the people the old traditions of an entry into a "promised land" would naturally have a new value So, the story of the Wanderings in the Wilderness is that of the disciplining of a people even the leaders Moses and Aaron cannot offend the "holiness" of Yahweh with impunity (Num. xx 12) This absolute supremacy of Deity is characteristic of the heights of the religion (*cf* Jeremiah's impassioned cry, xx. 7): Yahweh surpassed all that his most privileged prophets or priests might claim as his message or perform on his behalf Yahweh was unfathomable—but he was Israel's own God (*see* § 14).

From an analysis of Deuteronomy and "Deuteronomic" literature it would seem that the prominence of Jerusalem is not an original feature of our narratives A reforming movement which probably began in (north) Israel, in Samaria, and perhaps at the ancient sanctuary of Shechem with its "covenant god" (El-Berith), becomes specifically Judaean, and the latest literature is hostile towards the brother people of the north. But foreign and pagan though the population of Samaria may have been, Jeremiah and Ezekiel regard it not without sympathy; both north and south are Yahweh's, and Ephraim is his first-born (Jer. xxxi. 9). The book of Deuteronomy in its earlier form is probably northern, of exilic date, and represents a Pan-Israelite standpoint (with R. H Kennett). It is possible that the restoration of Judah and the Messianic zeal of Zerubbabel (520–516 B C.), led to plans for the restoration of a Davidic empire with the inclusion of an unwilling Samaria. At all events, in the time of Nehemiah and Ezra—such is the natural order—Judah is desolate, surrounded by jealous neighbours, and the bitter divorce of Judah and Samaria implies an earlier period of close union. The importance which the temple and ritual of Jerusalem gain in the later literature stands in contrast to the indifference of the earlier great reforming prophets to the cultus. So, the history tells how the place which Yahweh shall choose—perhaps originally Shechem—proved to be Jerusalem, how David the head of its dynasty was preferred to the faithless Saul (contrast the praise in 2 Sam. 1), and how depraved priesthoods were ultimately supplanted by Zadok, the first priest of the temple built by David's son Solomon.

Thus, the old Hebrew religion was freed from earlier national limitations by the spiritual prophets. The way was prepared for a religion founded upon a common tradition. The old Israel (in the wide sense) became a Judaean Israel based on Jerusalem, the north was rejected, and the true Israelite tribes of the north are supposed to be carried away centuries earlier. The history is artificially handled, with the result that Judah, the survivor of the true Israel, goes into exile, and Judah returns to a heathen land and restores the religion of which it had been the guardian. Jerusalem accordingly becomes the only centre of the only true religion, which was not to be found elsewhere (*cf.* the standpoint, 2 Chron. xiii. 8 *seq.* xxv. 7); and the old religion is thus transformed—under influences and circumstances which have been

concealed and forgotten—until the religion in its post-exilic form was believed to be that of the Mosaic age And in days to come the religion of the late pre-Christian age was dated even from the pre-Mosaic period (*see* JUBILEES, BK. OF; TESTAMENTS OF THE TWELVE PATRIARCHS). One is tempted to speak of the transition from the prophets to the priestly post-exilic religion as a retrogression. But Zoroastrianism, too, with its fine ethical universalism was followed by a priestly organization, and in the words of Israel Abrahams, "ritual may be machinery for applying principle; Law the means of making simple prophetic ideas work in the complex life of society" (in Peake, *People and Book,* p. 407).

14. **The Servant of Yahweh.**—These changes of epoch-making importance for the history of religion can be only imperfectly and hypothetically reconstructed, and in them a place must be found for the superb idealism of Is. xl. *seq.* and the "Servant of Yahweh." Hebrew monotheism here reaches its height, and the doctrine of Yahweh's absolute sovereignty is nowhere else so impressively and decisively set forth. There is no return to some past monotheism, for monotheising tendencies are to be estimated by their content and efficiency From various writings (*e.g.,* Jeremiah, Habakkuk, Zephaniah, Is. xl *seq.*, etc), it can be seen that serious minds were utterly overwhelmed by the changing conditions in and about the sixth century. To this period (approximately) belong both blank scepticism—Yahweh may be safely ignored (Zeph i. 12) and the crudest cults even of a totemistic character (Robertson Smith, *Religion of the Semites,* p. 628 *seq*) When the "scheme of things" had been shattered and the disintegration of life and thought allowed room for new combinations of a higher and lower type, the conviction of Yahweh's supremacy over and immediate intervention in the world received new strength It was not that—as in India—the world was illusion (*maya*), for the Semites were characteristically "this worldly"; but God was so real and immediate that the Israelite saw through the world unto his God He would repudiate the Indian formula "that art thou"—*tat tvam asi*—the ultimate identity of man, God and the world; but would view the world as, so to speak, the sea that both severs man from and unites him to God. So, a writer (or it may be a school) in a series of passages of unequalled force passes from the unique monotheistic teaching of Israel's God to the unique destiny of His people Israel A "servant" had been anticipated, as the deliverer of an oppressed people; "*the* servant" had come and passed unrecognized, indeed rejected—not without apparent reason. New convictions arose of the efficacy of sacrifice and of Israel's function in history as a "servant" of an Israel within an Israel, and of an Israel as a light to the world The interpretation of the biblical passages is, it is true, keenly disputed (*see* ISAIAH); but there is no doubt that the religious idealism of Israel here attained its zenith; a new era, it was felt, had been inaugurated; and the Deutero-Isaiah takes its proper place along with epoch-making religious events elsewhere—China (Lao-tse and Confucius), India (Mahavira and Buddha), Greece (Orphism, etc.); *see* G F. Moore, *Hist. of Religions,* i. p. viii. *seq.*

So penetrating is the thought of the Deutero-Isaiah in its significance for Semitic self-consciousness and energy that all earlier conceptions of the special relation between Yahweh and Israel (*e g.,* Am. iii. 2), here reach their climax. Israel felt herself called for high office, and this required a preparatory purgation (*cf.* the call of Isaiah, Ch. vi ; also Jer. xv. 19). The "servant" who bore the penalty of Israel's sins becomes an Israel, neither a "prophet" nor a "priest" people, but the sacrificial victim for the world. So naturally does the idea of the Servant lead on to the age when Jesus of Nazareth brought new conceptions of God and Man that it is only to be expected that some fateful events lie behind Is. xl.–lvi. But whereas later a Jewish sect had to cut itself off from Judaism in order to live, here Jewish history has thrown a veil over vicissitudes which must have had the profoundest influence—the fact that the chapters are preserved is itself significant—and the events and the leading figures in them have passed into oblivion.

15. **Post-Exilic Religion.**—Israel's kindred, Edom, Moab and Ammon, like the great surrounding empires, fell in their day; even the Samaritans gradually ceased to enter into history. But Hebrew religion survived as Judaism. The "spirit of Yahweh" had breathed into the dead bones (Ez. xxxvii.), there had been another stage in evolution, and the new organism retains much that is old, though in a new form. For example, the old rite of CIRCUMCISION (*q.v.*) becomes exceptionally valuable, not as that of entry into the privileges of the social group, but as the participation, even of the young babe, in the covenant relation between Yahweh and Israel. The efforts of the prophets for a "spiritual" circumcision (*e.g.,* as a means of loving Yahweh, Deut. xxx. 6) were not lost, nor were the spiritual and ethical meanings they gave to ideas of righteousness and holiness forgotton The EPHOD (*q.v.*), formerly denounced as idolatrous, becomes legitimate when confined to the legitimate priesthood. "Indeed, some of the priestly rites embody superstitious ideas of extremest antiquity, and are strangely pagan in their very form and enactment, yet out of all the heathen sting is removed through their adoption and promulgation by Yahweh" (Montefiore, *Rel. of the Ancient Hebrews,* p. 322).

Political aggrandisement is renounced: a last effort is charged against Nehemiah (vi. 6 *sq.*); but the High Priest has more than the glories of the old monarchy, and in the performance of his priestly office evoked scarcely less enthusiasm (Ecclus. L.). Yahweh lives in the very centre of Israel, amid the most meticulous ritual. The gulf between Yahweh and man is not ethical or spiritual (*cf.* Is. lvii. 15), but ceremonial; and the ideas of "sin," too, are prevailingly material and ritualistic. The past crises had manifested the utter dependence of Israel upon an omnipotent Yahweh and the necessity of safeguarding his holiness. Hence "sin" and the need for *Atonement* (*q v*) are more conspicuous than before; and upon the Temple depend the ordinary needs of life. In the place of the "democratic" covenant between Yahweh and Israel and its material effects as in Deuteronomy (*e.g.,* ch. xxviii.), the crops depend upon the temple-service (*cf.,* Hag. i. 9, Mal. iii. 10, Zech. xiv. 17), and are endangered by a faithless priesthood (Mal. ii 3) It was an old belief in a new dress, Israel's conviction of her meaning for the world fluctuated between a Prophet-people possessing the Truth and a Priest-people that controlled the Rites—a "suffering servant" was an alien conception. The enhanced supremacy of Yahweh exalted his people Israel and the officiating priesthood, and it is easy both to imagine what Hebrew religion was before the prophets gave it new form, and to understand how Rabbinical Judaism was convinced of the real benefits accruing to the world through Israel and her merits.

16. **Universalism.**—The Jews were only a small part of the mighty Persian empire which with a *lingua franca* (Aramaic), a well-organized and international administration, and the possession of the lofty ethical god of heaven, Ahura-Mazda, favoured an at least external unification of religion. The Persian kings treated other religions with tolerance and, for a century at all events, the Jews seem to have been especially favoured. But while the Jews found much in ethical Zoroastrianism to appreciate, there was the danger that in this cosmopolitan empire their Yahweh would be placed on a level with the pre-eminent gods of other peoples. To identify Yahweh with Ahura-Mazda might be easy; but the more the name of Yahweh was extended beyond the limits of Israel—to become "great among the nations" (Mal. i. 11), the graver the risk of weakening the uniquely intimate bond beyond Yahweh and Israel. Universalism had its dangers. Moreover, while the later prophets extol the future glory of Jerusalem, the resort of pilgrims and tribute-bearers, this extension of Yahwism was a sort of religious imperialism. Was the world ruled by Yahweh alone or through his vicegerents at Jerusalem? That Israel had a mission, she was convinced; but was she to carry the light among the nations, were the nations to see in her stirring history the principles of Divine Governance, or was Jerusalem to be the centre of tribute-bearing worshippers of Yahweh?

It is as a universal history that the Pentateuch opens, gradually narrowing its scope until the history of the Chosen People

begins with the choice of Abraham. The Pentateuch, which assumed its present form during the Persian period, was the charter of Judaism, preserving the scattered Jews and giving them solidarity against attack. It was at once their pride and their gospel. But, including as it does both the priestly source, P, and the earlier and more popular J and E (*see* BIBLE: *O.T. Crit.*), it is a compromise, and that a compromise should ever have been determined is of outstanding interest, though what events lie behind it are unknown. Although the Pentateuch consequently covered a wide range of interest, it never precluded the further development of tradition and myth. Archaeological and other evidence testifies to the persistence of magic and superstition, and to the profound difference between the Pentateuch, and all it stood for, and the social religious conditions amid which the Jews lived. When the sage could declare that "the name of Yahweh was a strong tower" (Prov. xviii. 10), the use of the Holy Name for magical purposes by other classes of society is entirely intelligible; and while simple piety, as in the Psalms, knew how readily the troubled soul could call upon Yahweh's name, priestly religion surrounded Yahweh with a *cordon* of priests, and the utterance of the Name was avoided. Divine Transcendence characterises post-exilic religion, but Yahweh was completely *in* as well as completely *over* the world; and one of the problems of Yahwism was to keep between the extremes of an esoteric cult exclusively in priestly hands and a universalism which tended to deprive the Jew of all that made Yahweh his own God, and Israel his "peculiar treasure" (Mal iii 17).

17. **Intermediaries.**—Persian idealism is characteristically ethical and rational, and incompatible with Jewish theism; and when Artaxerxes II. (404–359 B.C.) officially recognized the cult of Anahita an old goddess of the Astarte-Ishtar type, and of Mithra, the mediating solar god (*cf.*, Mitra above, 4), his deference to popular religion would repel orthodox Judaism It was, in any event, difficult to uphold a strictly monotheistic doctrine of Yahweh's supremacy, and even a Psalmist could praise Yahweh as greatest among other gods (Ps. lxxxvix. 6). Earlier, the angel or messenger of Yahweh was partly a temporary self-manifestation of Yahweh and partly an independent being (Ex xxiii. 21, Judg. vi. 13–22, etc.), and whatever the sacred "Presence" (lit. "face" Is. lxiii. 9) and "Name" (Is. xlviii. 9, etc.), may have meant, in Phoenician the goddesses, Tanit and Astarte are respectively styled Baal's "face" and "name." Various mediating terms come into use, *e g.*, "Holy Spirit" (*see* esp. Is. lxiii. 10 *sq.*), and the Rabbinic Memrā (Logos), Shekhinah, etc., but the popular tendency was to regard them as independent entities. So also the Zoroastrian Amesha-Spentas, the attributes, phases or qualities of Ahura-Mazda came to have independent existence.

Numerous angels and demons are met with in the Palestine of the Persian and Greek periods. They are usually ascribed to Persian influence, but the polytheism and demonism of ancient Babylonia and the figurines, amulets, etc., unearthed in Palestine show that these post-exilic beings, who are embodiments or causes of good and evil, etc., are the descendants of the Baals, demons, satyrs and other beings of the older times. To the Persian conception of tutelary beings, presiding *genii*, there are parallels in O.T. and later literature; and Michael (*q.v.*) the patron angel and champion of Israel, with whose fortunes Israel is bound up (Dan. x. 13, 20), goes back to archaic ideas. The fate of a tribe or people might depend upon the safety of the image of its god, or its king might be an effective and responsible representative. Yahweh himself appears as Israel's *go'el* or champion (in the Deutero-Isaiah), that he could not be at once the god of Israel alone and also god of all nations. On the other hand, Michael is the more anthropomorphic genius of Israel, a more national figure than the Persian Mithra, the contemporary universal all-seeing god of light and conqueror of evil. Later, in the Apocalypse of St. John, which preserves a number of old Hebraic elements, Michael fights against the dragon Satan, thus taking over the conflict which was otherwise waged by Marduk god of light in Babylonia, by Yahweh (Is. li. 9) and by Ahura-Mazda. *See* SATAN.

Ideas of conflict between light and darkness and good and evil were further developed. The more nearly Yahweh was brought into the world the more distressing became the problem of evil. That God might send misfortune (*ra'*) as well as what was good (*tōb*) was admitted; but when ethical ideas became more explicit, how could God be responsible for what offended ethical conscience? Already some old religious usages were a stumbling block, and human sacrifice, it had been said, either had never been ordained by Yahweh (Jer vii. 31, xix. 5), or was a just penalty (*cf.* Ez. xx. 25; Ps. lxxxi. 12). Averse from speculation, the Jew found answer to all his tormenting questions in God. Job (*q.v.*) comes to learn that though the God who was so vindictively tormenting him was the God of the Universe, he could escape from the one to the other. Even if God cannot deliver man, yet He and not Nebuchadrezzar's image is the object of worship (Dan. iii. 18); and though He should fail to relieve man's needs, yet in the past He had shown His might, and Israel would still "rejoice in Yahweh, and joy in the God of his Salvation" (Hab. iii). Here too was the solution of the problem of life after death. The prophets had attacked certain mourning-customs, resort to the dead and other practices, probably bound up with ancestor-cults, traces of which continue to persist The archaeological evidence also shows that death was not believed to be the end of man's existence, though it cannot be definitely asserted that Egyptian influence in Palestine had introduced the Egyptian ideas of another life The name of the dead could be kept alive by being "mentioned" and Yahweh had a "book of the living" (Ex. xxxii. 32 *seq* ; Ps lxix. 28). But the older belief that a man's life was inextricably part of the more permanent life of the family or national group explains the care taken to preserve the group This belief becomes more explicitly theistic when the emphasis is laid solely upon the relationship between the individual and Yahweh; and in the knowledge of this man neither fears nor speculates (*cf* Ps. xxiii 4, lxxiii. 25).

18. **Wisdom.**—On the one side an internationalism wherein differences in religion could be reconciled or ignored, and, on the other, the conviction that God was a transcendent being, behind all things, led to the transition from theism to deism, and characteristic of the age of Greek influence is the so-called Wisdom Literature Where the devotee found a single Divine Being, the sage found a single Law ruling all life, and this "wisdom" (*Hokmah*) itself becomes the centre of speculation It is something almost mythological, self-existent; "got" by Yahweh before the creation of the world; the guide of rulers and the controller of morality and intelligence (Prov. viii.). It is the world-plan, causing things to be what they are; and Ben Sira (Ecclus xxiv.) identifies it with the Jewish Law or Torah (*i.e.*, "direction"). The sages agree with the prophets that conduct is better than ritual. Morality pays, and the obvious offences (*e g.*, adultery) bring obvious penalties. It is better to be poor than to be rich by illgotten gains, and pity for the poor brings a divine reward (Prov. xix. 17). Yahweh's blessings enrich a man (x. 22), and he treats men as they treat him (iii. 34). He is not to be blamed for the consequences of one's own folly (xix. 3); and no one can be harmed by an undeserved curse (*cf.* xxvi. 2). In the place of the inner life of the PSALMS (*q.v.*), the sages recommend prudence and sagacity; and the instructive and typical differences between personal piety and a moral philosophy find parallels outside Palestine, as far afield as the land of Lao-tse and Confucius. *See* further WISDOM (BOOK OF) and WISDOM LITERATURE.

19. **Apocalypse.**—An eternal world-order could be in the care of a righteous God (or the prophets), or it could be a moral order (so the sages); but it might also be viewed by the sceptic pessimistically as a pre-determined scheme from which there was no escape (*cf.* ECCLESIASTES). Distressful conditions and the failure of religion and philosophy to teach men to be at home in the world encouraged what is called APOCALYPTIC LITERATURE (*q.v.*). It came to be felt that the age of prophecy belonged to the past (I. Macc. iv. 46, ix. 27); whereas to create history, apocalypse awaited it. The prophet moved in Yahweh's world and was filled with a living experience; whereas the apocalyptist placed a gulf between this world and the supernatural order: God had made two worlds (4 Ezra vii. 50). Yahweh did nothing without telling the prophets (Am. iii. 7), and there are stories of detailed proph-

ecies of a somewhat mechanical type (*e.g.*, 2 Kings xiii. 2–5, xxiii., 16 *seq.*): but apocalypse foreshadows the working-out of a predetermined drama and reveals the future. It was an ancient belief that earthly things had a heavenly pattern, or that history had been written as "heavenly tablets" or could be deduced from the stars; and apocalypse is extraordinarily interesting for its ideas of history and destiny.

There was a feeling of impending, inevitable change, and that God would intervene in some spectacular or catastrophic way (as earlier, 1 Kings xix. 11 *seq*). Things might be kept in reserve, to be brought forth at their time (*cf.* Is. xlviii. 6), and great changes could be betokened by a new name (Is lxii. 2 *seq*, *cf.*, Abram-Abraham, Jacob-Israel). Or the old might come again in a new form: a new Exodus, a new Elijah (Mal iv 5), or a new heaven and earth (*cf.*, Is lxv. 17). Characteristic is the use of an old name for new teaching (*cf*, Baruch, Enoch, Moses, etc, in the apocalyptical literature); truth is represented as unchanging, or as given from the first. Yahweh's world-plan pre-existed. He chose men from the womb to achieve his purposes, Jeremiah (i. 5), Cyrus (Is. xliv. 24), even the ideal Jacob-Israel (*ib.* v. 2), and at times there was some special supernatural intervention (Isaac, Gen xvii., Samson, Judg xiii.). Moreover, on the old group-idea a man was born of the group which lived on in the individuals; and he was so far pre-existent in that he carried on the life of the pre-existing group to which he belonged; or the "spirit (or breath)" of man comes from and returns to its eternal divine source (*cf.*, Eccles xii. 7). More explicitly *some* part of man is believed to pre-exist (*cf.* Wisdom viii. 19 *sq*), and according to 2 Enoch xxiii 5, it is the soul. Ideas of man's place in the universe were indeed further developed, but Yahweh's purposes for either Israel or mankind had not yet been accomplished and were awaiting fulfilment

20 **The Maccabaean Age.**—Greek culture had penetrated deeply after the conquests of Alexander the Great (333 B.C), though the paucity of historical material and the difficulty of dating the literature make it impossible to trace clearly the steps in the religious development The stirring deeds of the Maccabees (*q.v.*) must have called forth and must have been shaped by literature of a national "prophetical" stamp, and many scholars have sought to discern Maccabaean passages in the Old Testament, as apart from the book of Daniel (*q v.*) evidently contemporary in its present form Antiochus Epiphanes attempted to establish throughout his domain a single religion, symbolical of his own supremacy as the "god made manifest." Jews and Samaritans alike were threatened, and fought to maintain the supremacy of Yahweh against the Zeus Olympius and the Zeus Xenius to whom the daring king had dedicated the temples of Jerusalem and Gerizim respectively Then the Jews, triumphant in their victories, became as of old fanatical nationalists, fighting both non-Jews and especially their less rigorous and Hellenizing brethren. Before long, John Hyrcanus is conquering the Samaritans, destroying their temple; the Idumaeans (the earlier Edomites) are forcibly Judaized, and a Jewish kingdom, almost Solomonic in its extent, flourishes between the end of the Seleucid and the beginning of the Roman period (141–63 B.C.). If the Davidic dynasty arose, as some evidence suggests, under South Palestinian or semi-Edomite auspices, it was through the Idumaean Herods that the Jews entered upon their last period of prosperity under Roman patronage, and with all the dangers this meant for national Judaism. And the final catastrophe was witnessed—if not hastened—by the last of this strangely non-Jewish family, Agrippa II.

Meanwhile the Maccabaean revolt against a semi-Greek and semi-Oriental life had purified the priesthood, and had given a fresh endorsement to Judaism shortly to become part of the Roman empire. It was a newly consolidated Judaism that now entered upon the western phase of its history, with a profounder conception of the part it was to play in universal history. The Jew with his Law, his traditions and his universal God, had something to offer a world from which, however, his own religion tended to keep him aloof. Judaism had already attracted the attention of the world, whether the curious Hecataeus of Abdera (*c.* 290 B.C.) or his contemporary the anti-Jew historian Manetho. Judaism felt a world-call, and its proselytising zeal was favoured by the Romans, at least up to the time of Hadrian. Indeed there is a remarkable vigour throughout the Oriental religions, and many diverse tendencies of thought and a variety of sects characterise the eastern Roman empire at the birth of Christianity, primarily another Jewish sect. Besides certain striking ethical tendencies, and also the more impressive Messianic expectations (*see* MESSIAH), a Damascus body of Jewish covenanters, whose date unfortunately is seriously disputed, look for a "Teacher of Righteousness" who is to be followed by a Messiah not of Davidic origin. Their appreciation of the Law and of the Prophets combines Ezekiel's reforming Zadokite priesthood and Jeremiah's new covenant, and they testify to some reforming movement, whose further history is unknown, outside Judaea, and therefore in districts more remote from the narrower exclusive Judaism of Jerusalem Similarly the book of Enoch (*q.v.*) appears to proceed from a North Palestinian (Galilaean) district, largely non-Jewish. *See* further, PHARISEES, SADUCEES, SCRIBES.

21. **The Last of the Prophets.**—Only the briefest account can here be given of the final act in the history of the old Hebrew religion · It is played upon a large stage amid the recurrence of the psychological characteristics of the VIth century B.C., viz, the intense anticipation of approaching cataclysmic changes (*cf.*, Ezek. xxxviii, *seq*), and the need for a New Covenant (*cf.* Jer. xxxi) The Galilaean Jesus of Nazareth, with uniquely heightened conceptions of God and of the individual is in the line of the great prophets. He demands a higher type of "righteousness," and a rebirth (*cf*, the "new" heart and spirit of Ezek. xviii. 31); not ceremonial rectitude, but social ethical conduct (*cf*, already Mic. vi 8). As at an earlier inauguration of new conditions (§ 12) the individual's worth and his responsibilities are alike increased; there is a yoke, but it is easy (Matt xi. 30, *cf*, Deut. xxx. 11–14). Instead of a divinely-chosen Israel, or Davidic dynasty, or Aaronite priesthood it is the individual who is sought after, as a lost sheep or coin. A new group-idea is formed; it is not that of a Jewish nation or church, or an inner Israelite circle or fellowship, but a Christian body or body of Christ. The real group is based (as with the prophets, § 6 end), not on its recognised members, but on Christ and what he demands of those that would be his, or—even unconsciously—do his will. The individual is the atom, but Jesus is "*the* individual," an ideal representative of humanity

The old Israelite ideology finds its further development, especially the Deutero-Isaiah Jesus is the Servant (*cf.* § 14), the Messiah, with a kingdom, though he is not a king. He is "Son of Man" (*i.e.*, a man); the title once applied expressively to Ezekiel the priest-prophet, watchman, representative and intermediary, later gains a deeper significance when used as a term of comparison for a glorified people of God, an Israel the possessor of a universal and everlasting kingdom (Dan. vii. 13). Again, in place of this ideal Israel, the Son of Man becomes, in the book of Enoch, a pre-existent Messiah, the vicegerent of the Almighty. Israel, as Yahweh's people, had had its representative king or priest, or prophet, or its Michael; but Israel was also the intermediary between God and the world. From the religious idealism of the Old Testament we pass to Christ as the representative and intermediary, and to the Christian body corresponding to the Israel of old.

Jesus and Paul share the uncompromising thoroughness and the iconoclasm of the great prophets. The old claims, doctrines and dogmas become secondary, *e.g.*, the descent from Abraham and all it entailed (*cf*, John the Baptist, Matt. iii. 9). Israel possessed no natural or inherited claims; for God had no favourites, absolute freedom of choice was his. A new doctrine of evolution was virtually introduced; Jewish branches are lopped off and the Gentiles grafted on, yet there is a real continuity. But the Gentiles must not boast for, like the prophets before him, Paul cannot conceive an ultimate separation of God and Israel; and, in a remarkable conception of Destiny, sees the ultimate "salvation" of Israel (Rom. xi. 25). The reign of Christ will lead up to the establishment of God's kingdom (1 Cor. xv. 24); like the Law

in its day and the present enmity of the Jews, all are part of a majestic world-process, as it had been in the day when He let Israel go into exile.

22. **The End.**—The Messiah came and went. It was the end of a complete cycle, from the beginning of sin to the act of redemption, from Death to Life, from the First Adam to the Second. But the end of one cycle was the beginning of another; and now there is much more that awaits "fulfilment" and a new finale before the end of things. Thus, there will be an anti-Christ, the embodiment of all evil, or a Dragon (in Rev. xiii., the late Hebraized form of an old myth), and there will be a false Messiah, a false God (2 Thess. ii. *cf.* Matt. xxiv. 5, 11, 23 *seq*)—either stark evil or the more subtle evil of what looks like Religion but is its worst enemy. There is a perplexing and mutually inconsistent medley of ideas in early Christianity, due partly to the earlier experience of conflicts, and to earlier reflection upon world history, and partly the world of thought in which the new sect was reflecting upon the significance of Jesus

Of peculiar value is the book of Revelation (*see* APOCALYPSE) where, with its traces of old Babylonian, Persian and other elements, the old Hebrew religion may be said to come to an end. The unique type of experience which characterizes the best Semites has here produced a final conception of world history which looks back to the Creation (Gen. i.) and forward to a New Heaven and Earth—the influence of the Deutero-Isaiah is perspicuous (*see* Rev. xxi 1–8). All history is contained within Yahweh, who is First and Last (Is. xliv. 6), or within God, who is Alpha and Omega (Rev. i. 8, xxi. 6; said of Christ in i. 17, xxii. 13). So the Jewish-Christians feel themselves one with all that has gone before, and the unity and continuity of which they are conscious covers a remarkable development of ideas of God and man, yet a development so natural that there is a "fulfilment" far more impressive than the rather mechanical and artificial examples of "fulfilment" which the less sensitive and more prosaic minds sought and found between the history of Israel and Jesus of Nazareth, a rather mechanical process which tended to obscure the fact that the close of one age was the beginning of another with another process of development All the great stages in the development of religion in Palestine are part of the larger field of history and religion in which Palestine was involved With the sweeping changes in South-west Asia during the eighth and following centuries a new type of religion was introduced, which broke with the old national religions and nature cults. Whatever be the cause, from China to Greece, there was "a maximum in the tides of religion" a "simultaneity in progress and decline comparable to geological epochs of upheaval and subsidence" (G. F. Moore, *op cit.* pp. vi.–ix) The Hebrew prophets mark the difference between an old and dying Egypto-Semitic world and the developments under Persian, Greek and Roman rule. The most significant period extends from Jeremiah to Jesus, or rather from Amos to Paul. The essential religion of Israel broke away from the old Hebrew and was thereby preserved, and as the curve proceeds, Judaism flies off at a tangent and develops the Old Testament in its own characteristic way (*see* MIDRASH, TALMUD). Yet when Judaism had first canonised the Pentateuch with its most diverse sources, and later fixed the canon of the whole of the Old Testament with all its extraordinary range of interest, it established a working rather than a systematic synthesis, it manifested an insight not less precious than that of the Western Christian Church when it determined to retain the Apocalypse, and so enabled the western mind to gain the profoundest conceptions of the nature of religious development and human progress.

BIBLIOGRAPHY.—*See* Peterson, *Israel its life and culture* (1926), W. Robertson Smith, *Rel. of the Semites* (3rd ed by S. A. Cook, 1927); Holscher, *Gesch. d. israelit. u. judischen Relig.;* Kittel Gesch. d Volkes Israel i.; Kraeling, "The Real Rel. of ancient Palestine," in *Journ. of Bibl. Lit.* xlvii. 133–159; E. Meyer, *Ursprung d. Christentums,* ii. (1921), *Camb. Anc. Hist.* ii. ch. 13, iii. ch. 14 *seq.* vi. ch. 7, and the essays in *People and the Book,* ed. Peake (1925). *See* also BIBLE: OLD TESTAMENT. (S. A. C.)

HEBREWS, EPISTLE TO THE, a book of the New Testament, which in the oldest mss. bears no other title than "To Hebrews," *i.e.,* Christians of Jewish extraction. It was, however, directed to a definite circle of readers with whom the author had personal relations (xiii. 19, 23). Probably, then, the original limited address, or rather salutation, fell away when this appeal in letter form passed into the wider circulation which its contents merited.

Authorship.—In the earlier mss. it is anonymous; and the Roman Church, where the first traces of the epistle occur, about A.D. 96 (1 Clement), and which was in constant connection with provincial churches, was at a later date sure only that it was not by Paul (Euseb., *Eccl. Hist.,* iii. 3). The Alexandrine tradition, on the other hand, dwells on its affinities to Paul's thought. Origen implies that "the men of old" regarded it as Paul's. But he feels that the language is un-Pauline, though the "admirable" thoughts are not second even to Paul's Thus he is led to the view that the ideas were orally set forth by Paul, but that the written form was due to some one giving free interpretation of his mind. According to some this was Clement of Rome; others named Luke; but the truth, says Origen, is known to God alone (Euseb. vi. 25, *cf.* iii. 38). From the time of Origen the theory of Paul's own authorship became prevalent in the East The earliest north African tradition preserved by Tertullian (*De pudicitia,* c 20), but hardly invented by him, ascribed the epistle to Barnabas. Yet it was probably only an inference, as if this "word of exhortation" (xiii. 22) must needs be by the Son of Exhortation (Acts iv. 36; *see* BARNABAS). On the whole, then, the earliest traditions in East and West alike agree that it was not by Paul, but by one of his associates.

This is also the result reached by modern scholarship. Following the lead of Erasmus, Luther (who suggests Apollos) and Calvin added the decisive argument that Paul, who lays such stress on the fact that his gospel was not taught him by man (Gal. i.), could not have written Heb. ii. 3. And since the revival of the historical sense, more than a century ago, opinion has set irrevocably against Pauline authorship. Its type of thought is really different The Jewish Law is viewed not as a code of "works of righteousness," as by Paul, but as a system of religious rites (vii. 11) shadowing forth the way of access to God in worship, of which the Gospel reveals the archetypal realities (ix. 1, 11, 15, 23 *seq.*, x. 1 *sqq.*, 19 *sqq.*). The Old and the New Covenants are related to one another as imperfect (earthly) and perfect (heavenly) forms and methods of salvation—differing in point of spiritual reality—each with its own type of sacrifice and priesthood Thus the conception of Christ as High Priest emerges, for the first time, as a central point in Christianity The Old Testament is cited after the Alexandrian version more exclusively than by Paul, even when the Hebrew differs Nor is this accidental. The author was, in fact, a Hellenist who lacked knowledge of the Hebrew text, and derived his metaphysic and his allegorical method from the Alexandrian rather than the Palestinian schools. Yet the epistle has Pauline affinities, and can hardly have originated beyond the Pauline circle, to which it is related, not only by the author's friendship with Timothy (xiii 23), but by many echoes of the Pauline theology, and even, it seems, of passages in Paul's epistles (*see* Holtzmann, *Einleitung in das N.T.*, 1892, p. 298). Everything turns, then, on internal criticism of the epistle, together with such personal allusions as it affords.

Readers.—As to its first readers, with whom the author stood in close relations (xiii. 19, 23, *cf.* vi. 10, x. 32–34), it used to be agreed that they were "Hebrews" or Christians of Jewish birth. But this can not be inferred simply from the fact that the epistle approaches Christian truth through Old Testament forms. That was the common method since the Jewish scriptures were the Word of God to all Christians alike Still the exclusive use of the argument from Mosaism, as itself implying the Gospel of Jesus the Christ as final cause (τέλος), does favour the view that the readers were of Jewish origin Further, there is no allusion to the incorporation of "strangers and foreigners" (Eph. ii. 19) with the people of God. Yet the readers are not to be sought in Jerusalem (see *e.g.*, ii. 3), nor anywhere in Judaea. The whole Hellenistic culture of the epistle (let alone its language), and the personal references, notably that to Timothy in xiii. 23, are against any such view. Caesarea, as a city of mixed population and lying just

outside Judaea proper, would satisfy many conditions of the problem. Yet these might exist among other members of the Dispersion, like "the Jews of Asia" whose zeal for the Temple and the Mosaic ritual customs led to Paul's arrest in Jerusalem (Acts xix. 27 *seq., cf.* 20 *seq.*). The dispersed Christian Jews, who kept in touch with the Temple by annual contribution to its services, would tend to continue their reliance on those services for the forgiveness of their recurring "sins of ignorance" even after the great initial Messianic forgiveness coming with faith in Jesus. Accordingly many of them, while placing their hope for the future upon Messiah and His return in power, might seek continuous cleansing of conscience in the old mediatorial system. In particular the annual Day of Atonement might be relied on, and that in proportion as the expected Parousia tarried and the first enthusiasm of a faith that was largely eschatological died away, while ever-present temptations pressed the harder as disappointment and perplexity increased.

Its Argument.—Such was the general situation of the readers, men who rested partly on the Gospel and partly on Judaism. For lack of a true theory as to the relation between the two, they were now drifting away (ii. 1) from effective faith in the Gospel, as being mainly future in its application, while Judaism was a very present, concrete, and impressive system of religious aids—to which also their sacred scriptures gave constant witness. The points at which it chiefly touched them may be inferred from the author's counter-argument, with its emphasis on the spiritual ineffectiveness of the whole Temple-system, its high-priesthood and its supreme sacrifice on the Day of Atonement. With passionate earnestness he sets over against these his constructive theory as to the efficacy, the heavenly yet unseen reality, of the definitive "purification of sins" (i. 3) and perfected access to God's inmost presence, secured for Christians as such by Jesus the Son of God (x. 9–22); and traces their moral feebleness and slackened zeal to want of progressive insight into the essential nature of the Gospel as a "new covenant," moving on a totally different plane of religious reality from the now antiquated covenant given by Moses (viii. 13).

The following plan of the epistle may help to make apparent the writer's theory of Christianity as distinct from Judaism, which is related to it as "shadow" to reality:

Thesis: The finality of the form of religion mediated in God's Son, i. 1–4.

i. The supreme excellence of the Son's Person (i. 5–iii. 6), as compared with (*a*) angels, (*b*) Moses.
Practical exhortation, iii. 7–iv 13, leading up to:

ii. The corresponding efficacy of the Son's High-priesthood (iv. 14–ix.).
(1) The Son has the qualifications of all priesthood, especially sympathy.
Exhortation, raising the reader's thought to the height of the topic reached (v. 11–vi. 20).
(2) The Son as absolute high priest, in an order transcending the Aaronic (vii) and relative to a Tabernacle of ministry and a Covenant higher than the Mosaic in point of reality and finality (viii , ix).
(3) His Sacrifice, then, is definitive in its effects (τετελείωκε), and supersedes all others (x. 1–18).

iii. Appropriation of the benefits of the Son's high-priesthood, by steadfast faith, the paramount duty (x. 19–xii.). More personal epilogue (xiii.).

As lack of insight lay at the root of their troubles, it was not enough simply to enjoin the moral fidelity to conviction which is three parts of Faith to the writer, who has but little sense of the mystical side of faith, so marked in Paul. There was need of a positive theory based on real insight, to inspire faith for more strenuous conflict with the influences tending to the apostasy from Christ, and so from "the living God," which already threatened some of them (iii 12). Such "apostasy" was not a formal abjuring of Jesus as Messiah, but the subtler lapse involved in ceasing to rely on relation to Him for daily moral and religious needs, summed up in purity of conscience and peace before God (x. 19–23, xiii. 20 *seq*). This "falling aside" (vi. 5, *cf.* xii. 12 *seq.*), rather than conscious "turning back," is what is implied in the repeated exhortations which show the intensely practical spirit of the whole argument. These exhortations are directed chiefly against the dullness of spirit which hinders progressive moral insight into the genius of the New Covenant (v. 11–vi. 8). The antidote to such "profane" negligence (ii. 1, 3, xii. 12 *seq.*, 15–17) is an earnestness animated by a fully-assured hope, and sustained by a "faith" marked by patient waiting (μακροθυμία) for the inheritance guaranteed by Divine promise (x. 11 *seq.*). The outward expression of such a spirit is "bold confession," and mutual encouragement therein (iii. 6, 12 *seq.*); while the sign of its decay is neglect to assemble together for mutual stimulus, as if it were not worth the odium and opposition from fellow Jews called forth by a marked Christian confession (x. 23–25, xii. 3)—a very different estimate of the new bond from that shown by readiness in days gone by to suffer for it (x. 32 *seq.*). Their special danger, then, the sin which deceived (iii. 13) the more easily that it represented the line of least resistance (perhaps the best paraphrase of "the besetting sin" in xii. 1), was the exact opposite of "faith" as the author uses it, especially in the chapter of Old Testament illustrations, and of which Jesus Himself was at once the example and the inspiration (xii. 2 *sqq.*). To quicken this by awakening deeper insight into the real objects of "faith," as these bore on their actual life, he develops his high argument on the lines already indicated.

The Special Situation.—Their situation was so dangerous just because it combined inward debility and outward pressure, both tending to the same result, viz., practical disuse of the distinctively Christian means of grace, as compared with those recognized by Judaism, and such conformity to the latter as would make the reproach of the Cross to cease (xiii. 13, *cf.* xi. 26). But the practical surrender of what was distinctive in their new faith meant a theoretic surrender of the value once placed on that element, when it was a living religious experience far in advance of what Judaism had given them (vi. 4 *seq.*, x. 26–29). This twofold infidelity, in thought and deed, God, the "living" God of progress from the "shadow" to the substance, would yet visit (x. 30 *seq.*, xii. 22–29). For it meant turning away from an appeal that had been known as "heavenly," for something inferior and earthly (xii. 25); from a call sanctioned by the incomparable authority of a greater than Moses and all media of the Old Covenant, even the Son of God. Thus the key of the whole exhortation is struck in the opening words, which contrast the piecemeal revelation "to the fathers," in the past, with the complete and final revelation to themselves in the last stage of the existing order, in a Son of transcendent dignity (i. 1 *sqq., cf.* ii. 1 *sqq.*, x. 28 *seq.*, xii. 18 *sqq.*). This goes to *the root of their difficulty,* ambiguity as to the relations of the old and the new elements in Judaeo-Christian piety, so that there was danger of the old overshadowing the new, since national Judaism remained hostile. At a stroke the author separates the two. There is *no use,* religiously, in falling back upon the old forms, in order to avoid the social penalties of a sectarian position within Judaism, when the secret of religious "perfection" or maturity (vi. 1, *cf.* the frequent use of the kindred verb) lies elsewhere. Hence the moral of his whole argument as to the two covenants, though it is formulated only incidentally amid final detailed counsels (xiii. 13 *seq.*) is to leave Judaism and adopt a purely Christian standing on the same footing with their non-Jewish brethren in the local church. For this the time was now ripe; and in it lay the true path of safety—eternal safety as before God, whatever man might say or do (xiii. 5 *seq.*). The obscure section xiii. 9 *seq.,* is to be taken as "only a symptom of the general retrogression of religious energy" (Jülicher) and not as bearing directly on the main danger of these "Hebrews."

External Occasion.—In trying further to define the readers addressed one must note the stress laid on suffering as part of the divinely appointed discipline of sonship (ii. 10, v. 8, xii. 7 *seq.*), and the way in which the analogy in this respect between Jesus, as Messianic Son, and those united to Him by faith, is set in relief. He is both the inspiring example for heroic faith in the face of unbelievers (xii. 3 *sqq.*) and the mediator qualified

by experience of suffering to sympathize with His tried followers, and so to afford them moral aid (ii. 17 *seq*, v. 8 *seq.*, *cf.* iv 15). This means that suffering for Christianity, at least in respect of possessions (xii 5 *seq*, *cf.* x 34), was imminent for those addressed; and it seems as if they were mostly men of wealth and position (xiii. 1–6, vi. 10 *seq.*, x. 34) Such would also possess a mental culture (*cf.* v. 11 *seq.*) capable of appreciating the form of an epistle "far too learned for the average Christian" (Julicher), yet for which its author apologizes as inadequate (xiii. 22) It was now long since they themselves had suffered seriously for their own faith (x 32 *seq.*) and the writer's impatience to hurry to their side implies that the crisis was both sudden and urgent.

Place and Author.—Many attempts have been made to identify the home of the Hellenistic Christians addressed in this epistle. For Alexandria little can be urged. "Alexandrine" idealism and allegorism was a mode of thought diffused throughout the Eastern Mediterranean, and the divergencies from Philo's spirit are as notable as the affinities (*cf* Milligan, *ut infra* 203 *sqq*). For Rome there is more to be said, in view of the reference to "them of Italy" (xiii. 23 *seq*); and the theory has found many supporters It usually contemplates a special Jewish-Christian house-church, like that meeting in the house of Prisca and Aquila (Rom. xvi 5)—a chapter which some hold to have been part of a recension sent to Ephesus (*see* ROMANS, EPISTLE TO). Little, however, really points to Rome and a good deal points away from it. The words in xii. 4 "Not yet unto blood have ye resisted," would ill suit Rome after the Neronian "bath of blood" in A.D. 64 (as is usually held), save at a date too late to suit the reference to Timothy. Nor does early currency in Rome count for much, any more than do the words "they of Italy salute you" Read in the light of the reference to Timothy they rather suggest that he had been in prison in Rome and was about to return, possibly in the writer's company, to the region which was apparently the headquarters of both Now this in Timothy's case, as far as we can judge, was Ephesus; and it is natural to ask whether it will not suit all the conditions of the problem It suits those of the readers, as analysed above, a house-church which the gospel had reached as it had also the writer himself through certain hearers of the Lord (ii 3), not necessarily apostles (*cf* the Ephesian group of Acts xix 1 *sqq*). And it has the merit of suggesting to us as author the very person of all those described in the New Testament who seems most capable of the task, Apollos, the learned Alexandrian (Acts xviii 24 *sqq*), connected with Ephesus and with Paul and his circle (*cf.* 1 Cor xvi. 12), yet having his own distinctive manner of presenting the Gospel (1 Cor. iv. 6). That Apollos visited Italy during Paul's imprisonment in Rome is a reasonable inference from Titus iii 13 (*see* PAUL); and if so, it is quite natural that he should be there again about the time of Paul's martyrdom. With that event it is again natural to connect Timothy's imprisonment, his release from which our author records in closing; while the news of Jewish success in Paul's case would enhance any tendency among Asian Jewish Christians to shirk "boldness" of confession in fear of further aggression from their compatriots. On the chronology adopted in the article PAUL, this would yield as date for the epistle A.D. 61–62 The place of writing would be some spot in Italy ("they of Italy salute you") outside Rome, probably a port of embarkation for Asia, such as Brundisium.

Historical Significance.—Be this as it may, the epistle is of great importance, as reflecting a crisis inevitable in the development of the Jewish-Christian consciousness, when a definite choice between the old and the new form of Israel's religion had to be made, both for internal and external reasons. It seems to follow directly on the situation implied by the appeal of James to Israel in dispersion, in view of Messiah's winnowing-fan in their midst (James i. 1–4, ii. 1–7, v. 1–6 and especially v. 7–11) It may well be the immediate antecedent of that revealed in 1 Peter, an epistle which perhaps shows traces of its influence (*e.g.*, in i 2, "sprinkling of the blood of Jesus Christ"). It is also of high interest theologically, as exhibiting, along with affinities to several types of New Testament teaching (*see* STEPHEN), a type all its own, and one which has had much influence on later Christian thought (*cf.* Milligan, ch. ix.). Indeed, it shares with Romans the right to be styled "the first treatise of Christian theology."

BIBLIOGRAPHY.—The older literature may be seen in F. Bleek, *Der Brief an die Hebraer* (1828–40); the more recent in G. Milligan, *The Theology of the Epistle of the Hebrews* (1899), a useful summary of all bearing on the epistle, and in the large New Testament Introductions (*e.g.*, Jülicher or Moffatt). *See* also Hastings's *Dict. of the Bible*, the *Encycl Biblica*, A. S Peake in *The Century Bible* and J. Moffatt in the *Internat. Crit. Comm.* (J. V. B.)

HEBRIDES, THE, a group of islands off the west coast of Scotland, between 55° 35′ and 58° 30′ N and 5° 26′ and 8° 40′ W., also known as the Western Isles. They have been broadly classified into Outer and Inner Hebrides, the Minch and Little Minch dividing one group from the other. The chief islands of the Outer Hebrides are Lewis-with-Harris (or Long Island), North Uist, Benbecula, South Uist, Barra, the Shiants, St. Kilda and the Flannan Isles, or Seven Hunters, about 20 m. N.W. of Gallon Head in Lewis. Of these the Lewis portion of Long Island, the Shiants and the Flannan belong to the county of Ross and Cromarty, and the remainder to Inverness-shire The total length of this group, from Barra Head to the Butt of Lewis, is 130 m., the breadth varying from less than 1 m to 30 miles. The Inner Hebrides include Skye, Small Isles (Canna, Sanday, Rum, Eigg and Muck), Coll, Tyree, Lismore, Mull, Ulva, Staffa, Iona, Kerrera, the Slate Islands (Seil, Easdale, Luing, Shuna, Torsay), Colonsay, Oronsay, Scarba, Jura, Islay and Gigha Of these Skye and Small Isles belong to Inverness-shire, and the rest to Argyllshire The Hebridean islands exceed 500 in number, of which less than one-fifth are inhabited Of the inhabited islands ten belong to Ross and Cromarty, 46 to Inverness-shire, and 39 to Argyllshire, but of this total of 95 islands, 33 have a population of only ten persons, or fewer, each The population of the Hebrides in 1921 numbered 70,517, of whom 8,797 spoke Gaelic only and 51,375 Gaelic and English The most populous island is Lewis-with-Harris (32,283), and next to it are Skye (11,031), Islay (6,496) and Mull (3,389).

Most of the surface is moorland and mountain, with many lochs, and only a small proportion is under cultivation.

A geological division sometimes made, into the Gneiss islands and the Trap islands, is appropriate as concerns the Outer Hebrides, for these, together with Coll and Tyree, consist almost wholly of the Lewisian gneiss The rocks of the other principal islands, however, differ greatly. Basalts have a wide extension in south-western Skye, in Canna, Eigg and Muck, in Mull, and in most of the small neighbouring islands such as Staffa, though the gneiss reappears in Iona The complex geological structure of south-eastern Skye (*q.v.*) is in some measure repeated in Rum, where bold elevations of gabbro rise nearly 2,700 ft from sea-level, surrounded in great part by a lower table-land of dark red Torridonian sandstone, which reappears farthest south in Colonsay and western Islay The greater part of Islay and of Jura, however, consists of the Dalradian quartzites, schists and (in Islay) clay slates. The scenery of the islands, exposed as they are to the Atlantic storms, and generally treeless or nearly so, is wild and beautiful

Potatoes and turnips are the only root crops that succeed, and barley and oats are grown in some of the islands. Sheep-farming and cattle-raising are carried on very generally, and, with the fisheries, provide the main occupation of the inhabitants, who profit also from tourists in summer. Industries include distilling, slate-quarrying and manufacture of tweeds, tartans and other woollens. There are extensive deer forests in Lewis-with-Harris, Skye, Mull and Jura. On many of the islands there are prehistoric remains and antiquities within the Christian period. The larger islands are all in regular communication with certain points of the mainland by means of steamers from Glasgow, Oban and Mallaig. The United Free Church has a strong hold on the people, but in a few of the islands the Roman Catholic church is still strong In the larger inhabited islands schools have been established. The islands unite with the counties to which they belong in returning members to parliament.

History.—The Hebrides are mentioned by Ptolemy under the name of "Εβουδαι and by Pliny under that of *Hebudes*, the mod-

ern spelling having, it is said, originated in a misprint. By the Norwegians they were called *Sudreyjar* or Southern Islands The Latinized form was *Sodorenses,* preserved to modern times in the title of the bishop of Sodor and Man. In the 6th century Scandinavian hordes poured in but in time adopted the language and faith of the islanders. The principal immigration took place towards the end of the 9th century in the early part of the reign of Harald Fairhair, king of Norway, and consisted of persons driven to the Hebrides, as well as to Orkney and Shetland, to escape from his tyrannous rule. Soon afterwards they began to make incursions against their mother-country, and on this account Harald fitted out an expedition against them, and placed Orkney, Shetland, the Hebrides and the Isle of Man under Norwegian government The chief seat of the Norwegian sovereignty was Colonsay. About the year 1095 Godred Crovan, king of Dublin, Man and the Hebrides, died in Islay His third son, Olaf, succeeded to the government about 1103, and the daughter of Olaf was married to Somerled, who became the founder of the dynasty known as Lords of the Isles. Many efforts were made by the Scottish monarchs to displace the Norwegians. Alexander II. led a fleet and army to the shores of Argyllshire in 1249, but died on the island of Kerrera. On the other hand, Haakon IV., king of Norway, at once to restrain his jarls and to keep in check the Scottish kings, set sail in 1263 on a great expedition, which, however, ended disastrously at Largs. Magnus, son of Haakon, concluded in 1266 a peace with the Scots, renouncing all claim to the Hebrides and other islands except Orkney and Shetland, and Alexander III. agreed to give him a sum of 4,000 merks in four yearly payments. It was also stipulated that Margaret, daughter of Alexander, should be betrothed to Eric, the son of Magnus, whom she married in 1281 She died two years later, leaving an only daughter, the Maid of Norway.

The race of Somerled continued to rule the islands, and from a younger son sprang the lords of Lorne, who took the patronymic of MacDougall. John MacDonald of Islay, who died about 1386, was the first to adopt the title of Lord of the Isles. He was married to a daughter of the earl of Strathearn, afterwards Robert I. His son, Donald of the Isles, was memorable for his unsuccessful rebellion in support of his claim to the earldom of Ross. Alexander, son of Donald, resumed the hereditary warfare against the Scottish crown; and in 1462 a treaty was concluded between Alexander's son and successor, John and Edward IV of England, by which John, his son John, and his cousin Donald Balloch, became bound to assist King Edward and James, earl of Douglas, in subduing the kingdom of Scotland In the reign of James V. another John of Islay resumed the title of Lord of the Isles, but was compelled to surrender the dignity. From the time of Bruce the Campbells had been gaining the ascendancy in Argyll. The MacLeans, MacNaughtons, MacLachlans, Lamonts and others had sunk before this favoured family. The lordship of Lorne was wrested from the MacDougalls by Robert Bruce, and their extensive possessions, with Dunstaffnage Castle, bestowed on the king's relative, Stewart, and his descendants, afterwards lords of Lorne. The MacDonalds of Sleat, direct representatives of Somerled, though driven from Islay and deprived of supreme power by James V., still kept a sort of insular state in Skye. There were also the MacDonalds of Clanranald and Glengarry (descendants of Somerled), with the powerful houses of MacLeod of Dunvegan and MacLeod of Harris, M'Neill of Barra and MacLean of Mull, all turbulent rivals. James VI. made an abortive endeavour to colonize Lewis. William III. and Queen Anne attempted to subsidize the chiefs in order to preserve tranquillity, but the wars of Montrose and Dundee, and the Jacobite insurrections of 1715 and 1745, showed how futile were all such efforts. In 1748 the abolition of heritable jurisdictions, and the appointment of sheriffs in the different districts brought a great change, but led to high rents and emigration of tacksmen, or large tenants, to North America.

Sheep-farming on a large scale was next introduced, and the crofters were thrust into villages or barren corners of the land. The result was that, despite the numbers who entered the army or emigrated to Canada, the standard of civilization sank lower, and the population multiplied in the islands. The people came to subsist almost entirely on potatoes and herrings; and in 1846, when the potato blight began its ravages, nearly universal destitution ensued. Temporary relief was given by employment on roads and other works; and, an emigration fund being raised, from 4,000 to 5,000 of the people in the most crowded districts were removed to Australia. The Crofters' Holdings Act was passed in 1886, and in the course of a few years some improvement was evident and has since been sustained. In recent years large numbers have emigrated to Canada.

HEBRON, a city of Palestine about 20 m. S.W. of Jerusalem and about 3,000 ft. above sea-level (mod. *El-Khalīl*); pop. 16,500 (16,000 Muslims, 400 Jews). The town, no longer walled, with its stone houses, boasting curious vaulted cupolas, and narrow, winding streets, stands on the eastern slope of a shallow valley. It possesses a great many wells and two large reservoirs, one of which is generally identified with the Pool of Hebron (2 Sam. iv. 12). The town is divided into several quarters, and its chief industries are the manufacture of glass objects (lamps, bracelets, etc.), leather water-bottles from goats' skins, cotton goods. The Jews engage in wine-making and produce an excellent wine.

History.—Reputed one of the oldest cities (Num. xiii. 22), it was closely connected with Abraham in Bible tradition and was destroyed by Joshua (x. 26). From Hebron Joseph set out to seek his brethren at Shechem. David made it his home for a period. Absalom was born there and Abner was treacherously murdered at its gates by Joab. Absalom made the town the headquarters of his revolt It was fortified by Rehoboam, captured from the Edomites by Judas Maccabaeus, and destroyed by the Romans. It revived under the Muslims and was a substantial town when captured by the Crusaders. It was occupied by British troops on Dec. 4, 1917.

Harām.—Hebron's chief interest is its Harām, an enclosure (198 ft. by 112 ft.) built over the traditional side of the cave of Machpelah. The ancient wall which encloses it rises to a height of 40 ft. (above that rise modern walls) and in construction and masonry closely resembles that of the Harām in Jerusalem. Within the enclosure is a mosque formerly a Crusaders' church (12th century), which in its turn was built on the site of a basilica of Justinian's time. Within the mosque are the cenotaphs of Abraham, Isaac, Jacob, Sarah, Rebecca and Leah, erected above the places where their tombs are presumed to be in the rocky cavern beneath. The cave itself has not been entered for more than 600 years. The mosque is approached by two flights of steps, but Jews are not permitted to go beyond the seventh step. At the fifth step there is an aperture believed to lead to the tomb of the patriarchs.

See C. R. Conder, *Pal. Expl. Fund Memoirs,* iii. (1881). 333, *seq.*; C. Warren, "Hebron," in *Hastings' Bible Dictionary;* L. H. Vincent, E. J. H. Mackay, F. M. Abel, *Hébron, Le Haram el-Khalīl: Sépulture des Patriarches* (1923); B. Meistermann, *Guide to the Holy Land* (1923); W. M. Flinders Petrie, *The Cave of Machpelah: Ancient Egypt* (1923), 105, *seq.*; P. J. Baldensperger, *Pal Expl. Fund Quart. Statement,* 1915, *seq.* (on characteristics of people of Hebron). (E. Ro.)

HECATAEUS OF ABDERA (or of Teos) (*fl.* 4th century B.C.), Greek historian and Sceptic philosopher, accompanied Ptolemy I. Soter to Syria, and sailed up the Nile to Thebes with him. His travels were described in Αἰγυπτιακά and Περ Ὑπερβορέων, which were used by Diodorus Siculus.

Fragments in C. W. Müller's *Frag. hist. Graec.* and Diels: *Fragmente der Vorsokratiker,* vol. 2 (4th ed. 1922).

HECATAEUS OF MILETUS (6th–5th century B.C.), Greek historian and traveller, son of Hegesander, flourished during the time of the Persian invasion. He tried to dissuade the Ionians from revolt against Persia, and (Herodotus v. 36, 125) in 494, when they were obliged to sue for terms, he was one of the ambassadors to the Persian satrap, whom he persuaded to restore the constitution of the Ionic cities (Diod. Sic. x. 25). He is by some credited with a geographical work entitled Γῆς περίοδος ("Travels round the Earth"), in two books, one on Europe, the other on Asia, the account of Egypt being especially comprehensive; the book was accompanied by a map, based upon that of Anaximander. The authenticity of the work is, however, strongly

attacked by J. Wells in the *Journal of Hellenic Studies* (1909), xxix. pt. i. The only certainly genuine work of Hecataeus was the Γενεηλογίαι or Ἱστορίαι, a systematic account of the traditions and mythology of the Greeks. He was probably the first to write a serious prose history and employ critical method to distinguish myth from fact, though he accepts Homer and the other poets as trustworthy authority. Herodotus, though he once at least (vi. 137) controverts his statements, is indebted to Hecataeus not only for facts, but also in regard to method and general scheme, but the extent of the debt depends on the genuineness of the Γῆς περίοδος.

See fragments in C. W. Müller, *Fragmenta historicorum Graecorum*, i.; or F. Jacoby, *Fragmente der griechischen Historiker* (1923), i., where references in ancient authors are quoted. H. Berger, *Geschichte der wissenschaftlichen Erdkunde der Griechen* (1903); E. H. Bunbury, *History of Ancient Geography*, i.; W. Mure, *History of Greek Literature*, iv.; H. Diels, *Herodot und Hekataios* in *Hermes*, 1887; especially J. V. Prašek, *Hekataios als Herodots Quelle zur Geschichte Vorderasiens. Beitrage zur alten Geschichte* (Klio) (1904), iv. 193 *seq.*, and J. Wells in *Journ. Hell. Stud.*, as above, and in reply, Max Carey in *J.H.S.* xxx.

HECATE (Gr. Ἑκάτη, "she who works from afar"), a goddess in Greek mythology. According to the generally accepted view, she was of Hellenic origin, but Farnell regards her as a foreign importation from Thrace, the home of Bendis, with whom Hecate had many points in common She is not mentioned in the *Iliad* or the *Odyssey*, but in Hesiod (*Theogony*, 409) she is the daughter of the Titan Perses and Asterie. She is there represented as a mighty goddess, having power over heaven, earth and sea; hence she is the bestower of wealth and all the blessings of daily life. Hecate is frequently identified with Artemis, and both occasionally with the moon

Later, Hecate is the chief goddess who presides over magic arts and spells; hence occasionally she is referred to as the mother of Circe, and her name is very common in charms. She is said to have been worshipped at Samothrace, and is closely connected with Demeter. Alone of the gods besides Helios, she witnessed the abduction of Persephone, and, torch in hand, assisted Demeter in her search for her daughter. On moonlight nights she was seen at the cross-roads (hence her name τριοδῖτις, Lat. *Trivia*), accompanied by ghosts and hell-hounds. There, on the last day of the month, eggs and fish were offered to her. Black puppies and she-lambs (black victims being offered to chthonian deities) were also sacrificed (Schol. on Theocritus ii. 12), the former unusual but not quite unparalleled victims in Greece. Pillars like the Hermae, called Hecataea, stood, especially in Athens, at cross-roads and doorways, perhaps to keep away the spirits of evil. It is to be noted that Hecate plays little or no part in mythological legend.

In older times Hecate is represented as single-formed, clad in a long robe, holding burning torches; later she becomes *triformis*, "triple-formed," with three bodies standing back to back—probably in order to look all ways at once from the cross-road. In her six hands are various emblems

See L. R. Farnell, *Cults of the Greek States*, ii. ch xvi., xix.; Preller-Robert i., p. 321 et seq.; O. Gruppe, *Griechische Mythologie*, ii p. 1,288 (1906); and the classical dictionaries.

HECATOMB, originally, perhaps, the sacrifice of a hundred victims, then of any large number. Hence in modern languages, the destruction of a multitude of living, or even of inanimate, things. (Gr. ἑκατόμβη from ἑκατόν, a hundred.)

HECKER, FRIEDRICH FRANZ KARL (1811–1881), German revolutionary, was born at Eichtersheim in the Palatinate on Sept. 28, 1811, the son of a revenue official. On entering the Second Chamber of Baden in 1842, he at once began to oppose the government A speech, denouncing the projected incorporation of Schleswig and Holstein with Denmark, delivered in the chamber of Baden on Feb. 6, 1845, spread his fame beyond the limits of his own state, and his popularity was increased by his expulsion from Prussia on the occasion of a journey to Stettin. In 1847 he became president of the *Volksverein*, where, with Struve, he drew up the Radical programme carried at the Liberal meeting held at Offenburg on Sept 12, 1847 (entitled "thirteen claims put forward by the people of Baden"). In addition to the Offenburg programme, the *Sturmpetition* of March 1, 1848 demanded further far-reaching concessions. New demands were made at Offenburg on March 19, and Hecker moved a resolution in the preliminary parliament of Frankfort that Germany should be declared a republic.

On April 12, Hecker and Struve sent a proclamation to the inhabitants of the *Seekreis* and of the Black Forest "to summon the people who can bear arms to Donaueschingen at mid-day on the 14th, with arms, ammunition and provisions for six days." They expected 70,000 men, but only a few thousand appeared. The troops of Baden and Hesse marched against them, under the command of General Friedrich von Gagern, and Hecker was defeated at Kandern (April 20). Hecker escaped to Switzerland, and in Sept. 1848 retired to the United States, where he had a farm near Belleville, (Ill). During the second rising in Baden in the spring of 1849 he returned, and had got as far as Strasbourg when he had to retreat before the victories of the Prussian troops over the Baden insurgents.

After his return to America he fought in the Civil War as colonel of a regiment which he had himself got together on the Federal side in 1861 and 1864. In a famous festival speech at St. Louis in 1871 he expressed the enthusiasm of the German Americans for their newly-united fatherland He received a less favourable impression during a journey he made in Germany in 1873. He died at St. Louis on March 24, 1881

Hecker was very much beloved of all the German democrats. The song and the hat named after him (the latter a broad slouch hat with a feather) became famous as the symbols of the middle-classes in revolt. In America, too, he won great esteem, not only on political grounds but also for his personal qualities

Hecker's works are: *Die Erhebung des Volkes in Baden fur die deutsche Republik* (Baden, 1848); and *Reden und Vorlesungen* (Neerstadt a. d. H., 1872). *See* F. v. Weech, *Badische Biographien*, iv (1891); L. Mathy, *Aus dem Nachlasse von K. Mathy, Briefe aus den Jahren 1846–1848* (Leipzig, 1898).

HECKER, ISAAC THOMAS (1819–1888), American Roman Catholic priest, the founder of the "Paulist Fathers," was born in New York city, of German immigrant parents, on Dec. 18, 1819. When barely 12 years of age, he had to go to work, but he studied at every opportunity. Isaac was deeply religious, and remained so amid all the reading and agitating in which he engaged. He joined the Brook Farm movement, and remained in the colony for six months. Shortly after leaving it (in 1844) he was baptized into the Roman Catholic Church by Bishop McCloskey, of New York. In 1845 he was entered in the novitiate of the Redemptorists in Belgium, where he cultivated that spirit of lofty mystical piety which marked him through life.

Ordained a priest in London by Cardinal Wiseman in 1849, he returned to America, and worked until 1857 as a Redemptorist missionary. With all his mysticism, Isaac Hecker had the wide-awake mind of the typical American. He perceived that the missionary activity of the Catholic Church in the United States must remain to a large extent ineffective unless it adopted methods suited to the country and the age. Acting on this idea, and with the consent of his local superiors, Hecker went to Rome to beg of the Rector Major of his Order that a Redemptorist novitiate might be opened in the United States, in order to attract American youths to the missionary life. Though he took with him the strong approval of some members of the American hierarchy, the Rector Major expelled him from the Order for having made the journey to Rome without sufficient authorization. Hecker and four other American Redemptorists, however, were permitted by Pius IX. in 1858 to form the separate religious community of the Paulists. Hecker trained and governed this community until his death in New York City, on Dec. 22, 1888. He founded and was the director of the Catholic Publication Society, and the founder, and from 1865 until his death the editor, of the *Catholic World;* and wrote *Questions of the Soul* (1855), *Aspirations of Nature* (1857), *Catholicity in the United States* (1870), and *The Church and the Age* (1888).

HECKMONDWIKE, an urban district of the West Riding of Yorkshire, England, 8 m. S.S.E. of Bradford, on the L.M.S. railway Pop. (1921), 9,023. It lies in the centre of the blanket and carpet manufacturing area Coal is extensively mined in the

neighbourhood, and there are machine works, dye works and iron foundries.

HECTOGRAPH: *see* OFFICE APPLIANCES.

HECTOR, son of Priam and Hecuba and husband of Andromache In Homer he is the chief Trojan warrior. He is an especial favourite of Apollo; and later poets even describe him as son of that god. After Achilles (*q.v.*) had killed him, Aphrodite and Apollo preserved his body from corruption and mutilation. Priam, guarded by Hermes, went to Achilles and prevailed on him to give back the body, which was buried with great honour. Hector was afterwards worshipped in the Troad and also at Tanagra.

HECUBA, in Greek HEKABE, principal wife of Priam, daughter of the Phrygian king Dymas (or of Cisseus, or of the river-god Sangarius). When Troy was captured and Priam slain, she was made prisoner by the Greeks. Her fate is told in various ways, most of which connect her with the promontory Cynossema ("dog's monument") on the Hellespont According to Euripides (in the *Hecuba*), her youngest son Polydorus had been placed during the siege of Troy under the care of Polymestor, king of Thrace. When the Greeks reached the Thracian Chersonese on their way home she discovered that her son had been murdered, and in revenge put out the eyes of Polymestor and murdered his two sons. Later, she was turned into a dog, a legend variously rationalized by later writers, and her grave became a mark for ships (Ovid, *Metam*, xiii. 399–575; Juvenal, x. 271 and Mayor's note).

HEDA, WILLEM CLAASZ (1594–1680), Dutch painter, born at Haarlem, was one of the first Dutchmen to devote himself to the painting of still life. He showed considerable skill and taste in arranging and colouring chased cups and beakers and tankards. Nothing is so appetizing as his "luncheon," with rare comestibles set out upon rich plate, oysters—seldom without the cut lemon—bread, champagne, olives and pastry, painted in a silvery tone against a grey background. Most of Heda's pictures are on the European continent, notably in the galleries of Aix-la-Chapelle, Amsterdam, Dresden, Ghent, The Hague, Karlsruhe, Munich, Paris, Rotterdam, Schwerin and Vienna (Liechtenstein gallery). There is one picture by him in the National Gallery, London

HEDGE BINDWEED (*Calystegia Sepium* or *Convolvulus Sepium*), a perennial vine of the morning-glory family, Convolvulaceae (*q.v.*), called also great bindweed, bracted bindweed and Rutland beauty. It is cosmopolitan in temperate regions, occurring in hedges and thickets in the British Isles and found in North America from Newfoundland to British Columbia and southward to Mexico. It is an extensively trailing or high-climbing vine, 3 ft. to 10 ft. high, with slender-stalked, spear-shaped leaves, and handsome solitary flowers, pink with white stripes or entirely white, about 2 in. long The species varies greatly and several races have been described, some of which are cultivated for ornament. (*See* CALYSTEGIA.)

HEDGEBOT or **HAYBOTE,** an ancient legal term signifying the right of a tenant or copyholder to take or cut wood for specific purposes such as the repairs of fences and hedges for the upkeep of the premises as distinguished from the cutting of timber for building purposes, which constituted an infringement of the law. *See* HAY.

HEDGEHOG or **URCHIN,** a mammal of the order Insectivora (*q.v.*), remarkable for its armature of spines and short tail. The upper jaw is longer than the lower, the snout long and flexible, and the claws long but weak. The animal is about 10in long, the lower surface covered with hairs of the ordinary character. Its eyes are small. The brain is remarkable for its low development The hedgehog has the power of rolling itself up into a ball, from which the spines stand out in every direction; these are sharp, hard, and elastic, and form an efficient defence The moment it is touched, or even hears the report of a gun, it rolls itself up by the action of four muscles beneath the skin, while the same contraction effects the erection of the spines.

Though insectivorous, the hedgehog will devour mice, frogs, and toads, as well as plants and fruits It also eats snakes, and its fondness for eggs has provoked the enmity of game preservers; and there is no doubt it occasionally attacks leverets and game-chicks. It does not emerge from its retreat during daylight, unless urged by hunger or by the necessities of its young. During winter it passes into a state of hibernation (*q.v.*), rolled up in a nest of dry leaves. In July or August the female brings forth four to eight young; at birth the spines, which in the adult are black in the middle, are white and soft, but soon harden, attaining their full size in the succeeding spring.



THE COMMON HEDGEHOG (ERINACEUS EUROPAEUS)

The hedgehog, known scientifically as *Erinaceus europaeus,* is the type of the family *Erinaceidae,* and extends over nearly the whole of Europe. The genus is represented by about a score of species, ranging over Europe, Asia, except the Malay countries, and Africa, being also found at 6,000 to 8,000 ft. above sea-level.

HEDGE NETTLE (*Stachys palustris*), a plant of the mint family (Labiatae), called also marsh-wound wort, marsh-betony and clown's-heal, widely distributed in Europe, Asia and North America. It is an erect, slender, sometimes slightly branched, rather stiffly hairy perennial, 1 ft to 4 ft. high, with lance-shaped, more or less sharply toothed leaves and purplish flowers, about ¾ in. long, borne usually in elongated clusters at the end of the stem but sometimes also in the upper axils of the leaves. This plant is typically representative of the botanical genus *Stachys,* embracing some 200 species, found (except in Australia) widely throughout the world; four others, including the wound-wort (*S. Betonica*), occur in Great Britain, and some 20 others are native to the United States and Canada.

HEDGE-SPARROW (*Prunella modularis*), a small, brown-backed European bird somewhat smaller than the house sparrow. It is a common resident and partial migrant in Great Britain and in most parts of Europe The hedge-sparrow, or dunnock, which has nothing in common with the house sparrow but the name, has a short, musical, high-pitched song, constantly repeated The cuckoo often chooses the hedge-sparrow as foster-mother for its young, as recorded by Shakespeare in *King Lear.* Like many small English birds, the hedge-sparrow has been successfully introduced into New Zealand.

HEDGING, a method by which traders in commodities may partially or entirely insure themselves against loss from price fluctuations The technique of hedging is the making at about the same time of two contracts of an opposite though corresponding nature; one a genuine trade contract in a cash or "spot" market, with a view to obtaining a dealer's ordinary trade profit, the other an insurance or protective contract in the speculative or "futures" market which counteracts loss (and profit) on the first transaction through price fluctuations. In simpler terms, hedging is the offsetting of a cash transaction in a commodity by an opposite and corresponding future transaction; one involves a purchase and the other a sale. Both involve the same amount of commodity.

The following example illustrates the execution of a simple "hedge" by a grain elevator in a local growers' market. A grain elevator operator in Walhalla, N D., buys on Oct 5, 5,000 bu. of No 1 red winter wheat at $1.33 per bushel from a farmer who has delivered the wheat to the elevator, knowing that the cash price of this grade of wheat in Minneapolis, Minn., is $1.41, 8 cents more than he pays the farmer. This difference is represented by the elevator operator's estimate of a cost of 5 cents per bushel to pay the freight from Walhalla to Minneapolis, and by the necessary margin for handling wheat of 3 cents per bushel. The purpose of hedging is to protect the trade profit in this case, a portion of the 3 cent margin Consequently, the elevator operator telegraphs a broker holding a membership on the Minneapolis Chamber of Commerce to execute on the exchange a sale of 5,000 bu. of wheat for delivery in December. The price of a December futures contracts on Oct. 5, in Minneapolis, is $1.45 The difference between the cash price of $1.41 and the December futures price of $1.45 is theoretically what the price difference should be to cover the cost (storing, insuring, etc.) of carrying the wheat

from October to December. With the conclusion of the future sale on the Minneapolis exchange, the elevator operator has protected his cash wheat either entirely or partially from loss (and profit) because of price fluctuations. As soon, however, as the trade transaction is terminated by a cash sale, the future sale, at that moment a "short" sale, must also be terminated, *i.e.*, covered by a purchase on the exchange. Both contracts are entered into at about the same time, and both must be terminated at about the same time if the hedger wishes to avoid pure speculation.

Hedging is actually a relatively imperfect form of price insurance because of its dependency upon a parallel movement of cash (spot) and future prices. In practice, the future price often runs at a discount under the cash (spot) price for long periods and the more distant delivery months often sell at a discount under the near months. Moreover, occasionally the future price may run at a premium over the cash (spot) price, a premium higher than is necessary to cover carrying charges. In such cases speculative losses and profits are possible. Hedging has reached its highest stage in the cases of wheat and cotton. It is used, however, in trading in rubber and in many other commodities, wherever organized commodity exchanges permit future contracts under careful regulation

HEDIN, SVEN (1865–), Swedish explorer, was born in Stockholm on Feb. 19, 1865 He was educated at Stockholm high school, and Uppsala university, and later studied in Berlin and Halle. In 1885–86 he travelled through Persia and Mesopotamia, and in 1890 was attached to King Oscar's Embassy to the shah of Persia. In the same year he visited Khurasan and Turkestan and reached Kashgar in 1891 His travels in Tibet placed him in the first rank of modern Asiatic explorers. Between 1893 and 1897 he travelled across the Asiatic continent from Orenburg by the Ural over the Pamirs and the plateau of Tibet to Peking. During two other expeditions (1899–1902, 1906–08) he made valuable additions to the scientific knowledge of these tracts and explored specially the sources of the Sutlej and the Brahmaputra. In 1902 he became a Swedish noble, and in 1909 the Indian Government invested him with the K C I E. In 1923 he travelled round the world, through the United States, Mongolia and Russia. He is one of the 18 members of the Swedish Academy.

Sven Hedin's writings include: *Journey through Persia and Mesopotamia and the Caucassus* (1887); *Journey through Khorasan and Turkestan* (1892–93); *Through Asia* (1898); *Central Asia and Tibet* (1903); *Adventures in Tibet* (1904); *Scientific Results of a Journey in Central Asia 1899–1902* (8 vol., 1904–07); *Transhimalaya* (3 vol., 1909–12); *Overland to India* (2 vol., 1910); *Bagdad, Babylon, Nineveh* (1917); *To Jerusalem* (1917); *Southern Tibet* (12 vol., 1917–22); *Eine Routenaufnahme durch Ostpersien* (2 vol., 1918–24); *My Life as an Explorer* (1926).

HEDJAZ: *see* HEJAZ.

HEDON, a municipal borough of the East Riding of Yorkshire, England, 5¼ m. E. of Hull by L.N.E. railway, and 2 m. from the river Humber. Pop. (1921), 1,321. It was formerly a considerable port. According to tradition the men of Hedon received a charter of liberties from King Aethelstan. The manor is not mentioned in Domesday, but it formed part of the lordship of Holderness which William the Conqueror granted to Odo, count of Albemarle. An undated charter of Henry II. contains the first certain evidence of settlement. By it, the king granted to William, count of Albemarle, free borough rights in Hedon so that his burgesses might hold of him as freely and quietly as the burgesses of York or Lincoln held of the king. An earlier charter, granted to the inhabitants of York, shows that these rights included a trade gild and freedom from many dues, not only in England, but also in France. In 1200, King John granted a confirmation of these liberties, and for this second charter the burgesses themselves paid 70 marks. In 1272, Henry III. granted to Edmund, earl of Lancaster, and Avelina his wife, then lord and lady of the manor, the right of holding a fair at Hedon on the eve, day, and morrow of the feast of St. Augustine and for five following days. After the countess' death the manor came to the hands of Edward I. In 1280 it was found by an inquisition that the men of Hedon "were few and poor" and that if the town were demised at a fee-form rent, the town might improve. Apparently the grant was not made until 1346. Hedon was incorporated by Charles II. in 1661, and James II. in 1680 gave the burgesses and the charter, granting, among other privileges, that of holding two extra fairs The church of St. Augustine is of Early English, Decorated and Perpendicular styles. The west front is particularly fine, and there is a lofty clerestory. Bricks are manufactured, but the population is mainly agricultural. The corporation possesses a remarkable mace of 15th century workmanship.

HEDONISM, in ethics, a general term for all theories of conduct in which the criterion is pleasure of one kind or another (Gr. *ἡδονή*, pleasure, from *ἡδύς*, sweet, pleasant). Hedonistic theories of conduct have been held from the earliest times, though they have been by no means of the same character. Moreover, hedonism has, especially by its critics, been very much misrepresented owing mainly to two simple misconceptions. In the first place hedonism may confine itself to the view that, as a matter of observed fact, all men do in practice make pleasure the criterion of action, or it may go further and assert that men ought to seek pleasure as the sole human good The former statement takes no view as to whether or not there is any absolute good: it merely denies that men aim at anything more than pleasure. The latter statement admits an ideal, *summum bonum*—namely, pleasure. The second confusion is the tacit assumption that the pleasure of the hedonist is necessarily or characteristically of a purely physical kind; this assumption is in the case of some hedonistic theories a pure perversion of the facts. Practically all hedonists have argued that what are known as the "lower" pleasures are not only ephemeral in themselves but also productive of so great an amount of consequent pain that the wise man cannot regard them as truly pleasurable; the sane hedonist will, therefore, seek those so-called "higher" pleasures which are at once more lasting and less likely to be discounted by consequent pain. It should be observed, however, that this choice of pleasures by a hedonist is conditioned not by "moral" (absolute) but by "prudential" (relative) considerations.

The earliest and the most extreme type of hedonism is that of the Cyrenaic School as stated by Aristippus, who argued that the only good for man is the sentient pleasure of the moment. Since (following Protagoras) knowledge is solely of momentary sensations, it is useless to try, as Socrates recommended, to make calculations as to future pleasures, and to balance present enjoyment with disagreeable consequences. The true art of life is to crowd as much enjoyment as possible into every moment. This extreme or "pure" hedonism regarded as a definite philosophic theory practically died with the Cyrenaics, though the same spirit has frequently found expression in ancient and modern, especially poetical, literature.

The confusion already alluded to between "pure" and "rational" hedonism is nowhere more clearly exemplified than in the misconceptions which have arisen as to the doctrine of the Epicureans. To identify Epicureanism with Cyrenaicism is a complete misunderstanding. It is true that pleasure is the "supreme good" of Epicurus, but his conception of that pleasure is profoundly modified by the Socratic doctrine of prudence and the eudaemonism of Aristotle. The true hedonist will aim at a life of enduring rational happiness; pleasure is the end of life, but true pleasure can be obtained only under the guidance of reason. Self-control in the choice of pleasures with a view to reducing pain to a minimum is indispensable. "Of all this, the beginning, and the greatest good, is prudence." The negative side of Epicurean hedonism was developed to such an extent by some members of the school (*see* HEGESIAS) that the ideal life is held to be rather indifference to pain than positive enjoyment. This pessimistic attitude is far removed from the positive hedonism of Aristippus.

Between the hedonism of the ancients and that of modern philosophers there lies a great gulf. Practically speaking ancient hedonism advocated the happiness of the individual: the modern hedonism of Hume, Bentham and Mill is based on a wider conception of life. The only real happiness is the happiness of the community, or at least of the majority: the criterion is society, not the individual. Thus we pass from Egoistic to Universalistic hedonism, to Utilitarianism and to Social Ethics, especially in relation to the broad theories of evolution. These theories are

confronted by the problem of reconciling and adjusting the claims of the individual with those of society. One of the most important contributions to the discussion is that of Sir Leslie Stephen (*Science of Ethics*), who elaborated a theory of the "social organism" in relation to the individual. The end of the evolution process is the production of a "social tissue" which will be "vitally efficient." Instead, therefore, of the criterion of "the greatest happiness of the greatest number," Stephen has that of the "health of the organism." Life is not "a series of detached acts, in each of which a man can calculate the sum of happiness or misery attainable by different courses." Each action must be regarded as directly bearing upon the structure of society.

See ETHICS, CYRENAICS, EPICURUS, etc. J. S. Mackenzie, *Manual of Ethics* (1924); J. Watson, *Hedonistic Theories*, 1895.

HEDRICK, ULYSSES PRENTISS (1870–), American horticulturist, was born at Independence, Ia., on Jan. 15, 1870. He graduated in 1893 at Michigan Agricultural college in which he was assistant horticulturist in 1893–95. He was professor of horticulture in Oregon Agricultural college in 1895–97, in Utah Agricultural college in 1897–99 and in Michigan Agricultural college in 1899–1905. In 1905 he became horticulturist at the New York agricultural experiment station, Geneva, where he conducted extensive researches in fruit growing, especially in pomology, in which he became a prominent American authority.

His works include *Grapes of New York* (1908); *Plums of New York* (1910); *Cherries of New York* (1915); *Peaches of New York* (1917); *Manual of American Grape Growing* (1919); *Sturdevant's Notes on Edible Plants* (1919); *Cyclopedia of Hardy Fruits* (1921); *The Pears of New York* (1922); *Systematic Pomology* (1925); and *Small Fruits of New York* (1925).

HEEL, (1) that part of the foot in man which is situated below and behind the ankle; by analogy, the calcaneal part of the tarsus in other vertebrates. The heel proper in digitigrades and ungulates is raised off the ground and is commonly known as the "knee" or "hock," while the term "heel" is applied to the hind hoofs; (2) to turn over to one side, especially of a ship.

HEEM, JAN DAVIDSZ VAN or **JOHANNES DE** (*c.* 1600–*c.* 1683), Dutch painter. He was, if not the first, certainly the greatest painter of still life in Holland. Sometimes de Heem painted alone, sometimes in company with men of his school, Madonnas or portraits surrounded by festoons of fruit or flowers. At one time he signed with initials, at others with Johannes, at others again with the name of his father joined to his own. De Heem entered the guild of Antwerp in 1635–36, and became a burgher of that city in 1637. He steadily maintained his residence till 1667, when he moved to Utrecht, where traces of his presence are preserved in records of 1668, 1669 and 1670. It is not known when he finally returned to Antwerp, but his death is recorded in the guild books of that place. A very early picture, dated 1628, in the gallery of Gotha, bearing the signature of Johannes in full, shows that de Heem at that time was familiar with the technical habits of execution peculiar to the youth of Albert Cuyp. Out of 100 pictures or more to be met with in European galleries scarcely eighteen are dated.

CORNELIUS DE HEEM, the son of Johannes, was in practice as a flower painter at Utrecht in 1658, and was still active in his profession in 1671 at The Hague. His pictures are not equal to those of his father, but they are all well authenticated, and most of them in the galleries of The Hague, Dresden, Cassel, Vienna and Berlin. In the Staedel at Frankfurt is a fruit piece, with potherbs and a porcelain jug, dated 1658; another, dated 1671, is in the museum of Brussels. DAVID DE HEEM, another member of the family, entered the guild of Utrecht in 1668 and that of Antwerp in 1693. The best piece assigned to him is a table with a lobster, fruit and glasses, in the gallery of Amsterdam; others bear his signature in the museums of Florence, Leningrad and Brunswick.

HEEMSKERK, JOHAN VAN (1597–1656), Dutch poet, born at The Hague on Feb. 27, 1597. He was educated at Bayonne, and at the university of Leyden in 1617. In 1621 he went abroad. He settled in 1640 in Amsterdam where he died on Feb. 27, 1656. For the last 12 years of his life he sat in the upper house of the States-general. Heemskerk published volumes of poems—*Minnekunst* (1622), *Minnepligt* (1625), and *Minnekunde* (1628); but he is famous as the author of *Batavische Arcadia* (1647), which introduced the Italian pastoral romance into Holland.

HEEMSKERK, MARTEN JACOBSZ (1498–1574), Dutch painter, sometimes called Van Veen, was born at Heemskerk in Holland in 1498, and apprenticed by his father, a small farmer, to Cornelisz Willemsz, a painter at Haarlem. He worked under Jan Lucadz at Delft and under Jan Schoreel at Haarlem, where he formed what is known as his first manner, a quaint and *gauche* imitation of the florid style brought from Italy by Mabuse and others. He then made a tour of northern and central Italy, before going to Rome, where he spent some years. With Antonio da San Gallo, Battista Franco and Francesco Salviati, he was selected to decorate the triumphal arches erected at Rome in April 1536 in honour of Charles V. On his return to the Netherlands he settled at Haarlem, where he became (1540) president of his gild, and married twice. In 1572 he left Haarlem for Amsterdam, where he died on Oct. 1, 1574.

The works of Heemskerk are very numerous. The portrait of the artist's father in the metropolitan Museum of Art at New York, "Adam and Eve," and "St. Luke painting the Likeness of the Virgin and Child" in the gallery of Haarlem, and the "Ecce Homo" in the museum of Ghent, are characteristic works of the period preceding Heemskerk's visit to Italy. An altar-piece executed for St. Laurence of Alkmaar in 1538–41, and composed of at least a dozen large panels, now in the cathedral of Linköping in Sweden, a "Crucifixion" executed for the Riches Claires at Ghent (now in the Ghent museum) in 1543, and the altar-piece of the Drapers Company at Haarlem, now in the gallery of The Hague, and finished in 1546, are representative of his style after his return from the south. Other notable works are in the galleries of Brussels, Brunswick, Cologne, Delft, Dresden, The Hague, Hampton Court, Haarlem, Petrograd, Prague, Rennes, Turin and Vienna. His self portrait is in the Fitz-William museum at Cambridge.

HEEMSKERK, THEODORE (1852–), Dutch statesman, son of Jan Heemskerk, entered the second chamber in 1888. He made a great reputation as a jurisconsult, and as prime minister (1908–13) reserved for himself the portfolio of the interior. He was minister of justice (1918–25) and minister of State (1926). He was the leader in the second chamber of the Anti-Revolutionary Party.

HEER, JAKOB CHRISTOPH (1859–1925), a prolific Swiss novelist, was born at Töss (Canton Zürich) on July 17, 1859, and died on Aug. 20, 1925. After some experience as a teacher and editor, he devoted himself to writing romantic novels, chiefly dealing with Swiss life and marked by a certain old-fashioned air that enhances rather than detracts from their charm. His best work is *An Heiligen Wassern* (1898), but the most popular is *Der König der Bernina* (1900), describing an interesting phase in the history of the Grisons. His *Tobias Heider* (1923) is autobiographical in character.

See G. H. Heer, *Jakob Christoph Heer* (1927).

HEER, OSWALD (1809–1883), Swiss geologist and naturalist, was born at Nieder-Utzwyl in Canton St. Gallen on Aug. 31, 1809. He was a pioneer in palaeobotany, distinguished for his researches on the Miocene flora. In 1851 he became professor of botany in the University of Zurich, and he directed his attention to the Tertiary plants and insects of Switzerland. For some time he was director of the botanic garden at Zurich. He died at Lausanne on Sept. 27, 1883.

He published *Flora Tertiaria Helvetiae* (3 vols., 1855–59); *Die Urwelt der Schweiz* (1865), and *Flora fossilis Arctica* (1868–83).

HEEREN, ARNOLD HERMANN LUDWIG (1760–1842), German historian, was born on Oct. 25, 1760 at Arbergen, near Bremen. He studied history at Göttingen, and was appointed (1787) one of the professors of philosophy, and then of history in his university. He died at Göttingen on March 6, 1842. Heeren regarded the states of antiquity from an altogether fresh point of view; he examined their economic relations, their constitutions, their financial systems, and thus threw a new light on the development of the ancient world. He was a pioneer in the movement for the economic interpretation of history.

Heeren's chief works are: *Ideen über Politik, den Verkehr, und den Handel der vornehmsten Völker der alten Welt* (2 vols., Göttingen, 1793–96; 4th ed., 6 vols., 1824–26; Eng. trans. 1833); *Geschichte des Studiums der klassischen Litteratur seit dem Wiederaufleben der Wissenschaften* (2 vols., Göttingen, 1797–1802; new ed., 1822); *Geschichte der Staaten des Altertums* (Göttingen, 1799; Eng. trans., Oxford, 1840); *Geschichte des europäischen Staatensystems* (Göttingen, 1800; 5th ed., 1830, Eng. trans., 1834); *Versuch einer Entwickelung der Folgen der Kreuzzüge* (Göttingen, 1808; French trans. 1808), a prize essay of the Institute of France. With Friedrich August Ukert (1780–1851) he founded the famous historical collection, *Geschichte der europäischen Staaten* (Gotha, 1819 *seq.*), which reached its 158th volume in 1925, and contributed many papers to learned periodicals.

HEERLEN, a town of Holland in the south of the province of Limburg, on the railway from the German frontier at Alsdorf westward and northward, and about 5 m. from the frontier. Pop. (1927), 40,719 The town is one of the centres of the coalfield which is now in course of development.

HEFELE, KARL JOSEF VON (1809–1893), German Catholic theologian, was born at Unterkochen, Württemberg, on March 15, 1809, and was educated at Tübingen, where, after minor appointments elsewhere, in 1840 he became professor of Church history and patristics. From 1842 to 1845 he sat in the National Assembly of Württemberg, and in 1869 was enthroned bishop of Rottenburg Previous to this appointment, Hefele had won a reputation for scholarship by his early publications: *Patrum Apostolicorum Opera* (1839, 4th ed. 1855), *Der Kardinal Ximenes* (1844, 2nd ed. 1851), *Chrysostomuspostille* (1845, 3rd ed. 1857) and particularly the *Conciliengeschichte* (1855–74, 2nd ed. 1873–90, Eng. trans. 1871). He opposed the decrees of papal infallibility at the Vatican Council of 1870, and did not submit until 1871. Hefele died at Rottenburg on June 6, 1893

See Herzog, *Realencyklopadie,* and *Dict. de Théol. catholique.*

HEGEL, GEORG WILHELM FRIEDRICH (1770–1831), German philosopher, was born at Stuttgart on Aug. 27, 1770. His father was a revenue officer. He learned the elements of Latin from his mother before he went to the Stuttgart grammar school, where he remained until he was 18. As a schoolboy he made a collection of extracts, alphabetically arranged, comprising annotations on classical authors, passages from newspapers, treatises on morals and mathematics from the standard works of the period. In this way he absorbed raw materials for elaboration. Yet as evidence that he was not merely receptive we have essays already breathing that admiration of the classical world which he never lost.

In the autumn of 1788 he entered at Tübingen as a student of theology; but he showed no interest in theology and his sermons were a failure. He found more congenial reading in the classics, on the advantages of studying which his first essay was written. After two years he took the degree of Ph D., and in the autumn of 1793 received his theological certificate, stating him to be of good abilities, but of middling industry and knowledge, and especially deficient in philosophy. As a student, his elderly appearance gained him the title "Old man," but he took part in the walks, beer-drinking and love-making of his fellows. He gained most from intellectual intercourse with his contemporaries, among whom were J. C. F. Hölderlin and Schelling. With Hölderlin Hegel learned to feel for the old Greeks a love which grew stronger as the semi-Kantianized theology of his teachers more and more failed to interest him. With Schelling like sympathies bound him. They both protested against the political and ecclesiastical inertia of their native state, and adopted the doctrines of freedom and reason.

On leaving college, he became a private tutor at Bern and lived in intellectual isolation. He compiled a systematic account of the fiscal system of the canton Bern; but the main factor in his mental growth came from his study of Christianity. Under the impulse given by Lessing and Kant he turned to the original records of Christianity, and attempted to construe for himself the real significance of Christ. He wrote a life of Jesus, in which Jesus was simply the son of Joseph and Mary. He did not stop to criticize as a philologist, and ignored the miraculous. He asked for the secret contained in the conduct and sayings of this man which made him the hope of the human race. Jesus appeared as revealing the unity with God in which the Greeks in their best days unwittingly rejoiced, and as lifting the eyes of the Jews from a lawgiver who metes out punishment on the transgressor, to the destiny which in the Greek conception falls on the just no less than on the unjust.

The interest of these ideas is twofold. In Jesus Hegel finds the expression for something higher than mere morality: he finds a noble spirit which rises above the contrasts of virtue and vice into the concrete life, seeing the infinite always embracing our finitude, and proclaiming the divine which is in man and cannot be overcome by error and evil, unless man close his eyes and ears to the godlike presence within him. In religious life, in short, he finds the principle which reconciles the opposition of the temporal mind. But, secondly, the general source of the doctrine that life is higher than all its incidents is of interest He does not free himself from the current theology either by rational moralizing like Kant, or by bold speculative synthesis like Fichte and Schelling. He finds his panacea in the concrete life of humanity

During these years Hegel kept up a slack correspondence with Schelling and Hölderlin. Schelling, already on the way to fame, kept Hegel abreast with German speculation. Both of them were intent on forcing the theologians into the daylight, and grudged them any aid they might expect from Kant's postulation of God and immortality to crown the edifice of ethics Meanwhile, Hölderlin in Jena had been following Fichte's career with an enthusiasm with which he infected Hegel Towards the close of his engagement at Bern, Hegel had received hopes from Schelling of a post at Jena. Fortunately his friend Hölderlin, now tutor in Frankfort, secured a similar situation there for Hegel in the family of Herr Gogol, a merchant (Jan. 1797). The new post gave him more leisure and the society he needed.

About this time he turned to questions of economics and government He had studied Gibbon, Hume and Montesquieu in Switzerland We now find him making extracts from the English newspapers on the Poor-Law Bill of 1796; criticizing the Prussian land laws, promulgated about the same time; and writing a commentary on James Steuart's *Inquiry into the Principles of Political Economy* Here, as in criticisms of Kant's ethical writings, Hegel aims at correcting the abstract discussion of a topic by treating it in its systematic interconnections. Church and state, law and morality, commerce and art are reduced to factors in the totality of human life, from which the specialists had isolated them. But the best evidence of Hegel's attention to contemporary politics is two unpublished essays—one of them written in 1798, "On the Internal Condition of Wurttemberg in Recent Times, particularly on the Defects in the Magistracy," the other a criticism on the constitution of Germany, written, probably, not long after the peace of Lunéville (1801). Both essays are critical rather than constructive.

His old interest in the religious question reappears, but in a more philosophical form. Starting with the contrast between a natural and a positive religion, he regards a positive religion as one imposed upon the mind from without, not a natural growth crowning the round of human life. A natural religion, on the other hand, was not, he thought, the one universal religion of every clime and age, but rather the spontaneous development of the national conscience varying in varying circumstances. A people's religion completes and consecrates their whole activity: in it the people rises above its finite life in limited spheres to an infinite life where it feels itself fulfilled. Even philosophy with Hegel at this epoch was subordinate to religion; for philosophy must never abandon the finite in the search for the infinite. Soon, however, Hegel adopted a view according to which philosophy is a higher mode of apprehending the infinite than even religion.

At Frankfort, meanwhile, the philosophic ideas of Hegel first assumed proper philosophic form. In a ms. of 102 quarto sheets, of which the first three and the seventh are wanting, there is preserved the original sketch of the Hegelian system, so far as the logic and metaphysics and part of the philosophy of nature are concerned. The third part of the system—the ethical theory—seems to have been composed afterwards; it is contained in its first draft in another ms. of 30 sheets.

Circumstances soon put Hegel in the way to complete these out-

lines. His father died in January 1799; and the slender sum which Hegel received as his inheritance, 3,154 gulden (about £260), enabled him to think once more of a studious life. Hegel arrived at Jena in January 1801. An end had already come to the brilliant epoch at Jena, when the romantic poets, Tieck, Novalis and the Schlegels made it the headquarters of their fantastic mysticism, and Fichte turned the results of Kant to the service of revolutionary ideas Schelling was the main philosophical lion of the time; and in some quarters Hegel was spoken of as a new champion summoned to help him in his struggle with the more prosaic continuators of Kant. Hegel's first performance seemed to justify the rumour. It was an essay on the difference between the philosophic systems of Fichte and Schelling, tending in the main to support the latter. Still more striking was the agreement shown in the *Critical Journal of Philosophy*, which Schelling and Hegel wrote conjointly during the years 1802–03. So latent was the difference between them at this epoch that in one or two cases it is not possible to determine by whom the essay was written. The dissertation by which Hegel qualified for the position of *Privatdozent* (*De orbitis planetarum*) was probably chosen under the influence of Schelling's philosophy of nature.

Hegel's lectures, in the winter of 1801–02, on logic and metaphysics were attended by about eleven students. Later, in 1804, we find him with a class of about thirty, lecturing on his whole system; but his average attendance was rather less. Besides philosophy, he once at least lectured on mathematics. As he taught, he was led to modify his original system, and notice after notice of his lectures promised a text-book of philosophy—which, however, failed to appear Meanwhile, after the departure (1803) of Schelling from Jena, Hegel was left to work out his own views. Besides philosophical studies, where he now added Aristotle to Plato, he read Homer and the Greek tragedians, made extracts from books, attended lectures on physiology, and dabbled in other sciences. On his own representation at Weimar, he was in February 1805 made a professor extraordinarius, and in July 1806 drew his first and only stipend—100 thalers. At Jena, though some of his hearers became attached to him, Hegel was not a popular lecturer

Of the lectures of that period there still remain considerable notes. The language often had a theological tinge (never entirely absent), as when the "idea" was spoken of, or "the night of the divine mystery," or the dialectic of the absolute called the "course of the divine life." Still his view was growing clearer, and his difference from Schelling more palpable. Both Schelling and Hegel stand in a relation to art, but while the aesthetic model of Schelling was found in the contemporary world where art was a special sphere and the artist a separate profession in no intimate connection with the age and nation, the model of Hegel was found rather in those works of national art in which art is not a part but an aspect of the common life, and the artist is not a mere individual but a concentration of the passion and power of beauty in the whole community.

On the 14th of October 1806 Napoleon was at Jena. Hegel, like Goethe, felt no patriotic shudder at the national disaster, and in Prussia he saw only a corrupt and conceited bureaucracy. Writing to his friend F. J. Niethammer (1766–1848) on the day before the battle, he speaks with admiration of the "world-soul," the emperor, and with satisfaction of the probable overthrow of the Prussians. Hegel's fortunes were now at the lowest ebb. Yet at this time he finished and published his first great work, the *Phänomenologie des Geistes* (1807). He was, therefore, glad to become editor of the *Bamberger Zeitung* (1807–1808). Of his editorial work there is little to tell; no leading articles appeared in his columns. It was not a suitable vocation, and he gladly accepted the rectorship of the Aegidien-gymnasium in Nuremberg, a post which he held from December 1808 to August 1816. As a teacher and master Hegel inspired confidence in his pupils, and maintained discipline without pedantic interference in their associations and sports.

In 1811 Hegel married Marie von Tucher (twenty-two years his junior) of Nuremberg. The marriage was entirely happy. His income amounted at Nuremberg to 1,500 gulden (£130) and a house; at Heidelberg, as professor, he received about the same sum; at Berlin about 3,000 thalers (£300). Two sons were born to them; the elder, Karl, became eminent as a historian. The younger, Immanuel, was born on Sept. 24, 1816.

In 1812 appeared the first two volumes of his *Wissenschaft der Logik*, and the work was completed by a third in 1816. This work, in which his system was for the first time presented in what, with a few minor alterations, was its ultimate shape, brought him the offer of three professorships, at Erlangen, Berlin and Heidelberg. He accepted the post at Heidelberg, whence Fries had just gone to Jena (October 1816). Among his pupils was Hermann F. W. Hinrichs (*q.v.*), to whose *Religion in its Inward Relation to Science* (1822) Hegel contributed an important preface.

In 1817 he brought out the *Encyklopädie d. philos. Wissenschaften im Grundrisse* for use at his lectures. It is the only exposition of the Hegelian system as a whole which we have direct from Hegel's own hand. Besides this work he wrote two reviews for the Heidelberg *Jahrbücher*—the first on F. H. Jacobi, the other a political pamphlet entitled a *Criticism on the Transactions of the Estates of Württemberg in 1815–1816.*

In 1818 Hegel accepted the renewed offer of the chair of philosophy at Berlin, vacant since the death of Fichte. His influence upon his pupils, and his solidarity with the Prussian government, gave him a position such as few professors have held.

In 1821 Hegel published the *Grundlinien der Philosophie des Rechts*. It is a theory in which the fundamental principles of law, morality and social institutions (municipal and political) are shown to be connected stages in the logical evolution of rational will. It is animated by the idea that whatever is real is rational, and whatever is rational is real. His theory was not a mere formulation of the Prussian state. It is inspired by an overpowering sense of the value of organization—a sense that liberty can never be dissevered from order, that a vital interconnection between all the parts of the body politic is the source of all good.

During his thirteen years at Berlin Hegel's whole soul seems to have been in his lectures. Between 1823 and 1827 his activity reached its maximum. His notes were subjected to perpetual revisions and additions We can form an idea of them from the shape in which they appear in his published writings. Those on *Aesthetics*, on the *Philosophy of Religion*, on the *Philosophy of History* and on the *History of Philosophy*, have been published by his editors, mainly from the notes of his students, under their separate heads; while those on logic, psychology and the philosophy of nature are appended in the form of illustrative and explanatory notes to the sections of his *Encyklopädie*. During these years hundreds of hearers from all parts of Germany, and beyond, came under his influence. His fame was carried abroad by eager or intelligent disciples

Three courses of lectures are especially the product of his Berlin period: those on aesthetics, the philosophy of religion and the philosophy of history. In the years preceding the revolution of 1830, public interest, excluded from political life, turned to theatres, concert-rooms and picture-galleries. At these Hegel became a frequent and appreciative visitor and made extracts from the art-notes in the newspapers. In his holiday excursions, the interest in the fine arts more than once took him out of his way to see some old painting. This familiarity with the facts of art, though neither deep nor historical, gave a freshness to his lectures on aesthetics, which, as put together from the notes of 1820, 1823, 1826, are in many ways the most successful of his efforts.

The lectures on the philosophy of religion are another application of his method. Shortly before his death he had prepared for the press a course of lectures on the proofs for the existence of God. In his lectures on religion he dealt with Christianity, as in his philosophy of morals he had regarded the state. On the one hand he turned his weapons against the rationalistic school, who reduced religion to the modicum compatible with an ordinary worldly mind. On the other hand he criticized the school of Schleiermacher, who elevated feeling to a place in religion above systematic theology. His middle way attempts to show that the dogmatic creed is the rational development of what was implicit in religious feeling. To do so, of course, philosophy becomes the

interpreter and the superior.

A Hegelian school began to gather. The flock included intelligent pupils, empty-headed imitators, and romantic natures who turned philosophy into lyric measures. Opposition and criticism only served to define more precisely the adherents of the new doctrine. Hegel himself grew more and more into a belief in his own doctrine as the one truth for the world. He was in harmony with the government, and his followers were on the winning side. Though he had soon resigned all direct official connection with the schools of Brandenburg, his real influence in Prussia was considerable, and as usual was largely exaggerated in popular estimate. In the narrower circle of his friends his birthdays were the signal for congratulatory verses. In 1831 he received a decoration from Frederick William III. In 1830 he was rector of the university.

One of the last literary undertakings in which he took part was the establishment of the Berlin *Jahrbücher für wissenschaftliche Kritik,* in which he assisted Edward Gans and Varnhagen von Ense. The aim of this review was to give a critical account, certified by the names of the contributors, of the literary and philosophical productions of the time, in relation to the general progress of knowledge. The journal was not solely in the Hegelian interest; and more than once, when Hegel attempted to domineer over the other editors, he was met by vehement and vigorous opposition.

The revolution of 1830 was a great blow to him, and the prospect of democratic advances almost made him ill. His last literary work, the first part of which appeared in the *Preussische Staatszeitung*, was an essay on the English Reform Bill of 1831. It contains primarily a consideration of its probable effects on the character of the new members of parliament, and the measures which they may introduce. In the latter connection he enlarged on several points in which England had done less than many continental states for the abolition of monopolies and abuses.

In 1831 cholera first entered Europe. Hegel and his family retired for the summer to the suburbs, and there he finished the revision of the first part of his *Science of Logic*. At the beginning of the winter session he returned to his house in the Kupfergraben. On Nov. 14, after one day's illness, he died of cholera and was buried, as he had wished, between Fichte and Solger.

Hegel in his class-room was neither imposing nor fascinating. You saw a plain, old-fashioned face, without life or lustre—a figure which had never looked young, and was now prematurely aged; the furrowed face bore witness to concentrated thought. Sitting with his snuff-box before him, and his head bent down, he looked ill at ease, and kept turning the folios of his notes. His utterance was interrupted by frequent coughing; every sentence came out with a struggle. The style was no less irregular. Sometimes in plain narrative the lecturer would be specially awkward, while in abstruse passages he seemed specially at home, rose into a natural eloquence, and carried away the hearer by the grandeur of his diction. (For bibliography see *s.v.* HEGELIAN PHILOSOPHY.)

HEGELIAN PHILOSOPHY. Hegelianism is confessedly one of the most difficult of all philosophies. Every one has heard the legend which makes Hegel say, "One man has understood me, and even he has not." He abruptly hurls us into a world where old habits of thought fail us. In three places, indeed, he has attempted to exhibit the transition to his own system from other levels of thought; but in none with much success. In the introductory lectures on the philosophy of religion he gives a rationale of the difference between the modes of consciousness in religion and philosophy (between *Vorstellung* and *Begriff*). In the beginning of the *Encyklopädie* he discusses the defects of dogmatism, empiricism, the philosophies of Kant and Jacobi. In the first case he treats the psychological aspect of the difference; in the latter he presents his doctrine less in its essential character than in special relations to the prominent systems of his time. The *Phenomenology of Spirit*, called "the first part" of his system, suffers from a different fault. It is not an introduction—for the philosophy which it was to introduce was not then fully elaborated. Even to the last Hegel had not so externalized his system as to treat it as something to be led up to by gradual steps His philosophy was not one aspect of his intellectual life, to be contemplated from others; it was the ripe fruit of concentrated reflection, and had become the one all-embracing form and principle of his thinking. More than most thinkers, his thought was moulded by the influences of his time and the lessons of history.

The Phenomenology.—The *Phenomenology* is the picture of the Hegelian philosophy in the making—at the stage before the scaffolding has been removed from the building. For this reason the book is at once the most brilliant and the most difficult of Hegel's works—the most brilliant as a speculative effort constructed to combine the abstract record of a logical evolution with the real history of an intellectual growth; the most difficult because, instead of treating the rise of intelligence (from its first appearance in contrast with the real world to its final recognition of its presence in, and rule over, all things) as a purely subjective process, it exhibits this rise as wrought out in historical epochs, national characteristics, forms of culture and faith, and philosophical systems. The theme is identical with the introduction to the *Encyklopädie;* but it is treated in a very different style. From all periods of the world—from mediaeval piety and stoical pride, Kant and Sophocles, science and art, religion and philosophy—regardless of mere chronology, Hegel gathers in the vineyards of the human spirit the grapes from which he crushes the wine of thought The mind coming through a thousand phases of mistake and disappointment to a sense and realization of its true position in the universe—such is the drama which is subjectively Hegel's own history, but is represented objectively as the process of the spiritual history of humanity reproduced in himself. The *Phenomenology* stands to the *Encyklopadie* somewhat as the dialogues of Plato stand to the Aristotelian treatises. It contains almost all his philosophy—but irregularly and without due proportion.

The *Phenomenology* treats of the attitudes of consciousness towards reality under the six heads of consciousness, self-consciousness, reason (*Vernunft*), spirit (*Geist*), religion and absolute knowledge. The native attitude of consciousness towards existence is reliance on the evidence of the senses; but a little reflection is sufficient to show that the reality attributed to the external world is as much due to intellectual conceptions as to the senses, and that these conceptions elude us when we try to fix them. If consciousness cannot detect a permanent object outside it, so self-consciousness cannot find a permanent subject in itself. It may, like the Stoic, assert freedom by holding aloof from the entanglements of real life, or like the sceptic regard the world as a delusion, or finally, as the "unhappy consciousness" (*Unglückliches Bewusstsein*), may be a recurrent falling short of a perfection which it has placed above it in the heavens. But in this isolation from the world, self-consciousness has closed its gates against the stream of life. The perception of this is reason Reason convinced that the world and the soul are alike rational observes the external world, mental phenomena, and specially the nervous organism, as the meeting ground of body and mind. But reason finds much in the world recognizing no kindred with her, and so turning to practical activity seeks in the world the realization of her own aims. Reason abandons her efforts to mould the world, and is content to let the aims of individuals work out their results independently, only stepping in to lay down precepts for the cases where individual actions conflict, and to test these precepts by the rules of formal logic.

So far we have seen consciousness on one hand and the real world on the other. The stage of *Geist* reveals the consciousness no longer as critical and antagonistic but as the indwelling spirit of a community, as no longer isolated from its surroundings but the union of the single and real consciousness with the vital feeling that animates the community This is the lowest stage of concrete consciousness—life, and not knowledge; the spirit inspires, but does not reflect. It is the age of unconscious morality, when the individual's life is lost in the society of which he is an organic member. But increasing culture presents new ideals, and the mind, absorbing the ethical spirit of its environment, gradually emancipates itself from conventions and superstitions. This *Aufklärung* prepares the way for the rule of conscience, for the moral view of the world as subject of a moral law. From the moral

world the next step is religion; the moral law gives place to God. But the idea of Godhead, too, as it first appears, is imperfect, and has to pass through the forms of nature-worship and of art before it reaches a full utterance in Christianity. Religion in this shape is the nearest step to the stage of absolute knowledge; and this absolute knowledge—"the spirit knowing itself as spirit"—is not something which leaves these other forms behind but the full comprehension of them as the organic constituents of its empire; "they are the memory and the sepulchre of its history, and at the same time the actuality, truth and certainty of its throne." Here, according to Hegel, is the field of philosophy.

The preface to the *Phenomenology* signalled the separation from Schelling—the adieu to romance. Philosophy is to be the science of the actual world—it is the spirit comprehending itself in its own externalizations and manifestations. The philosophy of Hegel is idealism, but it is an idealism in which every idealistic unification has its other face in the multiplicity of existence. It is realism as well as idealism, and never quits its hold on facts. Nature and mind in the Hegelian system—the external and the spiritual world—have the same origin, but are not co-equal branches. The natural world proceeds from the "idea," the spiritual from the idea and nature. Reality, independent of the individual consciousness, there must be; reality, independent of all mind, is an impossibility At the basis of all reality, whether material or mental, there is thought. Thought in its primary form, when in all its parts completed, is what Hegel calls the "idea." But the idea, though fundamental, is in another sense final, in the process of the world. It only appears in consciousness as the crowning development of the mind. Only with philosophy does thought become fully conscious of itself in its origin and development. Accordingly the history of philosophy is the presupposition of logic, or the three branches of philosophy form a circle

Logic.—The exposition or constitution of the "idea" is the work of the Logic As the total system falls into three parts, so every part of the system follows the triadic law. Every truth, every reality, has three aspects or stages; it is the unification of two contradictory elements, of two partial aspects of truth which are not merely contrary, like black and white, but contradictory, like same and different. The first step is a preliminary affirmation and unification, the second a negation and differentiation, the third a final synthesis. For example, the seed of the plant is an initial unity of life, which when placed in its proper soil suffers disintegration into its constituents, and yet in virtue of its vital unity keeps these divergent elements together, and reappears as the plant with its members in organic union. Or again, the process of scientific induction is a threefold chain; the original hypothesis (the first unification of the fact) seems to melt away when confronted with opposite facts, and yet no scientific progress is possible unless the stimulus of the original unification is strong enough to clasp the discordant facts and establish a reunification. Thesis, antithesis and synthesis, a Fichtean formula, is generalized by Hegel into the essential law of thought.

In what we may call their psychological aspect these three stages are known as the abstract stage, or that of understanding (*Verstand*), the dialectical stage, or that of negative reason, and the speculative stage, or that of positive reason (*Vernunft*). The first of these attitudes taken alone is dogmatism; the second, when similarly isolated, is scepticism; the third, when detached from its elements, is mysticism. Thus Hegelianism reduces dogmatism, scepticism and mysticism to factors in philosophy. The abstract or dogmatic thinker believes his object to be one, simple and stationary, and intelligible apart from its surroundings The dialectic of negative reason rudely dispels these views. Appealing to reality it shows that the identity and permanence of forms are contradicted by history; instead of unity it exhibits multiplicity, instead of identity difference, instead of a whole, only parts. Dialectic is, therefore, a dislocating power; it shakes the solid structures of material thought, and exhibits the instability latent in such conceptions of the world. In the realm of abstract thought these transitions take place lightly. In the worlds of nature and mind they are more palpable and violent. But reason is not negative only; while it disintegrates the mass or unconscious unity, it builds up a new unity with higher organization. What is required is to readjust our original thesis in such a way as to include and give expression to both the elements in the process.

The universe, then, is a process or development, to the eye of philosophy. It is the process of the absolute—in religious language, the manifestation of God. In the background of all, the absolute is eternally present; the rhythmic movement of thought is the self-unfolding of the absolute. God reveals Himself in the logical idea, in nature and in mind; but mind is not alike conscious of its absoluteness in every stage of development. Philosophy alone sees God revealing Himself in the ideal system of thought, as it were "in his eternal being prior to the creation of nature and a finite mind"; in the natural world, as a series of materialized forces and forms of life; and in the spiritual world as the human soul, the legal and moral order of society, and the creations of art, religion and philosophy.

The logic of Hegel is the only rival to the logic of Aristotle. What Aristotle did for the theory of demonstrative reasoning, Hegel attempted to do for the whole of human knowledge. His logic is an enumeration of the forms or categories by which our experience exists. It carried out Kant's doctrine of the categories as *a priori* synthetic principles, but removed the limitation by which Kant denied them any constitutive value except in alliance with experience. According to Hegel the terms in which thought exhibits itself are a system of their own, with laws and relations which reappear in a less obvious shape in the theories of nature and mind Nor are they restricted to the small number which Kant obtained by manipulating the current subdivision of judgments. But all forms by which thought holds sensations in unity (the formative or synthetic elements of language) had their place assigned in a system where one leads up to and passes over into another.

The fact which ordinary thought ignores, and of which ordinary logic therefore provides no account, is the presence of gradation and continuity in the world The general terms of language simplify the universe by reducing its variety of individuals to a few forms, none of which exists simply and perfectly The method of the understanding is to divide and then to give a separate reality to what it has thus distinguished. It is part of Hegel's plan to remedy this one-sided character of thought, by laying bare the gradations of ideas. He lays special stress on the point that abstract ideas when held in their abstraction are almost interchangeable with their opposites—that extremes meet, and that in every true and concrete idea there is a coincidence of opposites.

The beginning of the Logic is an illustration of this The logical idea is treated under the three heads of being (*Sein*), essence (*Wesen*) and notion (*Begriff*). The simplest term of thought is being; we cannot think less about anything than when we merely say that it is. Being—the abstract "is"—is *nothing* definite, and nothing at least *is*. Being and not being are thus declared identical—a proposition which in this unqualified shape was to most people a stumbling-block at the very door of the system. Instead of the mere "is" which is as yet nothing, we should rather say "becomes," and as "becomes" always implies "something," we have determinate being—"a being" which in the next stage of definiteness becomes "one." And in this way we pass on to the quantitative aspects of being.

The terms treated under the first head, in addition to those already mentioned, are the abstract principles of quantity and number, and their application in measure to determine the limits of being. Under the title of essence are discussed those pairs of correlative terms which are habitually employed in the explanation of the world—such as law and phenomenon, cause and effect, reason and consequence, substance and attribute. Under the head of notion are considered, firstly, the subjective forms of conception, judgment and syllogism; secondly, their realization in objects as mechanically, chemically or teleologically constituted; and thirdly, the idea first of life, and next of science, as the complete interpenetration of thought and objectivity. The third part of logic evidently is what contains the topics usually treated in logic-books, though even here the province of logic in the ordinary

sense is exceeded. The first two divisions—the "objective logic"—are what is usually called metaphysics

The characteristic of the system is the gradual way in which idea is linked to idea so as to make the division into chapters only an arrangement of convenience. The merit of Hegel is to have indicated and to a large extent displayed the filiation and mutual limitation of our forms of thought; to have arranged them in the order of their comparative capacity to give a satisfactory expression to truth in the totality of its relations; and to have broken down the partition which in Kant separated the formal logic from the transcendental analytic, as well as the general disruption between logic and metaphysic.

Philosophy of Nature.—The Philosophy of Nature starts with the result of the logical development, with the full scientific "idea." But the relations of pure thought, losing their inwardness, appear as relations of space and time; the abstract development of thought appears as matter and movement. Instead of thought, we have perception; instead of dialectic, gravitation; instead of causation, sequence in time. The whole falls under the three heads of mechanics, physics and "organic"—the content under each varying somewhat in the three editions of the *Encyklopädie*. The charges of superficial analogies, so freely urged against the "Natur-philosophie" by critics who forget the impulse it gave to physical research by the identification of forces then believed to be radically distinct, do not particularly affect Hegel But in general it may be said that he looked down upon the mere natural world The meanest of the fancies of the mind and the most casual of its whims he regarded as a better warrant for the being of God than any single object of nature

His point of view was essentially opposed to the current views of science To metamorphosis he only allowed a logical value, as explaining the natural classification; the only real, existent metamorphosis he saw in the development of the individual from its embryonic stage. Still more distinctly did he contravene the general tendency of scientific explanation. "It is held the triumph of science to recognize in the general process of the earth the same categories as are exhibited in the processes of isolated bodies. This is, however, an application of categories from a field where the conditions are finite to a sphere in which the circumstances are infinite." In astronomy he depreciates Newton and elevates Kepler, accusing Newton particularly, à propos of the distinction of centrifugal and centripetal forces, of leading to a confusion between what is mathematically to be distinguished and what is physically separate

Philosophy of Mind. 1. Psychology.—The third part of the system is the Philosophy of Mind. Its three divisions are the "subjective mind" (psychology), the "objective mind" (philosophic jurisprudence, moral and political philosophy) and the "absolute mind" (the philosophy of art, religion and philosophy). The subjects of the second and third divisions have been treated by Hegel with great detail The "objective mind" is the topic of the *Rechts-Philosophie*, and of the lectures on the Philosophy of History; while on the "absolute mind" we have the lectures of Aesthetic, on the Philosophy of Religion and on the History of Philosophy—in short, more than one-third of his works

The purely psychological branch of the subject takes up half of the space allotted to *Geist* in the *Encyklopädie*. It falls under the three heads of anthropology, phenomenology and psychology proper. Anthropology treats of the mind in union with the body—of the natural soul—and discusses the relations of the soul with the planets, the races of mankind, the differences of age, dreams, animal magnetism, insanity and phrenology In the Phenomenology consciousness, self-consciousness and reason are dealt with. The title of the section and the contents recall, though with some important variations, the earlier half of his first work; but here the historical background on which the stages in the development of the ego were represented has disappeared. Psychology, in the stricter sense, deals with the various forms of theoretical and practical intellect, such as attention, memory, desire and will. In this account of the development of an independent, active and intelligent being from the stage where man like the Dryad is a portion of the natural life around him, Hegel has combined what may be termed a physiology and pathology of the mind—a subject far wider than that of ordinary psychologies. It is a great merit to have even attempted some system in the dark anomalies which lie under the normal consciousness, and to have traced the genesis of the intellectual faculties from animal sensitivity.

2. Law and History.—The theory of the mind as objectified in the institutions of law, the family and the state is discussed in the "Philosophy of Right." Beginning with the antithesis of a legal system and morality, Hegel, carrying out the work of Kant, presents the synthesis of these elements in the ethical life (*Sittlichkeit*) of the family and the state. Treating the family as an instinctive realization of the moral life, and not as the result of contract, he shows how by the means of wider associations due to private interests the state issues as the full home of the moral spirit, where intimacy of interdependence is combined with freedom of independent growth. The state is the consummation of man as finite; it is the necessary starting-point whence the spirit rises to an absolute existence in the spheres of art, religion and philosophy In the finite world or temporal state, religion, as the finite organization of a church, is, like other societies, subordinate to the state But on another side, as absolute spirit, religion, like art and philosophy, is not subject to the state, but belongs to a higher region.

The political state is always an individual, and the relations of these states with each other and the "world-spirit" of which they are the manifestations constitute the material of history The *Lectures on the Philosophy of History*, edited by Gans and subsequently by Karl Hegel, is the most popular of Hegel's works. The history of the world is a scene of judgment where one people and one alone holds for awhile the sceptre, as the unconscious instrument of the universal spirit, till another rises in its place, with a fuller measure of liberty—a larger superiority to the bonds of natural and artificial circumstance. Three main periods—the Oriental, the Classical and the Germanic—in which respectively the single despot, the dominant order, and the man as man possess freedom—constitute the history of the world Inaccuracy in detail and artifice in the arrangement of isolated peoples are inevitable in such a scheme A graver mistake, according to some critics, is that Hegel, far from giving a law of progress, seems to suggest that the history of the world is nearing an end, and has merely reduced the past to a logical formula. The answer to this charge is partly that such a law seems unattainable, and partly that the idealistic content of the present which philosophy extracts is always an advance upon actual fact, and so does throw a light into the future. And at any rate the method is greater than Hegel's employment of it.

3. Art, Religion and Philosophy.—As with Aristotle so with Hegel—beyond the ethical and political sphere rises the world of absolute spirit in art, religion and philosophy. The psychological distinction between the three forms is that sensuous perception (*Anschauung*) is the organon of the first, presentative conception (*Vorstellung*) of the second and free thought of the third. The work of art, the first embodiment of absolute mind, shows a sensuous conformity between the idea and the reality in which it is expressed. The so-called beauty of nature is for Hegel an adventitious beauty The beauty of art is a beauty born in the spirit of the artist and born again in the spectator; it is not like the beauty of natural things, an incident of their existence, but is "essentially a question, an address to a responding breast, a call to the heart and spirit." The perfection of art depends on the degree of intimacy in which idea and form appear worked into each other From the different proportion between the idea and the shape in which it is realized arise three different forms of art When the idea, itself indefinite, gets no further than a struggle and endeavour for its appropriate expression, we have the symbolic, which is the Oriental, form of art, which seeks to compensate its imperfect expression by colossal and enigmatic structures In the second or classical form of art the idea of humanity finds an adequate sensuous representation But this form disappears with the decease of Greek national life, and on its collapse follows the romantic, the third form of art, where the harmony of form and content again grows defective, because the object of Christian art—the

infinite spirit—is a theme too high for art. Corresponding to this division is the classification of the single arts. First comes architecture—in the main, symbolic art; then sculpture, the classical art *par excellence;* they are found, however, in all three forms. Painting and music are the specially romantic arts. Lastly, as a union of painting and music comes poetry, where the sensuous element is more than ever subordinate to the spirit.

The lectures on the Philosophy of Art stray largely into the next sphere and dwell with zest on the close connection of art and religion; and the discussion of the decadence and rise of religions, of the aesthetic qualities of Christian legend, of the age of chivalry, etc, make the *Ästhetik* a book of varied interest.

The lectures on the Philosophy of Religion, though unequal in their composition and belonging to different dates, serve to exhibit the vital connection of the system with Christianity. Religion, like art, is inferior to philosophy as an exponent of the harmony between man and the absolute. In it the absolute exists as the poetry and music of the heart, in the inwardness of feeling. Hegel after expounding the nature of religion passes on to discuss its historical phases, but in the immature state of religious science falls into several mistakes. At the bottom of the scale of nature-worships he places the religion of sorcery. The gradations which follow are apportioned with some uncertainty amongst the religions of the East. With the Persian religion of light and the Egyptian of enigmas we pass to those faiths where Godhead takes the form of a spiritual individuality, *i.e.*, to the Hebrew religion (of sublimity), the Greek (of beauty) and the Roman (of adaptation). Last comes absolute religion, in which the mystery of the reconciliation between God and man is an open doctrine. This is Christianity, in which God is a Trinity, because He is a spirit. The revelation of this truth is the subject of the Christian Scriptures. For the Son of God, in the immediate aspect, is the finite world of nature and man, which far from being at one with its Father is originally in an attitude of estrangement. The history of Christ is the visible reconciliation between man and the eternal. With the death of Christ this union, ceasing to be a mere fact, becomes a vital idea—the Spirit of God which dwells in the Christian community.

The lectures on the History of Philosophy deal disproportionately with the various epochs, and in some parts date from the beginning of Hegel's career. In trying to subject history to the order of logic they sometimes misconceive the filiation of ideas. But they created the history of philosophy as a scientific study. They showed that a philosophical theory is not an accident or whim, but an exponent of its age determined by its antecedents and environments, and handing on its results to the future.

Hegelianism in England.—On the continent of Europe the direct influence of Hegelianism was comparatively short-lived. This was due among other causes to the direction of attention to the rising science of psychology, partly to the reaction against the speculative method. In England and Scotland it had another fate. It supplied a reasoned corrective to prevailing tendencies towards naturalism and ethical individualism, and it offered a speculative vindication of religion, more particularly of the Christian religion. This explains the hold which it obtained upon both English and Scottish thought soon after the middle of the 19th century The first impulse came from J. F. Ferrier and J. H. Stirling in Scotland, and B. Jowett in Oxford. In the seventies there was a powerful school of English thinkers under the lead of Edward Caird and T. H. Green devoted to the study and exposition of the Hegelian system. With the general acceptance of its main principle that the real is the rational, there came in the eighties a more critical examination of the precise meaning to be attached to it and its bearing on the problems of religion. The earlier Hegelians had interpreted it in the sense that the world in its ultimate essence was not only spiritual but self-conscious intelligence whose nature was reflected inadequately but truly in the finite mind. As time went on it became obvious that without departure from the spirit of idealism Hegel's principle was susceptible of a different interpretation. Granted that rationality taken in the sense of inner coherence and self-consistency is the ultimate standard of truth and reality, does self-consciousness itself answer to the demands of this criterion? The question was definitely raised in F. H. Bradley's *Appearance and Reality* (1893; 2nd ed, 1897) and answered in the negative. The completeness and self-consistency which our ideal requires can be realized only in a form of being in which subject and object, will and desire, no longer stand as exclusive opposites, from which it seemed at once to follow that the finite self could not be a reality nor the infinite reality a self. On this basis Bradley developed a theory of the Absolute which, while not denying that it must be conceived of spiritually, insisted that its spirituality is of a kind that finds no analogy in our self-conscious experience. J. M E. McTaggart's *Studies in Hegelian Dialectic* (1896), *Studies in Hegelian Cosmology* (1901) and *Some Dogmas of Religion* (1906) and *Commentary on Hegel's Logic* (1910) opened a new chapter in the critical interpretation of Hegelianism. More valuable and reliable as an exposition of Hegel thought are the writings of W. Wallace, especially his *Prolegomena to Hegel's Logic* (2nd ed, 1892). The writer who has perhaps done more than any other to commend with persuasive logic to English readers the essential spirit of Hegelianism is Bernard Bosanquet. While carrying forward the thought of Bradley on independent lines, and owing much to Greek idealisms, he was profoundly influenced by Hegel. His works *The Principle of Individuality and Value* (1911), and *The Value of Destiny of the Individual* (1912) may be said to be the finest and the final efflorescence of English idealism of the second half of the 19th century.

Among Italian Hegelians are A. Vera, Raffaele Mariano and B. Spaventa (1817–1883); *see* V. de Lucia, *L'Hegel in Italia* (1891). In Sweden, J. J Borelius of Lund; in Norway, G. V Lyng (d. 1884), M. J. Monrad (1816–1897) and G Kent (d. 1892) have adopted Hegelianism; in France, P. Leroux and P. Prévost.

Works and Life.—Hegel's collected *Werke* appeared in 18 vols. (1832–40); vols. i.–viii. containing works previously published. New edition by G. Lasson (pub Meiner, Leipzig); begun 1907; 10 vols. published in 1928. English translations are: J. Sibree, *Philosophy of History* (1857); B. Bosanquet, *Philosophy of Fine Art; Introduction* (1886); W. Hastie, *Philosophy of Art* (1886); W. Wallace, *Logic of Hegel* (1892); and *Philosophy of Mind* (1894); E. S. Haldane and F. H. Simson, *History of Philosophy* (1892); E. B. Spiers and J. B. Sanderson, *Philosophy of Religion* (1895); W. Dyde, *Philosophy of Right* (1896); J. B. Baillie, *Phenomenology of Mind* (1910)

Biography.—K. Rosenkranz, *Leben Hegels* (1844), *Hegel als deutscher National-Philosoph* (1870) and *Neue Studien*, vol iv. (1878); R. R. Haym, *Hegel und seine Zeit* (1857); K. Kostlin, *Hegel in philosophischer, politischer und nationaler Beziehung* (Tübingen, 1870); K. Fischer, *Hegel's Leben und Werke* (1901); *Hegel Archiv* (ed. G. Lasson, Leipzig, 1912, etc.).

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II. Special. A. A. von Eschenmayer, *Die Hegel'sche Religions Philosophie verglichen mit dem christlichen Princip* (Tübingen, 1834); F. A. Trendelenburg, *Die logische Frage in Hegel's System* (1843); J. P. A. Marrast, *La Philosophie du Droit de Hegel* (1869); A. Schmid, *Entwicklungsgeschichte der Hegel'schen Logik* (2 vols., Regensburg, 1858); A. Vera, *Introduction à la Philosophie de Hegel* (1855); J. H. Stirling, *Lectures on the Philosophy of Law* (1873); L. Miraglia, *I principii fondamentali dei diversi sistemi di filosofia del diritto, e la dottrina etico-guiridica di Hegel* (1873); M. Ehrenhauss, *Hegel's Gottesbegriff* (Wittenberg, 1880); J. S. Kedney, *Hegel's Aesthetics* (Chicago, 1885); P. Barth, *Die Geschichtsphilosophie Hegels und der Hegelianer* (Leipzig, 1890); W. T. Harris, *Hegel's Logic* (1890); J. M. Sterrett, *Studies in Hegel's Philosophy of Religion* (1891); G. Noel, *La Logique de Hegel* (1897); J. B. Baillie, *Origin and Significance of Hegel's Logic* (1901); G. J. P. J. Bolland, *Hegel's Philosophie der Religion* (Leyden, 1901), *Philosophie des Rechts* (1902), *Hegel's Phaenomenologie des Geistes* (1907); J. G. Hibben, *Hegel's Logic* (1902); A. Bullinger, *Hegel's Phänomenologie des Geistes* (1904); E. Ott, *Die Religionsphilosophie Hegels* (1904); G. Lasson, *Phänome-*

nologie des Bewusstseins (with introduction, Leipzig, 1907); W. Purpus, *Zur Dialektik des Bewusstseins nach Hegel* (1908); O. Voss, *Kepler und Newton und das Problem der Gravitation in der Kant. Hegel und Schelling Naturphilosophie* (Heidelberg, 1908); H. M. Mackenzie, *Hegel's Educational Theory and Practice* (1909); J. M. E. McTaggart, *Commentary on Hegel's Logic* (1910); H. S. Macran, *Hegel's Doctrine of Formal Logic* (1912). (W. Wal.; J. B. Bs.)

HEGEMON OF THASOS, Greek writer of the old comedy, flourished during the Peloponnesian War. According to Aristotle (*Poetics,* ii. 5) he was the inventor of a kind of parody; by slightly altering the wording in well-known poems he transformed the sublime into the ridiculous.

Fragments in T. Kock, *Comicorum Atticorum fragmenta,* i. (1880); B. J. Peltzer, *De parodica Graecorum poesi* (1855).

HEGEMONY, the leadership especially of one particular state in a group of federated or loosely united states. The term was first applied in Greek history to the position claimed by different individual city-states, *e.g.,* by Athens and Sparta, at different times to a position of predominance among other equal states, coupled with individual autonomy. The reversion of this position was claimed by Macedon (*see* GREECE: *Ancient History,* and DELIAN LEAGUE).

HEGESIAS OF MAGNESIA (in Lydia), Greek rhetorician and historian, flourished about 300 B.C. Strabo (xiv. 648) speaks of him as the founder of the florid "Asiatic" style (*see* TIMAEUS). Agatharchides, Dionysius of Halicarnassus and Cicero all speak of him in disparaging terms, although Varro seems to have approved of his work. He professed to imitate the simple style of Lysias, avoiding long periods and expressing himself in short, jerky sentences, but his vulgar affectation and bombast made his writings a mere caricature of the old Attic.

See C. W. Muller, *Scriptores rerum Alexandri Magni,* p. 138 (appendix to Didot ed. of Arrian, 1840); Norden, *Die antike Kunstprosa* (1898); J. B. Bury, *Ancient Greek Historians* (1909), pp. 160–172, on origin and development of "Asiatic" style, with example from Hegesias. Fragments and references in ancient authorities in F. Jacoby, *Fragmente der griechischen Historiker* (1927), vol. ii.

HEGESIPPUS, Athenian orator and statesman, nicknamed Κρώβυλος ("knot"), probably from the way in which he wore his hair. He lived in the time of Demosthenes, whose anti-Macedonian policy he supported. In 343 B.C. he was one of the ambassadors sent to Philip to discuss the restoration of the island of Halonnesus. Soon afterwards Philip wrote to Athens, offering to resign the island or to submit to arbitration the question of ownership. In reply to this letter the oration *De Halonneso* was delivered, which, although included among the speeches of Demosthenes, is generally considered to be by Hegesippus. Dionysius of Halicarnassus and Plutarch, however, favour the authorship of Demosthenes.

See Demosthenes, *De falsa legatione* 364, 447, *De corona* 250, *Philippica* iii. 129; Plutarch, *Demosthenes* 17, *Apophthegmata,* 187D; Dionysius Halic, *ad. Ammaeum,* i.; *see* also Grote, *History of Greece,* ch. 90.

HEGESIPPUS (*fl.* A.D. 150–180), early Christian writer, was of Palestinian origin, and lived under the Emperors Antoninius Pius, Marcus Aurelius and Commodus. He belonged to that group of Judaistic Christians which, while keeping the law themselves, did not attempt to impose on others the requirements of circumcision and Sabbath observance. He was the author of a treatise (ὑπομνήματα) in five books dealing with various aspects of the Christian Religion, fragments of which are found in Eusebius. Hegesippus was also a great traveller, and like many other leaders of his time came to Rome about the middle of the 2nd century. His journeyings impressed him with the idea that the continuity of the church in the cities he visited was a guarantee of its fidelity to apostolic orthodoxy: "in each succession and in every city, the doctrine is in accordance with that which the Law and the Prophets and the Lord (*i.e.,* the Old Testament and the evangelical tradition) proclaim." To illustrate this opinion he drew up a list of the Roman bishops.

HEGESIPPUS, the supposed author of a free Latin adaptation of the *Jewish War* of Josephus under the title *De bello Judaico et excidio urbis Hierosolymitanae.* The seven books of Josephus are compressed into five, but much has been added from the *Antiquities* and from the works of Roman historians, while several entirely new speeches are introduced to suit the occasion. Internal evidence shows that the work could not have been written before the 4th century A.D. The author, who is undoubtedly a Christian, describes it in his preface as a kind of revised edition of Josephus. Some authorities attribute it to Ambrose, bishop of Milan (340–397), but there is nothing to settle the authorship definitely. The name Hegesippus itself appears to be a corruption of Josephus, through the stages Ἰώσηπος, Iosippus, Egesippus, Hegesippus, unless it was purposely adopted as reminiscent of Hegesippus, the father of ecclesiastical history (2nd century).

Best edition by C. F. Weber and J. Caesar (1864); authorities in E. Schürer, *History of the Jewish People* (Eng. trans.), i. 99 *seq.;* F. Vogel, *De Hegesippo, qui dicitur, Josephi interprete* (Erlangen, 1881).

HEGIUS (VON HEEK), ALEXANDER (*c.* 1433–1498), German humanist, so called from his birthplace Heek in Westphalia. In his youth he was a pupil of Thomas à Kempis, at that time canon of the convent of St. Agnes at Zwolle. In 1474 he settled down at Deventer in Holland, where he either founded or succeeded to the headship of a school, which had many famous pupils, chief of whom was Erasmus. Hegius died at Deventer on Dec. 7, 1498. His writings were published after his death by his pupil Jacob Faber, but his fame rests not on these, but upon his services in the cause of humanism. He succeeded in abolishing the old-fashioned mediaeval textbooks and methods of instruction, and led his pupils to the study of the classical authors themselves.

See D. Reichling, "Beiträge zur Charakteristik des Alex. Hegius," in the *Monatsschrift fur Westdeutschland* (1877); H. Hamelmann, *Opera genealogico-historica* (1711); H. A. Erhard, *Geschichte des Wiederaufblühens wissenschaftlicher Bildung* (1826), C. Krafft and W. Crecelius, "Alexander Hegius und seine Schüler," from the works of Johannes Butzbach, one of Hegius's pupils, in *Zeitschrift des bergischen Geschichtsvereins,* vii. (Bonn, 1871).

HEHE, a Bantu tribe inhabiting the Tanganyika plateau, combining agriculture with animal husbandry. Sheep, goats and fowls are kept in addition to cattle, the care of which is almost exclusively man's province, while women are responsible for agricultural economics, raising millet, yams, maize and a variety of leguminous and other vegetable crops. While their characteristics are chiefly Eastern they display certain lacustrian contacts and Southern influences can be traced in their internal organization.

The most characteristic feature is the *tembe,* a long building partitioned into separate chambers for families. Each chamber is subdivided into two rooms, the outer one for boys, the inner for women and the head of the family. A *tembe* varies in size from one sufficient for a few families to the length of a kilometre, and a village may consist of anything from one small *tembe* to a number of large ones adjoining. The houses are made of palings neatly plastered with clay, with a slightly curved roof also constructed with palings covered with rushes and caulked with clay.

Kinship is mainly reckoned in the paternal line and the maternal kinship imposes obligations for one generation only, whereas any paternal relationship that can be proved in the remotest degree is important and is a bar to marriage. Marriage is arranged between a man and the bride's father and involves the payment of a dowry by the former. Polygyny is practised, but the first wife must be the mother's brother's daughter, and only after this statutory marriage may a man exercise his own choice. On marriage a boy or girl leaves the family chamber and builds anew. A peculiar system of totemism prevails, as every one possesses one or two totems inherited paternally. The totem may be an animal or part of an animal or a part of all animals, for instance a sheep's head or the heart of all animals. But though there is no prohibition against killing the totem, a dispensatory ceremony is required before it may be eaten. The possession of the same totem is no bar to marriage unless a common paternal ancestor can also be determined.

The weapons employed are the heavy-bladed thrusting spear, light throwing spears with barbed blades and a battle axe, showing an influence which is probably traceable to the Angoni. A large oval shield of ox-hide is carried.

The Hehe believe in a vague deity *Ngurulie,* who controls things

in general but to whom neither prayers nor sacrifices are offered. Their religion consists mainly of the worship of ancestor-spirits (*masoka*), to whom prayers are made for success and prosperity and the avoidance of evils. Offerings of grain, milk or flesh are made at the grave of an ancestor by the head of the family.

See E. Nigmann, *Die Wahehe* (1908). (J. H. D.)

HEIBERG, JOHAN LUDVIG (1791–1860), Danish poet and critic, son of the political writer Peter Andreas Heiberg (1758–1841), and of the novelist, afterwards the Baroness Gyllembourg-Ehrensvärd (*q.v.*), was born at Copenhagen on Dec. 14, 1791. In 1800 his father was exiled and settled in Paris, where he was employed in the French foreign office, retiring in 1817 with a pension. His political and satirical writings continued to exercise great influence over his fellow-countrymen. Johan Ludvig Heiberg was taken by K. L. Rahbek and his wife into their house at Bakkehuset. He was educated at the University of Copenhagen, and his first publication, entitled *The Theatre for Marionettes* (1814), included two romantic dramas. This was followed by *Christmas Jokes and New Year's Tricks* (1816), *The Initiation of Psyche* (1817), and *The Prophecy of Tycho Brahé*, a satire on the eccentricities of the Romantic writers, especially on the sentimentality of Ingemann. In 1817 Heiberg took his degree, and in 1819 went abroad with a grant from Government. He spent the next three years abroad with his father. In 1822 he published his drama of *Nina*, and was made professor of the Danish language at the University of Kiel, where he delivered a course of lectures, comparing the Scandinavian mythology as found in the *Edda* with the poems of Öhlenschläger. These lectures were published in German in 1827.

In 1825 Heiberg came back to Copenhagen with the intention of introducing the vaudeville on the Danish stage. He composed a great number of these vaudevilles; he took his models from the French theatre but the subjects and the humour were essentially Danish and even topical. Meanwhile he was producing dramatic work of a more serious kind; in 1828 he brought out the national drama of *Elverhöi;* in 1830 *The Inseparables;* in 1835 the fairy comedy of *The Elves*, a dramatic version of *Tieck's Elfin;* and in 1838 *Fata Morgana.* In 1841 Heiberg published a volume of *New Poems* containing "A Soul after Death," a comedy which is perhaps his masterpiece, "The Newly Wedded Pair," and other pieces. He edited from 1827 to 1830 the famous weekly, the *Flyvende Post*, and subsequently the *Interimsblade* (1834–37) and the *Intelligensblade* (1842–43). In his journalism he combated the excessive pretensions of the Romanticists, and produced much valuable and penetrating criticism of art and literature. In 1831 he married the actress Johanne Louise Paetges (1812–90), herself the author of some popular vaudevilles.

Heiberg's scathing satires made him very unpopular; and this antagonism reached its height when, in 1845, he published his malicious little drama of *The Nut Crackers.* Nevertheless he became in 1847 director of the national theatre. He filled the post for seven years, working with great zeal and conscientiousness, but was forced by intrigues from without to resign it in 1854. Heiberg died at Bonderup Aug. 25, 1860.

The poetical works of Heiberg were collected, in 11 vols., in 1861–62, and his prose writings (11 vols.) in the same year. The last volume of his prose works contains some fragments of autobiography. For the elder Heiberg *see* monographs by Thaarup (1883) and by Schwanenflügel (1891). For the younger Heiberg *see* P. Hansen, *Om J. L. Heiberg* (1867), and J. Clausen, *Kulturhistoriske studier over Heibergs Vaudeviller* (1891).

HEIDE, a town in the Prussian province of Schleswig-Holstein, on a small plateau between the marshes and moors bordering the North Sea, 35 m. N.N.W. of Glückstadt. Pop. (1925) 10,656. In 1447 it became the capital of the Ditmarsh peasant republic, but on June 13, 1559 it was the scene of the complete defeat of the peasant forces by the Danes.

HEIDEGGER, JOHANN HEINRICH (1633–1698), Swiss theologian, was born at Bärentschweil, in the canton of Zürich, Switzerland, on July 1, 1633. After studying in Germany he settled in 1665 in Zürich, where he was successively professor of moral philosophy and of theology. He died there on Jan. 18, 1698. Heidegger was the principal author of the *Formula Consensus Helvetica* in 1675, which was designed to unite the Swiss Reformed churches, but had an opposite effect.

His writings include: *De historia sacra patriarcharum exercitationes selectae* (1667–71); *De ratione studiorum, opuscula aurea*, etc. (1670); *Historia papatus* (1684; under the name Nicander von Hohenegg); *Manuductio in viam concordiae Protestantium ecclesiasticae* (1686); *Tumulus concilii Tridentini* (1690); *Exercitationes biblicae* (1700), with a life of the author prefixed; *Corpus theologiae Christianae* (1700, edited by J. H. Schweizer); *Ethicae Christianae elementa* (1711); and lives of his friends J. H. Hottinger (1667) and J. L. Fabricius (1698). His autobiography appeared in 1698, under the title *Historia vitae J. H. Heideggeri.*

See the articles in Herzog-Hauck's *Realencyklopädie* and the *Allgemeine deutsche Biographie;* and *cf.* W. Gass, *Geschichte der protestantischen Dogmatik*, ii. 353 ff.

HEIDELBERG, the name of two towns in South Africa: (*a*) 26° 31′ S., 28° 22′ E. Altitude, 5,026 feet. Pop. (1921), 2,084 white and about 1,500 natives. The town is built on the Blesbok spruit, just on the south-eastern side of the Witwatersrand goldfields. It is situated in the Transvaal, 42 m. S.E. of Johannesburg, and 450 m. from Durban. The town possesses five schools and a training college. The District of Heidelberg extends southward to the Vaal river, and is part of the great maize triangle of South Africa. (*b*) 34° 5′ S., 20° 59′ E., situated on the Duivenhoeks river in the Cape Province, 100 ft. above sea-level. It is a small town with a white population of 994 (1926), and about an equal number of coloured people. The principal productions of the district are wool and aloes

HEIDELBERG, a town of Germany, on the south bank of the Neckar, 12 m. above its confluence with the Rhine, 13 m. S.E. from Mannheim and 54 m. from Frankfort-on-Main by rail. The town lies between lofty hills covered with vineyards and forests, at the spot where the rapid Neckar leaves the gorge and enters the plain of the Rhine. The town itself consists practically of one long, narrow street—the Hauptstrasse—running parallel to the river. A number of smaller streets intersect the Hauptstrasse at right angles and run down to the river. Heidelberg is an important railway centre, and is connected by trunk lines with Frankfort, Mannheim, Karlsruhe, Spires and Würzburg. Of the churches the chief are the Protestant Peterskirche dating from the 15th century and restored in 1873, to the door of which Jerome of Prague in 1460 nailed his theses; the Heilige Geist Kirche (Church of the Holy Ghost), an imposing Gothic edifice of the 15th century; and the Jesuitenkirche (Roman Catholic), with a decorated interior.

Heidelberg castle, overhanging the east of the town, stands on the Jettenbuhl, a spur of the Königsstuhl (1,800 ft.), 330 ft. above the Neckar. It is one of the chief monuments of Germany, begun in the 13th century and extended by addition of a wing, Ruprechtsbau, under the elector palatine and the German king Rupert III. (d. 1410). Otto Henry "the Magnanimous" (d. 1559), built the beautiful early Renaissance wing (1556–59); the fine late Renaissance wing called the Friedrichsbau was added (1601–07) under Frederick IV.; and, on the west side, the Elisabethenbau or Englischebau (1618), named after his wife, the daughter of James I. of Great Britain, built under Frederick V. At the peace of Westphalia, Heidelberg was given back to Frederick V.'s son, Charles Louis, who restored the castle. At the end of the 17th century it was despoiled by the French and finally, in 1764, it was struck by lightning and reduced to ruin. Apart from outworks, the castle is an irregular square with round towers at the angles, the principal buildings being grouped round a central courtyard containing the Alte Bau and the Bandhaus with the entrance from the south through a series of gateways. In this courtyard, besides the buildings already mentioned, are the oldest parts of the castle, the so-called Alte Bau (old building) and the Bandhaus. The Friedrichsbau was elaborately restored and rendered habitable between 1897 and 1903. The fountain in the courtyard is decorated with four granite columns from Charlemagne's palace at Ingelheim; the Elisabethentor is a beautiful gateway named after the English princess, there is a beautiful octagonal bell-tower at the north-east angle; and the castle chapel and the museum of antiquities are in the Friedrichsbau. In a cellar entered from the courtyard is the famous vat built in 1751, which has been used only occasionally. Its capacity is 49,000 gal., and it is 20 ft.

high and 31 ft. long. Behind the Friedrichsbau is the Altan (1610), or castle balcony with a magnificent view.

The university of Heidelberg was founded by the elector Rupert I., the bull of foundation being issued by Pope Urban VI. in 1385. It was constructed after the type of Paris, and had four faculties; Otto Henry gave it a new organization, further endowed it and founded the library, first kept in the choir of the Heilige Geist Kirche, and consisting of 3500 mss. In 1623 it was sent to Rome by Maximilian I. of Bavaria, and stored as the Bibliotheca Palatina in the Vatican. It was afterwards taken to Paris, and in 1815 was restored to Heidelberg. At the Reformation it became a stronghold of Protestant learning. Damaged by the Thirty Years' War, it led a struggling existence for a century and a half and many of its endowments were cut off by the peace of Lunéville (1801). In 1803, however, Charles Frederick, grand-duke of Baden, raised it anew and reconstituted it.

Heidelberg makes metalware, pianos, cigars, leather, cement, surgical instruments and beer, but is largely concerned with catering for tourists and students. Pop. (1925) 73,034.

HEIDELBERG CATECHISM, THE, the most attractive of all the catechisms of the Reformation, was drawn up at the bidding of Frederick III., elector of the Palatinate, and published on Tuesday the 19th of January 1563. The task was entrusted to two young men who have won deserved remembrance alike by their learning and their character: Zacharias Ursinus (1536–1583), a man of modest and gentle spirit, unwearied in study and well fitted to impart his learning to others; and Caspar Olevianus (1536–1587), whose ardour and enthusiasm made him the happy complement of Ursinus. The elector could have chosen no better men, young as they were, for the task in hand. As a first step each drew up a catechism of his own composition, that of Ursinus being naturally of a more grave and academic turn than the freer production of Olevianus, while each made full use of the earlier catechisms already in use. But when the union was effected it was found that the spirits of the two authors were most happily and harmoniously wedded, the exactness and erudition of the one being blended with the fervency and grace of the other. Thus the Heidelberg Catechism, which was completed within a year of its inception, has an individuality that marks it out from all its predecessors and successors. The Heidelberg synod unanimously approved of it; it was published in January 1563, and in the same year officially turned into Latin. The Heidelberg book, in spite of violent attacks on it by the extreme Lutherans, rapidly passed beyond the bounds of the Palatinate and gained an abundant success not only in Germany but also in the Netherlands and in the Reformed churches of Hungary, Transylvania and Poland. It was officially recognized by the synod of Dort in 1619, passed into France, Britain and America, and probably shares with the *De imitatione Christi* and *The Pilgrim's Progress* the honour of coming next to the Bible in the number of tongues into which it has been translated.

This wide acceptance and high esteem are due largely to an avoidance of polemical and controversial subjects, and even more to an absence of the controversial spirit. There is no mistake about its Protestantism, even when we omit the unhappy addition made to answer 80 by Frederick himself (in indignant reply to the ban pronounced by the Council of Trent), in which the Mass is described as "nothing else than a denial of the one sacrifice and passion of Jesus Christ, and an accursed idolatry"—an addition which is the one blot on the ἐπιείκεια of the catechism. The work is the product of the best qualities of head and heart, and its prose is frequently marked by all the beauty of a lyric. It follows the plan of the epistle to the Romans (excepting chapters ix.–xi.) and falls into three parts: Sin, Redemption and the New Life. This arrangement alone would mark it out from the normal Reformation catechism, which runs along the stereotyped lines of Decalogue, Creed, Lord's Prayer, Church and Sacraments. These themes are included, but are shown as organically related.

BIBLIOGRAPHY.—See *The Heidelberg Catechism, the German Text, with a Revised Translation and Introduction,* edited by A. Smellie (London, 1900), and *The Heidelberg Catechism* (New York, 1863), with introduction and German, Latin and English text; also Schaff, *Creeds of Christendom,* vols. i. 529 ff. and iii. 307 ff., and Müller, *Die Bekenntniss Schriften der Reformierten Kirche* (Leipzig, 1903).

HEIDENHEIM, a town of Germany, in the republic of Württemberg, 31 m. by rail N. by E. of Ulm. Pop. (1925) 19,363. The town, which received municipal privileges in 1356, is overlooked by the ruins of the castle of Hellenstein, standing on a hill 1,985 ft. high. Its industrial establishments include cotton, tobacco, machinery, metal and rubber factories, bleach-works, dyeworks and breweries. Heidenheim is also the name of a small place in Bavaria famous on account of the Benedictine abbey, founded in 748 by the bishop of Eichstätt, which formerly stood therein. It was plundered by the peasantry in 1525 and was closed in 1537.

HEIDENSTAM, VERNER VON (1859–), Swedish writer, was born on July 6, 1859, in Olshammar. He lived for several years in the south of Europe, Egypt and the East. On his return home, he published a collection of poems, *Vallfart och Vandringsaar* (Pilgrimage and Years of Wandering) (1888), based on oriental life, which formed a protest against the naturalism then prevalent in Swedish literature. This book marked the beginning of the great literary renaissance of the '90s in Sweden. In 1889 he published *Endymion,* an oriental story, and in 1892 his great work, *Hans Alienus,* a fanciful epic concerning a pilgrimage in search of beauty through various ages and countries. His other collection of *Poems* (1895) indicates the author's transition to national ideas. This national tendency attained its zenith in his great prose work, *Karolinerna* (2 vols., 1897–98; Eng. trans. *The Carlists,* 1902), dealing with the time of Charles XII. Then followed *Den Hellige Birgittas Pilegrimsfaerd* (St. Bridget's Pilgrimage) in 1901; descriptions of Sweden in ancient times and in the Middle Ages in *Folkungaträdet* (2 vol., 1905, 1920), and *Svenskarna og deres høvdinger* (Swedes and Their Chieftains, 2 vol, 1908, 1909). In 1915 Heidenstam published *Nya Dikter,* which established him as the greatest of contemporary Swedish lyricists, and in 1916 he was awarded the Nobel prize for literature.

See F. Böök, *Sveriges moderna litteratur* (2nd ed., 1921).

HEIFER, a young cow that has not calved.

HEIJERMANS, HERMANN (1864–1924), Dutch writer, of Jewish origin, was born on Dec. 3, 1864, at Rotterdam. In the Amsterdam *Handelsblad* he published a series of realistic sketches of Jewish family life under the pseudonym of "Samuel Falkland," which were collected in volume form. His novels and tales include *Trinette* (1892), *Fles* (1893), *Kamertjeszonde* (2 vols., 1896), *Intérieurs* (1897), *Diamantstadt* (2 vols., 1903). He created great interest by his play *Op Hoop van Zegen* (1900), represented at the Théâtre Antoine in Paris, and in English by the Stage Society as *The Good Hope.* His other plays include: *Dora Kremer* (1893), *Ghetto* (1898), *Ora et labora* (1901), *De Groote Vlucht* (1908), *Eva Bonheur* (1919). *A Case of Arson,* an English version of the one-act play *Brand in de Jonge Jan,* was notable for the impersonation (1904 and 1905) by Henri de Vries of all the seven witnesses who appear as characters. Heijermans lived for a few years in Berlin, but returned to Holland in 1912 in order to manage a society of players. He died at Zantvoort on Nov. 22, 1924.

HEILBRONN, a town of Germany, in the republic of Württemberg, on the Neckar, 33 m. by rail N. of Stuttgart, and at the junction of lines to Crailsheim and Eppingen. Pop. (1925) 45,520. Heilbronn occupies the site of an old Roman settlement; it is first mentioned in 741, and the Carolingian princes had a palace here. It owes its name—originally Heiligbronn, or holy spring—to a spring of water which used to be seen issuing from under the high altar of the church of St. Kilian.

The older streets are narrow, and contain a number of high turreted houses with quaint gables. The principal public buildings are the church of St. Kilian (restored 1886–1895) in the Gothic and Renaissance styles, begun about 1019 and completed in 1529, with a tower 210 ft. high, a beautiful choir, and a finely carved altar; the town hall (Rathaus), founded in 1540, and possessing a curious clock made in 1580; the house of the Teutonic knights (Deutsches Haus); the Roman Catholic church of St. Joseph, formerly the church of the Teutonic Order; and the tower (Diebsturm or Götzens Turm) on the Neckar. The town is commer-

cially the most important in Württemberg, and possesses an immense variety of manufactures, of which the principal are gold, silver, steel and iron wares, machines, motor cars, sugar of lead, white lead, vinegar, beer, sugar, tobacco, soap, oil, chemicals, artificial manure, glue, soda, paper and leather.

HEILSBERG, a town in the province of East Prussia, at the junction of the Simser and Alle, 38 m. S. of Königsberg. Pop. (1925) 7,033. It has an old castle, founded by the Teutonic order in 1240, which was from 1306–*c.* 1800 the seat of the bishops of Ermeland. In 1807 the French fought the Russians and Prussians nearby. The principal industries are tanning, dyeing and brewing, and there is considerable trade in grain.

HEILSBRONN or **KLOSTER-HEILSBRONN,** a village of Germany, in the Bavarian province of Middle Franconia, on the railway between Nürnberg and Ansbach, has 1,500 inhabitants. In the middle ages it possessed one of the great monasteries of Germany, which belonged to the Cistercian order and owed its origin to Bishop Otto of Bamberg in 1132, existing till 1555. Its sepulchral monuments are of exceptionally high artistic interest. It was the hereditary burial-place of the Hohenzollern family. The buildings of the monastery have mostly disappeared, with the exception of the fine church, a Romanesque basilica, restored between 1851 and 1866, and possessing paintings by Albert Dürer.

HEIM, ALBERT VON ST. GALLEN (1849–), Swiss geologist, was born at Zürich on April 12, 1849. He was educated at Zürich and Berlin universities, and became professor of geology at Zürich, and director of the geological survey of Switzerland. With E Schmidt he prepared the geological map of Switzerland (2nd ed. 1912). His researches on the structure of the Alps threw light on the structure of mountain masses in general. He traced the plications from minor to major stages, and illustrated the remarkable foldings and overthrust faultings in numerous sections with the aid of pictorial drawings. His *Mechanismus der Gebirgsbildung* (1878) is a classic.

HEIMDAL or **HEIMDALL,** in Scandinavian mythology, keeper of the gates of Heaven, guardian of the rainbow bridge Bifrost, used by the gods between heaven and earth, son of Odin by nine virgins. He lives in the fort of Himinsbiorg at the end of Bifrost. Nothing can escape his vigilance, for he sleeps less than a bird, sees at night and in his sleep, can hear grass and the wool on a lamb's back grow. With Gjallar (*q.v.*) he will summon the gods on the day of judgment.

HEINE, HEINRICH (1797–1856), German poet and journalist, was born at Düsseldorf, of Jewish parents, on the 13th of December 1797. He was the eldest of four children, and received his education, first in private schools, then in the Lyceum of his native town. When he left school in 1815, an attempt was made to engage him in business in Frankfort, but without success. In the following year his uncle, Solomon Heine, a wealthy banker in Hamburg, took him into his office. A passion for his cousin Amalie Heine seems to have made the young man more contented with his lot in Hamburg, and his success was such that his uncle decided to set him up in business for himself. But in a very few months the firm of "Harry Heine & Co." was insolvent. His uncle now generously provided him with money to enable him to study at a university, with the view to entering the legal profession, and in the spring of 1819 Heine became a student at Bonn. During his stay there he devoted himself rather to the study of literature and history than to that of law. In the autumn of 1820 Heine left Bonn for Göttingen, where he proposed to devote himself more assiduously to professional studies, but in February of the following year he challenged to a pistol duel a fellow-student who had insulted him, and was, in consequence, rusticated for six months. The pedantic atmosphere of the university of Göttingen was, however, little to his taste; the news of his cousin's marriage unsettled him still more; and he was glad of the opportunity to seek distraction in Berlin.

In the Prussian capital a new world opened up to him; a very different life from that of Göttingen was stirring in the new university there. He was also fortunate in having access to the chief literary circles of the capital; he was on terms of intimacy with Varnhagen von Ense and his wife, the celebrated Rahel, and made the acquaintance of leading men of letters like Fouqué and Chamisso. Under such favourable circumstances his own gifts were soon displayed. He contributed poems to the *Berliner Gesellschafter,* some of which were subsequently incorporated in the *Buch der Lieder,* and in December 1821 a little volume came from the press entitled *Gedichte.* He was also employed at this time as correspondent of a Rhenish newspaper, as well as in completing his tragedies *Almansor* and *William Ratcliff,* which were published in 1823. Heine had plans of settling in Paris, but as he was still dependent on his uncle, the latter's consent had to be obtained. As was to be expected, Solomon Heine did not favour the new plan, but promised to continue his support on the condition that Harry completed his course of legal study. He sent the young student for a six weeks' holiday at Cuxhaven, which opened the poet's eyes to the wonders of the sea; and three weeks spent subsequently at his uncle's county seat near Hamburg were sufficient to awaken a new passion—this time for Amalie's sister, Therese. In January 1824 Heine returned to Göttingen, where, with the exception of a visit to Berlin and the excursion to the Hartz mountains in the autumn of 1824, which is immortalized in the first volume of the *Reisebilder,* he remained until his graduation in the summer of the following year. A few weeks before obtaining his degree, he took a step which he had long meditated: he formally embraced Christianity. This "act of apostasy," was actuated by practical considerations. The summer months which followed his examination Heine spent by his beloved sea in the island of Norderney. The question of his future now became pressing, and for a time he seriously considered the plan of settling as a solicitor in Hamburg, and hoped to marry his cousin Therese. Meanwhile he had made arrangements for the publication of *Die Harzreise,* which appeared in May 1826. The success of the book was instantaneous. Its lyric outbursts and flashes of wit; its rapid changes from grave to gay; its flexibility of thought and style, came as a revelation to its generation. It was followed in 1827 by the most famous of all Heine's works, the *Buch der Lieder.*

In the spring of the following year Heine paid a long planned visit to England, where he was impressed by the free and vigorous public life, by the size and bustle of London; above all, he was filled with admiration for Canning. But the picture had also its reverse; the sordidly commercial spirit of English life and brutal egotism of the ordinary Englishman, grated on Heine's sensitive nature; he missed the finer literary and artistic tastes of the continent and was repelled by the austerity of English religious sentiment and observance. Unfortunately the latter aspects of English life left a deeper mark on his memory than the bright side. In October Cotta, the well-known publisher, offered Heine—the second volume of whose *Reisebilder* and the *Buch der Lieder* had meanwhile appeared—the joint-editorship of the *Neue allgemeine politische Annalen* He gladly accepted the offer and betook himself to Munich. Heine did his best to adapt himself to the new surroundings. But the stings of the *Reisebilder* were not so easily forgotten; the clerical party in particular did not leave him long in peace. In July 1828, he left Munich for Italy, where he remained until the following November, a holiday which provided material for the third and part of the fourth volumes of the *Reisebilder.* In the beginning of 1829 Heine took up his abode in Berlin, where he resumed old acquaintanceships; in summer he was again at the sea, and in autumn he returned to Hamburg, where he virtually remained until May 1831. These years were not a happy period of the poet's life; his efforts to obtain a position, apart from that which he owed to his literary work, met with rebuffs on every side; his relations with his uncle were unsatisfactory, and for a time he was seriously ill. When in 1830 the news of the July Revolution in the streets of Paris reached him, Heine hailed it as the beginning of a new era of freedom, and his thoughts reverted once more to his early plan of settling in Paris. All through the following winter the plan ripened, and in May 1831 he finally said farewell to his native land.

Heine's first impressions of Paris were jubilantly favourable. He was soon on friendly terms with many of the notabilities of the capital; and there was every prospect of a congenial and

lucrative journalistic activity as correspondent for German newspapers. Two series of his articles were subsequently collected and published under the titles *Französische Zustände* (1832) and *Lutezia* (written 1840–1843, published in the *Vermischte Schriften*, 1854). In December 1835, however, the German Bund, incited by W. Menzel's attacks on "Young Germany," issued its notorious decree, forbidding the publication of any writings by the members of that coterie; the name of Heine headed the list. This was the beginning of a series of literary feuds in which Heine was, from now on, involved; and they curtailed considerably his sources of income. His uncle, it is true, had allowed him 4,000 francs a year when he settled in Paris, but at this moment he was not on the best of terms with his Hamburg relatives. In these circumstances he was induced to apply to the French government for support from a fund formed for the benefit of "political refugees" who were willing to place themselves at the service of France. From 1836 or 1837 until the Revolution of 1848 Heine was in receipt of 4,800 francs annually from this source.

In October 1834 Heine made the acquaintance of a young Frenchwoman, Eugénie Mirat, a saleswoman in a boot-shop in Paris. Although ill-educated, vain and extravagant, she inspired the poet with a deep and lasting affection, and in 1841, on the eve of a duel in which he was involved, he made her his wife. Her death occurred in 1883. His relations with her helped to weaken his ties with Germany; he only revisited it twice, in the autumn of 1843 and the summer of 1847. In 1845 appeared the first unmistakable signs of the terrible spinal disease, which, for eight years, from the spring of 1848 till his death, condemned him to a "mattress grave." These years of suffering—suffering which left his intellect as clear and vivacious as ever—seem to have effected a spiritual purification in Heine's nature, and to have brought out the better sides of his character. The lyrics of the *Romanzero* (1851) and the collection of *Neueste Gedichte* (1853–54) surpass in sincerity at least the poetry of the *Buch der Lieder*. Most wonderful of all are the poems inspired by Heine's strange mystic passion for the lady he called *Die Mouche*, a countrywoman of his own—her real name was Elise von Krientz, but she had written in French under the *nom de plume* of Camille Selden—who helped to brighten the last months of the poet's life. He died on Feb. 17, 1856, and lies buried in Montmartre.

Between 1833 and 1839 Heine published a collection of prose writings under the title *Der Salon* (1834–1840). It includes, besides papers on French art and the French stage, *Zur Geschichte der Religion und Philosophie in Deutschland*, *Aus den Memoiren des Herrn von Schnabelewopski*, *Der Rabbi von Bacherach* and *Florentinische Nächte*. *Die romantische Schule* (1836) is disfigured by an unpardonable personal attack on the elder Schlegel. In 1839 appeared *Shakespeares Mädchen und Frauen*, the text to a series of illustrations; and in 1840, the witty and trenchant satire on a writer, who, in spite of many personal disagreements, had been Heine's fellow-fighter in the liberal cause, Ludwig Börne. Of Heine's poetical work in these years, his most important publications were, besides the *Romanzero*, the two satirical poems, *Deutschland, ein Wintermärchen* (1844), the result of his visit to Germany, and *Atta Troll, ein Sommernachtstraum* (1847), an attack on the politically inspired literature of the 'forties.

In the case of no other of the greater German poets is it so hard to arrive at a final judgment as in that of Heinrich Heine. In his *Buch der Lieder* he unquestionably struck a new lyric note, not merely for Germany but for Europe. No singer before him had been so daring in the use of nature-symbolism as he, none had given such concrete expression to the spiritual forces of heart and soul. At times, it is true, his imagery is exaggerated to the degree of absurdity, but it exercised, none the less, a fascination over his generation. His lyric appealed with particular force to foreign peoples, who had less understanding for the intangible, undefinable spirituality which the German people regard as an indispensable element in their national lyric poetry. Thus his fame has always stood higher in England and France than in Germany itself, where his lyric method, his self-consciousness, his cynicism in season and out of season, were less in harmony with the literary traditions. As far as the development of the German lyric is concerned, it was Heine's particular achievement to introduce a new and invigorating element, the poetry of the sea.

As a prose writer, Heine's merits were very great. His work, it may be, was journalism, but it was journalism of a high order. His light fancy, his agile intellect, his straightforward, clear style stood him here in excellent stead. The prose writings of his French period mark, together with Borne's *Briefe aus Paris*, the beginning of a new era in German prose. Above all things, Heine was great as a wit and a satirist; here his powers were of the highest order. He combined the holy zeal and passionate earnestness of the "soldier of humanity" with the withering scorn and ineradicable sense of justice common to the leaders of the Jewish race. Heine felt that his real mission was to be a reformer, to restore, with instruments of war rather than of peace, "the interrupted order of the world." The more's the pity that his magnificent Aristophanic genius should have had so little room for its exercise, and have been frittered away in the petty squabbles of an exiled journalist.

BIBLIOGRAPHY.—The first collected edition of Heine's works was edited by A. Strodtmann in 21 vols. (1861–1866) good modern editions are edited by E. Elster (7 vols., 1887–1890), and O. Walzel, 10 vols., 1911 ff. His works have been translated into English by C. G. Leland and others (13 vols., 1892–1905), and the attempts to render the *Buch der Lieder* have been very numerous. *See* A. Strodtmann, *Heines Leben und Werke* (3rd ed., 1884); H. Hueffer, *Aus dem Leben H. Heines* (1878); and by the same author, *H. Heine: Gesammelte Aufsätze* (1906); W. Bolsche, *H. Heine: Versuch einer ästhetisch-kritischen Analyse seiner Werke und seiner Weltanschauung* (1888); G. Brandes, *Det unge Tyskland* (1890; Eng. trans., 1905); G. Karpeles, *H. Heine: aus seinem Leben und aus seiner Zeit* (1900); J. Legras, *H. Heine, poète* (1897); H. Lichtenberger, *H. Heine, penseur* (1905); M. J. Wolff, *Heinrich Heine*, Munich, 1923; *Heines Gespräche*, ed. by H. H. Houben, Frankfort, 1926. An English biography by W. Stigand, *Life, Works and Opinions of Heinrich Heine*, appeared in 1875, but it has little value; there is also a short life by W. Sharp (1888). The essays on Heine by George Eliot and Matthew Arnold are well known. (J. W. Fe.; J. G. R.)

HEINECCIUS, JOHANN GOTTLIEB (1681–1741), German jurist, was born on Sept. 11, 1681, at Eisenberg, Altenburg, and died at Halle, where he was professor of law, on Aug. 31, 1741. Heineccius endeavoured to treat law as a rational science, and not merely as an empirical art whose rules had no deeper source than expediency. Thus he continually refers to first principles, and he develops his legal doctrines as a system of philosophy. His most important work was *Elementa juris naturae et gentium* (1737; Eng. trans. by Turnbull, 2 vols., 1763).

His *Opera omnia* (9 vols., Geneva, 1771, etc.) were edited by his son J. C. G. Heineccius (1718–91).

HEINECKEN, CHRISTIAN HEINRICH (1721–1725), a child prodigy, was born on Feb. 6, 1721, at Lübeck. Able to speak at the age of ten months, by the time he was one year old he knew by heart the principal incidents in the Pentateuch. At two years of age he is said to have mastered sacred history; at three he was intimately acquainted with history and geography, ancient and modern, sacred and profane, besides being able to speak French and Latin; and in his fourth year he began the study of religion and church history. Crowds of people flocked to Lübeck to see the wonderful child, who was able to discuss what he had learnt. He began to learn writing, but died on June 22, 1725, at the age of four.

The Life, Deeds, Travels and Death of the Child of Lübeck were published in the following year by his tutor Schöneich. *See* also *Deutsche Bibliothek*, xvii., and *Mémoires de Trévoux* (Jan. 1731).

HEINEMANN, WILLIAM (1863–1920), British publisher, was born on May 18, 1863, at Surbiton and educated privately. He first studied music but, realizing that he could not hope to be in the front rank of musicians, started a publishing business. Amongst his earliest publications were Whistler's *Gentle Art of Making Enemies* (1890) and *Heinemann's International Library*, edited by Edmund Gosse. In 1897 he opened the series of *Short Histories of the Literatures of the World* with Gilbert Murray's *Ancient Greek Literature*. Heinemann's most conspicuous service to literature probably lies in his introduction to the English read-

ing public of Maeterlinck, Ibsen, Björnson, Tolstoy, Couperus and others. He died in London on Oct. 5, 1920.

See *William Heinemann: A Memoir,* ed. F. W. Whyte (1928).

HEINICKE, SAMUEL (1727–1790), the originator in Germany of systematic education for the deaf and dumb, was born on April 10, 1727, at Nautschütz, Germany, and died at Leipzig on April 30, 1790. In 1768, when living in Hamburg, he successfully taught a deaf and dumb boy to talk, following the methods prescribed by Amman in his book *Surdus loquens,* but improving on them. Recalled to his own country by the elector of Saxony, he opened in Leipzig, in 1778, the first deaf and dumb institution in Germany.

HEINRICH VON VELDEKE (*fl.* 12th century), German poet, was born near Maestricht, Holland, of a noble family. He served at the court of Cleves, where his poem *Eneit* (ed. by Behaghel, 1882) was begun *Eneit* is modelled on a French version of the famous tale of the *Roman d'Enéas,* commonly attributed to Benoit de Ste. Mox (*q.v.*). Heinrich was in the service of Hermann, landgrave of Thuringia, and was present at the famous tournament at Mainz in 1184. He wrote his poem in Flemish, but the extant version is in the Thuringian dialect. It was begun some time after 1173, and completed in 1186, when he recovered it from a Count of Schwarzburg, by whom it had been stolen. The work is the first really important example of the courtly epic in German. Heinrich probably also wrote the *Legende von San Servaes* (St. Servatius). Gottfried of Strasbourg looked back to him as the father of German verse

See C. Kraus, *Heinrich von Veldeke und die mhd Dichtersprache;* F. Wilhelm, *Sankt Servatius* (1910); Jan van Dam, *Das Veldeke Problem* (1924).

HEINSE, JOHANN JAKOB WILHELM (1749–1803), German author, was born near Ilmenau in Thuringia on Feb. 16, 1749. As a law-student at Erfurt he became acquainted with Wieland and through him with "Father" Gleim, who in 1772 procured him the post of tutor in a family at Quedlinburg. In 1774 he went to Dusseldorf, where he helped J. G. Jacobi in editing the periodical *Iris.* He spent the years 1780–83 in Italy, and after his return to Germany became librarian to the archbishop of Mainz at Aschaffenburg, where he died on June 22, 1803. Both as novelist and art critic, Heinse had considerable influence on the romantic school.

Heinse's complete works (*Samtliche Schriften*) were published by H. Laube in 10 vols. (Leipzig, 1838) and by C. Schüddekopf (Leipzig, 10 vols. 1902–13). *See* H. Prohle, *Lessing, Wieland, Heinse* (1877), and J. Schober, *Johann Jacob Wilhelm Heinse, sein Leben und seine Werke* (Leipzig, 1882); K. D. Jessen, *Heinses Stellung zur bildenden Kunst* (1903) and A. Jolivet, *W. Heinse, sa vie et son oeuvre jusqu'en 1787* (1922).

HEINSIUS or **HEINS, DANIEL** (1580–1655), one of the most famous scholars of the Dutch Renaissance, was born at Ghent on June 9, 1580, and died at The Hague on Feb. 25, 1655. The troubles of the Spanish war drove his parents to settle first at Veere in Zeeland, then in England, next at Ryswick and lastly at Flushing. In 1594 he was sent to the University of Franeker; six months later he went to Leyden, where he remained for the rest of his life, becoming professor and then librarian. There he studied under Joseph Scaliger, and there he found Marnix de St. Aldegonde, Janus Douza, Paulus Merula and others, and was soon taken into the society of these celebrated men as their equal. His proficiency in the classic languages won the praise of all the best scholars of Europe, and offers were made to him, but in vain, to accept honourable positions outside Holland. The remainder of his life is recorded in a list of his productions. He published his original Latin poems in three volumes—*Iambi* (1602), *Elegiae* (1603) and *Poëmata* (1605); his *Emblemata amatoria,* poems in Dutch and Latin, were first printed in 1604. In the same year he edited Theocritus, Bion and Moschus, having edited Hesiod in 1603. In 1609 he printed his Latin *Orations.* In 1610 he edited Horace, and in 1611 Aristotle and Seneca. In 1613 appeared in Dutch his tragedy of *The Massacre of the Innocents;* and in 1614 his treatise *De politica sapientia.* In 1616 he collected his original Dutch poems into a volume He edited Terence in 1618, Livy in 1620, published his oration *De contemptu mortis* in 1621, and brought out the *Epistles* of Joseph Scaliger in 1627.

HEINSIUS, NIKOLAES (1620–1681), Dutch scholar, son of Daniel Heinsius, was born at Leyden on July 20, 1620. His boyish Latin poem of *Breda expugnata* was printed in 1637, and attracted much attention. In 1642 he began his wanderings with a visit to England in search of mss. of the classics. From 1644 to 1653 he travelled without cessation between the principal libraries of Europe, everywhere collating mss. and taking philological and textual notes He collected his Latin poems into a volume in 1653. His latest labours were the editing of Velleius Paterculus in 1678, and of Valerius Flaccus in 1680. He died at The Hague on Oct. 7, 1681. Nikolaes Heinsius was one of the purest and most elegant of Latinists, and if his scholarship was not quite so perfect as that of his father, he displayed higher gifts as an original writer.

HEINZE, RUDOLF (1865–1928), German politician, son of Max Heinze, the philosopher and the editor of Überweg's *Grundriss der Geschichte der Philosophie,* was born at Oldenburg on July 22, 1865. He served in the Saxon department of justice. He sat in the *Reichstag* (1907–11) with the National Liberals. For two years during the war (1916–18) he was under-secretary of State in the Turkish ministry of justice After the revolution he joined the new German People's party, founded by Stresemann and other former National Liberals. In June 1920 he was asked to form a Government, but gave up the attempt since he could not secure the co-operation of the Social Democrats. He was minister of justice and vice-chancellor in the Fehrenbach (June 1920–May 1921) and Cuno (Nov. 1922–Aug. 1923) cabinets. He was nominated commissioner of the Reich in Saxony during the troubles of 1923, and in this capacity, supported by armed force, dismissed the Socialist-Communist Government. In 1926 he presided over the consular court in Egypt. Heinze died at Dresden on May 16, 1928.

HEIR, in law, technically one who succeeds, by descent, to an estate of inheritance, in contradistinction to one who succeeds to personal property, *i.e.,* next of kin. The rules regulating the descent of property to an heir will be found in the articles INHERITANCE; INTESTACY; SUCCESSION, etc.

An *heir apparent* is he whose right of inheritance is indefeasible, provided he outlives the ancestor, *e.g.,* an eldest or only son.

Heir general, or heir at law, he who after the death of his ancestor has, by law, the right to the inheritance

Heir presumptive, one who is next in succession, but whose right is defeasible by the birth of a nearer heir.

Ultimate heir, he to whom lands come by escheat on failure of proper heirs. In Scots law the technical use of the word "heir" is not confined to the succession to real property, but includes succession to personal property as well, and this meaning is usual in many Continental codes which in this respect derive from the Roman law.

HEIRLOOM, strictly so called in English law, a chattel which by immemorial usage is regarded as annexed by inheritance to a family estate. Any owner of such heirloom may dispose of it during his lifetime, but he cannot bequeath it by will away from the estate. If he dies intestate it goes to his heir-at-law, and if he devises the estate it goes to the devisee. At the present time such heirlooms are almost unknown, and the word has acquired a secondary and popular meaning and is applied to furniture, pictures, etc., vested in trustees to hold on trust for the person for the time being entitled to the possession of a settled house. Such things are more properly called settled chattels. An heirloom in the strict sense is made by family custom, not by settlement. A settled chattel may, under the Settled Land Act, 1882, be sold under the direction of the court, and the money arising under such sale is capital money. By the Law of Property Act, 1925, pt. iv., settlements of realty and personal property are assimilated.

HEJAZ, THE, part of the independent kingdom of the Nejd and the Hejaz, and formerly under the old Ottoman empire a vilayet, which extended from Ma'an and 'Aqaba in the north to Hali Point on the Red sea coast on the south, and had its headquarters under a *Wali* at Mecca. The northern part of this territory is now included in Transjordan, the present northern boun-

dary running east from the Gulf of 'Aqaba in approximately 29° 35′ N. as far as the 38° E. An indeterminate frontier with the Yemen forms its southern boundary. It is about 800 miles long and forms a narrow strip varying in depth from about 100 to 200 miles broad. The frontiers are indeterminate but the area probably does not exceed 150,000 sq.m. The population is under a million, some estimates giving the figure as low as 800,000. The majority of the inhabitants are Beduin, but the Muslim Holy Places of Mecca (70,000), the birthplace of the Prophet, Medina (15,000), the tomb of the Prophet, and Jidda (25,000) the port of Mecca, form considerable urban areas, greatly swollen by the annual influx of pilgrims, whose presence, much interrupted by the troublous events of the World War and post-war years, formed one of the most important parts of the commercial activities of the Hejaz. Medina produces dates, and Taif and the mountain oases fruit and honey; otherwise the products of the Hejaz are limited to such desert commodities as camels, horses, sheep and donkeys, and hides and wool.

Geography.—The Hejaz is divided into two zones, a coastal and an inland, by a range of mountains whose highest peaks probably reach 7,000 feet. Along the coastal strip there are a few settlements where the wadis (stony valleys) run from the hills on to the coastal plains, the most important of these wadis being the Wadi Hamd, which has three main sources, a northern, a central, on which Kheibar stands, and a southern, which supplies Medina. The valley of Medina can also be approached from the coast, either from Yenbo or Jidda by the Wadi es Safra. The wadis though liable to heavy floods are not permanent water supplies, but in places permanent springs are to be found, accompanied by the luxuriant vegetation of palm groves Along the desolate coast of the Red sea there are a series of ports, of which Jidda, the port for Mecca, and Yenbo' (for Medina), are the most important. The others include Muwaila, Wejh, Rabigh, Lith and Qunfida. Wejh was formerly of importance as a port for Egyptian pilgrims, while in Roman times it was a post and the port of the Nabatean town of El Hajr.

The inland region consists of a series of basins, mostly with internal drainage, but in one or two cases, through the wadis mentioned above, the valleys communicate with the coastal region. Over this barren mountain country runs the old pilgrim way and the track of the Hejaz railway. North of Tebuk there is a large arid sandstone plateau, much eroded and carved into fantastic forms, whence it has been suggested the sands of the interior are derived, while along the western boundary of the Nejd plateau stretches the desolate volcanic lava bed of the Harrat. There are few settlements, apart from the oasis of Tebuk, and Al 'Ela (Egra of Ptolemy). The southern Hejaz is more fortunate in its water supplies. The city of Medina lies in the broad plain between the coastal range and the Nejd plateau. Here at an altitude of 2,500 feet there is an abundance of water, and dates, wheat and barley flourish. There is also a string of small settlements down to the port of Yenbo' along the Wadi es Safra. Mecca (*q.v.*) the chief town of the Hejaz lies to the south, about 48 m. from Jidda. From the hot lowland in which Mecca is situated the country rises up steeply to the Taif plateau, which owing to its altitude, about 6,000 ft., possesses a climate closely resembling the southern part of Arabia. On the northern edge of the plateau lies Jabal al Kura, a fertile well watered region, producing grain and fruit as well as dates. Taif itself lies in a sandy plain, surrounded by low mountains.

History.—The Hejaz, together with the other provinces of Arabia, which on the overthrow of the Baghdad Caliphate in 1258, by the Mongol invaders, had fallen under Egyptian domination, became, after the conquest of Egypt by the Turks in 1517, a dependency of the Ottoman empire. Although the title Caliph passed to Constantinople, the Government remained for the most part in the hands of the Sharifs of Mecca, until, in the religious upheavals at the beginning of the 19th century, the holy cities were pillaged by Wahhabis. The sultan accordingly entrusted to Mohammed Ali, viceroy of Egypt, the task of restoring peace. Eventually in 1817 the Wahhabis were defeated but not destroyed and their capital Deraiya, in Nejd, was taken by Ibrahim Pasha. Egypt continued to administer the Hejaz until 1845, when the administration, under a wali was taken over by Constantinople directly. Owing to bad communications however it was difficult to control these distant and unruly parts of the Ottoman dominions and in 1900 Abdul Hamid decided to build a railway which should both improve communications and also avoid the Suez canal route. The first part of the line from Damascus to Ma'an was opened in 1904 and four years later the last section, terminating at Medina, was finished, and the Turkish control of the whole region considerably strengthened. It was however in this year (1908) that Husain ibn 'Ali was appointed Amir of Mecca, and this ambitious man at once began to oppose the Turkish plans, particularly in regard to the further extension of the railway to Mecca itself The outbreak of the World War gave him further opportunities to satisfy his aspirations. So long as the railway was in the hands of the Turks, who had proclaimed a *Jihad,* the sea route to the east was exposed to attack; Great Britain therefore negotiated with Husain, Jidda was bombarded by British ships and that town and Mecca, and later Taif were taken from the Turks. Medina however held out and was defended by Fakhri Pasha till Jan 1919, when he surrendered on receiving explicit orders from Constantinople. Meanwhile Col. T. E Lawrence and Husain's third son, Amir Feisul, organized a brilliant guerrilla warfare against the railway and the northern positions of the Turks. Yenbo, Wejh and 'Aqaba (1917) fell and after the capture of Ma'an, Shaubak and Hejaz they reached a northern frontier which was kept until 1925. Husain assumed the title of king in 1916. He was represented by the Amir Feisul at the Peace Conference in Paris in 1919, and the Hejaz was admitted as an original member of the League of Nations, but eventually he refused to ratify the Peace Treaties. In the summer of 1921 Lawrence visited Jidda on behalf of the British Government to negotiate a treaty with King Husain, but as the latter would not accept the *de facto* position in Palestine negotiations broke down.

Meanwhile other factors were clouding the horizon During the War Husain's reign had been mild, but he gradually became more and more autocratic and alienated the sympathies both of his neighbours and of his own people. He had undertaken, by the terms of the Peace Treaties to maintain the annual pilgrimage but his administration of the arrangements for the reception of the pilgrims was very unsatisfactory. Government departments were corrupt, even the army was not properly cared for and the Air Force which had been organized lapsed more than once until revived once more by his successor. On the other hand his transport fleet and system of wireless communication were satisfactory and proved of value. It was under such conditions that the Hashimite dynasty faced its new perils Early in 1919 King Husain's relations with Ibn Sa'ud became strained owing to a dispute over Khurma oasis. His forces were defeated by the Wahhabis at Turaba and in 1922 Ibn Sa'ud occupied Khaibar and Taima. Meanwhile negotiations with the British Government were kept alive by Dr. Naji al Asil, the Hashimite representative in London and were not finally abandoned till the outbreak of war between Nejd and Hejaz in 1924. King Husain, however, refused until it was too late to send a representative to the conference summoned by the British Government at Kuwait, but at the beginning of 1924 visited Transjordan where he assumed the title of Khalifa and returned to Mecca to attempt to obtain recognition of his new position by the Muslim world. This brought matters to a head and Ibn Sa'ud declared war on the Hejaz. Taif fell without any resistance and Husain abdicated in favour of his son 'Ali. The latter evacuated Mecca and attempted to raise an army. Jidda was organized for defence. Ibn Sa'ud occupied Mecca in Dec. 1924 and at the beginning of the year attacked Jidda without any success. The siege was temporarily raised in June. In the meantime however considerable success attended his arms, the ports fell one by one, and at the beginning of December Medina, and shortly afterwards Wejh surrendered. The end was not far off. King Ali abdicated a fortnight later. Jidda and Yenbo' surrendered and Ibn Sa'ud was master of the Hejaz. He was crowned king at Mecca in Jan. 1926. Certain changes have taken

place in the actual political boundaries. Asir, the coastal strip south of Hali Point, was in a difficult position between her two powerful neighbours, Ibn Sa'ud and the Imam of the Yeman. In Oct. 1926 the former was definitely recognized as paramount sovereign. The annexation on the other hand by the British Government, in July 1925, of the 'Aqaba-Ma'an region to the Palestine mandated territory deprived the Hejaz of territory won during the war In this region alone is the Hejaz railway, which made this land so important during the World War, in working order. The southern section was put out of order during the Wahhabi siege of Medina and has never been repaired. In May 1927 a treaty was signed between Great Britain and Ibn Sa'ud at Jidda. Great Britain agreed to recognize Ibn Sa'ud's independence. He therefore occupies a dominant position in Arabia from his headquarters at Riyadh, holding the crown of Nejd and of the Hejaz. In Jan. 1928 the old currency was superseded by a silver currency of Riyals (10=£1). (For bibliography *see* ARABIA.)

HEJIRA or **HEGIRA,** the name of the Mohammedan era (Arab, *hijra,* flight). It dates from 622, the year in which Mohammed "fled" from Mecca to Medina to escape the persecution of his kinsmen of the Koreish tribe. The years of this era are distinguished by the initials "A.H." (*anno hegirae*). The Mohammedan year is a lunar one, about 11 days shorter than the Christian. Although Mohammed himself appears to have dated events by his flight, it was not till later that the actual era was systematized by Omar, the second caliph (*see* CALIPHATE), as beginning from the first day of Muharram (the first lunar month of the year) which in that year (630) corresponded to July 16. The term *hejira* is also applied in its more general sense to other "emigrations" of the faithful, *e.g.*, to that to Abyssinia (*see* MOHAMMED), and to that of Mohammed's followers to Medina before the capture of Mecca. These latter are known as *Muhajirun.*

BIBLIOGRAPHY.—*See* the article MOHAMMED, and also *cf.* Wüstenfeld, *Vergleichungstabellen der muhammedanischen und christlichen Zeitrechnung* (2nd ed., Leipzig, 1903); D. Nielson, *Die altarabische Mondreligion* (Strassburg, 1904); Hughes, *Dictionary of Islam,* s.v. "Hijrah."

HEL or **HELA,** in Scandinavian mythology, goddess of the dead, a child of Loki and the giantess Angurboda, dwelt beneath the roots of the sacred ash, Yggdrasil (*q.v.*), and ruled the nine worlds of Helheim In early myth all the dead went to her: in later legend only those who died of old age or sickness; she then became synonymous with suffering and horror.

HELDENBUCH, DAS, the title under which a large body of German epic poetry of the 13th century has come down to us. The subjects of the individual poems are taken from national German sagas which originated in the epoch of the Migrations (*Völkerwanderung*), although doubtless here, as in all purely popular sagas, motives borrowed from the forces and phenomena of nature were, in course of time, woven into events originally historical. The poems of the *Heldenbuch* belong to two cycles, (1) the Ostrogothic saga of Ermanrich, Dietrich of Bern (*i.e.,* Dietrich of Verona, Theodoric the Great) and Etzel (Attila), and (2) the cycle of Hugdietrich, Wolfdietrich and Ortnit, which was probably of Franconian origin Dietrich of Bern (*q.v.*) the central figure of the more important group, was the ideal type of German mediaeval hero. Of the romances of this group, the chief are *Biterolf und Dietlieb,* evidently the work of an Austrian poet. *Der Rosengarten* tells of the conflicts round Kriemhild's "rose garden" in Worms—conflicts from which Dietrich always emerges victor, even when he is confronted by Siegfried himself. *Laurin und der kleine Rosengarten* deals with the adventures of Dietrich and his henchman Witege with the wily dwarf Laurin, who watches over another rose garden, that of Tyrol. Other elements of the Dietrich saga are represented by *Alpharts Tod, Dietrichs Flucht,* and *Die Rabenschlacht* ("Battle of Ravenna"). Of these, the first is much the finest poem of the entire cycle. The other two Dietrich epics belong to the end of the 13th century—the author being an Austrian, Heinrich der Vogler—and show the decay that had by this time set in in Middle High German poetry.

The second cycle of sagas is represented by several long romances, all of them unmistakably "popular" in tone. The epics of this group are *Ortnit* (*q.v.*), *Hugdietrich, Wolfdietrich,* (*q.v.*). Although many of the incidents and motives of this cycle are drawn from the best traditions of the Heldensage, its literary value is not very high.

BIBLIOGRAPHY.—This collection of romances was one of the first German books printed. The date of the first edition is unknown, but the second edition appeared in the year 1491 and was followed by later reprints in 1509, 1545, 1560 and 1590. The last of these forms the basis of the text edited by A von Keller for the Stuttgart *Literarische Verein* in 1867. In 1472 the *Heldenbuch* was remodelled in rough *Knittelvers* or doggerel; this version was printed by F. von der Hagen and S. Primisser in their *Heldenbuch* (1820–25). *Das Heldenbuch,* which F. von der Hagen published in 2 vols. in 1855, was the first attempt to reproduce the original text by collating the mss. A critical edition, was published in 5 vols. by O. Jänicke, E. Martin, A. Amelung and J. Zupitza at Berlin (1866–73). A selection, edited by E. Henrici, will be found in Kürschner's *Deutsche Nationalliteratur,* vol. 7 (1887). Recent editions have appeared of *Der Rosengarten* and *Laurin,* by G. Holz (1893 and 1897). All the poems have been translated into modern German by K. Simrock and others. *See* F. E. Sandbach, *The Heroic Saga-Cycle of Dietrich of Bern* (1906). The literature of the *Heldensage* is very extensive. *See* especially W. Grimm, *Die deutsche Heldensage,* 3rd ed. (1889); L. Uhland, "Geschichte der deutschen Poesie im Mittelalter," *Schriften,* vol. i. (1866); O. L. Jiriczek, *Deutsche Heldensage,* vol. i. (1898); and especially B. Symons, "Germanische Heldensage," in Paul's *Grundriss der germanischen Philologie,* 2nd ed. (1898).

HELDER, seaport in province of North Holland, 51 m. by rail N.N.W. of Amsterdam. Pop. (1926) 29,897. It is situated on the Marsdiep, the channel separating the island of Texel from the mainland and the main entrance to the Zuider Zee. It is the terminus of the North Holland canal from Amsterdam, and an important naval and military station. On the east side of the town is the harbour with naval wharves and magazines, wet and dry docks. The great sea-dike stretches from Nieuwe Diep to Fort Erfprins, a distance of about 5 m. It descends at an angle of 40° for 200 ft. into the sea. The town is fortified and there is a permanent garrison, while the province can be flooded from this point. It has a meteorological observatory, a zoological station and a lighthouse.

HELEN, in Greek mythology, daughter of Zeus by Leda (wife of Tyndareus, King of Sparta) or by Nemesis: sister of Polydeuces and Clytaemnestra, and wife of Menelaus (Gr. Ἑλένη). She was the most beautiful woman in Greece, and indirectly the cause of the Trojan war When a child she was carried off from Sparta by Theseus to Attica, but was recovered and taken back by her brothers. When she grew up, the most famous of the princes of Greece sought her hand in marriage and her father's choice fell upon Menelaus. During her husband's absence she was induced by Paris, son of Priam, with the connivance of Aphrodite, to flee with him to Troy. After the death of Paris she married his brother Deïphobus, whom she is said to have betrayed into the hands of Menelaus at the capture of the city (Aeneid vi. 517ff). Menelaus thereupon took her back, and they returned together to Sparta, where they lived happily till their death and were buried at Therapnae in Laconia. According to another story, Helen survived her husband, and was driven out by her stepsons. She fled to Rhodes, where she was hanged on a tree by her former friend Polyxo, to avenge the loss of her husband Tlepolemus in the Trojan War (Pausanias iii. 19). After death, Helen was said to have married Achilles in his home in the island of Leukē. According to Stesichorus, Paris, on his voyage to Troy with Helen, was driven ashore on the coast of Egypt, where King Proteus detained the real Helen in Egypt, while a phantom Helen was carried off to Troy; the real one was recovered by her husband after the war. (Herodotus ii. 112–120; Euripides, *Helena*). Helen was worshipped as the goddess of beauty at Therapnae in Laconia, where a festival was held in her honour. At Rhodes she was worshipped under the name of Dendritis (the tree goddess), where the inhabitants built a temple in her honour. We have thus an epic heroine Helen and a goddess Helen; the relations between the two are a problem as yet unsolved. Like her brothers, the Dioscuri, she was a patron deity of sailors.

See R. Englemann in Roscher's *Lexikon;* O. Gruppe, *Griechische Mythologie,* i. 163.

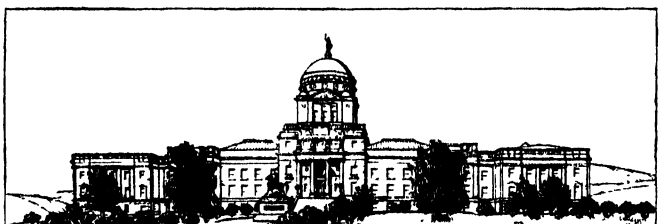
HELENA, ST. (*c.* 247–*c.* 327) the wife of the emperor Constantius I. Chlorus, and mother of Constantine the Great. She was a woman of humble origin, born probably at Drepanum, a town on the Gulf of Nicomedia, which Constantine named Helenopolis in her honour. Very little is known of her history. It is certain that, at an advanced age, she undertook a pilgrimage to Palestine, visited the holy places, and founded several churches. She was still living at the time of the murder of Crispus (326). Constantine had coins struck with the effigy of his mother. The name of Helena is intimately connected with the commonly received story of the discovery of the Cross. But the accounts which connect her with the discovery are much later than the date of the event. The Pilgrim of Bordeaux (333), Eusebius, and Cyril of Jerusalem were unaware of this important episode in the life of the empress. It was only at the end of the 4th century and in the West that the legend appeared.

The principal centre of the cult of St. Helena in the West seems to be the abbey of Hautvilliers, near Reims, where since the 9th century they have claimed to be in possession of her body. In England legends arose representing her as the daughter of a prince of Britain. Following these Geoffrey of Monmouth makes her the daughter of Coel, the king who is supposed to have given his name to the town of Colchester. These legends have doubtless not been without influence on the cult of the saint in England, where a great number of churches are dedicated either to St. Helena alone, or to St Cross and St. Helena. Her festival is celebrated in the Latin Church on the 18th of August. The Greeks make no distinction between her festival and that of Constantine, the 21st of May

See *Acta sanctorum*, Augusti iii. 548–580; Tixeront, *Les Origines de l'église d'Édesse* (Paris, 1888); F. Arnold-Foster, *Studies in Church Dedications or England's Patron Saints*, i. 181–189, iii. 16, 365–366 (1899). (H. De.)

HELENA, a city of Arkansas, U.S.A., on the Mississippi river, 55m. (in a bee-line) below Memphis; the county seat of Phillips county. It is served by the Illinois Central, the Missouri and Northern Arkansas, and the Missouri Pacific railways, and is at the head of navigation for ocean-going steamers. The population was 9,112 in 1920 (53% negroes). The city is built partly on a ridge 150ft. above sea-level, and is well protected by levees. It is an important shipping point for cotton, cotton-seed products, lumber and lumber products from its own plants Helena was founded about 1821. During the Civil War it was of considerable strategic importance. It was occupied and strongly fortified by Union troops in July, 1862, and on July 4, 1863, when attacked by the Confederates, was the scene of hot fighting, resulting in the loss of a fifth of the Confederate force

HELENA (hĕl'-ĕ-na), the capital city of Montana, U.S.A., the county seat of Lewis and Clark county; near the centre of the



BY COURTESY OF THE CHAMBER OF COMMERCE, HELENA, MONTANA

THE STATE CAPITOL OF MONTANA, AT HELENA

western part of the State, at the eastern foot of the Continental Divide. It is on Federal highway 91; is served by the Great Northern and the Northern Pacific railways; and has a municipal airport. The population was 12,037 in 1920 and was estimated locally at 13,500 in 1928.

Helena is delightfully situated, at an altitude of 3,955ft in the hollow of the Prickly Pear valley, a rich agricultural region surrounded by rolling hills and lofty mountains. It is an important touring centre. Mt. Helena forms a background for the city. The State capitol has a fine site, with open country in two directions. In the State library are files of scarce old newspapers and other valuable material on the early history of the region. Mt. St. Charles college for men (Roman Catholic) was established in 1909 Intermountain Union college was formed in 1923 by the consolidation of the College of Montana (Presbyterian; established in 1878 at Deer Lodge) and Montana Wesleyan college (Methodist; established at Helena in 1889). There is a U.S assay office in Helena. At East Helena (pop. 1920, 1,109) are quartz crushers and smelters and a large zinc reduction plant of the Anaconda Mining company (built in 1927).

Gold was discovered in Last Chance Gulch, now the main street of Helena, in July 1864. About the same time silver-bearing lead ores were found 20m S.E., and a little later gold-bearing quartz veins were found 5m S On Oct. 30, 1864, a town was organized, which within two years had a population of 7,500 Gold to the value of $16,000,000 was taken from the gravel of Last Chance Gulch, mostly before 1868 By 1870 the placers were exhausted, and a period of stagnation set in, lasting until the Northern Pacific railway reached this point On July 4, 1883, the first regular train left the city, carrying 1,000,000lb. of silver bullion. The total yield of gold, silver, lead and copper has totalled between $150,000,000 and $200,000,000 Helena was burned down in 1869 and in 1874. It was made the capital of the Territory in 1874 and in 1881 was chartered as a city

HELENSBURGH, a burgh of barony and police burgh and watering-place in Dumbartonshire, Scotland, on the north shore of the Firth of Clyde, opposite Greenock, 24 m N.W. of Glasgow by the L.N.E.R., with another station at Upper Helensburgh Pop (1921) 9,701. There is steamer communication with Garelochhead, Dunoon and other pleasure resorts on the western coast, and with Greenock, Glasgow, etc., from the old pier at Helensburgh. In 1776 the site began to be built upon, and in 1802 the town, named after Lady Helen, wife of Sir James Colquhoun of Luss, the ground landlord, was erected into a burgh of barony.

HELENUS, in Greek legend, son of Priam and Hecuba, and twin brother of Cassandra. In Homer, he appears as a seer and warrior. In later writers it is related that he and his sister fell asleep in the temple of Apollo Thymbraeus and that snakes came and cleansed their ears, whereby they obtained the gift of prophecy, and were able to understand the language of birds. After the death of Paris, because Helen rejected him for Deiphobus, Helenus withdrew in indignation to Mt. Ida, where he was captured by the Greeks; in other accounts he was captured by a stratagem of Odysseus, or surrendered voluntarily in disgust at the treacherous murder of Achilles (*q.v.*). He informed the Greeks of the "fates" of Troy, (Palladium, arrows of Heracles, arrival of Neoptolemus, *see* Troy) and advised the building of the Wooden Horse.

After the capture of Troy he and his sister-in-law Andromache accompanied Neoptolemus (Pyrrhus) as captives to Epirus, where Helenus persuaded him to settle. After the death of Neoptolemus, Helenus married Andromache and became ruler of the country. He was the reputed founder of Buthrotum and Chaonia, named after a brother or a companion, whom he had accidentally slain while hunting He was said to have been buried at Argos, where his tomb was shown

See Homer, *Iliad*, vi. 76, vii. 44, xii. 94, xiii. 576; Sophocles, *Philoctetes*, 604, who probably follows the *Little Iliad* of Lesches; Pausanias i. 11, ii. 23; Conon, *Narrationes* 34; Dictys Cretensis, iv. 18; Virgil, *Aeneid* iii. 294–490; Servius on *Aeneid* ii. 160, iii. 334.

HELFFERICH, KARL (1872–1924), German financier and politician, was born in Neustadt-on-the-Havel on July 22, 1872. In 1901 he became a professor of political science in Berlin, and in 1906 went to Constantinople as manager of the Anatolian Railway. He returned to Berlin in 1908 to take up the chairmanship of the Deutsche Bank In 1913 he was the chief German delegate at the Paris conference for the settlement of Balkan financial affairs. In 1915 Helfferich was appointed secretary of state for the Imperial treasury, where he followed the principle of defraying the cost of the War by borrowing rather than by fresh taxation, relying on a final German victory. In June 1916

he left the treasury for the home office. In June 1918 he was appointed to succeed Count Mirbach, who had been assassinated, as Germany's representative in Moscow. He remained in Moscow for three months, returning to Berlin in August to conduct the economic and industrial demobilization of Germany after the Armistice. He devoted himself thenceforward principally to financial questions. In 1923 he secured the currency of the Renten mark, and then fought against the Government policy of fulfilment of treaty obligations. He was fatally injured April 23, 1924.

His publications include: *Das Geld* (1903, 6th ed. 1923); *Deutschlands Volkswohlstand 1888–1913* (1913, 7th ed. 1917, trs. 1913); *Der Weltkrieg* (3 vols. 1919); *Die Politik der Erfullung* (1922); *Die deutsche Türkenpolitik* (1921), *Georg von Siemens, ein Lebensbild* (3 vols., 1922–23). *See* K. von Lumm, *Helfferich als Wahrungspolitiker und Gelehrter* (1926).

HELGAUD or **HELGALDUS** (d. *c.* 1048), French chronicler, was a monk of the Benedictine abbey of Fleury. Little else is known about him save that he was chaplain to the French king, Robert II. the Pious, whose life he wrote. The only extant ms. of this *Epitoma vitae Roberti regis* is in the Vatican. Editions have been printed by J. P. Migne in the *Patrologia Latina*, tome cxli. (Paris, 1844); and by M. Bouquet in the *Recueil des historiens des Gaules*, tome x. (Paris, 1760).

See *Histoire littéraire de la France*, tome vii. (1865–1869); and A. Molinier, *Les Sources de l'histoire de France*, tome ii. (1902).

HELGESEN, POVL[1], Danish humanist, was born at Varberg in Halland about 1480, of a Danish father and a Swedish mother. Helgesen was educated first at the Carmelite monastery of his native place and afterwards at another monastery at Elsinore, where he devoted himself to humanistic studies and adopted Erasmus as his model. As lector at the university of Copenhagen, gathered round him a band of young enthusiasts, the future leaders of the Danish Reformation. But Helgesen desired an orderly, methodical, rational reformation, and denounced Luther, whose ablest opponent in Denmark he became, as a hot-headed revolutionist. Helgesen's denunciation of Christian II. made it necessary for him to leave the capital. Under Frederick I. (1523–1533) he returned to Copenhagen and resumed his chair at the university, becoming soon afterwards provincial of the Carmelite Order for Scandinavia. Helgesen was attacked as bitterly by the Catholics as by the Protestants. In October 1534, however, Helgesen issued an eirenicon in which he attempted to reconcile the two contending confessions. After that every trace of him is lost. Helgesen was indisputably the greatest master of style of his age in Denmark. His historical works, *Danmark's Kongers Historie* and *Skibby Kröniken*, have some importance.

See Ludwig Schmitt, *Der Karmeliter Paulus Heliä* (Freiburg, 1893); *Danmarks Riges Historie* (Copenhagen, 1897–1905), vol. iii.

HELIACAL, relating to the sun (ἥλιος), a term applied in the ancient astronomy to the first rising of a star which could be seen after it emerged from the rays of the sun, or the last setting that could be seen before it was lost from sight by proximity to the sun.

HELIAND. The 9th-century poem on the Gospel history, to which its first editor, J. A. Schmeller, gave the appropriate name of *Heliand* (the word used in the text for "Saviour"), is, with the fragments of a version of the story of Genesis believed to be by the same author, all that remains of the poetical literature of the Old Saxons, *i.e.*, the Saxons who continued in their original home. It contained when entire about 6,000 lines, and portions of it are preserved in four mss. The poem is based on the pseudo-Tatian's harmony of the Gospels, and shows acquaintance with the commentaries of Alcuin, Baeda and Rabanus Maurus (whose commentary on the gospel of Matthew was finished about 820).

A part of the Genesis poem, as is mentioned in the article CAEDMON, is extant only in an Old English translation, but portions have been preserved in the original language in the same Vatican ms. that includes a fragment of the *Heliand*. In the one language or the other, there are in existence the following three fragments: (1) The passage which appears as lines 235–851 in the so-called "Caedmon's *Genesis*," on the revolt of the angels and the temptation and fall of Adam and Eve. Of this the part corresponding to lines 790–820 exists also in the original Old Saxon. (2) The story of Cain and Abel, in 124 lines. (3) The account of the destruction of Sodom, in 187 lines. The main source of the *Genesis* is the Bible, but considerable use was made of two Latin poems by Alcimus Avitus, *De initio mundi* and *De peccato originali*.

The two poems give evidence of genius and trained skill. Within the limits imposed by the nature of his task, the poet's treatment of his sources is remarkably free, the details unsuited for poetic handling being passed over, or, in some instances, boldly altered. In the *Heliand* the Saviour and His Apostles are conceived as a king and his faithful warriors, and the use of the traditional epic phrases appears to be the spontaneous mode of expression of one accustomed to sing of heroic themes. The *Genesis* fragments have less of the heroic tone, except in the splendid passage describing the rebellion of Satan and his host. It is noteworthy that the poet, like Milton, sees in Satan no mere personification of evil, but the fallen archangel, whose guilt could not obliterate all traces of his native majesty.

Such external evidence as exists bearing on the origin of the *Heliand* and the companion poem is contained in a Latin document printed by Flacius Illyricus in 1562. This is in two parts; the one in prose, entitled (perhaps only by Flacius himself) "*Praefatio ad librum antiquum in lingua Saxonica conscriptum*"; the other in verse, headed "*Versus de poëta et Interpreta hujus codicis.*" The *Praefatio* begins by stating that the emperor, Ludwig the Pious, commanded a certain Saxon, who was esteemed as an eminent poet, to translate the Old and New Testaments. The poet rendered into verse all the most important parts of the Bible with admirable skill, dividing his work into *vitteas*, a term which, the writer says, may be rendered by "*lectiones*" or "*sententias.*" The *Praefatio* goes on to say that it was reported that the poet, till then knowing nothing of the art of poetry, had been admonished in a dream to turn into verse the precepts of the divine law, which he did with so much skill that his work surpasses in beauty all other German poetry. The *Versus* practically reproduces in outline Baeda's account of Caedmon's dream, without mentioning the dream, but describing the poet as a herdsman, and adding that his poems, beginning with the creation, relate the history of the five ages of the world down to the coming of Christ.

As the *Praefatio* speaks of the emperor Ludwig in the present tense, the former part of it at least was probably written in his reign, *i.e.*, not later than A.D. 840. The general opinion of scholars is that the latter part, which represents the poet as having received his vocation in a dream, is by a later hand, and that the sentences in the earlier part which refer to the dream are interpolations. The date of these additions, and of the *Versus*, is of no importance, as their statements are incredible. That the author of the *Heliand* was, so to speak, another Caedmon—an unlearned man who turned into poetry what was read to him from the sacred writings—is impossible, because in many passages the text of the sources is so closely followed that it is clear that the poet wrote with the Latin books before him. On the other hand, there is no reason for rejecting the almost contemporary testimony of the first part of the *Praefatio* that the author of the *Heliand* had won renown as a poet before he undertook his great task at the emperor's command.

BIBLIOGRAPHY.—The first complete edition of the *Heliand* was published by J. A. Schmeller in 1830; the second volume, containing the glossary and grammar, appeared in 1840. The standard edition is that of E. Sievers (1877), in which the texts of the Cotton and Munich mss. are printed side by side. Other useful editions are those of M. Heyne (3rd ed., 1903), O. Behaghel (1882) and P. Piper (1897, containing also the Genesis fragments). The fragments of the *Heliand* and the *Genesis* contained in the Vatican ms. were edited in 1894 by K. Zangemeister and W. Braune under the title *Bruchstücke der altsächsischen Bibeldichtung*. *See* also E. Windisch, *Der Heliand und seine Quellen* (1868); E. Sievers, *Der Heliand und die angelsächsische Genesis* (1875); R. Kögel, *Deutsche Literaturgeschichte*, Bd. i. (1894) and *Die altsächsische Genesis* (1895); R. Kögel and W. Bruckner, "Althoch- und altniederdeutsche Literatur," in

[1] He wrote his name Heliae or Eliae.

Paul's *Grundriss der germanischen Philologie*, Bd. ii. (2nd ed., 1901), which contains references to many other works; Hermann Collitz, *Zum Dialekte des Heliand* (1901). (H. Br.; X.)

HELICON, a mountain range in Greece, celebrated in classical literature as an abode of the Muses, is situated between Lake Copaïs and the Gulf of Corinth. The highest summit, the present Palaeovouni (old hill), rises to the height of about 5,000 ft. On the fertile eastern slopes stood a temple and grove sacred to the Muses, and adorned with statues, which, taken by Constantine the Great to beautify his new city, were consumed there by a fire in A.D. 404. Hard by were the fountains Aganippe and Hippocrene, the latter created by the tread of the winged horse Pegasus. At the neighbouring Ascra dwelt the poet Hesiod, a fact which probably enhanced the poetic fame of the region. Pausanias describes Helicon as the most fertile mountain in Greece; neither poisonous plant nor serpent was to be found on it, while many of its herbs possessed miraculous virtue. His description makes it possible to reconstruct the classical topography and French excavators have discovered the temple of the Muses and a theatre.

See W. M Leake, *Travels in Northern Greece* (vol. ii., 1835); J. G. Frazer, *Pausanias*, v. 150.

HELICON, the circular form of the B flat contrabass tuba used in military bands, worn round the body, with the enormous bell resting on the left shoulder and towering above the head of the performer, (Fr. *hélicon, bombardon circulaire;* Ger. *Helikon*). The pitch of the helicon is an octave below that of the euphonium.

HELICOPTER. A flying machine whose supporting surfaces are rotated mechanically, being equivalent to an air-screw (or air-screws) so arranged as to give an approximately vertical thrust. Since such a system does not derive its lift from a motion of the whole machine through the air (contrast both the ordinary aeroplane and the Gyroplane, *q.v.*) it is in principle capable of hovering, and of rising or descending vertically. Schemes for helicopters are found throughout the literature of flying, from the earliest times, but there are few records of actual construction, and none of successful flight The device is in fact extravagant of power. In the light of modern knowledge one horse-power cannot be expected to lift more than about 15 lb The whole of the power of a modern commercial aeroplane arranged as a helicopter would be needed merely to sustain it, leaving nothing to raise or propel it.

The most hopeful line of development for the helicopter is along the lines of the gyroplane A mechanical drive to the rotating wings will enable the gyroplane to rise from the ground after a shorter run than is necessary for the "autogiro," though it is unlikely that, for a given expenditure of power the rate of climb will be thereby improved. It may be possible to dispense with the driving air-screw of the gyroplane, devoting the whole power to rotating wings and obtaining the thrust required for forward motion by inclining their axis. The essential difficulty is in the control, and as with the aeroplane success will not be attained until the problem of control has been solved. Failure of the power plant will force a helicopter to descend, but need not result in a catastrophe. Given effective control over the inclination of the axis of the wings, all the ordinary manoeuvres of a normal aeroplane about to land may be regarded as within its powers, with the additional possibility of a steep final descent at a slow speed.

It is unlikely that the helicopter, even as visualized above, will equal the aeroplane in performance, or in the proportion of its total weight available for load. If it ultimately displaces the aeroplane for certain purposes, it will be entirely on account of the gain in safety in which the practical realization of its essential feature—lift not dependent on forward speed—will result.

(W S. F.)

HELIGOLAND (Ger. *Helgoland*), an island of Germany, in the North Sea, lying off the mouths of the Elbe and the Weser, 28 m. from the nearest point in the mainland. Pop. (1925) 2,588. The generally accepted derivation of Heligoland (or Helgoland) from *Heiligeland, i.e.*, "Holy Land," seems doubtful. According to northern mythology, Forseti, a son of Balder and Nanna, the god of justice, had on the island a temple subsequently destroyed by St. Ludger. This legend may have given rise to the derivation "Holy Land." The more probable etymology, however, is that of Hallaglun, or Halligland, *i.e.*, "land of banks, which cover and uncover." Here Hertha, according to tradition, had her great temple, and hither came from the mainland the Angles to worship at her shrine, and on this isle St. Willibrord in the 7th century first preached Christianity. For its ownership, before and after that date, many sea-rovers have fought until it finally became a fief of the dukes of Schleswig-Holstein. The island was a Danish possession in 1807, when the English seized and held it until it was formally ceded to them in 1814 A British possession until 1890, it was ceded in that year to Germany, and since 1892 has formed part of the Prussian province of Schleswig-Holstein. It consists of two islets, the main, or Rock island, and the small Dunen-Insel, a quarter of a mile to the east, connected by a neck of land until 1720, when they were severed by a violent irruption of the sea The former is nearly triangular in shape and is surrounded by steep red cliffs, the only beach being the sandy spit near the south-east point, with the landing-stage. The cliffs are worn into caves, arches and columns The impression made by the red cliffs, fringed by a white beach and supporting the green Oberland, is commonly believed to have suggested the national colours, red, white and green, or, as the old Frisian rhyme goes:—

"Gron is dat Land,
Rood is de Kant,
Witt is de Sand,
Dat is de Flagg vun't hillige Land"

The lower town of Unterland, on the spit, and the upper town, or Oberland, situated on the cliff above, are connected by a wooden stair and a lift. There is a powerful lighthouse, and after cession by Great Britain to Germany, the main island was strongly fortified, but the fortifications were demolished according to the terms of the Treaty of Versailles Inside the Dunen-Insel the largest ships can ride safely at anchor, and take in coal and other supplies. The greatest length of the main island, which slopes somewhat from west to east, is just a mile, and the greatest breadth less than a third of a mile, its average height 198 ft, and the highest point, crowned by the church, 216 feet. The Dünen-Insel is a sand-bank protected by groynes, and here the numerous visitors bathe Most of the houses are built of brick, but some are of wood. In 1892 a biological institute, with marine museum and aquarium (1900) attached, was opened.

German is the official language, though among themselves the natives speak a dialect of Frisian, barely intelligible to the other islands of the group. There is regular communication with Bremen and Hamburg.

The winters are stormy. May and the early part of June are wet and foggy, so that few visitors arrive before the middle of the latter month.

HELIGOLAND BIGHT. On Aug. 28, 1914, a sweep by the British light naval forces into the Heligoland Bight brought about the first serious contact between the opposing naval forces during the World War. The action began at daylight, developed into a series of confused fights, in misty weather upon a glassy-smooth sea, and lasted until 1 30 P.M., when, the sweep having been completed, Vice-Admiral Sir David Beatty withdrew his forces. The day ended to the distinct advantage of the British, who had one cruiser ("Arethusa") and three destroyers damaged with a total casualty list of 35 killed and 40 wounded. The Germans lost 1,242 officers and men, killed, wounded, and prisoners; three cruisers ("Mainz," "Cöln," and "Ariadne") and one destroyer (V. 187) were sunk; one cruiser ("Frauenlob") was badly crippled, and there was unreported damage to other cruisers and torpedo craft.

THE PLAN OF OPERATIONS

From the first days of the war a watching patrol, maintained by British submarines off the entrance to the German ports, had obtained an accurate knowledge of the routine movements of the German patrols. Against these patrols the sweep was planned, to be carried out by light forces, upon a day when the German heavy ships would be tide-bound until afternoon, inside the Jade river bar. In the original plan of the operation, Comm. Roger Keyes, commanding the submarine flotilla (eight submarines of the "D"

and "E" class and the destroyers "Lurcher" and "Firedrake") was to place an inner line of three submarines close to Heligoland, with orders to remain submerged until after a certain hour. An outer line of three submarines was stationed 40m. to the westward, instructed to try and draw the enemy destroyers to sea. Two other submarines were to watch the entrance to the Ems river.

The destroyer force, under Comm. Reginald Tyrwhitt, consisted of the "Arethusa" with the 3rd flotilla (16 t.b.d's) and the "Fearless" (Capt. Blunt) with the 1st flotilla (15 t.b.d's). The battle-cruisers "Invincible" (Rear-Admiral Sir Archibald Moore) and "New Zealand" were to act in support and were to meet the destroyer force to the south-east of the Dogger Bank on the evening of the 27th. Whilst the submarines were taking up their positions the cruisers and destroyers were to steer for a point 75m N.N.W. from Heligoland, so as to arrive there by daylight on the 28th. The flotillas were then to sweep south and west through the Bight to cut off the German destroyers on their return from their nightly patrol. The two battle-cruisers would be in support to seaward and, away to the west, off the Terschilling light, an armoured cruiser force under Rear-Admiral Christian was held in reserve.

Such was the original plan. It was modified at the last moment on account of the diversion at Ostende. A brigade of Royal Marines was landing at that place on the 26th, under cover of the ships of the channel squadron, and a countermove by the German high sea fleet seemed likely. Therefore, support from the grand fleet was arranged and Admiral Jellicoe sent Vice-Admiral Beatty south in command of a force consisting of the battle-cruisers "Lion," "Queen Mary," and "Princess Royal" and Comm. Goodenough's squadron of six light cruisers ("Southampton," "Falmouth," "Birmingham," "Nottingham," "Lowestoft," and "Liverpool"). Beatty joined the "Invincible" off the Dogger Bank on the evening of the 27th and Goodenough's cruisers were sent on towards the destroyers' daylight position. Unfortunately, a wireless message, informing Tyrwhitt and Keyes of the change of plan, miscarried and neither commodore was aware of the presence of the northern forces until after the operation had commenced.

At about 3.30 A.M. Goodenough's cruisers came into contact with Tyrwhitt's destroyers and were at first mistaken for an enemy: recognition signals, however, averted the danger of an attack and at 4.0 A.M. Tyrwhitt, with his destroyers, began his run to the south. Goodenough's six cruisers were eight miles astern of him, and 30m. away on his starboard quarter was Beatty with five battle-cruisers. Keyes, in the "Lurcher," had stationed his submarines, but was still unaware of the presence of the cruisers, a fact which, as will be seen later, complicated the situation during the forenoon, when, owing to the mist, the course of events was by no means clear. Meanwhile, intercepted wireless signals had warned the Germans that a considerable force was approaching the Bight and they altered their normal dispositions. Their patrol force was ordered to retire before the British destroyers and to try and entice them into the Bight, where the light cruisers would be ready to cut them off. Thus, at daylight, the position was an interesting one, the destroyer forces being each intent upon leading its opponent into the arms of its supporting cruisers.

THE FIRST PHASES

The morning broke dull and overcast, with a smooth sea. To seaward the horizon was clear, but inshore it was misty, with the visibility never exceeding three to four miles and sometimes much less. At 4.45 A.M. E 7 fired a torpedo at one of the German outer patrol (G. 194), and this brought the German 5th flotilla out from Heligoland to hunt the submarine. At this time Tyrwhitt, in the "Arethusa," with the 3rd flotilla, was steering S.S.E. into the Bight, followed by "Fearless" with the 1st flotilla. Shortly before 7.0 A.M. a German t.b.d. was sighted on the port bow, about 3½m. off, and "Laurel," with the 4th division, was sent in chase (*see* fig. 1). The enemy turned S.E. and "Laurel" soon sighted ten more destroyers; shots were exchanged at long range as the Germans made off towards Heligoland. Tyrwhitt turned to the eastward to support his chasing division and, just before 8 A.M., the "Stettin" came in sight to the N.E. Her arrival was opportune, for the German destroyer "V.1" had been hit and was dropping astern A few minutes later "Frauenlob" was seen to the eastward and "Arethusa" for a short time came under a heavy fire from both German cruisers. "Stettin," which had not yet got steam for full speed, on sighting "Fearless" with her flotilla, turned away and disappeared into the mist. "Frauenlob" turned to the south-west-

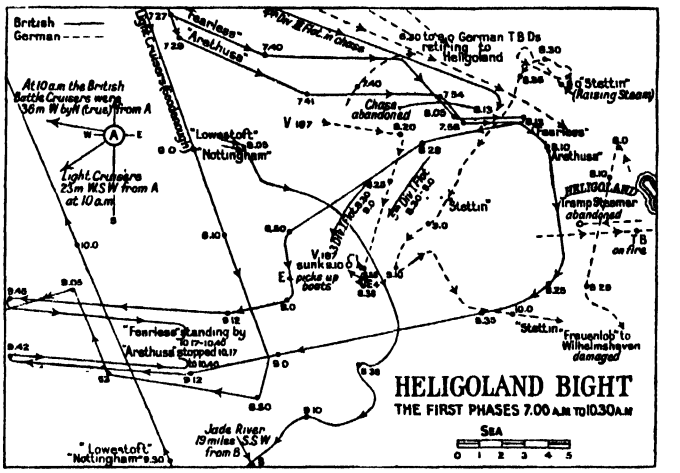


FIG. 1.—INITIAL MOVEMENTS IN BATTLE OF HELIGOLAND BIGHT, DURING WHICH ONE GERMAN CRUISER WAS DAMAGED, ONE DESTROYER SUNK AND H.M.S. "ARETHUSA" RECEIVED DAMAGE TO HER ENGINES

ward, and "Arethusa," turning to a converging course, a sharp fight ensued. "Arethusa," which had been commissioned only the day before, suffered heavily. She came under the fire of the forts of Heligoland and by 8.20 A.M. had only one 6in. gun remaining in action; but she continued her fight with "Frauenlob." At 8.25 A.M. the latter, heavily hit on her forebridge, broke off the action and retired. She reached Wilhelmshaven at noon with 50 killed and wounded on board. A tramp steamer, attempting to cross the bows of "Arethusa," was turned back by the British destroyers, who also chased and smashed up the torpedo boats D.8 and T. 33. After "Frauenlob" had retired S.E. Tyrwhitt turned W. He had, at 8.13 A.M., made the signal "Course W¼S" (the course for the sweep), but delayed turning himself until he had finished with "Frauenlob." "Fearless," having lost sight of "Stettin," turned to the new course and recalled the chasing destroyers. The first phase thus closed at 8.30 A.M. with the British flotillas steering to the westward as planned, "Fearless" being about six m. to the north of "Arethusa."

THE SINKING OF "V.187"

The mist had now thickened, and soon after turning, "Fearless" sighted a destroyer coming in from seaward. At first she was mistaken for the "Lurcher," but soon identified as an enemy. "Goshawk" with the 5th and "Ferret" with the 3rd divisions were sent in chase. The enemy was "V.187," the leader of the German flotillas, and she attempted to escape to the southward. At 8.0 A.M. Goodenough had detached "Nottingham" and "Lowestoft" to Tyrwhitt's assistance and "V.187," sighting these two cruisers ahead at 8.38 A.M., was turned back by their 6in. guns into the arms of "Fearless" and eight destroyers. She was soon reduced to a wreck and she sank at 9.10 A.M. "Fearless," leaving the destroyers to deal with "V.187," rejoined Tyrwhitt and together they resumed the westerly course by 9.0 A.M.

The survivors of the sinking German were rescued by boats from the British destroyers. Whilst the rescue work was in progress "Stettin" appeared from the north and, opening fire upon the destroyers, scattered them, herself receiving a few hits whilst doing so. In the confusion, five boats, full of German wounded and prisoners, were left behind. Submarine "E.4" (Lt.-Com. Leir), made an unsuccessful attack upon "Stettin," which caused that ship to withdraw; then, appearing suddenly on the surface, she went to the rescue of the British boat's crews. One German officer and three men were kept as prisoners; the remainder were left in the British boats, were supplied with bread and water, and given the course to Heligoland. "E.4" then submerged as dramat-

ically as she had appeared.

Goodenough, with four cruisers, turned westward at 8.30 A.M., being at that time ten m. ahead of the flotillas. "Nottingham" and "Lowestoft," after heading off "V.187," tried to rejoin Goodenough, but failing to regain touch, they steered N.W. for the battle-cruiser position. Keyes in "Lurcher," still unaware of the presence of the northern force, sighted and shadowed them, under the impression they were enemy ships. Through the mist, just before 9.0 A.M., Keyes sighted Goodenough's four other ships astern. He informed "Invincible" that he was being chased by four cruisers and was trying to lead them towards her. Goodenough followed "Lurcher" for about ten minutes and then turned back to the westerly course. This took his ships over the outer line of British submarines, who were still unaware of his presence. At 9.30 A.M. "Southampton" sighted "E.6" and promptly attempted to ram; the submarine escaped only by making a rapid dive. Towards 10 0 A.M., the weather to seaward becoming clearer, mutual recognition took place between Keyes and Goodenough and the latter went on to the westward, in order to give the submarines freedom of action.

Tyrwhitt had intercepted Keyes's message to "Invincible," and at 9 45 A.M. he gallantly turned back to his assistance with the crippled "Arethusa." "Fearless" turned back at the same time, and by 10.0 A.M. the 3rd and 5th divisions, having rejoined after sinking "V.187," the re-united flotillas turned once more to the westward. But by this time "Arethusa" could only steam at ten knots, and at 10.17 she was forced to stop to repair her engines. "Fearless" stood by her, and by 10.45 A.M. the two ships were under way again, steaming slowly W., with the destroyers spread out ahead of them.

THE MAIN ACTION

The German command, in the Jade river, had by now realized the situation and was endeavouring to concentrate the light cruisers to attack the British flotillas (*see* fig. 2). "Mainz" left the Ems river at 9 0 A.M. and was coming up from S.W., hoping to cut off the destroyers and to join "Strassburg." That ship left the Jade river at 9.30 A.M., followed at intervals by "Cöln," "Ariadne," "Stralsund," and "Kolberg," while the "Stettin" was on her way W. from Heligoland Thus six light cruisers were endeavouring to encompass the British flotillas, whose position

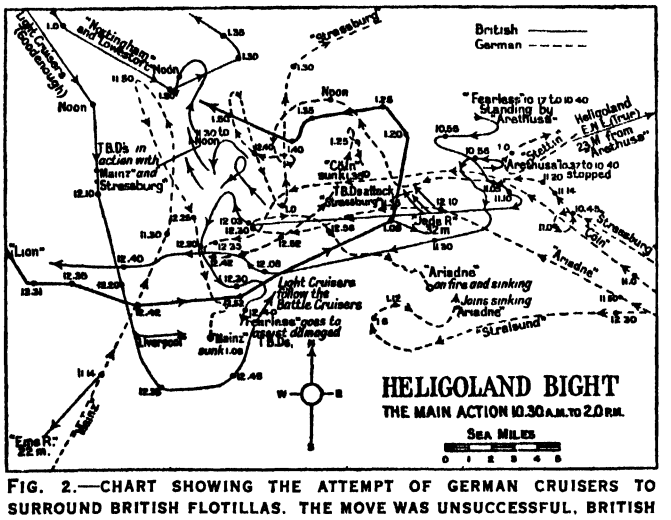


FIG. 2.—CHART SHOWING THE ATTEMPT OF GERMAN CRUISERS TO SURROUND BRITISH FLOTILLAS. THE MOVE WAS UNSUCCESSFUL, BRITISH BATTLE CRUISERS DASHING IN AND SINKING THREE GERMAN CRUISERS

from 11.0 A.M. onwards was precarious. Soon after "Arethusa" resumed her westerly course at 10.45 A.M. "Strassburg" appeared from S.E., and after firing a few salvoes at long range disappeared in the mist to the northward. She was followed at 11.5 A.M. by "Cöln," which also passed on after exchanging a few salvoes. When "Cöln" appeared Tyrwhitt asked Beatty for support. At 11.16 A.M. "Strassburg" reappeared to the northward and opened a heavy fire upon "Arethusa." A determined attack by the 1st and 2nd divisions of the 3rd and the 1st division of the 1st flotillas drove her off, and the stricken "Arethusa" continued her course to W., supported by "Fearless" and the destroyers. When "Strassburg" reappeared "Fearless" sent out an urgent call for help, and Beatty, at 11.20 A.M., ordered Goodenough to turn back to the assistance of the flotillas.

To Beatty, who had been steaming at high speed around a position about 50m. to the N. and W. of Heligoland, the course of events had by no means been clear The urgent call from "Fearless," however, made it evident that she and the "Arethusa" were in action with two or more cruisers. The flotillas were still within 30m. of Heligoland, and at any time after noon there was a possibility of heavy enemy ships appearing from the Jade river. Goodenough was turned back, and Beatty, accepting the risk of mines and submarines, determined to take his whole force into the Bight to clear matters up and to extricate "Arethusa" and the flotillas. By 11.30 A.M. the battle-cruisers were forming single line ahead on a S.E. course and were working up to full speed

The Sinking of the "Mainz."—At 11 30 A M. the 2nd, 3rd, and 5th divisions of the 1st flotilla were about six m to the westward of "Arethusa" when the "Mainz" appeared right ahead and chased them away to the north. At 11 50, after a 20 min. chase, "Mainz" sighted Goodenough's four cruisers coming out of the haze from N W. and the whole aspect of affairs was at once changed. "Mainz" turned S., followed by the destroyers she had been chasing, and was hit twice by the cruisers before she could draw away in the mist. At 12.08, she met "Fearless" with the remainder of the 3rd flotilla, and in the sharp fight that followed her rudder and port engine were damaged and she was hit by a torpedo from one of the destroyers. Goodenough's cruisers were now closing up and the fate of "Mainz" was sealed. She turned and dealt savagely with the 4th division when they attacked. "Laurel" had her after-funnel blown away and her captain severely wounded, "Laertes" was stopped dead by four hits from the same salvo, and "Liberty's" mast was shot away and her captain killed. But "Mainz," under the concentrated fire of the cruisers and destroyers, soon became a helpless wreck. She struck at 12 50, and 18 minutes later she rolled over and sank. Keyes, in the "Lurcher," went alongside and rescued 348 of her crew, narrowly escaping damage from her propellers as she sank.

The Battle-Cruisers in Action.—During the half-hour after noon the two British flotilla leaders were in grave danger of being overwhelmed. "Mainz" had appeared ahead, "Cöln" and "Ariadne" were fast coming up astern, followed by "Stralsund" and "Stettin," and "Strassburg" was in action with the destroyers about five m. to the N E. Goodenough's arrival and the sinking of the "Mainz" relieved the pressure and Tyrwhitt continued to limp slowly to the westward. At 12 30 "Arethusa" sighted a large ship in the mist ahead, and after a moment of breathless suspense recognized her as the "Lion," followed by the battle-cruiser squadron. Steaming at high speed, Beatty left the "Arethusa" to port and the sinking "Mainz" to starboard and swept on. Goodenough's cruisers joined in astern and "Fearless" turned away to the assistance of "Laurel" and her damaged consorts. The German cruisers fled. "Strassburg" turned N , disappeared into the mist, and was no more seen. "Cöln," sighted on the port bow of the "Lion," made a desperate attempt to escape to N.E. but a few salvoes disabled her engines. "Ariadne" tried to pass ahead of "Lion" on a S E. course, but, hit by the first two salvoes fired at her, she disappeared to the southward, badly on fire and sinking. "Stralsund" and "Stettin" turned eastward and escaped. At 1.09 P.M. Beatty, being only 32m. from the mouth of the Jade river, made the general signal to retire. The battle-cruisers turned in a wide circle to the N. and W. and at 1.25 P.M. the "Cöln" was seen again, steaming slowly to the S.E. Three salvoes caused her to list to port and at 1.35 P.M. she sank, taking with her the German cruiser admiral and all her ship's company

Thus, in a brief hour, Beatty's bold stroke with the battle-cruisers had turned an awkward situation into a brilliant success. The British force withdrew homewards and all ships arrived safely at their ports. Two only, the "Arethusa" and "Laurel," had to be towed home. The German battle-cruisers were slow in getting to sea and did not leave the Jade river until 2.0 P.M. By 4.0 P.M., accompanied by destroyers and the remnants of the light cruiser

squadron, they reached a position close to where the "Cöln" had sunk, and, seeing no enemy, returned to the shelter of their base.

The success achieved in this operation exceeded all expectations and its effects were far-reaching. It came at a time when the British nation needed a success to dispel the dismay caused by the overwhelming advance of the German armies. Upon the British navy the effect was exhilarating. The command of the North Sea had been asserted right up to the gates of the enemy and the young destroyer commanders had acquired a sense of superiority over their enemy and a trust in their leaders. Serious as was the material loss to the German fleet, it was not comparable to the effect upon its morale. Admiral Tirpitz stated that "August 28 was a day fateful, both in after effects and in incidental results, to the work of the German navy" Certainly, the marked disinclination shown by the German fleet throughout the war to be drawn from the protection of its bases is attributable to this early British success in the Bight of Heligoland.

(S. T. H. W.)

HELIOCENTRIC, *i.e.*, referred to the centre of the sun (ἥλιος) as an origin, a term designating especially co-ordinates of heavenly bodies referred to that origin.

HELIODORUS, of Emesa in Syria, Greek writer of romance. He was the author of the *Aethiopica*, the oldest and best of the Greek romances that have come down to us. It was first brought to light in modern times in a ms from the library of Matthias Corvinus, found at the sack of Buda (Ofen) in 1526, and printed at Basle in 1534. Other codices have since been discovered. The story is that the daughter of Persine, wife of Hydaspes, king of Aethiopia, was born white. Fearing an accusation of adultery, the mother gives the babe to the care of a gymnosophist. The child is finally taken to Delphi, and made a priestess of Apollo under the name of Charicleia. Theagenes, a noble Thessalian, comes to Delphi and the two fall in love with each other. He carries off the priestess with the help of an Egyptian, employed by Persine to seek for her daughter. After many adventures the chief personages meet at Meroë at the very moment when Charicleia is about to be sacrificed to the gods by her own father. Her birth is made known, and the lovers are married. The rapid succession of events, the variety of the characters, the graphic descriptions of manners and of natural scenery, the simplicity and elegance of the style, give the *Aethiopica* great charm. As a whole it offends less good taste and moral decency than other romances of its class. Homer and Euripides were the favourite authors of Heliodorus, who in his turn was imitated by French, Italian and Spanish writers. The early life of Clorinda in Tasso's *Jerusalem Delivered* (canto xii. 21 sqq.) is almost identical with that of Charicleia; Racine meditated a drama on the same subject; and it formed the model of the *Persiles y Sigismunda* of Cervantes. According to the ecclesiastical historian Socrates (*Hist. eccles.* v. 22), the author of the *Aethiopica* was a certain Heliodorus, bishop of Tricca in Thessaly. But it is now generally agreed that the real author was a sophist of the 3rd century A.D.

The best editions are: A. Coraës (1804), G. A. Hirschig (1856); *see* also M. Oeftering, *H. und seine Bedeutung fur die Literatur*, with full bibliographies (1901); J. C. Dunlop, *History of Prose Fiction* (1888); and especially E. Rohde, *Der griechische Roman* (1900). There are translations in almost all European languages.

HELIOGABALUS (ELAGABALUS), Roman emperor (A.D. 218–222), was born at Emesa about 205. His real name was Varius Avitus. On the murder of Caracalla (217), Iulia Maesa, Varius's grandmother and Caracalla's aunt, left Rome and retired to Emesa, accompanied by her grandsons (Varius and Alexander Severus). Varius, though still only a boy, was appointed high priest of the Syrian sun-god Elagabalus, one of the chief seats of whose worship was Emesa (Homs). His beauty, and the splendid ceremonials at which he presided, made him a great favourite with the troops stationed in that part of Syria, and Maesa increased his popularity by spreading reports that he was in reality the illegitimate son of Caracalla. An insurrection was set on foot, and on May 16, 218 Varius was proclaimed emperor as Marcus Aurelius Antoninus. The troops sent to quell the revolt went over to him, and Macrinus was defeated near Antioch on June 8. Heliogabalus was at once recognized by the senate as emperor. After spending the winter in Nicomedia, he proceeded in 219 to Rome, where he made it his business to exalt the deity whose priest he was and whose name he assumed. The shameless profligacy of the emperor's life was such as to shock even a Roman public. His popularity with the army declined, and Maesa, perceiving that the soldiers were in favour of Alexander Severus, persuaded Heliogabalus to raise his cousin to the dignity of Caesar (221), a step of which he soon repented. An attempt to murder Alexander was frustrated by Maesa. Another attempt in 222 produced a mutiny among the praetorians, in which Heliogabalus and his mother Soemias (Soaemias) were slain (probably in the first half of March).

AUTHORITIES.—Life by Aelius Lampridius in *Scriptores historiae Augustae;* Herodian v. 3–8; Dio Cassius lxxviii. 30 *sqq.*, lxxix. 1–21; monograph by G. Duviquet, *Héliogabale* (1903), containing a translation of the various accounts of Heliogabalus in Greek and Latin authors, notes, bibliography and illustrations; O. F. Butler, *Studies in the Life of Heliogabalus* (New York, 1908); Gibbon, *Decline and Fall*, ch. 6. On the Syrian god *see* F. Cumont in Pauly-Wissowa's *Realencyclopadie*, v. pt. ii. (1905). *See* also J. S. Hay, *The Amazing Emperor Heliogabalus* (1911).

HELIOMETER, an instrument originally designed for measuring the variation of the sun's diameter at different seasons of the year (named from Gr. ἥλιος, sun, and μέτρον, a measure) By subsequent improvements it became one of the most accurate astronomical instruments for measuring angular distances between stars, but its work is now done by photography and the heliometer is rarely used.

In the standard heliometer the object-glass is cut into two semi-circular segments In the zero position the two halves form practically a single object-glass; they can be displaced by sliding their straight edges over one another, the amount of displacement being measured by a screw; a double image of each star is thus formed, *i e*, one by each half-lens. If the distance between two stars is being measured, the observation consists in turning the screw until the image from one star coincides with that from the other. For greater precision it is found desirable to move both segments an equal amount in opposite directions, so that the centre of the field of view where the observations of coincidence are made remains a centre of symmetry. Distances up to 2° are measured with these instruments.

The first use of a divided object-glass to give a double image is due to Servington Savary in 1743, but his segments were not movable. Pierre Bouguer (1748) invented an instrument used in the manner of a modern heliometer but employing two complete lenses instead of half-lenses to give the double image. In 1754 John Dollond combined Savary's idea of the divided object-glass with Bouguer's method and constructed the first really practical heliometer. The heliometer acquired a great reputation through the work of Bessel at Königsberg, who used it to measure the parallax of 61 Cygni. Many instruments were made for the transit of Venus expeditions in 1874. The last great heliometer observer was Sir David Gill; his measurements of the parallax of southern stars remained for a long while unsurpassed; he used it also for his important determinations of the solar parallax by observations of Mars and certain minor planets.

See Bessel, *Astronomische Untersuchungen*, vol. i.; Gill, *Annals of Cape Observatory*, vol. vii., pp. 1–71.

HELIOPOLIS, an ancient city of Egypt (the Biblical *On*). It stood 5 m. E. of the Nile at the apex of the Delta. It was the principal seat of sun-worship, and in historic times its importance was entirely religious. There appear to have been two forms of the sun-god at Heliopolis in the New Kingdom—namely, Ra-Harakht, or Rē'-Harmakhis, falcon-headed, and Etōm, human-headed; the former was the sun in his mid-day strength, the latter the evening sun. A sacred bull was worshipped here under the name Mnevis (Egyp., *Mreu*), and was especially connected with Etōm. The sun-god Rē' (*see* EGYPT: *Religion*) was especially the royal god, the ancestor of all the Pharaohs, who therefore held the temple of Heliopolis in great honour. Each dynasty might give the first place to the god of its residence—Ptah of Memphis, Ammon of Thebes, Neith of Sais, Bubastis of Bubastis, but all alike honoured Rē'. His temple became in a special degree a

depository for royal records, and Herodotus states that the priests of Heliopolis were well informed in matters of history. The schools of philosophy and astronomy are said to have been frequented by Plato and other Greek philosophers; Strabo, however, found them deserted, and the town itself almost uninhabited, although priests were still there. The Ptolemies probably took little interest in their "father" Rē', and Alexandria had eclipsed the learning of Heliopolis; thus with the withdrawal of royal favour Heliopolis quickly dwindled.

In Roman times obelisks were taken from its temples to adorn Rome and the northern cities of the Delta. Finally the growth of Fostat and Cairo, only 6 m. to the S.W., caused the ruins to be ransacked for building materials. The site was known to the Arabs as *'Ayin esh shems*, "the fountain of the sun," more recently as Tel Hisn. It has now been brought for the most part under cultivation, but the ancient city walls are to be seen in the fields on all sides, and the position of the great temple is marked by an obelisk, and a few granite blocks bearing the name of Rameses II.

HELIOSTAT, an instrument containing a mirror driven by clockwork so as to reflect sunlight in a fixed direction; *e.g.*, on to the slit of a fixed spectroscope. It is of more complicated design than the coelostat (*q.v.*). It has the advantage over the coelostat that the instrument fed by it need not be moved from day to day as the declination of the sun changes; the disadvantage is that only one point of the image remains fixed, the remainder rotating around it, so that unlike the coelostat it cannot be used for photographing an extended region.

HELIOTHERAPY (*see* PUBLIC HEALTH; THERAPEUTICS). Heliotherapy, or treatment by sunlight, has been intermittently practised since the dawn of history, but its scientific use dates from the time of Finsen, who developed light treatment by employing artificial light, notably the carbon arc. It owes much to the work of Bernhard and Rollier, who commenced treatment with natural sunlight early in the present century. The latter has done much to popularize its use, especially in non-pulmonary tuberculosis.

Essential Conditions.—The most obvious benefits are seen in patients suitably exposed to solar rays. Certain essentials are necessary to obtain good results. The patient exposed to the sunlight should first be acclimatised; he must never be too hot nor too cold; in brilliant sunshine his head should be protected, and if there is much glare his eyes should be shielded by dark goggles. Exposure should be gradual: first the feet are sunned for short periods daily, the length of exposure and the area exposed being increased slowly, so that at the end of a fortnight exposure of the whole body may be generally tolerated with safety. Periods of exposure are gradually lengthened, until eventually the patients are often able to tolerate and benefit by exposure of the nude skin for from three to four hours daily.

There are great variations in the optimum exposure of different individuals. Generally speaking, brunettes tolerate exposure better than blondes; individuals who freckle but whose skins do not brown must be exposed with great caution, while albinos can barely tolerate exposure at all. On the normal skin an erythema develops within six hours of exposure; care should be taken not to exceed this erythema, and blistering is to be avoided. Gradually the skin becomes bronzed, and as this bronzing deepens so may exposure be prolonged, the pigment protecting the patient from the harmful effects of the actinic rays.

Insolation necessarily involves exposure of the body to the cold air, and the latter has been shown to increase the metabolic activity of the subject treated. The rays of greatest therapeutic value are the ultra-violet or actinic rays, the light waves of shortest wave-length in the solar spectrum. These are most intense at the seaside or on the mountains. Excess of heat rays is to be avoided, and insolation for its therapeutic value is thus better carried out in temperate than in tropic regions. Properly timed exposure on the individual responding to treatment is associated with a tonic and exhilarating effect; exposure unduly prolonged results in fatigue and exhaustion.

Effects of Insolation.—While properly applied insolation exercises a tonic effect on the body, it is equally stimulating to the mind. The exposed subject is more cheerful and exhilarated, mental responses are brisker and mental activities more pronounced. On the body the effect of insolation may be described as local or direct and remote or indirect. Light exercises a beneficial effect on superficial lesions by reason of the direct bactericidal action of the actinic rays, assisted by the favourable inflammatory response which carefully timed exposure elicits.

The remote beneficial effects are more marked but less easy to explain. Eidenow has shown that the haemobactericidal power is often raised after an erythema dose. This enhanced power of the blood to destroy pathogenic organisms is obtainable equally when a portion or the whole of the skin is exposed, and, if increased haemobactericidal power is alone sought, fractional exposures of different portions of the skin at consecutive sessions is the method of treatment of choice. Sonne has demonstrated that the visible rays of the solar spectrum have great penetrative power, pass through the skin, and are absorbed in the subjacent blood, their physical being transformed into thermal energy. He has suggested that this local heating effect is of value in destroying deleterious circulating toxins. Investigations have shown that the calcium, phosphorus and iron content of the blood may be raised by insolation.

Sunlight treatment has its greatest therapeutic value in increasing and maintaining bodily tone and energy, in the treatment of the various manifestations of surgical tuberculosis, in the treatment of rickets and the relief of nervous asthma. It is of proved value in certain affections of the skin, notably psoriasis. It is of great assistance in a variety of conditions, accelerating and consolidating the cure, particularly in convalescence from debilitating diseases such as infectious fevers. Its stimulating effect is seen in increasing fecundity and in the treatment of certain defects of the endocrine glands. The range of its usefulness is being rapidly extended, in the main, as an aid to cure rather than as a specific treatment.

See A. Rollier and others, *Heliotherapy* (1923). (H. J. G.)



FLOWERING BRANCH OF HELIOTROPE (HELIOTROPIUM SUAVEOLENS), A SPECIES FOUND CHIEFLY IN RUSSIA AND EASTERN EUROPE

HELIOTROPE or TURNSOLE, *Heliotropium*, *i.e.*, a plant which follows the sun with its flowers or leaves, a genus of usually more or less hairy herbs or undershrubs of the family Boraginaceae, having alternate, rarely almost opposite leaves; small white, lilac or blue flowers, in terminal or lateral one-sided simple or once or twice forked spikes, with a calyx of five deeply divided segments, a salver-shaped, 5-lobed corolla, and entire 4-celled ovary; fruit 2- to 4-sulcate or lobed, at length separable into four 1-seeded nutlets

or into two hard 2-celled carpels. The genus contains 220 species indigenous in the temperate and warmer parts of both hemispheres. A few species are natives of Europe, as *H. europaeum*, which is also a naturalized species in the southern parts of North America.

The common heliotrope of hothouses, *H. peruvianum*, popularly known as "cherry-pie," is on account of the delicious odour of its flowers a great favourite with florists. It was introduced into Europe by the younger Jussieu, who sent seed of it from Peru to the royal garden at Paris. About the year 1757 it was grown in England by Philip Miller from seed obtained from St. Germains. *H. corymbosum* (also a native of Peru), which was grown in Hammersmith nurseries as early as 1812, has larger but less fragrant flowers than *H. peruvianum*. The species commonly grown in Russian gardens is *H. suaveolens*, which has white, highly fragrant flowers. What, from the perfume of its flowers, is sometimes called winter heliotrope, is the fragrant butterbur, or sweet-scented coltsfoot, *Petasites fragrans*, a perennial plant of the family Compositae.

In Mineralogy.—Heliotrope is the mineral commonly called "bloodstone" (*q.v.*), and sometimes termed girasol—a name applied also to fire-opal. The name, like those of many ancient names of minerals, seems to have had a fanciful origin According to Pliny the stone was so called because when thrown into the water it turned the sun's light falling upon it into a reflection like that of blood.

HELIOZOA. Single-celled animals, mostly spherical in form, distinguished by numerous, somewhat stiff, protoplasmic processes (*axopodia*), which serve as organs of locomotion, and also are of use in the taking-in of food. *See* PROTOZOA.

HELIUM is a colourless, odourless gas of a family of elements, which on account of their extreme chemical inertness are termed the "inert" or "noble" gases. It is the lightest gas known except hydrogen. It was discovered in the sun (1868) many years before it was found on the earth. The spectroscope was used for the first time to examine the chromosphere round the sun during an eclipse, and it was observed that there was a brilliant yellow line, which the French astronomer J. Jannsen showed was not coincident with the already well-known D_1 and D_2 lines of sodium. J. N Lockyer and E Frankland shortly afterwards concluded that this yellow line (known as D_3) was due to an unknown element which they called helium (Greek, ἥλιος, sun), symbol He, atomic number 2, atomic weight 4 Terrestrial helium was discovered by Sir W. Ramsay during the year 1894 while engaged in experiments on the sources of argon. He found that the inert gas obtained in considerable volume by heating the mineral cleveite, and hitherto thought to be nitrogen, was only partially removed by sparking with oxygen in the presence of caustic soda The residual gas on spectroscopic examination showed a brilliant yellow line which W. Crookes definitely proved to be identical with the line observed by Jannsen. H. Kayser (1895), whose work was later confirmed by S. Friedländer, first discovered the presence of helium in the atmosphere by spectroscopic means. The actual separation of helium from the atmosphere was effected by W Ramsay and M. W. Travers, who obtained, by a method of fractional distillation, not only helium, but three new elements belonging to the same family of inert gases, namely neon, krypton and xenon. In the years that followed the discovery of helium, extensive work was carried out on its occurrences, properties and physical constants. W. Ramsay (1903) demonstrated that helium was a product of the radioactive disintegration of radium. This experiment stands out as being the first example of a transmutation of elements. The history of the production of helium on a commercial scale began when a German Zeppelin which had been pierced by incendiary bullets did not take fire (1914). Sir R. Threlfall suggested to the British Admiralty that the Germans had possibly discovered a new source of helium and had utilized this non-inflammable gas for filling the Zeppelin. The various possible sources of helium in the British empire were then reviewed. The natural gas supplies of Canada appeared to be the only source likely to yield helium in sufficient quantity for war purposes. A survey of the gas fields was instituted by J. C. McLennan of Toronto, and experimental plants for the extraction of helium were set up at Hamilton in Ontario and Calgary in Alberta (1918). At the conclusion of the work (1920), about 60,000cu.ft. of helium of 60 to 90% purity had been extracted. The work of H. P. Cady and D. F. Macfarlane (1907) on the helium-bearing gases of Kansas had already shown that the United States were in possession of supplies of helium which might be developed on a commercial scale, but nothing further was done until America entered the war (1917). Operations were then prosecuted with such vigour that at the time of the Armistice 147,000cu.ft. of helium of 93% purity were on the dock ready for despatch to Europe for aeronautical purposes. A large scale plant was built at Fort Worth (1925), capable of turning out 1,000,000cu.ft. per month, and this gas was proved by the aeronautical experts to be most eminently suitable for the filling of airships and balloons, provided it could be obtained in sufficient quantities at a reasonable price.

Occurrence.—Helium occurs, not only in the atmosphere of the sun, but also in certain of the fixed stars and many nebulae. It is a constituent of the earth's atmosphere and is found in most of the older rocks and minerals, in gases evolved from mineral springs, in natural gas, and in sea and river water in minute quantities It has also been detected in certain fumarole and volcanic gases. W. Ramsay, using Dewar's method, estimated the amount in the atmosphere as one part in 250,000 by volume. W. Watson, later, by analysis of the gas separated from air by G Claude's method, gave the value as one part in 185,000, which is probably a more exact figure. J. H. Jeans, on theoretical grounds, calculates, that at considerable altitudes, the proportion of helium in the atmosphere is materially increased, and that at a height of 500m the atmosphere is made up of helium and hydrogen. J. Stoney states that a planet of the earth's dimensions cannot permanently retain the helium in its atmosphere and that the helium together with the hydrogen is continually lost into space. The minerals which contain helium are widely distributed throughout the earth's crust, but with few exceptions it is only in those containing the radioactive elements, thorium and uranium, that it is found in measurable quantity. The most important helium minerals are cleveite, monazite, fergusonite, bröggerite, samarskite, thorianite and euxenite. Helium is found in the gases evolved from mineral springs The French springs which have been systematically examined by C. Moureu and A. Lepape evolve considerable amounts of helium. The Mazières spring gives a gas containing 6% of helium, whilst that at Santenay gives over 9%. This spring alone is calculated to give more than 600cu ft. of helium per year. The only mineral spring in England containing helium is the one at Bath, estimated by R. T. Elworthy (1918) to contain 0·21%. The natural gases of America are now recognized as the chief source of helium, as already mentioned. R. D. Moore estimates that more than 1,000,000cu ft. of helium run to waste in natural gas every 24 hours. The gas fields of Ontario and Alberta contain 0·33 to 0·34% helium, but the total Canadian supply is small compared with that of the United States

Isolation and Purification.—Helium may be prepared from any of the sources mentioned above. The preparation from the minerals is effected by heating them either alone or with sulphuric acid. Thorianite, which consists mainly of thorium oxide, is one of the most convenient minerals for the preparation of helium, since 1 gram yields as much as 9·5c.c. of the gas. Monazite, which is largely used in the incandescent mantle industry, contains less helium than thorianite but is more abundant. One gram of the mineral yields 1c.c. of helium. The monazite is heated with strong sulphuric acid, and the evolution of gas is complete within two hours. The gas, so obtained, after washing with caustic soda solution, contains about 90% helium. The isolation of helium from natural gas is most easily effected on a small scale by Dewar's method. The gases are passed over charcoal, cooled to the temperature of liquid air, and under these conditions only the helium escapes absorption. All gases, other than neon and hydrogen, may be completely separated from helium by Dewar's charcoal method. In order to separate neon from helium, the gas must be cooled to the temperature of liquid hydrogen, when the neon condenses. Hydrogen is usually removed by chemical means. Oxygen is

added, and the mixture is exploded by an electric spark, with the result that the hydrogen is converted into water. Alternatively, the gas is passed over copper oxide, when also conversion of the hydrogen to water takes place.

Properties.—Helium possesses several remarkable properties of special interest to the scientist. Its atom has a relatively simple structure, and it has been possible to draw many theoretical conclusions from its behaviour. The density (0·1368, air = 1) is less than that of any other known gas except hydrogen (0·0696). The molecular weight of helium calculated from its density is approximately 4. Helium is a monatomic gas. The calculated ratio of the two specific heats (those at constant pressure and at constant volume) of a monatomic gas is 1·667. W. Ramsay found the ratio for helium to be 1·652, and K. Scheel and W. Heuse found it to be 1·66 at 18° and 1·673 at 180°. Additional evidence that helium is monatomic is derived from a consideration of other physical properties, such as dielectric constant, thermal conductivity and Zeeman effect; also from its position in the periodic classification of the elements. The rate of diffusion of helium through a porous tube is less than the value calculated from Graham's law of diffusion of gases. F. G. Donnan has suggested that this is due to the rise in temperature which is known to occur on free expansion of the gas through a small orifice. The permeability of various fabrics to helium has been investigated on account of its use in airships and balloons. Rubbered fabrics are found to be only about 0·7 times as permeable to helium as to hydrogen. In the case of skin-lined fabrics, however, the ratio is nearly unity. Quartz glass is easily permeable to helium at red heat, and it has recently been discovered that it is also permeable at ordinary temperatures to helium at a pressure of 100 atm. Helium is less soluble in water than any other known gas: the solubility at 10° is a minimum, 0·0100. The coefficient of increase of pressure with rise of temperature at constant volume is perfectly normal. The value found by W. Ramsay for this coefficient between 0° and 100° is 0·0036616, and H. K. Onnes observed that this value is independent of the original pressure. The constancy of the pressure coefficient of helium has led to its application to thermometry where it is of especial value in the measurement of low temperatures. The thermal conductivity of helium has a comparatively high value, approaching that of hydrogen. The Shakespeare catharometer, whose operation depends on this physical property, has been applied to the analysis of helium produced on a commercial scale where nitrogen usually is the only impurity. The spectrum of helium was studied by C. Runge and F. Paschen, who found that it contained six series of lines which fall into two groups, each group consisting of a special series and two secondary series. The first group is a series of doublets of which the D_3 doublet is the principal. The second group is a single-line series, the most important of which is the green line 5015. The colour of the light emitted by a Plücker tube filled with helium under the influence of an electric discharge depends on the pressure of the gas: at 7–8mm. the colour of the glow is a brilliant yellow, since the D_3 (5876) line then reaches its maximum intensity. If the pressure is gradually reduced the intensity of the green line (5015·6) increases, till at 1 to 2mm. the tube emits a brilliant green light. The presence of impurities in helium causes a marked change in the appearance of the spectrum and may completely mask the helium lines; this masking effect is considerably reduced at low pressures. Helium was liquefied by H. K. Onnes (1908) who used a specially constructed liquefier of the Hampson type. It was necessary to pre-cool the helium to a temperature of −258° C with liquid hydrogen boiling under reduced pressure, since at ordinary temperatures heating is produced by the expansion of helium through a nozzle. Onnes obtained 60c.c. of liquid from 300 litres of gas, and determined its physical constants. It is a colourless mobile liquid boiling at 4·25° A. The critical temperature is 5·25° A., the critical pressure 2·26 atm., and the critical density 0·066. Liquid helium has proved an invaluable agent for the attainment of extreme cold. By its evaporation under reduced pressure it is possible to reach a temperature slightly lower than 0·9° A. Helium was solidified by W. H. Keesom (1926). When a tube system containing liquid helium became blocked he assumed that the helium had solidified. The following solidification points were determined: 1·1° A., 2·6 atm.; 2·2° A., 50 atm.; 3·2° A., 86 atm.; 4·2° A., 150 atm. Helium, as is also common with the other rare gases, is characterized by its extreme chemical inactivity. All the attempts of W. Ramsay and J. N. Collie to make helium combine with a second element ended in failure. Helium was circulated over various elements and substances at a bright red heat, but in no case was there any evidence of a reaction. Berthelot (1895) subjected helium to the action of a silent electric discharge in the presence of benzene and mercury. A large proportion of the gas was absorbed and a resinous solid produced. A green glow was also seen which gave the spectrum of mercury. J. J. Manley (1926) obtained evidence of the formation of a gaseous mercury helide formed from helium and mercury under the influence of an electric glow discharge. Boomer subjected helium, in conjunction with mercury, iodine, sulphur and phosphorus, to electronic bombardment in the presence of a surface cooled with liquid air, and obtained evidence of the formation of compounds of helium with the elements mentioned.

Radioactivity.—Whenever helium occurs in nature it appears, with few exceptions, to be associated with the phenomenon of radioactivity, and it is generally believed that helium in nature has arisen from the various radioactive elements. The best known of these elements, radium, thorium and uranium, are characterized by the emission of radiations which can be detected by the electrical or photographic effects produced by them. These radiations have been divided into three classes, namely, alpha-, beta-, and gamma-rays (briefly, α-, β-, and γ-). E. Rutherford (1907) was the first to suggest that the α-rays consisted of a stream of helium atoms carrying two unit positive charges. W. Ramsay and F. Soddy demonstrated the truth of this theory by a spectroscopic study of the emanation from a solution of radium bromide. The emanation gradually developed a helium spectrum, as shown by the characteristic D_3 line. Later E. Rutherford and T. Roydes conclusively showed the identity of the α-particle with helium. The emanation from radium was stored in exceedingly thin-walled glass tubes surrounded by an outer exhausted jacket. The tubes were impervious to ordinary gaseous helium but allowed nearly all the α-particles to escape into the outer jacket. The gas which collected there was passed into a tiny spectrum tube and shown to be helium. The radioactive elements are distributed with great uniformity in the rocks which constitute the earth's surface. Though the amount in most rocks is small, the sum total is sufficient to account for the helium that exists in nature.

Commercial Production.—Helium is separated from natural gas on a commercial scale by liquefaction methods, similar to those employed in the separation of oxygen from the atmosphere. A typical analysis of natural gas from the Petrolia field in the United States is as follows: helium 0·93%; carbon dioxide 0·25%; oxygen 0·54%; methane 56·85%; ethane and heavier hydrocarbons 10·30%; nitrogen 31·13%. In the large-scale extraction plant at Fort Worth, carbon dioxide is removed from the gas by washing with lime water; the gas is then compressed and cooled, first by a carbon dioxide cycle in a fore-cooler, and next in heat interchangers, when it meets the cold gases returning from the still. The gas is then expanded through a nozzle, and enters the bottom of the still, partly as a liquid and partly as a gas. The still consists of three units, each of which has a rectifying column with a condenser at the top and a receiver at the bottom. The liquids which collect in the upper receivers are used to cool the condensers underneath. The top condenser is cooled by a nitrogen cycle. The heavier hydrocarbons condense in the lowest unit, while methane and most of the nitrogen are liquefied in the top unit. Helium mixed with a little nitrogen, escapes from the top of the still and is passed to storage. The cold gases, obtained by the evaporation of the liquefied hydrocarbons and nitrogen, pass out through the heat interchangers. The natural gas thus stripped of its helium is returned to gas mains for subsequent industrial or domestic use. The plant at Fort Worth consists of six complete units each designed to handle approximately 44,000cu.ft. of natural gas per hour, and extracts on the average 60% of the helium of the gas.

Helium up to 95% purity may be obtained by this process, at a cost of about $24 per 1,000cu.ft. The patents for this process are owned by the Linde Air Products Co., which also designed and still operates the plant for the United States Government.

Technical Applications.—Various tests made in the United States have shown that helium is the ideal gas for filling airships and balloons, and its use has necessitated new methods in the operation of airships. The German practice has been to waste large amounts by valving, so that as much gas as 20 times the volume of the airship was used each year. In order to prevent wastage of helium by valving, the loss in weight due to consumption of fuel has been compensated by condensation of water from the exhaust gases of the engines. Also, when possible, the airship is driven down by means of her motors instead of by valving. Helium which has become too impure for flying purposes, through diffusion of air into the gas bag, is repurified either by cooling the compressed gas with liquid air, or by Dewar's charcoal method. Owing to the low solubility of helium in the fluids of the body, experiments have been made on the use of helium–oxygen mixtures in deep diving (*q.v.*) and caisson operations, as it is evident that the use of such mixtures in place of air will allow divers to work at greater depths or for longer periods. Many other technical applications of helium have been suggested, but the relatively small amount available for industrial use and the restriction on its export from the United States have hindered developments.

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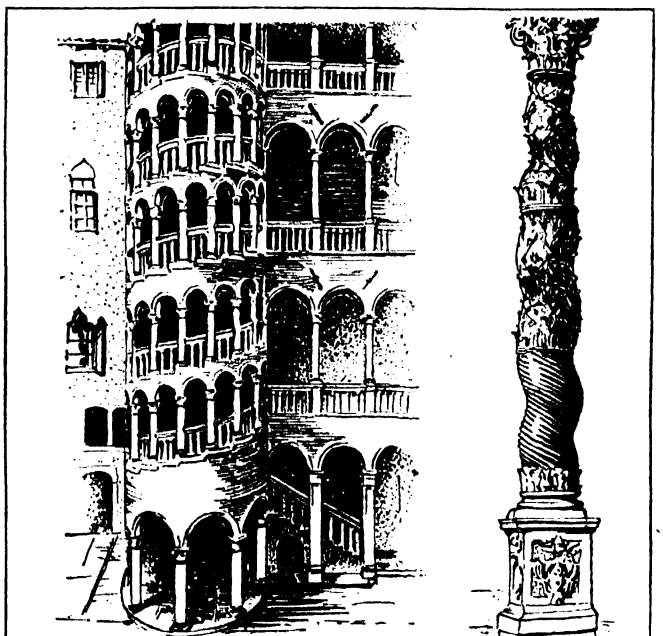
HELIX, a line which rises as it twists, such as the line of a screw thread. In architecture, the term helix is sometimes given to the spirally twisted stalks or volutes under the corners of the



LEFT, MINELLI COURT, VENICE, SHOWING HELIX FORM IN THE SPIRAL STAIRWAY; RIGHT, HELIX FORM OF A COLUMN, ST. PETERS, ROME

abacus of the Corinthian capital (*see* Order). The helix form is also found most commonly in architecture in those curving stairways which are popularly known as spiral.

HELL, used in English both of the place of departed spirits and of the place of torment of the wicked after death (O. Eng. *hel*, a Teutonic word from a root meaning "to cover"). In the O.T. it translates the Hebrew *Sheol*, in the N.T. the Greek ᾅδης, Hades, and γέεννα, Hebrew *Gehenna* (*see* Eschatology).

HELLANICUS of Lesbos, Greek logographer, flourished during the latter half of the 5th century B.C. According to Suidas, he lived for some time at the court of one of the kings of Macedon, and died at Perperene, a town on the gulf of Adramyttium opposite Lesbos. Some thirty works are attributed to him—chronological, historical and episodical. Mention may be made of: *The Priestesses of Hera at Argos*, a chronological compilation; the *Karneonikai*, a list of the victors in the Carnean games (the chief Spartan musical festival), including notices of literary events; *Phoronis*, chiefly genealogical, dealing with the period up till the return of the Heracleidae; *Deukalioneia;* his local histories include an *Atthis*, giving the history of Attica from 683 to the end of the Peloponnesian War (404), in which Thucydides (i.97), says the events of the years 480–431 were treated briefly and superficially, and with little regard to chronology; *Troika, Persika, Lesbiaka*, and others.

Hellanicus marks a real step in the development of historiography. He was not content to repeat the traditions that had gained general acceptation through the poets, but tried to give them as they were locally current, and by using the few national or priestly registers that presented something like contemporary registration, to lay the foundations of a scientific chronology, based primarily on the list of the Argive priestesses of Hera, and secondarily on genealogies, lists of magistrates (*e.g.* the archons at Athens), and Oriental dates, in place of the old reckoning by generations. But his materials were insufficient and he often had recourse to the older methods. On account of his deviations from common tradition, Hellanicus is called an untrustworthy writer by the ancients themselves. He appears to have made no systematic use of inscriptions, and he never, like his contemporary Herodotus, rose to the conception of a single current of events wider than the local distinction of race. His style, so far as it can be judged from the fragments, was bald.

Fragments in Müller, *Fragmenta historicorum Graecorum*, i. and iv.; and in F. Jacoby, *Fragmenta der Griechischen Historiker* (1923), where references in ancient authors are also quoted. *See* among older works L. Preller, *De Hellanico Lesbio historico* (1840); Mure, *History of Greek Literature*, iv.; late criticism in H. Kullmer, "Hellanikos" in *Jahrbücher für klass. Philologie* (Supplementband, xxvii. 455 sqq.) (1902) which contains new edition and arrangements of fragments; C. F. Lehmann-Haupt, "Hellanikos, Herodot, Thukydides," in *Klio* vi. 127 sqq. (1906); J. B. Bury, *Ancient Greek Historians* (1909), pp. 27 sqq.; the exhaustive article by Gudeman in Pauly-Wissowa viii. I.

HELL-BENDER, the American vernacular name for an aquatic salamander, *Cryptobranchus* (*q.v.*) *alleghaniensis*.

HELLEBORE, a genus (*Helleborus*) of plants of the family Ranunculaceae, natives of Europe and western Asia. They are coarse perennial herbs with palmately or pedately lobed leaves. The flowers have five persistent petaloid sepals, within the circle of which are placed the minute honey-containing tubular petals of the form of a horn with an irregular opening. The stamens are very numerous, and are spirally arranged; and the carpels are variable in number, sessile or stipitate and slightly united at the base and dehisce by ventral suture.

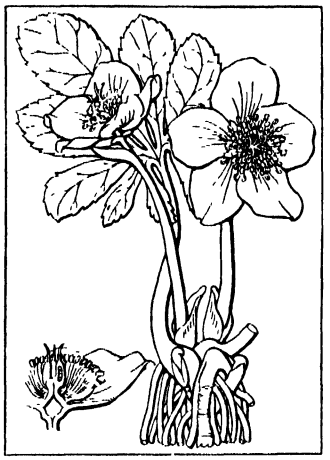
Helleborus niger, black hellebore, or, as from blooming in mid-winter it is termed the Christmas rose, is found in southern and central Europe, and with other species was cultivated in the time of Gerard (see *Herball*, p. 977, ed. Johnson, 1633), in English gardens. Its knotty root-stock is blackish-brown externally, and, as with other species, gives origin to numerous straight roots. The leaves spring from the top of the root-stock, and are smooth, distinctly pedate, dark-green above, and lighter below, with 7 to 9 segments and long petioles. The scapes, which end the branches of the rhizome, have a loose entire bract at the base, and terminate in a single flower, with two bracts, from the axis of one of which a second flower may be developed. The flowers have 5 white or pale-rose, eventually greenish sepals, 15 to 18 lines in breadth; 8 to 13 tubular green petals containing honey; and 5 to 10 free carpels. There are several forms, the best being *maximus*. The Christmas rose is extensively grown in many market gardens to provide white flowers about Christmas time for decorations.

H. orientalis, the Lenten rose, has given rise to several fine hybrids with *H. niger*, some of the best forms being clear in colour and distinctly spotted. *H. foetidus*, stinking hellebore, is a native of England, where like *H. viridis*, it is confined chiefly

to limestone districts; it is common in France and the south of Europe. Its leaves have 7- to 11-toothed divisions, and the flowers are in panicles, numerous, cup-shaped and drooping, with many bracts, and green sepals tinged with purple, alternating with the five petals.

H. viridis, or green hellebore proper, is probably indigenous in some of the southern and eastern counties of England, and occurs also in central and southern Europe. It has bright yellowish-green flowers, 2 to 4 on a stem, with large leaf-like bracts. O. Brunfels and H. Bock (16th century) regarded the plant as the black hellebore of the Greeks.

H. lividus, holly-leaved hellebore, found in the Balearic Islands, and in Corsica and Sardinia, is remarkable for the handsomeness of its foliage White hellebore is *Veratrum album* (*see* VERATRUM), a liliaceous plant.



BLACK HELLEBORE (HELLEBORUS NIGER), SHOWING GENERAL HABIT OF GROWTH. AT LEFT IS VERTICAL SECTION THROUGH THE FLOWER

The rhizome of *H. niger* occurs in commerce in irregular and nodular pieces, from about 1 to 3 in. in length, white and of a horny texture within Cut transversely it presents internally a circle of 8 to 12 cuneiform ligneous bundles, surrounded by a thick bark. It emits a faint odour when cut or broken, and has a bitter and slightly acrid taste. The drug is sometimes adulterated with the rhizome of baneberry, *Actaea spicata*, which, however, may be recognized by the distinctly cruciate appearance of the central portion of the attached roots when cut across, and by its decoction giving the chemical reactions for tannin. The rhizome is darker in colour in proportion to its degree of dryness, age and richness in oil.

H. niger, orientalis, viridis, foetidus, and several other species of hellebore contain the glucosides *helleborin*, $C_{36}H_{12}O_6$, and *helleborein*, $C_{26}H_{44}O_{15}$, the former yielding glucose and *helleboresin*, $C_{30}H_{38}O_4$, and the latter glucose and a violet-coloured substance *helleboretin*, $C_{14}H_{20}O_3$. Helleborin is most abundant in *H. viridis*. A third and volatile principle is probably present in *H. foetidus*. Both helleborin and helleborein act poisonously on animals.

HELLENISM. The term "Hellenism" is ambiguous It is derived from Gr. ἑλληνίζειν, to speak the language of the Greeks, who called themselves Ἕλληνες, after Hellēn, the son of Deucalion. In late Greek Ἑλληνισμός means imitation of the Greeks (Septuagint, 2 Macc. iv. 13) It may be used to denote ancient Greek culture in all its phases. The German historian J. G. Droysen introduced the fashion of using it to describe particularly the latter phases of Greek culture from the conquests of Alexander to the end of the ancient world, when those over whom this culture extended were largely not Greek in blood; *i.e.*, *Hellenes*, but peoples who had adopted the Greek speech and way of life, *Hellenistai*. While using the term in the larger sense, this article will devote its principal attention to Hellenism as it appeared in the world after spread of Greek culture which followed the Macedonian conquests.

I. THE EXPANSION OF HELLENISM BEFORE ALEXANDER

In the 5th century B.C. Greek cities dotted the coasts of the Mediterranean and the Black sea from Spain to Egypt and the Caucasus, and already Greek culture was beginning to pass beyond the limits of the Greek race. As early as the 7th century B.C., when Hellenism was still in a rudimentary stage, Greek mercenaries came to be in request throughout the Nearer East. But as Hellenism developed, its social and intellectual life began to exercise a power of attraction. The proud old civilizations of the Euphrates and the Nile might ignore it, but the ruder barbarian peoples came in various degrees under its spell. In some cases an outlying colony would coalesce with a native population, and a fusion of Hellenism with barbarian customs take place.

The great developments of the century and a half before Alexander set the Greek people in a very different light before the world. In the sphere of material power the repulse of Xerxes greatly enhanced Greek military prestige. The kings of the East leant more than ever upon Greek mercenaries, whose superiority to barbarian levies was further brought home to them by the expedition of Cyrus. But the developments within the Hellenic sphere itself were also of great consequence for its expansion outwards. The political disunion of the Greeks was to some extent neutralized by the rise of Athens to a leading position in art, literature and philosophy, and by the fact that the Attic dialect attained a classical authority; if Hellenism was to be propagated in the world at large, it was obviously convenient that it should have some one definite form of speech to be its medium.

1. **The Persians.**—The ruling race of the East, the Persian, was but little open to the new culture. The military qualities of the Greeks were appreciated, and so, too, was Greek science, where it touched the immediately useful; a Greek architect bridged the Bosporus for King Darius; Greek physicians were retained at the Persian court. Exactly how far Greek influence can be traced in the remains of Persian art, such as the palaces of Persepolis and Susa may be doubtful, but it is certain that the engraved gems for which there was a demand in the Persian empire were largely the work of Greek artists

2 **The Phoenicians.**—As early as the first half of the 4th century we find communities of Phoenician traders established in the Peiraeeus. In Cyprus, on the frontier between the Greek and Semitic worlds, a struggle for ascendancy went on. The Phoenician element seems to have been dominant in the island, when Evagoras made himself king of Salamis in 412, and restored Hellenism with a strong hand Even into the original seats of the Phoenicians Hellenism began to intrude. Abdashtart, king of Sidon (374–302 B.C.), called Straton by the Greeks, entered into close relations with the Greek states, and imitated the Hellenic princes of Cyprus.

3. **The Carians and Lycians.**—The seats of the Greeks in the East touched peoples more or less nearly related to the Hellenic stock, with native traditions not so far remote from those of the Greeks in a more primitive age, the Carians and the Lycians. The Carian princes of the 4th century B.C., Hecatomnus and especially Mausolus, modelled themselves upon the pattern of the Greek tyrant The capital of Mausolus was a Greek city, Halicarnassus, and all that we can still trace of his great works of construction shows conformity to the pure Hellenic type His famous sepulchre, the Mausoleum (the remains of it are now in the British Museum), was a monument upon which eminent Greek sculptors worked in rivalry. In Lycia Greek influence is more limited Here the native language maintains itself against Greek. The proper names are (if not native) mainly Persian But the Greek language makes an occasional appearance; the coins are Greek in type; above all, the monumental remains of Lycia show strong Greek influence, especially the well-known "Nereid Monument" in the British Museum, whose date is held to go back to the 5th century.

4. **South Russia and the Danube Lands.**—A brisk trade, which reached its highest point of development in the 4th century B.C., sprang up between the Scythian chieftains and the Greek colonists. The finds of Greek pottery, and still more of gold and silver ware, in the tombs of southern Russia, have been very considerable. But in Scythia Greek influence appears to have been limited to the material sphere (*see* SCYTHIA) A similar trade connection, which also flourished most in the 4th century, sprang up between Greek merchants from the Black sea or the Adriatic and the inhabitants of the Danube lands. But in these regions the Greeks did less than the Celts and the Italians to introduce a higher civilization.

5. **Egypt.**—From the time of Psammetichus (d. 610 B.C.) Greek mercenaries had been used to prop Pharaoh's throne, and Greek merchants had begun to find their way up the Nile and even to the oases. A Greek city, Naucratis (*q.v.*), was allowed

to arise at the Bolbitinic mouth of the Nile. But the racial repugnance to the Greek probably kept the soul of the people more shut against Hellenic influences than was that of the other orientals.

6. **Macedonia.**—In Macedonia the native chiefs had been attracted by Hellenic life, at any rate from the beginning of the 5th century, when Alexander I. persuaded the judges at Olympia that his house was of good Argive descent (Herodotus, v. 22). It was probably not until the reorganization of the kingdom by Archelaus (413–399) that Greek culture found any abundant entrance into Macedonia Archelaus' palace was decorated by Zeuxis; Euripides spent there the end of his days. From that time a certain degree of literary culture was general among the Macedonian nobility; their names in the days of Philip are largely Greek; the Macedonian service was full of men from the Greek cities within Philip's dominions, and Philip chose Aristotle to be the educator of his son. How far the country generally might be regarded as Hellenized is a problem which involves the vexed question whether Macedonian is to be considered a dialect of Greek.

7. **The West.**—The process of Hellenization was carried out most completely in Sicily, where the distinction between native Sicels and Greek settlers faded out in the 4th century B C.

In Italy the peoples of the south, who came into direct contact with the Greek colonists, showed some proficiency in their imitations of Greek ceramic art and coinage, and they derived their alphabets, directly or indirectly, from Greek script. In Central Italy the Romans at first remained comparatively impervious to Greek influence, but the Etruscans in the 6th and 5th centuries became partially Hellenized. It is a moot point how far their alphabet was copied from Greek models, but the dependence of their art (architecture, sculpture, pottery, coins) is unmistakable.

In Gaul the native culture was little affected by Greek civilization until the end of the 4th century B C. But by 300 B.C. the Greek colony of Massilia had become an important focus of Hellenism. The Druids of Gaul adopted the Greek alphabet and scraps of Greek philosophic lore Imitations of Greek coins (especially the pieces of Philip II. of Macedon) were struck even in the remote parts of the country, and rude copies of the Gallic pieces were in turn produced in Southern Britain

In Spain the native art of the eastern districts came under Greek influence in the 5th and 4th centuries B C., but the growing political ascendancy of Carthage in the peninsula proved unfavourable to the spread of this influence

In North Africa the Carthaginians, albeit political enemies of the Greeks, did not remain untouched by Greek culture. By the 4th century they had begun to copy Greek architecture, sculpture and coinage, and to use Greek as a subsidiary tongue.

II. AFTER ALEXANDER THE GREAT

By 350 B C. Hellenism had not seriously affected any but the more primitive races which dwelt upon the borders of the Hellenic lands, and here, with the doubtful exception of the Macedonians, was rather for the courts than for the people. Everything was changed when by the conquests of Alexander (334–323) Hellenism rose to material supremacy in all the East as far as India, and when cities of Greek speech and constitution were planted at the cardinal points of intercourse within those lands. The Macedonian chiefs found their pride in being champions of Hellenism. Their courts were Greek in language and atmosphere. All kings liked to win the good word of the Greeks. All of them in some degree patronized Greek art and letters, and some sought fame for themselves as authors. Even the barbarian courts, their neighbours or vassals, were swayed by the dominant fashion. But by the courts alone Hellenism could never have been propagated far. Greek culture had been the product of the city-state, and Hellenism could not be dissevered from the city. It was upon the system of Greek and Macedonian cities, planted by Alexander and his successors, that their work rested. Rome, when it stepped into their place, safeguarded its continuance, and acted as a Hellenistic power.

The Character of the New Greek Cities.—The citizen bodies at the outset were really of Greek or Macedonian blood—soldiers who had served in the royal armies, or men attracted from the older Greek cities to the new lands thrown open to commerce. The cities, of course, drew in numbers beside of the people of the land. The cities were Hellenic in their political organs and functions, with *boulē* and *demos* and popularly elected magistrates. Life was filled with the universal Hellenic interests, which centred in the gymnasium and the religious festivals, these last including, of course, not only athletic contests but performances of the classical dramas or later imitations of them. The wandering sophist and rhetorician would find a hearing no less than the musical artist. The language of the upper classes was Greek; and the material background of building and decoration, of dress and furniture, was of Greek design. A greater regularity in the street-plans distinguished the new cities from the older, slowly grown cities of the Greek lands.

Sometimes the Greek city was not an absolutely new foundation, but an old oriental city re-colonized and transformed. And in such cases the old name was often replaced by a Greek one. Even where there was no new foundation the older cities of Phoenicia and Syria became transformed from the overwhelming prestige of Hellenic culture. In Tyre and Sidon, no less than in Antioch or Alexandria, Greek literature and philosophy were seriously cultivated, as we may see by the great names which they contributed.

A. CHARACTERISTICS OF HELLENISM AFTER ALEXANDER

Hellenism had been the product of the free life of the Greek city-state, and after the Macedonian conquest the great days of the city-state were past. Not that all liberty was everywhere extinguished. In the history of the next two or three centuries the cities are by no means ciphers. Rhodes takes a great part in *Weltpolitik*, as a sovereign ally of one or other of the royal courts. In Greece itself the overlordship to which the Macedonian king aspires is imperfect in extent and only maintained by continual wars. The Greek States on their side show that they are capable even of progressive political development, the needs of the time being met by the federal system. The Achaean and Aetolian leagues are independent powers, which keep a field clear for Hellenic freedom within their borders. As to the cities outside Greece, within or around the royal realms, Seleucid, Ptolemaic or Attalid, their degree of freedom probably differed widely according to circumstances. At one end of the scale, cities of old renown could still make good their independence. At the other end of the scale the cities which were royal capitals, *e.g.*, Alexandria, Antioch and Pergamum, were normally controlled altogether by royal nominees. Between the two extremes there was variation not only between city and city, but, no doubt, in one and the same city at different times. With the extension of the single strong rule of Rome over this Hellenistic world, the conditions were changed. Just as the Macedonian conquest, whilst increasing the domain of Greek culture, had straitened Greek liberty, so Rome, whilst bringing Hellenism finally into secure possession of the nearer East, extinguished Greek freedom altogether. Even now the old forms were long religiously respected. Formally, the most illustrious Greek states, Athens, for instance, or Marseilles, or Rhodes, were not subjects of Rome, but free allies. Even in the case of tribute-paying states, municipal autonomy, subject indeed to interference on the part of the Roman governor, was allowed to go on. But during the first centuries of the Christian era, this municipal autonomy decayed. The *demos* first sank into political annihilation and the council, no longer popularly elected but an aristocratic order, concentrated the whole administration in its hands. After Diocletian and under the Eastern empire the Greek world was organized on the principles of a vast bureaucracy.

Social Changes.—With this long process of political decline correspond the inner changes in the temper of the Hellenistic peoples. When the vast field of the East was opened to Hellenic enterprise and the bullion of its treasuries flung abroad, fortunes were made on a scale before unparalleled. A new standard of sumptuousness and splendour was set up in the richest stratum of

society. This material elaboration of life was furthered by the existence of Hellenistic courts, where the great ministers amassed fabulous riches, and of huge cities like Alexandria, Antioch and the enlarged Ephesus. With the mingling of Greeks of all sorts in the newly-conquered lands, a generalized Greek culture, in which the old local characteristics were merged, overspread the world. The gradual supersession of the old dialects by the *koinē* the common speech of the Greeks, was one obvious sign of the new order of things. (*See* GREEK LANGUAGE.)

Art and Literature.—In its artistic, its literary, its spiritual products the age after Alexander gave evidence of change. In no department did activity immediately stop; but the old freshness and creative exuberance was gone. Artistic pleasure, grown less delicate, required the stimulus of a more sensational effect or a more striking realism. Artists and men of letters were now addressing themselves not to their fellow-citizens in a free city, but to kings and courtiers, or the educated class generally of the Greek world. In the study of the world of fact, the centuries immediately following Alexander witnessed notable advance. Scientific research might prosper under the patronage of kings, and such research had now a vast amount of new material at its disposal and could profit by the old Babylonian and Egyptian traditions. The medical schools, especially that of Alexandria, really enlarged knowledge of the animal frame. Knowledge of the earth gained immensely by the Macedonian conquests. The literary schools of Alexandria and Pergamum built up grammatical science, and brought literary and artistic criticism to a fine point. The classical products were registered, studied and commented upon. Libraries became a feature of the age; the one attached to the Museum at Alexandria is said to have contained 700,000 rolls.

With the general decay of ancient civilization under the Roman empire, even scientific research ceased, and though there were literary revivals, like that connected with the new Atticism under the Antonine emperors, these were mainly imitative and artificial, and learning became under the Byzantine emperors a formal tradition. (*See* GREEK LITERATURE.)

Religion and Philosophy.—The mingling of citizens of many cities and the close contact between Greek and barbarian in the conquered lands had made the old sanctions of civic religion and morality of less account. New guides of life were needed. The Stoic philosophy, with its cosmopolitan note, its fixed dogmas and plain ethical precepts came into the world to meet the needs of the new age. Its ideas became popular among ordinary men as the older philosophies had never been.

Although the cults of the old Greek deities in the new cities might still hold the multitude with their splendid apparatus, men turned ever in large numbers to alien religions, and the various gods of Egypt and the East began to find larger entrance in the Greek world. Before the end of the 2nd century B.C. there were temples of Serapis in Athens, Rhodes, Delos and elsewhere. Under the Roman empire the cult of Isis became popular in the Hellenistic world. Other religions of oriental origin penetrated far, the worship of the Phrygian Great Mother (*see* GREAT MOTHER OF THE GODS), and in the 2nd century A.D. the religion of Mithras (*q.v.*). The Jews, too, by the time of Christ were discovering in many quarters an open door. Besides those who were ready to accept circumcision, numbers adopted particular Jewish practices, observing the Sabbath, for instance, or turned from polytheism to the doctrine of the One God. The synagogues in the Gentile cities had generally attached to them a multitude of those "who feared God" and frequented the services.

Christianity.—Among the religions which penetrated the Hellenistic world from an Eastern source, Christianity ultimately overpowered all the rest and made that world its own. The teaching of Christ Himself contained, as it is given to us, no Hellenic element; so far as He built with older material, that material was exclusively the sacred tradition of Israel. So soon, however, as the Gospel was carried in Greek to Greeks, Hellenic elements began to enter into it; in the writings of St. Paul the appeal to what "nature" teaches would be generally admitted to be a Greek mode of thought. There was, at the same time, in the early church a powerful current of feeling hostile to Greek culture. What the attitude of the New People should be to it, whether it was all bad, or whether there were good things in it which Christians should appropriate, was a vital question to them. The School of Alexandria represented by Clement and Origen effected a durable alliance between Greek education and Christian doctrine. In proportion as the Christian Church had to go deeper into metaphysics in the formulation of its beliefs, the Greek philosophical terminology, which was the only vehicle then available for precise thought, had to become more and more an essential part of Christianity. At the same time Christian ethics incorporated much of the current popular philosophy, especially Stoical elements. In this way the Church itself became a propagator of Hellenism.

B. EFFECT UPON NON-HELLENIC PEOPLES

1 **India.**—In India (including the valleys of the Kabul and its northern tributaries, then inhabited by an Indian, not as now, by an Iranian, population, Alexander planted a number of Greek towns. Soon after 321 B.C. Macedonian supremacy beyond the Indus collapsed before the advance of the native Maurya dynasty, and about 303 B.C. large districts west of the Indus were ceded by Seleucus. But the Maurya dynasty broke up about 180 B.C., and at the same time the Greek rulers of Bactria began to lead expeditions across the Hindu-Kush. Menander, in the middle of the 2nd century B.C., extended his rule to the Ganges. Then "Scythian" peoples from Central Asia gradually squeezed within ever-narrowing limits the Greek power in India. The last Greek prince, Hermaeus, seems to have succumbed about 30 B.C. Under the Roman empire, though Greek rule in India had disappeared, active commercial intercourse went on between India and the Hellenistic lands. How far, through these changes, did the Greek population settled by Alexander or his successors in India maintain their distinctive character? What influence did Hellenism, during the centuries in which it was in contact with India, exert upon the native mind? Only extremely qualified answers can be given to these questions. Capital data are possibly waiting under ground—the Kabul valley, for instance, is almost virgin soil for the archaeologist—and any conclusion we can arrive at is merely provisional. If certain statements of classical authors were true, Hellenism in India flourished exceedingly. But the phil-Hellenic Brahmins in Philostratus' life of Apollonius had no real existence, and the statement of Dio Chrysostom that the Indians were familiar with Homer in their own tongue is a traveller's tale. India has yielded no Greek inscription except on the coins of the Greek kings and their Scythian successors. If we argue by probability from what we know of the conditions, we have to consider that the Greek rule in India was all through fighting for existence, and can have had little time or energy left for such things as art, science and literature. Perhaps we should rather think of the Hellenic colonists as resembling the Greeks found to-day dispersed over the nearer East, with interests mainly commercial, easily assimilating themselves to their environment. As to what India derived from Greece there has been a good deal of erudite debate. That the Indian drama took its origin from the Greek is still maintained by some scholars, though hardly proved. There is no doubt that Indian astronomy shows marked Hellenic features, including actual Greek words borrowed. But by far the most signal borrowing is in the sphere of art. The stream of Buddhist art which went out eastwards across Asia had its rise in North-West India, and the remains of architecture and sculpture unearthed in this region enable us to trace its development back to pure Greek types. How far to the east the distinctive influence of Greece went is shown by the seal-impressions with Athena and Eros types, the stucco reliefs and antefixes, and the frescoes found by Sir Marc Aurel Stein in the buried cities of Khotan. These remains belong to the period of the early and middle Roman empire, and were probably the work of Hellenized orientals rather than of Greeks; but their Hellenic character is unmistakeable. According to Mr E. B. Havell, there exist "paintings treasured as the most precious relics and rarely shown to Europeans, which closely resemble the Graeco-Buddhist art of India" in some of the oldest temples of Japan (*Studio*, vol. xxvii., 1903, p. 26).

2. **Iran and Babylonia.**—The colonizing activity of Alexander and his successors found a large field in Iran. Cities arose in all its provinces. Media was defended by a chain of Greek cities from barbarian incursion. In Eastern Iran the cities which are its chief places to-day then bore Greek names, and looked upon Alexander or some other Hellenic prince as their founder. Khojend, Herat, Kandahar were Alexandrias, Merv was an Alexandria till it changed that name for Antioch. One document from Antioch in Persis (about 206 B.C.) shows us the normal organs of a Greek city in full working. It also throws a remarkable light upon the solidarity of the Hellenic dispersion. The citizen body had been increased some generations before by colonists from Magnesia-on-Meander, and in this decree Antioch determines to take part in the new festival being started in honour of Artemis at Magnesia.

Greek Kingdoms.—About 250 B.C. Bactria and Sogdiana broke away from the Seleucid empire; independent Greek kings reigned there till the country was conquered by nomads from Central Asia a century later. Alexander had settled large masses of Greeks in these regions. For estimating the amount and quality of Hellenism in Bactria during the 180 years or so of Macedonian and Greek rule, we are reduced to building hypotheses upon the scantiest data. Mr. W. W Tarn's careful survey leads to the conclusion that palpable evidences of an active Hellenism have not been found; he inclines to think that the Greek kingdoms mainly took on the native Iranian colour The coins, of course, are adduced on the other side, being not only Greek in type and legend, but (in many cases) of a peculiarly fine execution. (*See* BACTRIA and works there quoted.)

The west of Iran slipped from the Seleucids in the course of the 2nd century B.C., to be joined to the Parthian kingdom or fall under petty native dynasties. Soon after 130 B.C. Babylonia, too, was conquered by the Parthian, and Mesopotamia before 88. Then the reconquest of the nearer East by Oriental dynasties was checked by the advance of Rome. Asia Minor and Syria remained substantial parts of the Roman empire until the Mohammedan conquests of the 7th century A.D. began a new process of recoil on the part of the Hellenistic power. The greatest of all the Hellenic colonies stood here—almost on the site of Bagdad—Seleucia on the Tigris It superseded Babylon as the industrial focus of Babylonia and counted some 600,000 inhabitants. In Mesopotamia, Pliny especially notes how the character of the country was changed when the old village life was broken in upon by new centres of population in the cities of Macedonian foundation.

Hellenic Iranian Culture.—When the Parthians rent away provinces from the Seleucid empire, the Greek cities did not cease to exist by passing under barbarian rule. Gradually, no doubt, the Greek colonies were absorbed, but the process was a long one. Seleucia on the Tigris is spoken of by Tacitus as being, in A.D. 36, "proof against barbarian influences." How important an element the Greek population of their realm seemed to the Parthian kings we can see by the fact that they claimed to be themselves champions of Hellenism. From the reign of Artabanus I. (128/7–123 B.C.) they bear the epithet of "Phil-Hellen" as a regular part of their title upon the coins. That the Parthian court itself was to some extent Hellenized is shown by the story that a Greek company of actors was performing the *Bacchae* before the king when the head of Crassus was brought in. Artavasdes, king of Armenia (54?–34 B.C.) composed Greek tragedies and histories. The Parthian princes were in many cases the children of Greek mothers who had been taken into the royal harems. Many of the Parthian princes resided temporarily, as hostages or refugees, in the Roman empire; but the nation at large looked with anything but favour upon too liberal an introduction of foreign manners at the court.

Such slight notices in Western literature do not give us any penetrating view into the operation of Hellenism among the Iranians. As an expression of the Iranian mind we have the Avesta and the Pehlevi theological literature. Unfortunately, in a question of this kind the dating of our documents is the first matter of importance; and we can only assign dates to the different parts of the Avesta by processes of fine-drawn conjecture. And even if we could date the Avesta securely, we could only prove borrowing by more or less close coincidences of idea, a tempting but uncertain method of enquiry. It is enough here to observe that Iran and Babylonia do, as a matter of fact, continually yield the explorer objects of workmanship either Greek or influenced by Greek models, belonging to the age after Alexander, and that we may hence infer at any rate such an influence of Hellenism upon the tastes of the richer classes as would create a demand for these things.

Sassanian Empire.—If any vestige of Hellenism still survived under the Sassanian kings, our records do not show it. At the court a limited recognition might be given, as fashion veered, to the values prevalent in the Hellenistic world. Chosroes I. interested himself in Greek philosophy and received its professors from the West with open arms; according to one account, he had his palace at Ctesiphon built by Greeks. But the account of Chosroes' mode of action makes it plain that the Hellenism once planted in Iran had withered away; representatives of Greek learning and skill had all to be imported from across the frontier.

3. **Asia Minor.**—*Greek Cities of the Diadochi*.—Very different were the fortunes of Hellenism in those lands which became annexed to the Roman empire. In Asia Minor, we have seen how, even before Alexander, Hellenism had begun to affect the native races and Persian nobility. During Alexander's own reign, we cannot trace any progress in the Hellenization of the interior, nor can we prove here his activity as a builder of cities. But under the dynasties of his successors a great work of colonization went on as each rival dynasty of Greek or Macedonian kings endeavoured to secure its hold on the country by founding fresh Greek settlements. While new Greek cities were rising in the interior, the older Hellenism of the western coast grew in material splendour under the munificence of Hellenistic kings. Its centre of gravity to some extent shifted. Ephesus grew in greatness and wealth, and Smyrna rose again after an extinction of four centuries. The great importance of Rhodes belongs to the days after Alexander, when it received the riches of the East from the trade-routes which debouched into the Mediterranean at Alexandria and Antioch. In Aeolis the centre of gravity moved to the Attalid capital, Pergamum. But the irruption of the Celts, beginning in 278–277 B.C., checked the Hellenization of the interior. Not only did the Galatian tribes take large tracts of the plateau in possession, but they were an element of perpetual unrest, which hampered and distracted the Hellenistic monarchies.

Native Dynasties.—The minor dynasties of non-Greek origin, the native Bithynian and the two Persian dynasties in Pontus and Cappadocia, were Hellenized before the Romans drove the Seleucid out of the country. In Bithynia the upper classes seem to have followed the fashion of the court; the dynasty of Pontus was phil-Hellenic by ancestral tradition; the dynasty of Cappadocia dated its conversion to Hellenism from the 2nd century B.C.

Hellenism under Rome.—When Rome began to interfere in Asia Minor, its first action was to break the power of the Gauls (189 B.C.). In 133 Rome entered formally upon the heritage of the Attalid kingdom and became the dominant power in the Anatolian peninsula for 1,200 years. Under Rome the process of Hellenization, which the divisions and weakness of the Macedonian kingdoms had checked, went forward. The coast regions of the west and south the Romans found already Hellenized. In Lydia not a trace of the old language was left in Strabo's time; in Lycia, the old language became obsolete in the early days of Macedonian rule. But inland, in Phrygia, Hellenism had as yet made little headway outside the Greek cities. It was not until the reign of Hadrian that city life on the Phrygian plateau became rich and vigorous, with its material circumstances of temples, theatres and baths. The lower classes at Lystra in St. Paul's time spoke Lycaonian (Acts xiv. 11). In Galatia the larger towns seem to have become Hellenized by the time of the Christian era, whilst the Celtic speech maintained itself in the country villages until the 4th century A.D. Cappadocia at the beginning of the Christian era was still comparatively townless, a country

of large estates with a servile peasantry. Even in the 4th century its Hellenization was still far from complete; but Christianity had assimilated so much of the older Hellenic culture that the Church was now a main propagator of Hellenism in the backward regions. The native languages of Asia Minor all ultimately gave way to Greek. The effective Hellenization of Armenia did not take place until the 5th century.

4. **Syria.**—In Syria the work of planting cities was pursued effectively north of the Lebanon by the house of Seleucus, and, less energetically, south of the Lebanon by the house of Ptolemy.

Seleucid Empire.—The whole of Syria was brought under the Seleucid sceptre, together with Cilicia, by Antiochus III. (223–187 B.C.). Under his son, Antiochus IV. (175–164), a fresh impulse was given to Syrian Hellenism. In 1 Maccabees he is represented as writing an order to all his subjects to forsake the ways of their fathers and conform to a single prescribed pattern, and though in this form the account can hardly be exact, it does no doubt represent the spirit of his action. Many cities exchanged their existing name for that of Antioch. With the ever-growing weakness of the Seleucid dynasty, the independence and activity of the cities increased, although they were less protected against military adventures and barbarian chieftains.

Roman Period.—When Pompey annexed Syria in 64 B.C. as a Roman province, he found it a chaos of city-states and petty principalities. The Nabataeans and the Jews above all had encroached upon the Hellenistic domain; in the south the Jewish raids had spread desolation and left many cities practically in ruins. Under Roman protection Hellenism was secured from the barbarian peril, and Greek city life, with its political forms, its complement of festivities, amusements and intellectual exercise, went on more largely than before. The great majority of the Hellenistic remains in Syria belong to the Roman period. Such local dynasties as were suffered by the Romans to exist had, of course, a Hellenistic complexion. Especially was this the case with that of the Herods. Not only were such marks of Hellenism as a theatre introduced by Herod the Great (37–4 B.C.) at Jerusalem, but in the work of city-building this dynasty showed itself active. Sebaste (the old Samaria), Caesarea, Antipatris were built by Herod the Great, Tiberias by Herod Antipas (4 B.C.–A.D. 39). In Syria, too, Hellenism under the Romans advanced upon new ground. Palmyra, of which we hear nothing before Roman times, is a notable instance.

Greek Culture in Syria.—In Syria we do not find the same disappearance of native languages and racial characteristics as in Asia Minor. Still less was this the case in Mesopotamia. At Doura-Europus on the middle Euphrates recent excavations have presented the picture of a Seleucid foundation, built and decorated in good Greek style, but unable to resist Semitic encroachments. By A.D. 300 even the people of the wealthier classes usually bear Semitic names. The lower classes at Antioch and no doubt in the cities generally, were in speech Aramaic or bilingual. The villages, of course, spoke Aramaic. The richer natives, on the other hand would become Hellenized in language and manners, and the "Syrian Code" of civil laws shows how far the social structure was modified by the Hellenic tradition. Of the Syrians who made their mark in Greek literature, some were of native blood; *e.g.*, Lucian of Samosata, and several later poets and philosophers.

On the other hand there was a Syriac-speaking church as early as the 2nd century, and with the spread of Christianity Syriac asserted itself against Greek. The Syriac literature which we possess is all Christian. But where Greek gave place to Syriac, Hellenism was not thereby effaced. It was to some extent the passing over of the Hellenic tradition into a new medium. There was an extensive translation of Greek works into Syriac during the next centuries, handbooks of philosophy and science for the most part.

5. **Hellenism and the Jews.**—In the first century and a half of Macedonian rule the relation of the Jews to Hellenism is very obscure, since the statements made by later writers, like Josephus, as to the privileges conferred upon the Jews in the new Macedonian realms, are justly suspected of being fiction. It has been maintained that Greek influence is to be traced in parts of the Old Testament assigned to this period, as, for instance, the Book of Proverbs; but even in the case of Ecclesiastes, the canonical writing whose affinity with Greek thought is closest, the coincidence of idea need not necessarily prove a Greek source. The one solid fact in this connection is the translation of the Jewish Law into Greek in the 3rd century B.C., implying a Jewish Diaspora at Alexandria, so far Hellenized as to have forgotten the speech of Palestine. Early in the 2nd century B.C. the priestly aristocracy of Jerusalem had, like the well-to-do classes everywhere in Syria, been carried away by the Hellenistic current, its strength being evidenced no less by the intensity of the conservative opposition embodied in the party of the "Pious" (Assideans, *Hasidim*). Under Antiochus IV. (176–165) the Hellenistic aristocracy contrived to get Jerusalem converted into a Greek city; the gymnasium appeared, and Greek dress became fashionable with the young men. But when Antiochus, for political reasons, interfered violently at Jerusalem, the conservative opposition carried the nation with them. The revolt under the Hasmonaean family (Judas Maccabaeus and his brethren) followed, ending in 143–142 in the establishment of an independent Jewish state. But the Hasmonaean state was of the nature of a compromise. The Mosaic Law was respected, but Hellenism still found an entrance in various forms. The first Hasmonaean king, Aristobulus I. (104–103), was known to the Greeks as Phil-Hellen. He and all later kings of the dynasty bear Greek names as well as Hebrew ones, and after Iannaeus Alexander (103–76) the Greek legends are common on the coins beside the Hebrew. Herod, who supplanted the Hasmonaean dynasty (37–4 B.C.) made, outside Judaea, a display of phil-Hellenism, building new Greek cities and temples. His court, at the same time, welcomed Greek men of letters like Nicolaus of Damascus. Even in the neighbourhood of Jerusalem, he erected a theatre and an amphitheatre. Meanwhile a great part of the Jewish people was living dispersed among the cities of the Greek world, speaking Greek as their mother-tongue. These are the Jews whom we find contrasted as "Hellenists" with the "Hebrews" in Acts. A large Jewish literature in Greek had grown up since the translation of the Law in the 3rd century. Beside the other canonical books of the Old Testament, it included translations of other Hebrew books (Ecclesiasticus, Judith, etc.); works composed originally in Greek but imitating to some extent the Hebraic style (like Wisdom); works modelled more closely on the Greek literary tradition, either historical, like 2 Maccabees, or philosophical, like the productions of the Alexandrian school, represented for us by Aristobulus and Philon; or Greek poems on Jewish subjects, like the epic of the elder Philon and Ezechiel's tragedy, *Exagógé*. It included also a number of forgeries contrived for the heathen public, as a means of propaganda, calculated to inspire them with respect for Jewish antiquity or turn them from idols to God.

Through the Hellenistic Jews, Greek influences reached Jerusalem itself, though their effect upon the Aramaic-speaking Rabbinical schools was naturally not so pronounced. The large number of Greek words, however, in the language of the Mishnah and the Talmud is a significant phenomenon. The attitude of the Rabbinical doctors to a Greek education does not seem to have been hostile until the time of Hadrian. The sect of the Essenes probably shows an intermingling of the Greek with other lines of tradition among the Jews of Palestine.

6. **Egypt and Aethiopia.**—In Egypt the Ptolemies were hindered by special considerations from building Greek cities after the manner of the other Macedonian houses. Even at Alexandria Hellenism was not allowed full development. In its population, too, Alexandria was only semi-Hellenic; for besides the proportion of Egyptian natives in its lower strata, its commercial greatness drew in elements from every quarter; the Jews, for instance, formed a majority of the population in two out of the five divisions of the city. At the same time the prevalent tone of the populace was, no doubt, Hellenistic, as is shown by the fact that the Jews who settled there acquired Greek in place of Aramaic as their mother-tongue, and in its upper circles Alexandrian society under the Ptolemies was not only Hellenistic, but notable among the Hellenes for its literary and artistic brilliance. The

State university, the "Museum," was in close connection with the court, and gave to Alexandria the same pre-eminence in natural science and literary scholarship which Athens had in moral philosophy. Probably in no other country, except Judaea, did Hellenism encounter as stubborn a national antagonism as in Egypt. Yet the papyri show us habitual marriage of Greeks and native women, and a frequent adoption by natives of Greek names. In Egypt, too, the triumph of Christianity brought into being a native Christian literature, and if this was in one way the assertion of the native against Hellenistic predominance, one must remember that Coptic literature, like Syriac, necessarily incorporated those Greek elements which had become an essential part of Christian theology.

From the Ptolemaic kingdom Hellenism early travelled up the Nile into Aethiopia Ergamenes, the king of the Aethiopians in the time of the second Ptolemy, who had received a Greek education and cultivated philosophy, broke with the native priesthood, and from that time traces of Greek influence continue to be found in the monuments of the Upper Nile When Aethiopia became a Christian country in the 4th century, its connection with the Hellenistic world became close

7. **Hellenism in the West.**—Whilst in the East Hellenism had been sustained by the political supremacy of the Greeks, in Italy *Graecia capta* had only the inherent power and charm of her culture wherewith to win her way Even before Alexander, as we saw, Hellenism had affected the peoples of Italy, but it was not until the Greeks of South Italy and Sicily were brought under the supremacy of Rome in the 3rd century B C. that the stream of Greek influence entered Rome in any volume It was now that the Greek freedman, L. Livius Andronicus, laid the foundation of a new Latin literature by his translation of the *Odyssey*, and that the Greek dramas were recast in a Latin mould The first Romans who set about writing history wrote in Greek. At the end of the 3rd century there was a circle of enthusiastic phil-Hellenes among the Roman aristocracy, led by Titus Quinctius Flamininus, who in Rome's name proclaimed the autonomy of the Greeks in 196. In the middle of the 2nd century B C. Roman Hellenism centred in the circle of Scipio Aemilianus, which included men like Polybius and the philosopher Panaetius The visit of the three great philosophers, Diogenes, Critolaus and Carneades in 155, was an epoch-making event in the history of Hellenism at Rome Opposition there could not fail to be, and in 161 a *senatus consultum* ordered all Greek philosophers and rhetoricians to leave the city. The effect of such measures was, of course, transient Even though the opposition found so doughty a champion as the elder Cato (censor in 184), it was ultimately of no avail. The Italians did not indeed surrender themselves passively to the Greek tradition. In different departments of culture the degree of their independence was different. The mere fact that they produced a literature in Latin argues a power of creation as well as receptivity The great Latin poets were imitators indeed, but *mere* imitators they were no more than Petrarch or Milton. On the other hand, even where the creative originality of Rome was most pronounced, as in the sphere of law, there were elements of Hellenic origin It has been often pointed out how the Stoic philosophy especially helped to shape Roman jurisprudence.

While the upper classes in Italy absorbed Greek influences by their education, the lower strata of the population of Rome became largely Hellenized by the actual influx on a vast scale of Greeks and Hellenized Asiatics, brought in for the most part as slaves, and coalescing as freedmen with the citizen body. The early Christian Church in Rome, to which St. Paul addressed his epistle, was Greek-speaking, and continued to be so until far into the 3rd century In the western Mediterranean a Greek element was introduced wherever the Romans fostered town life and thus invited the Greek trader and professional man. This later process of Hellenization is especially noticeable in North Africa, where the native king, Juba (under Augustus) actively encouraged it. But in the West the Latin language everywhere ousted the Greek as a spoken tongue, and the prevalent culture was Italian rather than Hellenic.

III. LATER HISTORY

It remains only to glance at the ultimate destinies of Hellenism in West and East. In the Latin West, knowledge of Greek, first-hand acquaintance with the Greek classics, became rarer and rarer as general culture declined, until in the dark ages (after the 5th century) it existed practically nowhere but in Ireland. In Latin literature, however, a great mass of Hellenistic tradition was maintained in currency, wherever culture of any kind continued to exist. Then the stream began to rise again, first with the influx of the learning of the Spanish Moors, then with the new knowledge of Greek brought from Constantinople in the 14th century. With the Renaissance and the new learning, Hellenism came in again in flood, to form a chief part of that great river on which the modern world is being carried forward. In the East it is popularly thought that Hellenism, as an exotic, withered altogether away. This view is superficial. Ultimately the Greek East was absorbed by Islam; the popular mistake lies in supposing that the Hellenistic tradition thereby came to an end. The Mohammedan conquerors found a considerable part of it taken over, as we saw, by the Syrian Christians, and Greek philosophical and scientific classics were now translated from Syriac into Arabic. These were the starting-points for the Mohammedan schools in these subjects Accordingly we find the Arabian philosophy (*q.v.*), mathematics, geography, medicine and philology are all based professedly upon Greek works Aristotle in the East no less than in the West was the "master of them that know"; the geography and astronomy of Claudius Ptolemaeus had canonical authority in Islam and in Christendom alike; and Muslim physicians to this day invoke the names of Hippocrates and Galen. The Hellenistic strain in Mohammedan civilization has, it is true, flagged and failed, but only as that civilization as a whole has declined.

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See also works quoted in articles GREECE, *History;* ROME, *History;* MACEDONIAN EMPIRE; PTOLEMIES; SELEUCID DYNASTY, etc.

(M. C.)

HELLER, STEPHEN (1815–1888), Austrian pianist and composer, was born at Pest on May 15, 1814. He studied at Vienna under Czerny and Halm. For some years he played as a *Wunderkind*, but in 1838, settled in Paris, where he became intimate with Liszt, Chopin, Berlioz and their circle, among whom was Hallé, throughout his life an admirer of Heller's music But Heller outlived the great reputation which he had enjoyed among cultivated amateurs for so many years, and was almost forgotten when he died in Paris on Jan. 14, 1888.

HELLES, LANDING AT, 1915: *see* DARDANELLES CAMPAIGN.

HELLESPONT (*i.e.*, "Sea of Helle"; variously named in classical literature Ἑλλήσποντος, ὁ Ἑλλησπόντος, *Hellespontum Pelagus,* and *Fretum Hellesponticum*), the ancient name of the Dardanelles (*q.v.*). It was so-called from Helle, the daughter of Athamas (*q.v.*), who was drowned here. *See* ARGONAUTS.

HELLEVOETSLUIS or **HELVOETSLUIS,** a fortified seaport in the province of South Holland, on the south side of the island of Voorne-and-Putten, 5½ m. S. of Brielle. It has a daily steamboat service with Rotterdam by the Voornsche canal. Pop. (1926) 2,324. Hellevoetsluis was formerly a naval station.

HELLÍN, the *Illunum* of the Romano, a town of south-eastern Spain, in the province of Albacete, on the Albacete-Murcia railway. Pop. (1921) 10,967. Hellín is built on the outskirts of the low hills which line the left bank of the river Mundo. It possesses the remains of a Roman castle and has a fine parish church The surrounding country yields wine, oil and saffron. Within the town there are manufactures of cloth, leather and pottery Sulphur is obtained from the mining district of Minas del Mundo, 12 m S, at the junction between the Mundo and the Segura; and there are warm sulphurous springs in the neighbouring village of Azaraque.

HELLO, ERNEST (1828–1885), French critic, was born in Tréguier. His best-known book, *Physionomie de saints* (1875), which has been translated into English (1903) as *Studies in Saintship,* does not display his qualities best. The real Hello is to be found in a series of philosophical and critical essays, from *Renan, l'Allemagne et l'athéisme* (1861), through *L'Homme* (1871) and *Les Plateaux de la balance* (1880), perhaps his best work, to the posthumously published *Le Siècle* His studies of Shakespeare, Hugo and others are of abiding importance

HELMERS, JAN FREDERIK (1767–1813), Dutch poet, was born at Amsterdam on March 7, 1767 His *Poems* (2 vols., 1809–10), but especially his great work *De Hollandsche Natie* (1812), a poem in six cantos directed against Napoleon, created great enthusiasm. Helmers died at Amsterdam on Feb 26, 1813.

HELMERSEN, GREGOR VON (1803–1885), Russian geologist, was born at Laugut-Duckershof, near Dorpat, on Sept. 29 (O.S.) 1803. He received an engineering training and became major-general in the corps of mining engineers In 1837 he was appointed professor of geology in the mining institute at St. Petersburg. He wrote *Studien über die Wanderblöcke und die Diluvialgebilde Russlands* (1869 and 1882). Most of his memoirs were published by the Imperial Academy of Sciences at St. Petersburg. He died at St. Petersburg on Feb. 3 (O.S.) 1885.

HELMET, a defensive covering for the head. The present article deals with the helmet during the middle ages down to the close of the period when body armour was worn. For the helmet worn by the Greeks and Romans *see* ARMS AND ARMOUR.

The head-dress of the warriors of the dark ages and of the earlier feudal period was far from being the elaborate helmet which is associated in the imagination with the knight in armour and the tourney. It was a mere casque, a cap with or without additional safeguards for the ears, the nape of the neck and the nose (fig. 1). By those warriors who possessed the means to equip and protect themselves more fully, the casque was worn over a hood of mail. In manuscripts, armoured men are sometimes portrayed fighting in their hoods, without casques, basinets or other form of helmet. The casque was, of course, normally of plate, but in some instances it was a strong leather cap covered with mail or imbricated plates. The most advanced form of this early helmet is the conical steel or iron cap with nasal; it was worn in conjunction with the hood of mail. This is the typical helmet of the 11th-century warrior, and is made familiar by the Bayeux Tapestry. From this point however (*c.* 1100) the evolution of war head-gear follows two different paths for many years On the one hand the simple casque easily transformed itself into the *basinet,* originally a pointed iron skull-cap without nasal, ear-guards, etc. On the other hand the knight in armour, especially after the fashion of the tournament set in, found the mere cap with nasal insufficient, and the *heaume* (or "helmet") gradually came into vogue. This was in principle a large heavy iron pot covering the head and neck Often a light basinet was worn underneath it—or rather the knight usually wore his basinet and only put the heaume on over it at the last moment before engaging. The earlier (11th century) war heaumes are intended to be worn with the mail hood and have nasals. Towards the close of the 13th century, however, the basinet grew in size and strength, just as the casque had grown, and began to challenge comparison with the heavy and clumsy heaume Thereupon the heaume, became, by degrees, the special head-dress of the tournament, and grew heavier, larger and more elaborate, while the basinet, reinforced with camail and vizor, was worn in battle



FIG. 1.—ANGLO-SAXON SPEARMAN OF THE 11TH CENTURY (FROM COTTON MS., CLAUDIUS B. IV.)



FIG 2 - FIGURE IN ARMOUR ON HORSEBACK ON THE GREAT SEAL OF HENRY III.

The basinet, then, is the battle head dress of nobles, knights and sergeants in the 14th century Its development from the 10th-century cap to the towering helmet of 1350, with its long snouted vizor and ample drooping "camail," is shown in fig 5, two of the examples given showing the same helmet but with vizor down and up But the tendency set in during the 15th century to make all parts of the armour thicker Chain "mail" gradually gave way to plate on the body and limbs, remaining only in those parts, such as neck and elbows, where flexibility was essential, and even there it was in the end replaced by jointed steel bands or small plates The final step was the discarding of the "camail" and the introduction of the "armet" The latter will be described later Soon after the beginning of the 15th century the high-crowned basinet gave place to the *salade* or *sallet,* a helmet with a low rounded crown and a long brim or neck-guard at the back This was the typical head-piece of the last half of the Hundred Years' War as the vizored basinet had been of the first. Like the basinet it was worn in a simple form by archers and pikemen and in a more elaborate form by knights and men-at-arms. The larger and heavier salades were also often used instead of the heaume in tournaments Here again, however, there is a great difference between those worn by light armed men, foot-soldiers and archers and those of the heavy cavalry The former, while possessing as a rule the bowl shape and the lip or brim of the type, and always destitute of the conical point which is the distinguishing mark of the basinet, are cut away in front of the face (fig 7*a*) In some cases this was remedied in part by the addition of a small pivoted vizor, which, however, could not protect the throat. In the larger salades of the heavy cavalry the wide brim served to protect the whole head, a slit being made in that part of the brim which came in front of the eyes (in some examples the whole of the front part of the brim was made movable). But the chin and neck, directly opposed to the enemy's blows, were scarcely protected at all, and

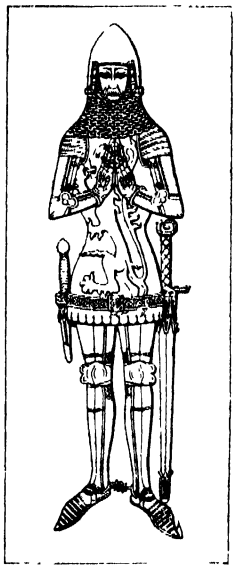
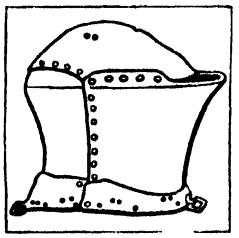


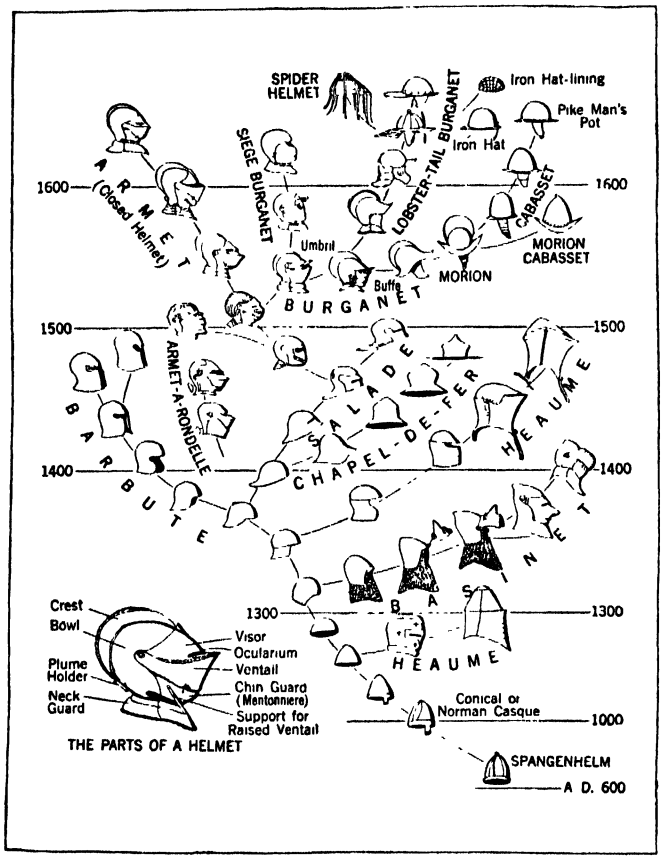
FIG. 3.—KNIGHT IN ARMOUR WITH BASINET AND MAIL HOOD. 1400



FROM FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUAN)

FIG. 4.—BARENDYNE HELM, GREAT HASELEY, OXFORD. WEIGHT 13LBS., 8 OZS.

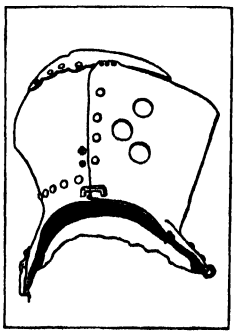
with these helmets, a large volant-piece or beaver (*mentonnière*)—usually a continuation of the body armour up to the chin or even beyond—was worn for this purpose, as shown in fig. 7*b*. This arrangement combined, in a rough way, the advantages of freedom of movement for the head with adequate protection for the neck



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK

FIG. 5.—DEVELOPMENT OF THE HELMET FROM 600 A D. TO THE 17TH CENTURY

and lower part of the face. The *armet*, which came into use about 1475–1500 and completely superseded the salade, realized these requirements far better, and later at the zenith of the armourer's art (about 1520) and throughout the period of the decline of armour it remained the standard pattern of helmet, whether for war or for tournament. It figures indeed in nearly all portraits of kings, nobles and soldiers up to the time of Frederick the Great, appearing with the suits of armour or half-armour worn by the subjects, and also in allegorical trophies, etc. The armet was a fairly close-fitting rounded shell of iron or steel, with a movable vizor in front and complete plating over chin, ears and neck, the latter replacing the mentonnièrre or beaver. The armet was connected to the rest of the suit by the gorget, which was usually of thin laminated steel plates. With a good armet and gorget there was no weak point for the enemy's sword to attack, a roped lower edge of the armet generally fitting into a sort of flange round the top of the gorget. Thus, and in other and slightly different ways, was solved the problem which in the early days of plate armour had been attempted by the clumsy heaume and the flexible, if tough, camail of the vizored basinet, and still more clumsily in the succeeding period by the salade, and its grotesque mentonnière. As far as existing examples show, the wide-brimmed salade itself first gave way to the more rounded armet, the mentonnière being carried up to the level of the eyes. Then the use

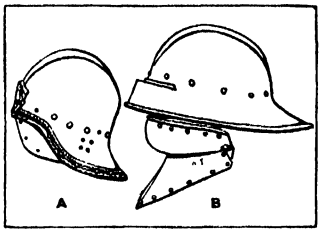


FROM FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUAN)

FIG. 6.—THE WESTMINSTER HELM OF 1500, WEIGHING 17LBS., 12OZS.

(growing throughout the 15th century) of laminated armour for the joints of the harness probably suggested the gorget, and once this was applied to the lower edge of the armet by a satisfactory joint, it was an easy step to the elaborate pivoted vizor which completed the new head-dress. Types of armets are shown in fig. 8.

The *burgonet*, often confused with the armet, is the typical helmet of the late 16th and early 17th centuries. In its simple form it was worn by the foot and light cavalry—though the latter must not be held to include the pistol-armed *chevaux-légers* of the wars of religion, these being clad in half-armour and vizored burgonet—and consisted of a (generally rounded) cap with a projecting brim shielding the eyes, a neck-guard and ear-pieces. It had almost invariably a crest or comb, as shown in the illustrations (fig. 9). Other forms of infantry head-gear much in vogue in the 16th century were the *morion* and *cabasset*, both lighter and smaller than the burgonet; indeed, much of their popularity was due to the ease with which they were worn or put on and off, for in the matter of protection they could not compare with the burgonet, which in one form or another was used by cavalry (and often by pikemen) up to the final disappearance of



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FIGS. 7A & 7B —(A) SALADE, CELATA TYPE; (B) SALADE, GERMAN TYPE

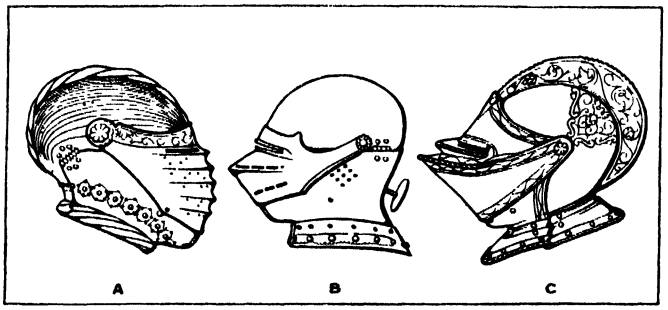

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FIG 8.—ARMETS, CLOSE HELMETS

The lower part of the helmet opens out with hinges, and the weight is borne by the gorget

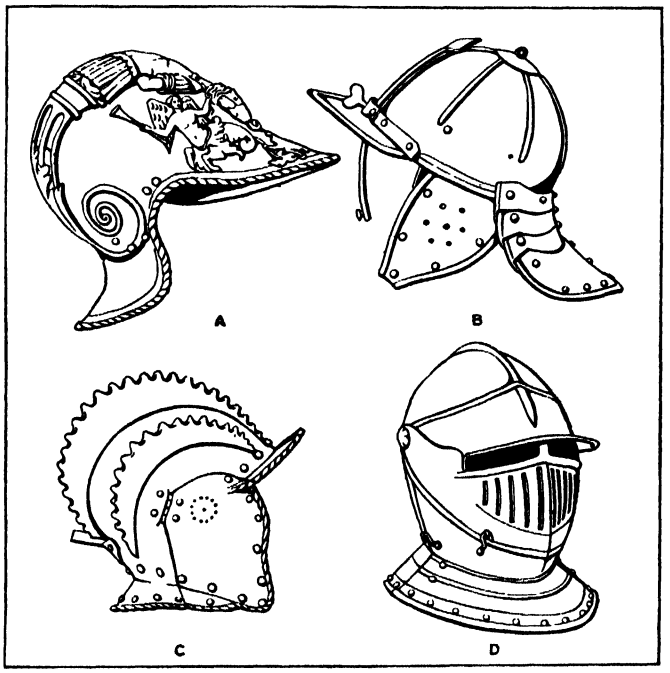

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FIG. 9.—(A, B, C) BURGONETS, HEAD PIECES SUITED TO LIGHT HORSE; (D) ARMET, CLOSE HELMET

armour from the field of battle about 1670. A richly decorated 16th-century Italian burgonet is in Vienna. Its archetype is perhaps the casque worn by the Swiss infantry at the epoch of Marignan (1515). This was probably copied by them from their former Burgundian antagonists, whose connection with this helmet is sufficiently indicated by its name. The lower part of the more elaborate burgonets worn by nobles and cavalrymen is often formed into a complete covering for the ears, cheek and chin, connected closely with the gorget. They therefore resemble the armets and have often been confused with them, but the distinguishing feature of the burgonet is invariably the front peak. Various forms of vizor were fitted to such helmets; these as a rule were fixed bars or continuations of the chin piece. Often a nasal was the only face protection. The latest-form burgonet in active service is the familiar Cromwellian cavalry helmet with its straight brim, from which depends the slight vizor of three bars or stout wires joined together at the bottom

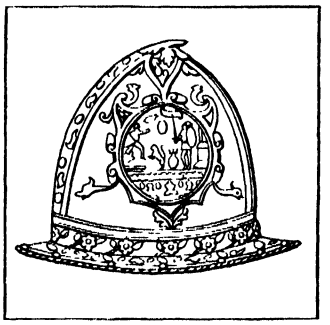

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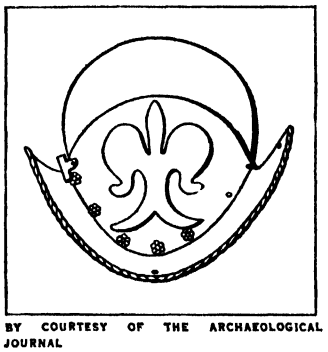
FIG. 10.—MORION WITH HIGH COMB

The above are of course only the main types Some writers class all remaining examples either as casques or as "war-hats," the latter term conveniently covering all those helmets which resemble in any way the head-gear of civil life For illustrations of many curiosities of this sort, including the famous iron hat of King Charles I. of England, and also for examples of Russian, Mongolian, Indian and Chinese helmets, the reader is referred to pp 262–269 and 285–286 of Demmin's *Arms and Armour* (English edition 1894).

Modern Steel Helmets.—During the World War the conditions of trench warfare left the head exposed to danger more than any other part of the body. In addition to this the increased employment of shrapnel against troops caused the proportion of head wounds to rise considerably. To meet these circumstances the French devised a steel helmet weighing 22 oz. and brought it into use in the spring of 1915. It afforded comparatively slight protection, being capable of resisting a shrapnel bullet, 41 to the pound, fired to give a striking velocity of 400 ft. per second The British authorities followed suit and after experiments, in October 1915, produced a helmet of hardened manganese steel weighing 21 oz. and capable of resisting shrapnel at 750 ft. per second. This helmet had the effect of reducing head wounds by 75% of what had formerly been experienced during the war. This gratifying result justified the acceleration of the rate of issue and by July 1916, a million helmets had been delivered to the B.E.F. in France. Later, over a million and a half British made helmets were supplied to the American forces. Helmets of this pattern were also issued to special constables at home for protection against shrapnel from anti-aircraft barrage. The Belgian forces adopted the French pattern. It was not until the summer of 1915 that Germany began to consider the matter of steel helmets, the impetus to the idea being supplied by Professor Friedrich Schwerd of Hanover. Schwerd was given a free hand and by the end of 1915 after many experiments had produced a satisfactory helmet, the first of which were used by the shock troops (Stosstruppen) at Verdun in January 1916. They were made from chrome-nickel-steel and weighed approximately 2 lb. 3 oz. The shape was chosen to ensure a maximum ricochet effect with rifle bullets. These steel helmets have become a permanent part of the soldier's equipment in most armies.



BY COURTESY OF THE ARCHAEOLOGICAL JOURNAL

FIG. 11.—MORION OF AN EARLY FORM

HELMHOLTZ, HERMANN LUDWIG FERDINAND VON (1821–1894), German philosopher and man of science, was born on Aug. 31, 1821, at Potsdam, near Berlin. He lived in Berlin from 1842 to 1849, when he became professor of physiology in Königsberg. There he remained from 1849 to 1855, when he removed to the chair of physiology in Bonn. In 1858 he became professor of physiology in Heidelberg, and in 1871 he occupied the chair of physics in Berlin. To this professorship was added in 1887 the post of director of the physico-technical institute at Charlottenburg, near Berlin, and he held the two positions together until his death on Sept 8, 1894

His investigations occupied almost the whole field of science, from physiology to mechanics. In 1847 Helmholtz read to the Physical Society of Berlin a famous paper, *Über die Erhaltung der Kraft* (on the conservation of force), which became one of the epoch-making papers of the century; indeed, along with J. R. Mayer, J. P. Joule and W Thomson (Lord Kelvin), he may be regarded as one of the founders of the law of the conservation of energy In 1851, he invented the ophthalmoscope

Helmholtz's contributions to physiological optics are of great importance. He investigated the optical constants of the eye, measured by his invention, the ophthalmometer, the radii of curvature of the crystalline lens for near and far vision, explained the mechanism of accommodation by which the eye can focus within certain limits, discussed the phenomena of colour vision, and gave a luminous account of the movements of the eyeballs so as to secure single vision with two eyes. In particular he revived and gave new force to the theory of colour-vision associated with the name of Thomas Young, showing the three primary colours to be red, green and violet, and he applied the theory to the explanation of colour-blindness. His great work on *Physiological Optics* (1856–66) is by far the most important book that has appeared on the physiology and physics of vision. Equally distinguished were his labours in physiological acoustics. He explained accurately the mechanism of the bones of the ear, and he discussed the action of the cochlea on the principles of sympathetic vibration.

Perhaps his greatest contribution, however, was his attempt to account for our perception of quality of tone. He showed, both by analysis and by synthesis, that quality depends on the order, number and intensity of the overtones or harmonics that may, and usually do, enter into the structure of a musical tone. He also developed the theory of differential and of summational tones. His work on *Sensations of Tone* (1862) may well be termed the *principia* of physiological acoustics. He may also be said to be the founder of the fixed-pitch theory of vowel tones, according to which it is asserted that the pitch of a vowel depends on the resonance of the mouth, according to the form of the cavity while singing it, and this independently of the pitch of the note on which the vowel is sung. For the later years of his life his labours may be summed up under the following heads: (1) On the conservation of energy; (2) on hydro-dynamics; (3) on electrodynamics and theories of electricity; (4) on meteorological physics; (5) on optics; and (6) on the abstract principles of dynamics. In all these fields of labour he made important contributions to science, and showed himself equally great in all.

Helmholtz continued his study of the phenomena of electrical oscillations from 1869 to 1871, and in the latter year he announced that the velocity of the propagation of electromagnetic induction was greater than 314,000 metres per second. This work is interesting in view of the fact that Hertz was a pupil of Helmholtz at this time and that later he demonstrated the existence of electromagnetic waves while studying a problem suggested to him by Helmholtz. This was followed by a series of papers on electrodynamics which were published from 1870 onwards. Helmholtz started with a formula due to F. E. Neuman for the potential of two current elements, and investigated the terms which must be added to give a general expression which agreed with the phenomena of closed circuits. There followed a controversy on the relative merits of the work of Helmholtz, Weber and Clerk Maxwell on this problem. In his paper on the "equations of motion of electricity in conductors at rest" (1874), Helmholtz

applied his generalized formula to the propagation of electric and magnetic disturbances through bodies capable of electric or magnetic polarization. He contributed papers on the theory of the electrical double layer and on electrolysis. Towards the end of his life he wrote on the physical meaning of the Principle of Least Action and applied the principle to electrodynamics. Helmholtz also wrote and lectured on philosophical and aesthetic problems. His position was that of an empiricist, denying the doctrine of innate ideas and holding that all knowledge is founded on experience, hereditarily transmitted or acquired.

See Engelmann, *Gedactnissrede auf Hermann von Helmholtz* (1894); Königsberger, *Hermann von Helmholtz* (1902; Eng. trans. by F. A. Welby, 1906); J. G. McKendrick, *H. L. F. von Helmholtz* (1899).

HELMINTHOLOGY, the study of parasitic worms. *See* PLATYHELMINTHES, TREMATODES, TAPEWORMS, NEMATODA, PARASITOLOGY.

HELMOLD, an historian of the 12th century, was a priest at Bosau near Plön He was a friend of the two bishops of Oldenburg, Vicelin (d. 1154) and Gerold (d. 1163), who did much to Christianize the Slavs. At Bishop Gerold's instigation Helmold wrote his *Chronica Slavorum,* a history of the conquest and conversion of the Slavonic countries from the time of Charlemagne. For the life and times of Henry the Lion, duke of Saxony, Helmold's chronicle, as that of a contemporary who had exceptional means for gaining information, is of first-rate importance. The history was continued down to 1209 by Abbot Arnold of Lübeck.

The *Chronica* were first edited by Siegmund Schorkel (Frankfort a. M., 1556). The best edition is by J. M. Lappenberg in *Mon. Germ. hist. scriptores,* xxi. (1869). For critical works on the *Chronica* see A. Potthast, *Bibliotheca hist. med. aevi,* s. "Helmoldus."

HELMOND, town in the province of North Brabant, Holland, on the river Aa, and on the canal Zuid-Willems Vaart between 'sHertogenbosch and Maastricht, 24½ m. by rail W N.W. of Venlo. It is connected by tramway with 'sHertogenbosch (21 m. N.W.). Pop. (1926) 22,924. The castle of Helmond, built in 1402, is a beautiful specimen of architecture. Helmond is one of the industrial centres of the province, and possesses over a score of factories for textiles, iron founding, soap boiling and tobacco dressing, as well as engine works and a margarine factory.

HELMONT, JEAN BAPTISTE VAN (1577–1644), Belgian chemist, physiologist and physician, was born at Brussels in 1577. (An alternative date for his birth is 1579 and for his death 1635; see *Bull. Roy. Acad. Belg.,* 1907.) He was educated at Louvain, and, after ranging from one science to another, turned to medicine, in which he took his doctor's degree in 1599. In 1609 he settled at Vilvorde, near Brussels, where he occupied himself with chemical experiments and medical practice until his death on Dec. 30, 1644.

Van Helmont presents curious contradictions. On the one hand he was a mystic with strong leanings to the supernatural, an alchemist who believed in the philosopher's stone; on the other hand he was touched with the new learning of Harvey, Galileo and Bacon, and was a careful observer and an exact experimenter. He was the first to understand that there are gases distinct in kind from atmospheric air. The very word "gas" he claims as his own invention, and he perceived that his "gas sylvestre" (carbon dioxide) given off by burning charcoal is the same as that produced by fermenting must. Van Helmont believed that water was the chief, if not the only ultimate constituent of all matter. He showed that plants could grow even though they received nothing but pure water, and so he argued that the wood, bark and roots had been formed from water alone. Van Helmont considered that digestion, nutrition and even movement are due to ferments, which convert dead food into living flesh in six stages. But having got so far with the application of chemical principles to physiological problems, he introduces a complicated system of supernatural agencies like the *archei* of Paracelsus, which preside over and direct the affairs of the body. At the same time chemical principles guided him in the choice of medicines—undue acidity of the digestive juices, for example, was to be corrected by alkalies and *vice versa;* he was thus a forerunner of the iatrochemical school.

His works were collected and published at Amsterdam as *Ortus medicinae, vel opera et opuscula omnia* in 1668 by his son Franz Mercurius (b. 1618 at Vilvorde, d. 1699 at Berlin), in whose own writings, *e.g., Cabbalah Denudata* (1677) and *Opuscula philosophica* (1690), mystical theosophy and alchemy appear in still wilder confusion.

See also M. Foster, *Lectures on the History of Physiology* (1901); also Chevreul in *Journ. des savants* (Feb. and March 1850), and Cap in *Journ. pharm. chim.* (1852). Other authorities are Poultier d'Elmoth, *Mémoire sur J. B. van Helmont* (1817); Rixner and Sieber, *Beiträge zur Geschichte der Physiologie* (1819–26), vol. ii.; Spiers, *Helmont's System der Medicin* (1840); Melsens, *Leçons sur van Helmont* (1848); Rommelaere, *Études sur J. B. van Helmont* (1860).

HELMSTEDT, or more rarely Helmstädt, a town of Germany, in the republic of Brunswick, 30 m. W.N.W. of Magdeburg on the main line of railway to Brunswick. Pop. (1925) 17,166. Helmstedt was probably founded about 900, and obtained civic rights in 1099. In 1457 it joined the Hanseatic League, and in 1490 it came into the possession of Brunswick. In 1576 Julius, duke of Brunswick, founded a university here, and throughout the 17th century this was one of the chief seats of Protestant learning. It was closed by Jerome, king of Westphalia, in 1809. The principal buildings are the Juleum, the former university, in Renaissance style (late 16th cent.) and the Stephanskirche dating from the 12th century. The principal manufactures are furniture, yarn, soap, tobacco, machinery, glass and earthenware

HELMUND, a river of Afghanistan, about 600 m. long, the ancient Etymander, the most important river in Afghanistan, next to the Kabul river, which it exceeds both in volume and length. It rises in the recesses of the Koh-i-Baba to the west of Kabul, its infant stream parting the Unai pass from the Irak, the two chief passes on the well-known road from Kabul to Bamian. About the parallel of 33° N. it enters the Zamindawar province which lies to the north-west of Kandahar, and thenceforward it is a well-mapped river to its termination in the lake of Seistan. Till about 40 m. above Girishk the character of the Helmund is that of a mountain river, flowing through valleys which in summer are the resort of pastoral tribes. On leaving the hills it enters on a flat country, and extends over a gravelly bed. Here also it begins to be used in irrigation. At Girishk it is crossed by the principal route from Herat to Kandahar. Forty-five miles below Girishk the Helmund receives its greatest tributary, the Arghandab, from the high Ghilzai country beyond Kandahar, and becomes a very considerable river, with a width of 300 or 400 yd. and an occasional depth of 9 to 12 ft. Even in the dry season it is never without a plentiful supply of water. The course of the river is more or less south-west from its source till in Seistan it crosses meridian 62°, when it turns nearly north, and so flows for 70 or 80 m. till it falls into the Seistan hamuns, or swamps, by various mouths. In this latter part of its course it forms the boundary between Afghan and Persian Seistan, and owing to constant changes in its bed and the swampy nature of its borders it has been a fertile source of frontier squabbles. Persian Seistan was once highly cultivated by means of a great system of canal irrigation; but, since the country was devastated by Timur, it has been a barren, treeless waste of flat alluvial plain. In years of exceptional flood the Seistan lakes spread southwards into an overflow channel called the Shelag which, running parallel to the northern course of the Helmund in the opposite direction, finally loses its waters in the Gaod-i-Zirreh swamp. Throughout its course from its confluence with the Arghandab to the ford of Chahar Burjak, where it bends northward, the Helmund valley is a narrow green belt of fertility sunk in the midst of a wide alluvial desert, with many thriving villages interspersed amongst the remains of ancient cities, relics of Kaiani rule.

HELM WIND, a violent, cold, easterly wind occasionally blowing down the western slope of Cross Fell, Cumberland, England, when a helm (helmet) cloud covers the summit.

HELOTS (Gr. Εἵλωτες or Εἵλωται), the serfs of the ancient Spartans. They were probably the aborigines of Laconia who had been enslaved by the Achaeans before the Dorian conquest. After the second Messenian war (*see* SPARTA), the conquered Messenians were reduced to the status of helots. The helots were State slaves bound to the soil and assigned to individual Spartiates to till their holdings (Gr. *klēroi*); their masters could neither emancipate them nor sell them off the land, nor raise the

rent payable yearly in kind by the helots. In time of war, they served as light-armed troops or as rowers in the fleet; from the Peloponnesian war onwards they were occasionally employed as heavy infantry (Gr. *hoplitai*), distinguished bravery being rewarded by emancipation. The general attitude of the Spartans towards them was one of distrust and cruelty. The ephors of each year, on entering office, declared war on the helots so that they might be put to death at any time without violating religious scruple, and we have a well-attested record of 2,000 helots being freed for service in war and then secretly assassinated. (Thuc. iv. 80.) (*See* CRYPTEIA.)

Intermediate between Helots and Spartiates were the *Neodamōdes* and *Mothōnes*. The former were emancipated helots, or their descendants, and were much used in war; they served especially on foreign campaigns, as that of Agesilaus (396–394 B.C.) in Asia Minor. The *mothōnes*, or *mothakes*, were the sons of Spartiates and helot mothers; they were free men sharing the Spartan training, but not full citizens.

See C. O. Müller, *History and Antiquities of the Doric Race* (Eng. trans.), bk. iii. ch. 3.; G. Gilbert, *Greek Constitutional Antiquities* (Eng. trans. 1895); A. H. J. Greenidge, *Handbook of Greek Constitutional History* (1896); A. Whibley, *Companion to Greek Studies* (1923).

HELPS, SIR ARTHUR (1813–1875), English writer and clerk of the privy council, son of a London merchant, was educated at Eton and at Trinity college, Cambridge. In 1860 he was appointed clerk of the privy council, on the recommendation of Lord Granville.

His appointment as clerk of the council brought him into personal communication with Queen Victoria and the Prince Consort, both of whom came to regard him with confidence and respect. After the prince's death, the queen asked Helps to prepare the appreciation of her husband's life and character contained in his introduction to the collection (1862) of the Prince Consort's speeches and addresses. He edited and wrote a preface to the Queen's *Leaves from a Journal of our Life in the Highlands* (1868). He died on March 7, 1875.

Helps's other works include *Friends in Council, a Series of Readings and Discourse thereon* (1847–59); *The Conquerors of the New World and their Bondsmen* (2 vols., 1848–52); and *The Spanish Conquest in America, and its Relation to the History of Slavery and the Government of Colonies* (4 vols., 1855–57–61).

HELSINGBORG, a seaport of Sweden in the district (*län*) of Malmohus, 35 m. N. by E. of Copenhagen by rail and water. Pop. (1928) 53,417. The original site of the town is marked by the tower of the old fortress, which is first mentioned in 1135 and whose ruins stand on a hill above the town. From 1370 along with other towns in the province of Skane, it was united for 15 years with the Hanseatic League. The fortress was destroyed by fire in 1418, and about 1425 Eric XIII. built another near the sea, and caused the town to be transported thither, bestowing upon it important privileges. Until 1658 it belonged to Denmark, and in 1684 its fortifications were dismantled. It was re-taken by the Danes several times but in 1710 the town came finally into the possession of Sweden. It stands on the narrowest part of Öresund (the Sound), here only 3 m. wide, opposite Helsingör (Elsinore) in Denmark. On the outskirts are the Öresund park containing iodide and bromide springs, and sea-baths. On the coast to the north is the royal *château* of Sofiero; to the south, the small spa of Ramlösa. North and east of Helsingborg lies the only coal-field in Sweden, extending into the Kullen peninsula. Potter's clay is also found. Helsingborg ranks among the first manufacturing towns of Sweden, having copper works, using ore from Sulitelma in Norway, india-rubber works, sugar refineries, super-phosphate works and breweries. The new harbour has a depth of 32 ft., and there are extensive docks. The chief exports are timber, dairy produce, paper, rubber wares and iron ore.

HELSINGFORS or **HELSINKI,** the capital, seaport and only large town of the republic of Finland. In 1810 it had only 4,065 inhabitants; in 1926 there were 215,829. Helsinki is well laid out with wide streets, parks and gardens. The principal square contains the cathedral of St. Nicholas, the Senate house and the university, all striking buildings of architectural distinction. They are mainly classical in style, but a number of modern buildings show the national spirit by using local material and decorative skill. Other public institutions are the Athenaeum, with picture gallery, a Swedish theatre and opera house, a Finnish theatre and the Archives. Some of the scientific societies have a wide reputation, and great interest and foresight is shown in educational matters. The use of the Finnish language for educational purposes has become general, but Western languages, French and English, and to some extent German, are also employed along with Swedish, the old language of culture in the country.

The fine harbour is divided into two parts by a promontory, and is protected at its entrance by a group of small islands. A third harbour is situated on the west side of the promontory, and all three have granite quays. The harbour accommodates the largest vessels, but it is usually closed by ice from January to the end of April, except for a channel kept open by an ice breaker. The harbour has been much improved in recent years and had over 7,000 yd. of quay in 1924. In 1925 a coal wharf was erected and a goods station was built alongside the harbour. Helsinki imports coal, machinery, sugar, grain and clothing. The manufactures of the city consist largely of tobacco, beer and spirits, and carpets.

HELST, BARTHOLOMAEUS VAN DER (1613–1670), Dutch painter, born at Haarlem, and died at Amsterdam. He was the son of Lodenyk Lowys v. d. Helst, merchant and innkeeper. The artist is first mentioned in 1636 when he married Anna du Pire at Amsterdam. He was a pupil of Nicolas Elias. His first great picture is the portrait group of the regents of the almshouse of Amsterdam, dated 1637. Then follow two groups of civic guards dated 1643 and 1648 in the gallery at Amsterdam. Here too are the noble portraits of the burgomaster Bicker and Andreas Bicker the younger, completed in 1642. The portrait of Bicker's wife is in the Dresden gallery. He produced little or nothing besides portraits at any time, but founded, in conjunction with Nicolaes de Helt Stokade, the painters' guild at Amsterdam in 1653. His likeness of Paul Potter at the Hague was executed in 1654.

His great work, "The Peace of Münster" (1648), in the gallery of Amsterdam challenges comparison at once with the so-called "Night Watch" by Rembrandt. But, great as the qualities of van der Helst undoubtedly are, he remains below the line of demarcation which separates the second from the first-rate masters of art.

His pictures number about 100. At Amsterdam the four regents in the Werkhuys (1650), four syndics in the gallery (1656), and four syndics in the town hall (1657) are masterpieces, to which may be added a number of fine single portraits. Rotterdam, notwithstanding the fire of 1864, still boasts of five of van der Helst's works. The Hague owns four. Leningrad, on the other hand, possesses ten. The Louvre has four, Munich three. Other pieces are in the galleries of Berlin, Brunswick, Brussels, Carlsruhe, Cassel, Darmstadt, Dresden, Frankfort, Gotha, London, New York, Schwerin, Utrecht and Vienna.

See J. J. Gelder, *Barth. van der Helst* (1921).

HELSTON, a market town and municipal borough of Cornwall, England, 11 m. W.S.W. of Falmouth. Pop. (1921) 2,616.

Helston (Henliston, Haliston, Helleston), the capital of the Meneage district of Cornwall, was held by Earl Harold in the time of the Confessor and by King William at the Domesday Survey. In 1585 Elizabeth granted a charter of incorporation, which was confirmed in 1641. From 1294 to 1832 Helston returned two members to parliament. In 1774 the number of electors (which by usage had been restricted to the mayor, aldermen and freemen elected by them) had dwindled to six, and in 1790 to one person only.

The town is situated on the river Cober, which expands into Looe Pool, the water being banked up by Looe Bar at the mouth. The mining industry on which the town formerly depended is extinct, but the district is agricultural and dairy farming is carried on. Helston is the nearest railway station to the Lizard, and there is a considerable tourist traffic in summer. Some trade passes through the small port of Porthleven, 3 m. south-west. A holiday held on May 8 (Flora day) was marked by floral decorations and the chanting of folk songs. Attempts have been made to revive it in recent years.

HELVETIC CONFESSIONS, the name of two documents expressing the common belief of the reformed churches of Switzerland. The first, known also as the Second Confession of Basel, was drawn up at that city in 1536 by Henry Bullinger and others. The Second Helvetic Confession was written by Bullinger in 1562 and revised in 1564 as a private exercise. It came to the notice of the elector palatine Friedrich III., who had it translated into German and published. It gained a favourable hold on the Swiss churches, who had found the First Confession too short and too Lutheran. It was adopted by the Reformed Church not only throughout Switzerland but in Scotland (1566), Hungary (1567), France (1571), Poland (1578), and next to the Heidelberg Catechism (*q.v.*) is the most generally recognized Confession of the Reformed Church.

See L. Thomas, *La Confession helvétique* (Geneva, 1853); P. Schaff, *Creeds of Christendom*, i. 390-420, iii. 234-306; Muller, *Die Bekenntnisschriften der reformierten Kirche* (Leipzig, 1903); W. A. Curtis, art. "Confessions," in Hastings, *Encyclopaedia of Religion and Ethics*, vol. iii. p. 800-61.

HELVETII, a Celtic people, whose original home was situated in the country between the Hercynian forest, the Rhine, and the Main. In Caesar's time their boundaries were the Jura on the W., the Rhone and the lake of Geneva on the S., the Rhine as far as Lake Constance on the N. and E. They thus inhabited the western part of modern Switzerland. They were divided into four cantons (*pagi*), common affairs being managed by the cantonal assemblies. They possessed the elements of a higher civilization (gold coinage and the Greek alphabet), and, according to Caesar, were the bravest people of Gaul. The reports of gold and plunder spread by the Cimbri and Teutones (qq.v.) on their way to southern Gaul induced the Helvetii to follow their example. In 107 B.C., two of their tribes, the Tougeni and Tigurini, crossed the Jura and defeated the Romans under L. Cassius Longinus. In 102 B.C., the Helvetii joined the Cimbri in the invasion of Italy, but after the defeat of the latter by Marius they returned home. In 58 B.C., hard pressed by the Germans and incited by one of their princes, Orgetorix, they resolved to found a new home west of the Jura. Joined by the Rauraci, Tulingi, Latobrigi, and some of the Boii they agreed to meet at Geneva and to advance through the territory of the Allobroges. They were overtaken by Caesar at Bibracte, defeated and forced to submit.

Under Augustus, Helvetia (*ager Helvetiorum*) proper was included under Gallia Belgica. Two Roman colonies were founded at Noviodunum (*Nyon*) and at Augusta Rauracorum (*Augst* near Basel) to keep watch over the inhabitants, who were treated with generosity by their conquerors. Under the name of *foederati* they retained their original constitution and division into four cantons. They were under an obligation to furnish a contingent to the Roman army for foreign service, but were allowed to maintain garrisons of their own, and their magistrates had the right to call out a militia; they managed their own local affairs and kept their own language, although Latin was used officially. Their chief towns were Aventicum (*Avenches*) and Vindonissa (*Windisch*). Under Tiberius, the Helvetii were separated from Gallia Belgica and made part of Germania Superior. After the death of Galba (A.D. 69), as they refused submission to Vitellius their land was devastated by Alienus Caecina. Under Vespasian, they attained the height of their prosperity. He greatly increased the importance of Aventicum, where his father had carried on business. Its inhabitants obtained the *ius Latinum*, had a council of *decuriones*, flamens of Augustus, etc. (*see* MUNICIPIUM). After the extension of the eastern frontier, the troops were withdrawn, and Helvetia became completely romanized. Aventicum had an amphitheatre, a public gymnasium, and an academy with Roman professors. Roads were made wherever possible, and commerce rapidly developed. The west of the country was more susceptible to Roman influence, and hence preserved its independence against barbarian invaders longer than its eastern portion. During the reign of Gallienus (A.D. 260-268) the Alamanni overran the country and it never regained its former prosperity. Under Honorius (A.D. 395-423) it was occupied by the Alamanni, except in the west, where the small portion remaining to the Romans was ceded in A.D. 436 by Aetius to the Burgundians.

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HELVÉTIUS, CLAUDE ADRIEN (1715-1771), French philosopher and littérateur, was born in Paris in Jan. 1715, the son of the chief physician to Queen Marie Leczinska of France. In 1738, at the queen's request, he was appointed farmer-general, a post of great responsibility and dignity. He proceeded to enjoy his leisure, producing a poem, *Le Bonheur* (published posthumously, with an account of Helvétius's life and works, by C. F. de Saint-Lambert; 1773), in which he develops the idea that true happiness is only to be found in making the interest of one that of all, and his famous philosophical study, *De l'esprit* (1758, Eng. trans. by W. Mudford, 1807), intended to be the rival of Montesquieu's *L'Esprit des lois*. This attracted immediate attention and aroused the most formidable opposition, especially from the dauphin, son of Louis XV. The Sorbonne condemned it as full of the most dangerous doctrines, and the author's three separate retractations did not save it from being publicly burnt. Voltaire said that it was full of commonplaces, and that what was original was false or problematical; Rousseau declared that the very benevolence of the author gave the lie to his principles. In 1764 Helvétius visited England, and the next year, on the invitation of Frederick II., went to Berlin. He then passed the remainder of his life quietly on his country estate in France. He died on Dec. 26, 1771.

The three chief contentions in Helvétius's crudely hedonistic work are: (1) All man's faculties may be reduced to physical sensation, even memory, comparison, judgment. (2) Self-interest, founded on the love of pleasure and the fear of pain, is the spring of judgment, action, affection; self-sacrifice is prompted by the fact that the sensation of pleasure outweighs the accompanying pain; it is thus the result of deliberate calculation; we have no liberty of choice between good and evil; there is no such thing as absolute right—ideas of justice and injustice change according to customs. (3) All intellects are equal; their apparent inequalities are due to the unequal desire for instruction, and this desire springs from passions, of which all men commonly well organized are susceptible to the same degree; and we can, therefore, all love glory with the same enthusiasm and we owe all to education.

De l'homme, de ses facultés intellectuelles et de son éducation (1773, Eng. trans. by W. Hooper, 1777), a supplement to *De l'esprit*, is a polemic against the distinction between private and public interests. A complete edition of the works of Helvétius was published at Paris, 1818. *See* V. Cousin, *Philosophie Sensualiste* (1863); D. G. Mostratos, *Die Padagogik des Helvétius* (1891); A. Guillois, *Le Salon de Madame Helvétius* (1894); A. Piazzi, *Le Idee filosofiche specialmente pedagogiche de C. A. Helvétius* (Milan, 1889); G. Plekhanov, *Beiträge zur Geschichte des Materialismus* (Stuttgart, 1896); L. Limentani, *Le Teorie psicologiche di Helvétius* (Verona, 1902); A. Keim, *Helvétius, sa vie et son oeuvre* (1907); J. B. Séverac, *Helvétius*, in *Les Grands Philosophes* series (1910).

HELVIDIUS PRISCUS, Stoic philosopher and statesman, lived during the reigns of Nero, Galba, Otho, Vitellius and Vespasian. He held high offices during this time, in spite of his republican views. During Nero's reign he was quaestor of Achaea and tribune of the plebs (A.D. 56), and restored order in Armenia. His declared sympathy with Brutus and Cassius occasioned his banishment in 66. Having been recalled to Rome by Galba in 68, he at once impeached Eprius Marcellus, the accuser of Thrasea Paetus, but dropped the charge, as the condemnation of Marcellus would have involved a number of senators. As praetor elect he ventured to oppose Vitellius in the senate (Tacitus, *Hist.* ii. 91), and as praetor (70) he maintained, in opposition to Vespasian, that the management of the finances ought to be left to the discretion of the senate; he proposed that the capitol, which had been destroyed in the Neronian conflagration, should be

restored at the public expense; he saluted Vespasian by his private name, and did not recognize him as emperor in his praetorian edicts. At length he was banished a second time, and shortly afterwards was executed by Vespasian's order.

See Tacitus, *Hist.* iv. 5, *Dialogus,* 5; Dio Cassius lxvi. 12, lxvii. 13; Suetonius, *Vespasian,* 15; Pliny, *Epp.* vii. 19.

HELWAN, a well-known health resort in Egypt, 16 m. south of Cairo and connected with it by rail. Standing 150 ft. above the Nile level, and surrounded by desert, it enjoys a dry equable climate specially suitable for invalids; and it possesses strong sulphur and salt springs with a natural temperature of 91° F. The Egyptian government opened a fully equipped thermal establishment in 1900, and the station has been provided with hotels and all the usual forms of amusement familiar at European spas. An astronomical observatory was built here in 1903–04, to replace the former observatory at Abbasia. On the opposite bank of the river lie the ruins of Memphis and the famous pyramids of Sakkara.

HELY-HUTCHINSON, JOHN (1724–1794), Irish lawyer, statesman, and provost of Trinity college, Dublin, son of Francis Hely, a gentleman of County Cork, was educated at Trinity college, Dublin, and was called to the Irish bar in 1748. He took the additional name of Hutchinson on his marriage in 1751. He entered the Irish House of Commons in 1759, but joining the "patriotic" party in opposition to the Government, and although he afterwards joined the administration he never abandoned his advocacy of popular measures.

For his support of the Augmentation bill (for an increase in the army establishment in Ireland) carried in the session of 1769, Hely-Hutchinson received an addition of £1,000 a year to the salary of his sinecure of Alnagar, a major's commission in a cavalry regiment, and a promise of the secretaryship of State. He was at this time one of the most brilliant debaters in the Irish parliament, and he was enjoying an exceedingly lucrative practice at the bar, which, with his sinecure, he sacrificed in 1774 to become provost of Trinity college, Dublin.

In the Irish House he advocated free trade, the relief of the Catholics from penal legislation, and the reform of parliament. He was one of the very earliest politicians to recognize the soundness of Adam Smith's views on trade; and he quoted from the *Wealth of Nations,* adopting some of its principles, in his *Commercial Restraints of Ireland,* published in 1779, which Lecky pronounces "one of the best specimens of political literature produced in Ireland in the latter half of the 18th century." Hely-Hutchinson's remarkably able state paper on the economic condition of Ireland (ms. in the Record Office, London), showed clear traces of the influence of Adam Smith. Not less enlightened were his views on the Catholic question.

In 1777 Hely-Hutchinson became secretary of State. When Grattan in 1782 moved an address to the king containing a declaration of Irish legislative independence, Hely-Hutchinson supported the attorney-general's motion postponing the question; but on April 16, after the Easter recess, he read a message from the lord lieutenant, the duke of Portland, giving the king's permission for the House to take the matter into consideration, and he expressed his personal sympathy with the popular cause which Grattan on the same day brought to a triumphant issue (*see* GRATTAN, HENRY). Hely-Hutchinson supported the opposition on the regency question in 1788, and one of his last votes in the House was in favour of parliamentary reform. He died at Buxton on Sept. 4, 1794.

In 1785 his wife had been created Baroness Donoughmore and on her death in 1788, his eldest son Richard (1756–1825) succeeded to the title.

See W. E. H. Lecky, *Hist. of Ireland in the Eighteenth Century* (5 vols., 1892); J. A. Froude, *The English in Ireland in the Eighteenth Century* (3 vols., 1872–74); H. Grattan, *Memoirs of the Life and Times of Henry Grattan* (8 vols., 1839–46); *Baratariana,* by various writers (Dublin, 1773).

HELYOT, PIERRE (1660–1716), Franciscan friar and historian, was born at Paris in Jan. 1660, and in 1683 entered the third order of St. Francis at Picpus, near Paris. During his travels to many parts of Europe on monastic business he collected materials for his great work, *L'Histoire des ordres monastiques, religieux, et militaires, et des congrégations séculières* (8 vols., 1714–21). Helyot died on Jan. 5, 1716, before the fifth volume appeared, but his friend Maximilien Bullot completed the edition. The *Histoire* is a work of great historical importance, and is profusely illustrated by plates exhibiting the dress of the various orders. The material has been arranged in dictionary form in Migne's *Encyclopédie théologique,* under the title "Dictionnaire des ordres religieux" (4 vols., 1858). Helyot's only other noteworthy work is *Le Chrétien mourant* (1695).

HEMANS, FELICIA DOROTHEA (1793–1835), English poetess, was born in Duke street, Liverpool, on Sept. 25, 1793, the daughter of George Browne, a Liverpool merchant of Irish extraction. Her mother seems to have been of Austrian origin. In 1806 the family moved to Gwrych, Denbighshire, and there Felicia grew up by the Welsh mountains and the sea-shore. When she was only 14, her *Juvenile Poems* were published by subscription, and were harshly criticized in the *Monthly Review.* Her *Domestic Affections and other Poems* appeared in 1812, on the eve of her marriage to Capt. Alfred Hemans, adjutant of the Northamptonshire Militia. While they lived at Bronwylfa, a house near St. Asaph, she published *The Restoration of Works of Art to Italy* (1816), *Modern Greece* (1817), and *Translations from Camoens and other Poets* (1818). Husband and wife separated in 1818, and though letters were interchanged concerning their five children, they never met again. Her next productions were *Tales and Historic Scenes in Verse* (1819), *The Sceptic* and *Stanzas to the Memory of the late King* (1820), a volume of poems containing "The Siege of Valencia," "The Last Constantine," and "Belshazzar's Feast" (1823), and *The Forest Sanctuary* and *Lays of Many Lands* (1825), which were two of her favourite works.

In 1828, Mrs. Hemans moved to Wavertree, near Liverpool. In the following summer she visited the Hamiltons of Chiefswood, where she enjoyed "constant, almost daily, intercourse" with Sir Walter Scott, who had written an epilogue for her play, *The Vespers of Palermo,* produced at Edinburgh in April 1824. It had been acted at Covent Garden on Dec. 12, 1823, but was withdrawn after the first performance. In 1830 she visited Wordsworth and the Lake country, and went again to Scotland. Her publications of this period include *Songs of the Affections* (1830), *Hymns for Childhood* (1834; had appeared in America in 1827), *National Lyrics* (1834), *Scenes and Hymns of Life* (1834), and a series of sonnets, *Thoughts during Sickness.* She died in Dublin on May 16, 1835.

Mrs. Hemans's poetry is the outcome of a beautiful but singularly circumscribed life, a life spent in romantic seclusion, without much worldly experience, and warped by domestic unhappiness and physical suffering. Scott complained that it contained "too many flowers" and "too little fruit." Her reputation rests on her short poems, such as "The Treasures of the Deep," "The Better Land," "The Homes of England," "Casabianca," "The Palm Tree," "The Graves of a Household," "The Wreck," "The Dying Improvisatore," "The Lost Pleiad," and the "Landing of the Pilgrims," beginning:

> The breaking waves dashed high on a stern and rock bound coast.

Mrs. Hemans's *Poetical Works* were collected in 1832 (last ed., Oxford, 1914); her *Memorials,* etc., by H. F. Chorley (1836).

HEMEL HEMPSTEAD, a town and municipal borough in Hertfordshire, England, 25 m. N.W. from London. Pop (1921) 13,826. Settlements in the neighbourhood of Hemel Hempstead (*Hamalamstede, Hemel Hampsted*) date from pre-Roman times, and a Roman villa has been discovered at Boxmoor. The manor, royal demesne in 1086, was granted by Edmund Plantagenet in 1285 to the house of Ashridge, and the town developed under monastic protection. In 1539 a charter incorporated the bailiff and inhabitants. A mayor, aldermen and councillors received governing power by a charter of 1898. It is situated in the Gade valley, near the Grand Junction canal. The church of St. Mary is a Norman building with Decorated additions. Industries include the manufacture of paper and iron founding.

HEMEROBAPTISTS: *see* ESSENES.

HEMICHORDA or **HEMICHORDATA,** a zoological term introduced by W. Bateson in 1884 as equivalent to Enteropneusta, which then included the single genus *Balanoglossus,* and now generally employed to cover a group of marine worm-like animals probably related to the lower vertebrates. Vertebrates, or Chordates, are distinguished by the presence of a notochord, which forms the longitudinal axis of the body; by the gill-slits in the pharynx; and by the hollow dorsal central nervous system (*see* VERTEBRATA). In the Hemichorda, the respiratory organs closely resemble gill-slits, and structures comparable with the notochord and the tubular dorsal nervous system are present.

The Hemichorda include two orders, the Pterobranchia (*q.v.*) and the Enteropneusta (*see* BALANOGLOSSUS), and are now generally regarded as a sub-phylum of the Chordata.

HEMICYCLE, in architecture, any large, semi-circular recess, usually covered with a semi-dome; a monumental exedra (*q.v.*).

HEMIMORPHITE, a mineral consisting of hydrous zinc silicate, $H_2Zn_2SiO_5$, of importance as an ore of the metal, of which it contains 54·4% It is interesting crystallographically by reason of the hemimorphic development of its orthorhombic crystals; these are prismatic in habit and are differently terminated at the two ends. Connected with this polarity of the crystals is their pyroelectric character—when a crystal is subjected to changes of temperature it becomes positively electrified at one end and negatively at the other. There are perfect cleavages parallel to the prism faces Crystals are usually colourless, sometimes yellowish or greenish, and transparent; they have vitreous lustre. The hardness is 5, and the specific gravity 3·45 The mineral also occurs as stalactitic or botryoidal masses with a fibrous structure, or in a massive, cellular or granular condition intermixed with calamine and clay. It is decomposed by hydrochloric acid with gelatinization; this property affords a ready means of distinguishing hemimorphite from calamine (zinc carbonate), these two minerals being, when not crystallized, very like each other in appearance.

Hemimorphite occurs with other ores of zinc (calamine and blende), forming veins and beds in sedimentary limestones. British localities are Matlock, Alston, Mendip hills and Leadhills; at Roughten Gill, Caldbeck Fells, Cumberland, it occurs as mammillated sky-blue incrustations. Well-crystallized specimens have been found in the zinc mines at Altenberg (Vieille-Montagne) in Belgium, Nerchinsk, Siberia and Elkhorn, Montana

HEMINGBURGH, WALTER OF, also commonly, but erroneously, called Walter Hemingford, a Latin chronicler of the 14th century, was a canon regular of the Austin priory of Gisburn in Yorkshire Hence he is sometimes known as Walter of Gisburn (Walterus Gisburnensis). Bale seems to have been the first to give him the name by which he became more commonly known. His chronicle embraces the period of English history from the Conquest (1066) to the nineteenth year of Edward III., with the exception of the years 1316–26. In compiling the first part, Hemingburgh apparently used the histories of Eadmer, Hoveden, Henry of Huntingdon, and William of Newburgh; but the reigns of the three Edwards are original, composed from personal observation and information. There are several manuscripts of the history extant—the best perhaps being that presented to the College of Arms by the earl of Arundel.

The first three books were published by Thomas Gale in 1687, in his *Historiae Anglicanae scriptores quinque,* and the remainder by Thomas Hearne in 1731. The first portion was again published in 1848 by the English Historical Society, under the title *Chronicon Walteri de Hemingburgh, vulgo Hemingford nuncupati, de gestis regum Angliae,* edited by H. C. Hamilton.

HEMIPODE, a name given to the bustard-quails, inhabitants of Africa, Southeastern Asia and Australia, which stand between the *quails* and the *rails.* Of the 30 species, 29 belong to the genus *Turnix.* They are called hemipodes (half-footed) because the first toe is absent. As among the phalaropes (*q.v.*) the females are larger and more brightly coloured than the males, which perform the duties of incubation and caring for the young.

HEMIPTERA (Gr. ἡμι half and πτερόν a wing), the name applied in zoological classification to that order of insects (*q.v.*) which includes plant-bugs, cicadas, aphides and scale insects The name was first given by Linnaeus (1735) who applied it in allusion to the half-coriaceous and half-membranous character of the fore-wings in many species of the order. This expression, however, is not very well suited as the fore-wings in many members are of a uniform texture, and the most characteristic feature is afforded by the mouth-parts which form a beak-like proboscis with piercing and sucking stylets. This latter feature led J. C. Fabricius (1775) to substitute the name Rhynchota (Rhyngota) which is still used by many authorities. Hemiptera number about 36,000 described species; the great majority are plant feeders and rank among the most destructive of all insects. Two pairs of wings are generally present, the anterior pair being most often of harder consistency than the posterior pair, or with the apical region more membranous than the remainder. The mouth-parts are always adapted for sucking and piercing and the palpi are atrophied. Metamorphosis is incomplete (fig. 13) in most cases but, more rarely, complete in certain others (fig. 14). Collectively the members of the order are known as plant-bugs: most of them are of small or moderate size while a few, such as the giant water-bugs and cicadas are very large insects. The prevailing type of colouration is green, but cicadas, lantern flies and their allies, and cotton stainers are often conspicuously coloured

General Structure.—The head is very variable in form and in most cases the sclerites are compactly fused with few noticeable sutures. As a rule the antennae have only four or five joints but in exceptional cases 10 (*Psyllidae*) or even 25 joints (males of a few *Coccidae*) may be present. The mouth-parts are of an exceptionally uniform character throughout the order, a feature that is correlated with the universal habit of feeding by means of piercing and sucking. The mandibles and maxillae are in the form of needle-like stylets and are intimately held together so as to function almost as one organ (fig 1) Each maxilla bears

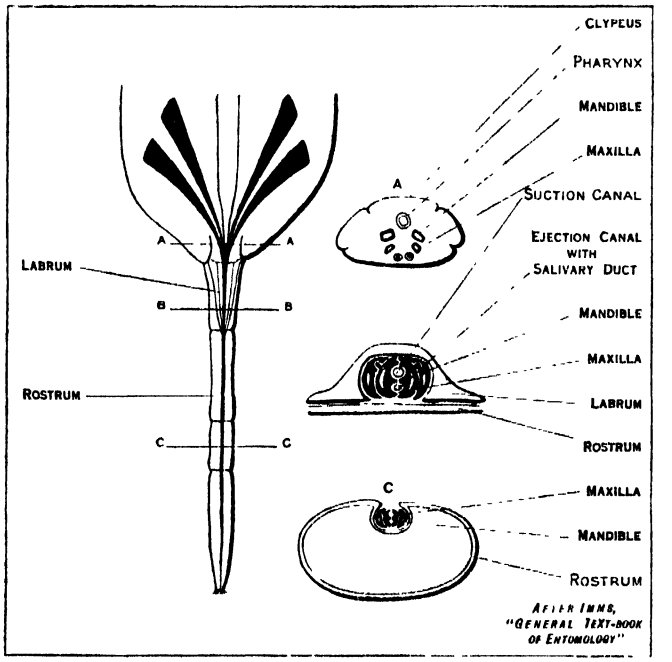
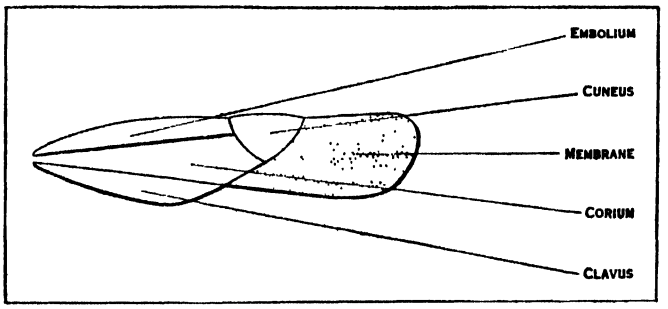


FIG 1.—DIAGRAM OF MOUTH PARTS AND ADJACENT REGIONS OF HEAD OF HEMIPTERAL INSECT. AT RIGHT ARE TRANSVERSE SECTIONS ACROSS REGIONS BEARING CORRESPONDING LETTERING ON LEFT-HAND FIGURE. (THE MAGNIFICATION OF THESE SECTIONS IS NOT UNIFORM)

two grooves separated by a longitudinal ridge and the two maxillae are locked together so that the grooves form a pair of minute tubes. The upper tube so formed is the suction canal through which the food is imbibed, while the lower tube allows for the flow of the saliva into the plant and is hence termed the ejection canal The labium takes the form of a jointed sheath or rostrum which is grooved above to form a slot in which the other mouth-parts repose when at rest. The labium takes no part in feeding, and both pairs of palpi are wanting In many members of the order the pronotum is a large conspicuous shield as in beetles,

the legs have three or fewer joints to the tarsi and the wings are exceedingly variable in character with relatively scanty venation. In the sub-order Heteroptera the forewings are termed hemelytra (hemi-elytra) and their proximal area is horny or leathery, re-



AFTER IMMS, "GENERAL TEXT BOOK OF ENTOMOLOGY"

FIG 2.—DIAGRAM OF THE FORE-WING, OR HEMELYTRON, OF AN HETEROPTEROUS BUG, SHOWING AREAS INTO WHICH IT IS DIVIDED

sembling an elytron, only the distal portion remaining membranous. The hind wings are always membranous and in repose are folded beneath the hemelytra. The hardened basal portion of the hemelytron is divided into a narrow posterior area or clavus and a broader main portion or corium. In some cases a narrow strip of the corium is marked off along the anterior margin to form the embolium and in Capsid bugs there is a triangular apical area to the corium which is termed the cuneus (fig 2). In the sub-order Homoptera the fore-wings are of uniform texture and frequently of harder consistency than the hind pair. Many members of the order are wingless, especially in aphides and the females of all scale insects. In other cases there are several degrees of wing development within a single species—wingless, fully-winged and half-winged individuals being present. The meaning of this wing-polymorphism is obscure. The abdomen sometimes exhibits indications of 11 segments, but reduction or suppression of one or more is the rule. In some water-bugs a true ovipositor is well developed but in other groups it is inconspicuous or wanting.

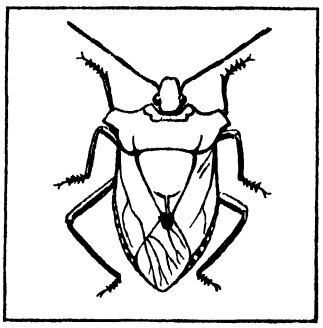
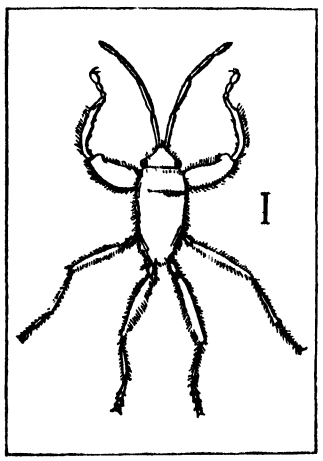


FIG 3.—TYPICAL SHIELD BUG (TROPICORIS RUFIPES) OF THE SUB-ORDER HETEROPTERA



FROM "STRUCTURE OF COLLEMBOLA," AFTER CARPENTER (ROYAL DUBLIN SOCIETY)

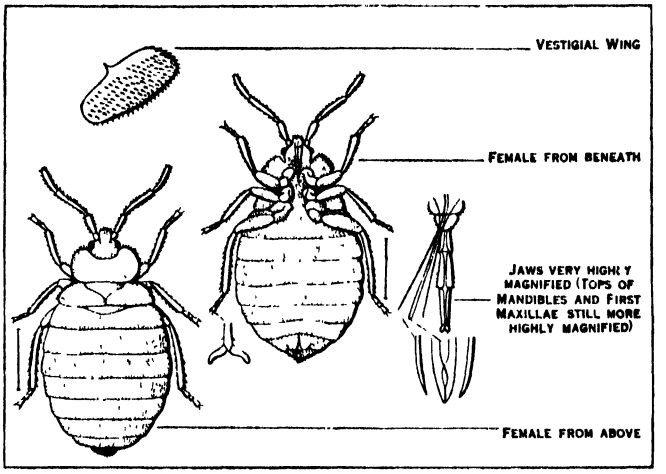
FIG. 4.—REEF-HAUNTING HEMIPTERON (HERMATOBATES HADDONII), WITH EXCESSIVELY REDUCED ABDOMEN. MAGNIFIED

Classification.—Plant bugs are divided into a large number of families which are grouped under two sub-orders as given below.

SUB-ORDER I. HETEROPTERA

Wings generally overlapping on the body when at rest, the fore-pair usually hardened, the apex only being membranous. Pronotum large; tarsi generally 3-jointed. The Heteroptera include both terrestrial and aquatic families the most important of which are the following:—

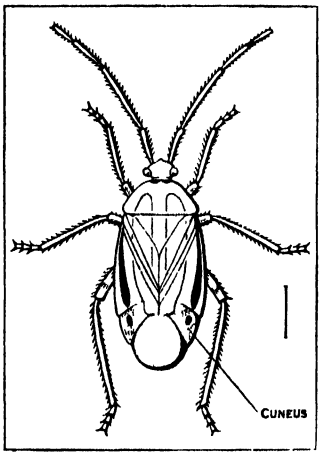
Series I. GYMNOCERATA.—Antennae conspicuous; terrestrial or in some cases living on the surface of water. The Pentatomidae or shield bugs are rather large and often brightly coloured insects, characterised by the great size of the scutellum which sometimes covers the abdomen (fig. 3). The Coreidae have a smaller scutellum and the antennae are placed high upon the head: the squash bug (*Anasa tristis*) of the U.S. is a well known example. The Lygaeidae are related to them, but the antennae are placed lower on the head: the American chinch bug (*Blissus leucopterus*) is well known and the family includes about 50 British species. The Pyrrhocoridae or red bugs differ from Lygaeidae in having no ocelli; most species have bright red, or green, and black coloration and the injurious cotton-stainers (*Dysdercus*) are well known examples. The Tingidae or lacebugs are small creatures, whose integument exhibits a beautiful net-like pattern and the



FROM "BULLETIN OF ENTOMOLOGY," AFTER MARLATT (U.S. DEPARTMENT OF AGRICULTURE)

FIG 5.—DORSAL AND VENTRAL VIEWS OF THE FEMALE BED-BUG (CIMEX LECTULARIUS, LINN.), WITH STRUCTURAL DETAILS

tarsi are 2-jointed. The Hydrometridae are a large family of pond-skaters which are clothed below with silvery pubescence: the genus Halobates and its allies (fig. 4) occur far out on the ocean in warm latitudes. The Reduviidae are a family of over 2,000 species, with a prominently curved rostrum, they mostly live on the blood of other insects, while species of *Triatoma* and *Reduvius* suck the blood of man. The Cimicidae (fig. 5) are the well known bed-bugs (*Cimex*) which are blood-suckers of mammals and birds and the Polyctenidae are curious parasites living on bats. The Capsidae are a large family in which the hemelytra have a cuneus, but no embolium (fig. 6): over 180 species are British and some are serious enemies of fruit trees.



FROM "CORNELL UNIVERSITY ENTOMOLOGY BULLETIN 58," AFTER SLINGERLAND (U.S. DEPARTMENT OF AGRICULTURE)

FIG. 6.—CAPSID LEAF-BUG (POECILOCAPSUS LINEATUS) OF NORTH AMERICA. MAGNIFIED

Series II. CRYPTOCERATA.—Aquatic species with concealed antennae. Included here are the Belostomatidae or giant water-bugs of the Tropics which may exceed 4in. in length. They feed upon small fish, tadpoles and other insects, but often take to the wing and are attracted to lights at night. The Nepidae or water scorpions (fig. 7) have an apical breathing tube at the extremity of the abdomen, raptorial forelegs and 3-jointed antennae. The Notonectidae or water-boatmen (*q.v.*) swim on their backs by means of their strong oar-like legs and when diving carry a supply of air beneath the wings. They are markedly predaceous and can inflict painful punctures when handled. The Corixidae are numerous in most countries, and are largely bottom-dwellers notable for their faculty of stridulation.

SUB-ORDER II. HOMOPTERA

Wings usually sloping roof-wise over the sides of the body when at rest, the fore-pair of uniform consistency, but wingless forms are frequent. Pronotum small, tarsi 1- to 3-jointed. By far the greater number of the Hemiptera belong to this sub-order and,

with the exception of the cicadas and lantern flies, they are mostly small or very small, fragile insects. The Cicadidae or cicadas (*q.v.*) include over 1,000 species of large insects with ample membranous wings and toothed femora to the fore-legs. The males almost always have a sound-producing apparatus on each side of the base of the abdomen (fig. 9) and are very powerful stridulators. The nymphs (fig. 8) live below ground at the roots of plants. The family is mainly tropical: 74 species occur in North America but there is only a single representative in Britain where it is rarely found. The Fulgoroidea are an assemblage of about 13 families, the members of many of which secrete wax in various forms: the best known examples are the large tropical lantern flies which, however, are not luminous. The Membracidae are remarkable on account of the development of the pronotum into variably shaped processes which extend far backward over the body. The Cercopidae comprise the cuckoo spit insects (*q.v.*) or froghoppers and the Jassidae include the leaf-hoppers (fig. 10). Both families are exceedingly large groups of small insects, numerous in Britain and most parts of the world. The Psyllidae or jumping lice include the apple- and pear-suckers and have usually 10-jointed antennae and the fore-wings are of somewhat firmer consistency than the hind pair. The Aphididae (fig. 11) are the large and very important family of aphides (*q.v.*) which include many injurious species and undergo a highly complex life-cycle: among the best known forms are the woolly aphis of the apple and the vine *Phylloxera* (*q.v.*). The Aleurodidae or white flies are minute fragile creatures dusted with a waxy powder: the greenhouse white-fly (*Asterochiton vaporariorum*) is the only species likely to attract notice. The

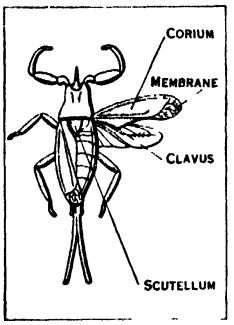
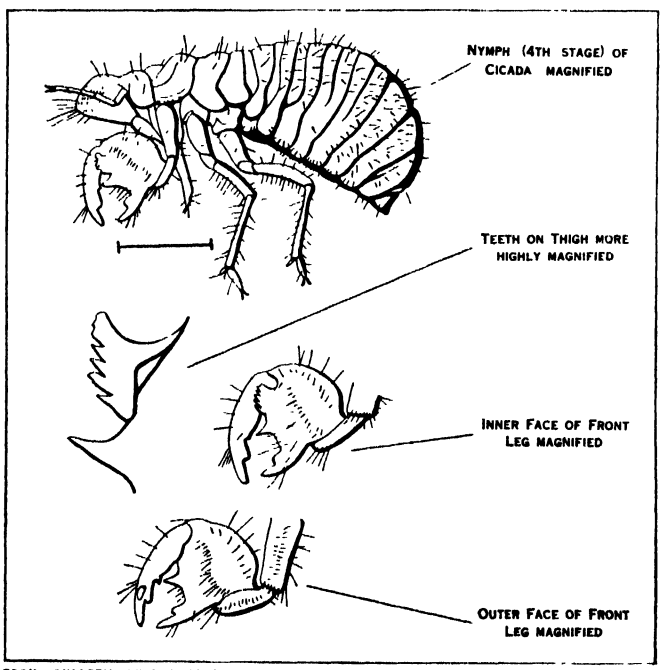


FIG. 7.—WATER-SCORPION (NEPA CINEREA) SOMEWHAT MAGNIFIED

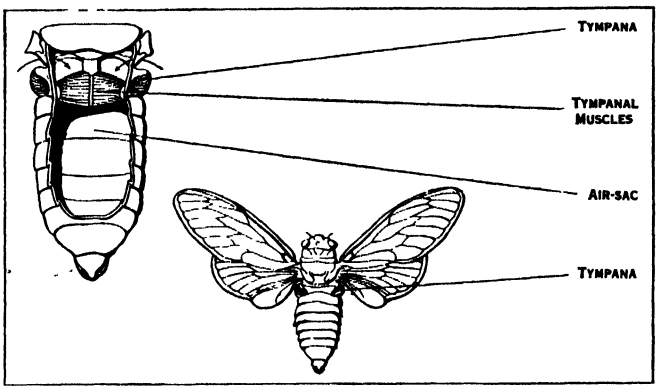


FROM "BULLETIN OF ENTOMOLOGY," AFTER MARLATT (U S DEPARTMENT OF AGRICULTURE)

FIG. 8.—DIAGRAM OF NYMPH OF CICADA, SHOWING LEG STRUCTURE

Coccidae (fig. 12) form one of most noxious groups of all insects and include the scale insects (*q.v.*) and mealy bugs. The females are degenerate wingless insects and cause most of the damage entailed by this family, while the males are very fragile creatures with a single pair of wings and no mouth-parts.

Reproduction and Development.—In most Hemiptera the nymphs resemble the parents except for the absence of wings and they are active through all stages of growth, feeding in a manner similar to the adults. The number of moults undergone is very variable and the wing-rudiments appear among Heteroptera about the fourth instar (fig. 13). Cicadas are remarkable because the young insects are adapted for burrowing, and suck the sap from roots, while the adults are aerial. In male Coccidae an incipient pupal stage is passed through (fig. 14) and the same occurs in both sexes of Aleurodidae: these families, therefore, afford a transition towards insects with complete metamorphosis. Most Heteroptera in temperate countries appear to be single-brooded, but among Homoptera the rate of reproduction is often extraordinarily rapid, which is an important factor bearing upon the injurious nature of many of the species. The estimates of Réaumur and Huxley regarding the fecundity of parthenogenetic

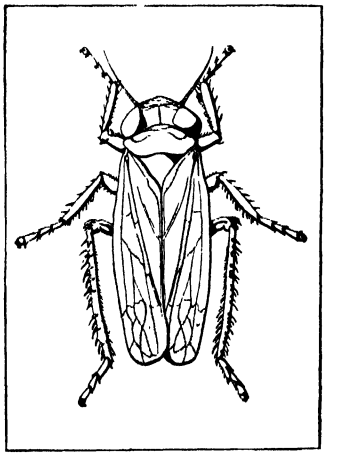


FROM "ANN REP SMITHSONIAN INSTITUTION," AFTER SNODGRASS (U S DEPARTMENT OF AGRICULTURE)

FIG 9 —MALE OF THE 17-YEAR CICADA (TIBICINA SEPTENDECIM) SHOWING THE SOUND-PRODUCING DRUMS OR TYMPANA
At upper left the abdomen has been opened from above to show the muscles that vibrate the tympana, and the large air-sac

aphides are well known. Buckton, on the other hand, thinks that they are placed too low and he states that the progeny of a single aphid at the end of 300 days (if all members survived) would be the 15th power of 210! R. C L. Perkins mentions with regard to leaf-hoppers, that if each hopper lays 50 eggs, and the sexes are about equal in number of individuals, in six generations the progeny of one female would amount at the end of the season to 500,000,000. Fortunately climatic changes, parasites and predators collectively maintain the proper balance of such prolific creatures by destroying them in vast numbers.

Geographical Distribution.—Although very widely distributed, Hemiptera have not penetrated as far into remote and inhospitable regions as have some of the other orders. The Fulgoroidea and Cicadidae are more especially tropical groups and the Membracidae attain their greatest development in Central and South America, but many of the other large families are well represented in most countries. Some species such as the bed-bug (*Cimex lectularius*) and the shield bug, *Nesara viridula*, are nearly world-wide and a number of European species have found their way into North America.



FROM "MEMOIRS OF THE DEPARTMENT OF AGRICULTURE," AFTER MISRA (HIGH COMMISSIONER FOR INDIA)

FIG. 10.—THE LEAFHOPPER (NEPHOLETTIX APICALIS)

Geological Distribution.—Hemiptera first appear in geological times in Lower Permian rocks of Kansas and Germany. The remarkable German fossil *Eugeron* has the typical Hemipterous mouth-parts except that the labium is paired and unfused, while the wing-venation is more like that of an early cockroach type. On these characters *Eugeron* has been referred to a separate extinct order, the Protohemiptera. In the Kansas rocks undoubted Homoptera occur, belonging to extinct families and the first Heteroptera appear in the Upper Trias of Ipswich (Australia), where they are represented by forms possibly ancestral

to shield bugs and water-boatmen. In Jurassic times both sub-orders are well represented and some of the dominant existing families differentiated. After the Jurassic period Hemiptera become more abundant as fossils, notably in the Miocene of Florissant and in Baltic amber.

Natural History.—By far the greater number of Hemiptera live and feed upon vegetation: a relatively small proportion suck

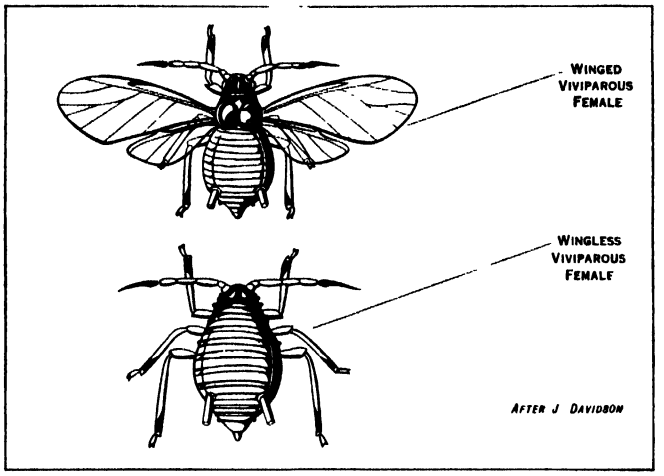
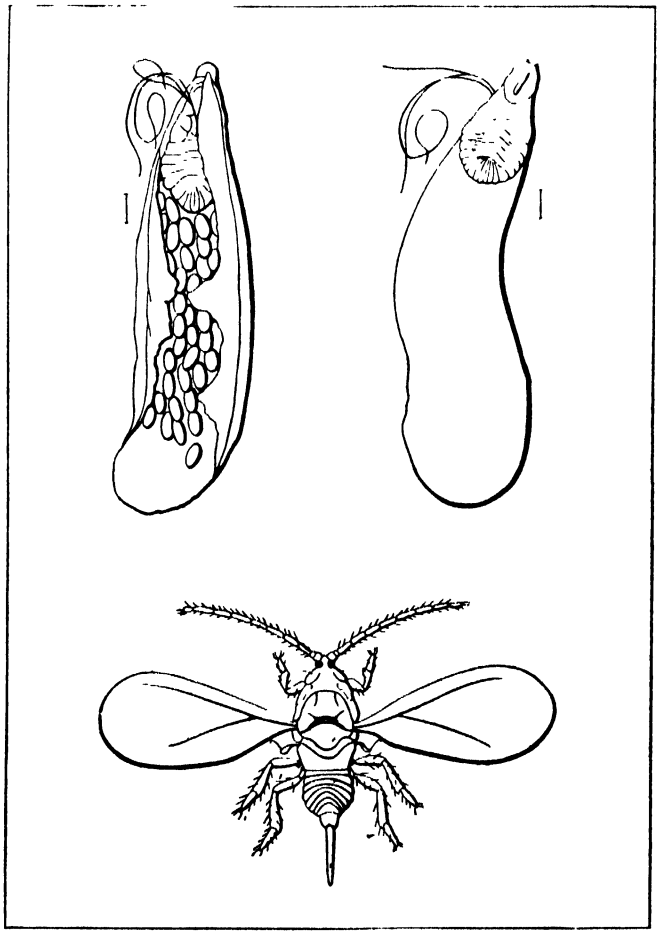


FIG. 11.—BEAN APHID (APHIS RUMICIS), A TYPICAL MEMBER OF THE APHIDIDAE FAMILY
During the spring and summer a number of generations of virgin females are produced, some winged, some wingless. These individuals bring forth living young, and it is only in autumn that the true sexually reproducing males and females appear

the body-fluids of other insects or the blood of mammals and birds. The vegetable feeders may live on any part of a plant: aphides tend to congregate on the young sappy shoots, while a few live at the roots: scale-insects often heavily infest the bark, but there are many other kinds found on the leaves and fruit and some on the roots, while leafhoppers and frog-hoppers are abundant on almost all kinds of vegetation. A few species of aphides, scale-insects and Psyllidae form galls but the habit is rare within the order. The carnivorous members mostly prey upon other forms of insect life and this habit is characteristic of the family Reduviidae and of most of the water-bugs: some of the large species of the latter also attack tadpoles and small fish. Other of the carnivorous bugs subsist upon the blood of vertebrates. Members of the genus *Triatoma* (Reduviidae) are voracious blood-suckers in the Tropics and the species *T. megista* is the main carrier of the Trypanosome of a fatal human disease in South America The bed-bugs (*Cimex*) infest man in most parts of the world where he is living under unhygienic conditions, while certain other members of the same family suck the blood of birds. Members of the curious tropical family *Polyctenidae* include about 20 species of wingless insects, which live deep down among the fur and suck the blood of bats: they are also remarkable in being viviparous, the young being brought forth relatively advanced in development.

Whatever their habits may be, all Hemiptera, upon emerging from the egg, live by piercing the plant or animal host, as the case may be, with their mouth-stylets. Their food always consists of fluids, either sap or blood and with the plant-feeders penetration of the tissues by the stylets is facilitated by the presence of enzymes in the insects' saliva. In some cases it appears that such enzymes are able to dissolve parts of the cell-walls and liquefy the surrounding tissues: and often the actual punctures are indicated by areas of discoloured necrotic cells. In some Hemiptera the saliva contains an enzyme which converts starch into sugar and, among many Homoptera, there appears to be an excess of sugars in their diet which is repeatedly voided in fluid drops from the anus in the form of honey-dew. Scale insects, aphides and Membracidae discharge large quantities of this material over the surrounding leaves which often become coated or discoloured by it. Honey-dew is very much sought after by ants which scour plants infested by these insects in order to imbibe it as it is actually being discharged. Some aphides are tended and sheltered by ants solely for the honey-dew they yield, while certain root-feeding Coccidae are tolerated in their nests for this same reason. Aquatic Hemiptera exhibit interesting adaptations for swimming and breathing in water. In the surface dwellers (Gymnocerata) these adaptations are less pronounced; the antennae are free and unconcealed, the legs not highly modified and these insects are clothed with a velvety pale below, which prevents wetting. The true aquatic forms (Cryptocerata) have the antennae concealed, the long antennae of surface forms obstructing the freedom of motion of submerged insects. The legs are highly modified as oars and various respiratory adaptations are present. They come to the surface to take in a supply of air at the caudal extremity, and this is retained in various ways for breathing while submerged. Many Hemiptera possess sound-producing organs and among shield-bugs wart-like tubercles on the hind legs are scraped across a set of fine ridges beneath the abdomen In the Corixidae sound is produced by drawing a row of teeth on the fore tarsus across a series of pegs on the femur of the opposite leg The loudest and most notorious stridulators are the cicadas whose notes have been variously compared to a railway whistle or a scissor-grinder; when numerous the noise



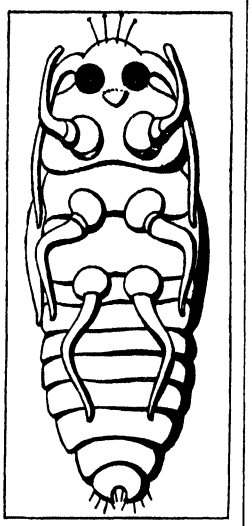
FROM "YEAR BOOK," AFTER HOWARD (U S DEPARTMENT OF AGRICULTURE)

FIGS. 12 AND 13.—THE APPLE SCALE INSECT (LEPIDOSAPHES ULMI)
Above: female and eggs seen from beneath (left) and from above (right). Below: male apple scale. Magnified

emitted by these insects is both trying and monotonous to human ears. It is produced by a pair of drums or membranes within the metathorax, which are worked by special muscles and the cavities within which they lie are usually protected by a prominent plate on either side of the base of the abdomen. Cicadas (*q v.*) are further remarkable for the length of their life-history in the case of certain species, the "periodical cicada" of North America requiring 13 to 17 years in order to complete its nymphal growth.

Economic Importance.—It has been observed that no other order of insects is so directly concerned with human welfare as

Hemiptera, on account of the vast amount of injury its members cause to vegetation by their sap-sucking propensity. Among the most notable of the noxious species are the cotton stainers (*Dysdercus*) whose punctures cause great injury to the bolls on account, more especially, of the bacterial and fungal infections which supervene The chinch-bug (*Blissus leucopterus*) is stated to have caused probably over £70,000,000 damage in about 60 years to cereals in the United States. Among Capsidae tea blight (*Heliopeltis*) is very injurious in Assam, and other species attack fruit trees in Britain and other parts of Europe as well as North America The green-house white-fly (*Asterochiton vaporariorum*) is a widely spread pest in hot-houses and other Aleurodidae infest citrus fruits The Coccidae, however, are the most harmful of all Hemiptera and a mere list of the noxious forms would occupy at least a column: mention can only be made of the San José scale, the mussel or oyster shell scale and the cottony cushion scale, together with the various species of mealy-bugs (*see* SCALE INSECTS). The aphides (*q.v.*) compete closely with scale-insects in point of injurious behaviour. The woolly aphis of the apple, the bean aphis, the Phylloxera (*q.v.*) of the vine and Chermes with its allies are notable examples Hemiptera also play an important rôle in the transmission of virus and other diseases among plants which is discussed in the article ENTOMOLOGY, ECONOMIC.



FROM RILEY AND HOWARD, "INSECT LIFE" (U S DEPARTMENT OF AGRICULTURE)

FIG. 14.—PASSIVE NYMPH, OR PUPA, OF MALE SCALE INSECT (ICERYA)

From the point of view of utility to man a few members of the order may be classed as beneficial The most important are the scale insects, notably the lac insect (*Tachardia lacca*) whose outer coverings yield the stick lac of commerce from which shellac is derived; the insect is native to India The cochineal insect (*Dactylopius coccus*) belongs to the same family and the dyestuff, cochineal, is prepared from the dried females. Similarly the dye-stuff known as Kermes or "granum tinctorium" has been prepared from almost time immemorial from the dried females of another Coccid, viz., *Kermes ilicis*. Several other Coccidae yield wax in sufficient quantities to have been used commercially in the East, while the outer pearly coverings of *Margarodes* are the so-called ground-pearls which are strung into necklaces in South Africa and the Bahamas.

Mention needs to be made of the predatory Capsid *Cyrtorhinus mundulus* which has been utilised for purposes of controlling the sugar-cane leafhopper in the Hawaiian islands. The insect was introduced into that territory from Queensland and Fiji by F. Muir in 1920 and the experiment has since proved highly successful.

BIBLIOGRAPHY.—No general comprehensive work on Hemiptera exists, but text-books are available dealing with the British species, and the most important of these are the following: E. Saunders, *Hemiptera-Heteroptera of the British Isles* (1892); J. Edwards, *Hemiptera-Homoptera of the British Isles* (1896); E. A. Butler, *A Biology of the British Hemiptera-Heteroptera* (1923); R. Newstead, *British Coccidae* (1901–03) and F. V. Theobald, *British Aphides* (Ashford, Kent [1926–27] still in course of pub.).

For the North American Hemiptera a useful guide is W. E. Britton, *The Hemiptera or Sucking Insects of Connecticut* (*Bull. 20 Conn. Geol. and Nat. Hist. Survey*, 1923) and most of the species inhabiting that continent are listed by E. P. Van Duzee *Catalogue of the Hemiptera of America* (*Univ. Calif. Tech. Bull., Agric. Exp. Station*, 2, 1917). For the scale-insects consult A. D. MacGillivray, *The Coccidae* (Urbana, Ill., 1921) and for the aphides numerous bulletins by E. M. Patch, pub. by the Maine Agricul. Experiment Station, are important. The same experiment station has also issued useful bull. (248 and 254: 1916) on froghoppers and leafhoppers by H. G. Osborn.

Among other works dealing with Hemiptera E. E. Green, *The Coccidae of Ceylon* (1896–1922) is comprehensive and beautifully illus. and the Lac insect is described by A. D. Imms and N. C. Chatterjee (*Indian Forest Memoirs*, 3, 1915). J. B. Buckton's *British Aphidae* (1875–1882) is now out of date, but useful for the coloured illus.; *see* also J. Davidson, *Catalogue of British Aphididae* (1925: bibl.). For aquatic Hemiptera an account is given by L. C. Miall, *Natural History of Aquatic Insects* (1912) and by G. W. Kirkaldy, *Guide to the Study of British Waterbugs* (*Entomologist*, 1898–1906). For the Cicadas *see* W. L. Distant, *Oriental Cicadidae* (1889–92) and C. L. Marlatt, *The Periodical Cicada* (*Bull. 71 U.S. Bureau of Entomol.*, 1907), while their sound-producing organs are described and figured by C. Carlet in *Annales des Sciences Naturelles* (ser. 6, vol. v. 1877). (A. D. I.)

HEMLOCK, the name commonly given in North America to trees of the genus *Tsuga*, of the pine family (Pinaceae), comprising nine species, five of which are native to eastern Asia and four to temperate North America. They are tall, pyramidal evergreen conifers, with cinnamon-red bark; slender, horizontal or somewhat drooping branches; flat, narrowly linear, short-stalked, two-ranked leaves and small, pendulous cones, with rounded, persistent, slightly woody scales.

The eastern hemlock (*T. canadensis*), called also Canada hemlock and hemlock-spruce, grows in upland forests from Nova Scotia to Minnesota and southward to Maryland, northern Indiana, south-western Wisconsin and in the mountains to Georgia and Alabama It is a handsome tree, usually 60 to 80 ft. but sometimes 100 ft high, with a trunk 2 to 4 ft. in diameter. The dark green leaves, $\frac{1}{2}$ to $\frac{3}{4}$ in. long, are grooved above and marked with two whitish bands beneath. The bark is valuable for tanning and the soft, coarse-grained, splintery wood, though much inferior to pine or spruce, is extensively used for various building purposes When young the eastern hemlock is one of the most ornamental of evergreens, and numerous varieties are in cultivation. It was introduced into Great Britain in 1736.

The much smaller Carolina hemlock (*T. caroliniana*), sometimes 70 ft. high, a beautiful but somewhat local tree of the southern Alleghenies from Virginia to Georgia, is extensively planted for ornament. The mountain hemlock (*T. Mertensiana*), also a small tree, 20 to 90 ft high, with densely crowded leaves spreading around the branchlets, occurs on high mountains from south-eastern Alaska to Montana and California. Its soft light wood is of but little commercial value The tree is sparingly grown as an ornamental.

The western hemlock (*T. heterophylla*), called also hemlock-fir and Prince Albert's fir, a valuable timber tree, often 200 ft. high, with a trunk 6 to 10 ft. in diameter, grows from south-eastern Alaska to northern Montana and central California, chiefly near the coast. In quality the wood of the western hemlock is greatly superior to that of all other hemlocks, comparing favourably with that of pine or spruce. In 1925 the total production of hemlock lumber in the United States was 2,139,631,000 bd. ft., of which 1,228,986,000 bd. ft. was western hemlock, cut in the States of Washington and Oregon, the remainder, except for small quantities of Carolina and mountain hemlock, being eastern hemlock The cut of western hemlock in the State of Washington was 51% of all the hemlock lumber produced in the United States.

Two Japanese species are cultivated as ornamental trees, namely, Siebold's hemlock (*T. Sieboldii*), which sometimes grows 100 ft. high, with glossy branches and long-stalked cones, and the Japanese hemlock (*T. diversifolia*), sometimes attaining a height of 80 ft., with downy branchlets and short-stalked cones. (*See* GYMNOSPERMS.)

Various poisonous plants of the parsley family (*Umbelliferae*) are also called hemlock, as the poison hemlock and the water hemlock (*qq.v.*). The fool's-parsley (*Aethusa Cynapium*) is known as lesser or small hemlock. Because of the resemblance of its foliage to that of the eastern hemlock the American yew (*Taxus Canadensis*) is frequently called ground hemlock. (*See* UMBELLIFERAE.)

HEMP, an annual herb (*Cannabis sativa*) having angular rough stems and deeply lobed leaves. The bast fibres of *Cannabis* are the hemp of commerce, but the products from many totally different plants are often included under the general name of hemp. In some cases the fibre is obtained from the stem, while in others it comes from the leaf. Sunn, Manila and Sisal hemps and Phormium (New Zealand flax, which is neither flax nor hemp) are treated

separately. All these are often classed as hemp, and so are the following:—Ambari or Deccan hemp, *Hibiscus cannabinus*, an Indian and East Indian malvaceous plant, the fibre from which is often known as brown or Bombay hemp; Piteira or Mauritius hemp, which is obtained from Aloe creole, *Furcraea foetida willemetiana*, native in Brazil and cultivated in Mauritius; *Agave americana*; and Moorva or bowstring hemp, which is obtained from an aloe-like plant, *Sansevieria zeylanica*, and is a native of India and Ceylon.

Characteristics.—The hemp plant, like the hop, which is of the same family, Moraceae, is dioecious, *i.e.*, the male and female flowers are borne on separate plants. The loose panicles of small yellow male flowers and the short spikes of green female flowers are borne in the axils of leaves at the top, or in clusters along the branches. The female flowers open only enough for the small feathery stigmas to protrude. Both male and female plants look alike until the time of flowering, after which the leaves on the male plants turn yellow and these plants die, while the female plants remain dark green about a month longer, or until the seeds ripen

The plants have straight, erect, undivided stalks 3 to 18 feet high, generally about 5 to 8 feet when grown broadcast for fibre production If not crowded or if planted in checks, as hemp is often cultivated for seed production, ascending leafy branches develop from nearly every node, but when sown broadcast for fibre production the crowded slender stalks are without branches or leaves except small tufts at the top.

Wild hemp still grows on the lower Ural, and the Volga, near the Caspian sea. It extends to Persia, the Altai range and northern and western China. "It is found in Kashmir and in the Himālaya, growing 10 to 12 ft. high, and thriving vigorously at an elevation of 6,000 to 10,000 ft." (*Pharmacographia.*) Wild hemp is little used for fibre but it produces a drug.

Origin and Distribution.—Hemp originated in some part of temperate Asia. The Emperor Shen Nung, in the twenty-eighth century B.C., taught the people of China to cultivate "ma," a plant, male and female, for fibre. According to Herodotus the Thracians and Scythians beyond the Caspian Sea used hemp; but it seems to have been unknown in western Europe until the beginning of the Christian era. Hemp was grown in France in the middle ages, primarily for the seeds which were used for food.

Hemp is now cultivated for fibre production in Russia, Italy, Jugoslavia, Rumania, Hungary, Poland, Spain, Belgium, France, Turkey, China, Japan, the United States and Chile. Other forms are cultivated for the narcotic drug cannabin, known in different forms and in different countries as hasheesh, bhang, gunga, charras, kif and marijuana, in India, Arabia, Africa and Mexico. In China, Manchuria and in some parts of Russia short stalked varieties of hemp are now cultivated for seed, which produces oil similar to linseed oil.

Although different forms have been described under different botanical names there are no essential differences in any of the specific characters and all cultivated and wild hemp is now recognized as belonging to one species, *Cannabis sativa L.*

Cultivation.—Hemp is an annual crop. The seed is sown as early in the spring as the land can be well prepared. The seed weighs 44 pounds per bushel and it is sown at the rate of 33 to 66 pounds per acre, the higher rate being sown on more fertile soils. The seed is sown broadcast by hand, or better with a drill, and the field is usually rolled after the seed is covered In some places in Europe the fields are weeded by hand after the hemp is up, but if the land is well prepared and the seed sown early the dense growth of hemp will usually kill out all weeds that may start later. The crop is harvested when the staminate plants are in flower, about four months after seeding. In Europe and in China and Japan, it is usually cut by hand with a straight bladed sickle. In many fields the largest female plants are left to produce seed. After cutting, the stalks,—3 to 8 ft. long and about the thickness of a pencil,—are laid flat on the ground for 2 or 3 days, then set up in shocks for about a week. In the United States the crop is cut with self-rake reaping machines, or more often with large hemp harvesters which cut a swath 7½ ft wide and lay the stalks smoothly and evenly on the ground where they remain until retted, requiring 3 to 6 weeks. The retted stalks are then picked up by another large machine which binds them in bundles. The bundles are set up in shocks to dry, after which they are hauled to the scutching mills and stored in sheds to await scutching. Hemp seed for sowing is there produced on plants grown in checks and cultivated like maize. This produces better seeds than are available from crowded plants grown broadcast for fibre production.

Preparation of Fibre.—In Italy and to some extent in other European countries, the hemp stalks, after curing in the shock, are tied in bundles and retted in water. They are left in the water from 10 to 20 days, or until the bark, including the fibre, separates easily from the woody, inner portion of the stalk Some of the hemp in Italy, and much of it in other countries, is dew retted by spreading it on the ground where it is exposed to dew and rain. This method of retting requires 15 to 30 days, but it is the least expensive, for there is usually no cost except the work of spreading the stalks and picking them up. The hemp stalks, either dew-retted, or water-retted are set up in loose open shocks to dry. The fibre is separated from the dry stalks by means of hand brakes, or in northern Italy by power driven machines In these machines handfuls of retted stalks pass endwise between rapidly revolving, fluted rollers, which break the woody portion into small pieces called hurds The fibre is then held by hand so that the loosened hurds are beaten away by smooth projections on revolving cylinders. The Italian hemp is very carefully graded before being baled for shipment. In China and Japan some of the hemp fibre is prepared by steaming the stalks and stripping off the fibre by hand

In the United States the work of scutching is done in winter, inside of buildings where it is independent of weather conditions. The retted stalks that have been stored in stacks or sheds, pass through long driers, then endwise through several pairs of fluted rollers, after which the fibre is turned sidewise and grasped near the centre by belts that take it past three pairs of scutching drums. The tow beaten out in scutching the long fibre and also that produced from short or tangled stalks, is cleaned by a tow machine. The hurds, used as fuel, furnish steam for the drier and for operating all of the machinery of the scutching mill.

Hemp Fibre.—Hemp is a soft fibre or bast fibre. It consists of very narrow flat strands from 3 to 10 ft long The ultimate cells composing these strands are ¼ to 1½ in. long. Dew retted hemp is gray; Italian water-retted, light yellow or golden yellow; and Russian water-retted, usually greenish. Hemp is the strongest and most durable of any of the commercial soft fibres except flax. It is more nearly like flax than any other fibre, and the finest hemp is often used as a substitute for the coarser grades of flax For more than 20 centuries hemp was the principal fibre used in ropes, but abacá (Manila hemp), stronger and lighter, has taken its place in marine cordage and in most other ropes, while jute, cheaper and more easily spun, but weaker and much less durable, has taken its place in sacking cloth, twines and for many purposes where hemp with its greater strength and durability would give better service.

Hemp is used in the manufacture of strong tying twines, sacking twine, book binders' twine, shoe and harness thread, net twine, carpet warp, marlines, canvas, sails, and in Europe it is used extensively in ropes of superior quality. Hemp tow is used in tarred oakum and in packing for pumps and engines

Hemp as a Drug.—Hemp as a drug or intoxicant for smoking and chewing occurs in the three forms of bhang, ganja and charras. The medicinal and intoxicating properties of hemp have probably been known in oriental countries from a very early period. A Chinese herbal of about the 5th century B.C. and earlier, in part notices the seed and flower-bearing kinds of hemp. Other early writers refer to hemp as a remedy. The medicinal and dietetic use of hemp spread through India, Persia and Arabia in the early middle ages. Its modern medicinal use is chiefly due to trials by Dr O'Shaughnessy in Calcutta (1838–1842). The plant is grown partly and often mainly for the sake of its resin in Persia, northern India and Arabia, in many parts of Africa and

in Brazil.

Pharmacology and Therapeutics.—The composition of this drug is still extremely obscure; partly, perhaps, because it varies so much in individual specimens. It appears to contain at least two alkaloids—cannabinine and tetano-cannabine—of which the former is volatile. The chief active principle may possibly be neither of these, but the substance cannabinon. There are also resins, a volatile oil and several other constituents. *Cannabis indica*—as the drug is termed in the pharmacopoeias—may be given as an extract (dose ¼–1 gr.) or tincture (dose 5–15 minims).

The drug has no external action. The apparent impossibility of obtaining it in pure and trustworthy form has led to its entire abandonment in therapeutics When a good sample is obtained it is a safe and efficient hypnotic, at any rate in the case of a European. The tincture should not be prescribed unless precautions are taken to avoid the precipitation of the resin which follows its dilution with water.

See Watt, *Dictionary of the Economic Products of India.*

HEMPSTEAD, a village of Nassau county, New York, U.S.A., 5 m. E of the Brooklyn city limits; served by the Long Island railroad. The population in 1925 was 9,952. It is a residential suburb and a summer resort, a trade centre, and has aeroplane and other factories. Mitchel Field, an Air Corps training camp, is near by. The village was incorporated in 1853.

HEMSTERHUIS, FRANÇOIS (1721–1790), Dutch writer on aesthetics and moral philosophy, was born at Franeker, on Dec. 27, 1721. Educated at the university of Leyden, he was for many years secretary to the state council of the United Provinces. He died at The Hague on July 7, 1790. Through his philosophical writings he met many distinguished persons—Goethe, Herder, Princess Amalia of Gallitzin, and especially Jacobi, who, like himself, was an idealist. His philosophy, strongly platonic, was founded on the desire for self-knowledge and truth.

His chief works are: *Lettre sur la sculpture* (1769), in which occurs the well-known definition of the Beautiful as "that which gives us the greatest number of ideas in the shortest space of time"; its continuation, *Lettre sur les désirs* (1770); *Lettre sur l'homme et ses rapports* (1772); *Sopyle* (1778), an attack on materialism; *Aristée* (1779), the "theodicy" of Hemsterhuis; *Simon* (1787), discussing the will, the imagination, the moral principle (both passive and active); *Alexis* (1787); *Lettre sur l'athéisme* (1787). The last collected edition of his works appeared at Leipzig 1912, 2 vols.

See C. Boulan, *F. Hemsterhuis le Socrate Hollandais* (1924); J. E. Poritzky, *Franz Hemsterhuis* (1926).

HEMSTERHUIS, TIBERIUS (1685–1766), Dutch philologist and critic, was born on Jan. 9, 1685, at Groningen in Holland, and died at Leyden on April 7, 1766. He was professor of Greek at Franeker from 1717 to 1740, and then at Leyden, and was also a mathematician and philosopher. In 1706 he completed Lederlin's edition of Pollux's *Onomasticon.* This was widely admired, but he was much mortified by the criticism of Bentley. Hemsterhuis was the founder of a laborious and useful Dutch school of criticism, which had famous disciples in Valckenaer, Lennep and Ruhnken.

See *Elogium T. Hemsterhusii* (with Bentley's letters) by Ruhnken (1789), and *Supplementa annotationis ad elogium T. Hemsterhusii,* etc. (Leyden, 1874); also J. E. Sandys' *Hist. Class. Scholarship,* ii. (1908).

HEMY, CHARLES NAPIER (1841–1917), British painter, born at Newcastle-on-Tyne, was trained in the Newcastle school of art, in the Antwerp academy and in the studio of Baron Leys. He is best known by his admirable marine paintings. He was elected an A.R.A. in 1898, associate of the Royal Society of Painters in Water Colours in 1890 and member in 1897. Two of his paintings, "Pilchards" (1897) and "London River" (1904), are in the National Galley of British Art. He died at Falmouth on Sept. 30, 1917.

HEN, the female of any bird, especially of the common fowl. (*See* POULTRY AND POULTRY FARMING, FOWL.)

HÉNAULT, CHARLES JEAN FRANÇOIS (1685–1770), French historian, was born in Paris. He became councillor of the *parlement* of Paris (1705), president of the court of *enquêtes* (1710) and superintendent of the household of Queen Marie Leszczynska (1753). On his recovery in his 80th year from a dangerous malady (1765) he professed to have undergone religious conversion and retired into private life, but his religion did not prevent him from continuing his friendship with Voltaire. Hénault wrote the *Abrégé chronologique de l'histoire de France,* first published anonymously in 1744, which had a prodigious success, and was translated into several languages, even into Chinese. He died at Paris on Nov. 24, 1770.

See Sainte-Beuve, *Causeries du lundi,* vol. xi.; and H. Lion, *Le Président Hénault* (1903).

HENBANE, the common name of the plant *Hyoscyamus niger,* a member of the family Solanaceae, indigenous to Britain, found wild in waste places, on rubbish about villages and old castles, and cultivated for medicinal use in various counties in the south and east of England. It occurs also in central and southern Europe and in Western Asia extending to India and Siberia, and has long been naturalized in the United States. There are two forms of the plant, an annual and a biennial, which spring indifferently from the same crop of seed—the one growing on during the summer to a height of from 1 to 2 ft., and flowering and perfecting seed; the other producing the first season only a tuft of radical leaves, which disappear in winter, leaving underground a thick fleshy root, from the crown of which arises in spring a branched flowering stem, usually much taller and more vigorous than the flowering stems of the annual plants.

The biennial form is that which is considered officinal. The radical leaves of this biennial plant spread out flat on all sides from the crown of the root; they are ovate-oblong, acute, stalked, and more or less incisely-toothed, of a greyish-green colour, and covered with viscid hairs; these leaves perish at the approach of winter. The flowering stem pushes up from the root-crown in spring, ultimately reaching from 3 to 4 ft. in height, and as it grows becoming branched, and furnished with alternate sessile leaves, which are stem-clasping, oblong, unequally-lobed, clothed with glandular clammy hairs, and of a dull grey-green, the whole plant having a powerful nauseous odour. The flowers are short-stalked, the lower ones growing in the fork of the branches, the upper ones sessile in one-sided leafy spikes which are rolled back at the top before flowering, the leaves becoming smaller upwards and taking the place of bracts. The flowers have an urn-shaped calyx which persists around the fruit and is strongly veined, with five stiff, broad, almost prickly lobes; these, when the soft matter is removed by maceration, form very elegant specimens when associated with leaves prepared in a similar way. The corollas are obliquely funnel-shaped, of a dirty yellow or buff, marked with a close reticulation of purple veins. The capsule opens transversely by a convex lid and contains numerous seeds.

Both the leaves and the seeds are employed in pharmacy. The Mohammedan doctors of India are accustomed to prescribe the seeds. Henbane yields a poisonous alkaloid, *hyoscyamine,* which is stated to have properties almost identical with those of atropine, from which it differs in being more soluble in water. It is usually obtained in an amorphous, scarcely ever in a crystalline, state. In small and repeated doses henbane has been found to have a tranquillizing effect upon persons affected by severe nervous irritability. In poisonous doses it causes loss of speech and paralysis. In the form of extract or tincture it is a valuable remedy in the hands of a medical man, either as an anodyne, a hypnotic or a sedative. The smoking of the seeds and capsules of henbane is noted in books as a somewhat dangerous remedy adopted by country people for toothache. Accidental poisoning from henbane occasionally occurs, owing sometimes to the apparent edibility and wholesomeness of the root.

HENCHMAN, one who attended on a horse, a groom, and hence, like groom (*q.v.*), a title of a subordinate official in royal or noble households. The first part of the word is the O.E. *hengest,* a horse. The word appears in the name, Hengest, of the Saxon chieftain (*see* HENGEST AND HORSA). Henchmen, pages of honour or squires, rode or walked at the side of their master in processions, and appear in the English royal household from

the 14th century till Elizabeth abolished the royal henchmen, known also as the "children of honour."

HENDERSON, ALEXANDER (1583–1646), Scottish ecclesiastic, born at Criech, Fifeshire, graduated at the University of St. Andrews in 1603, and in 1610 was appointed professor of rhetoric and philosophy and questor of the faculty of arts. Shortly after this he was presented to the living of Leuchars. As Henderson was forced upon his parish by Archbishop George Gladstanes, and was known to sympathize with episcopacy, his settlement was at first extremely unpopular; but he subsequently became a Presbyterian in doctrine and church government, and one of the most esteemed ministers in Scotland. He was one of the petitioners against the "five Acts" and later against the introduction of a service-book and canons drawn up on the model of the English prayer-book. On March 1, 1638, the public signing of the "National Covenant" began in Greyfriars church, Edinburgh. Henderson was mainly responsible for the final form of this document. In July of the same year he proceeded to the north to debate on the "Covenant" with the Aberdeen doctors. He was moderator of the famous Assembly which met in Glasgow on Nov. 21, 1638. Henderson was then transferred to Edinburgh; he had been at Leuchars for about 23 years, and was extremely reluctant to leave it.

While Scotland and England were preparing for the "First Bishops' War," Henderson drew up two papers, entitled respectively *The Remonstrance of the Nobility* and *Instructions for Defensive Arms*. The first of these documents he published himself; the second was published against his wish by John Corbet (1603–41), a deposed minister. In the negotiations for peace at Birks after the war Henderson was one of the Scottish commissioners, and made a very favourable impression on the king. In 1640 Henderson was elected by the town council rector of Edinburgh university—an office to which he was annually re-elected till his death. The Pacification of Birks had been wrung from the king; and the Scots, seeing that he was preparing for the "Second Bishops' War," took the initiative, and pressed into England so vigorously that Charles had again to yield everything. The maturing of the treaty of peace took time, and Henderson again took part in the negotiations, first at Ripon (Oct. 1) and afterwards in London. In London he had a personal interview with the king, with the view of obtaining assistance for the Scottish universities from the money formerly applied to the support of the bishops. On Henderson's return to Edinburgh in July 1641 the Assembly was sitting at St. Andrews. To suit the convenience of the parliament, however, it removed to Edinburgh; Henderson was elected moderator of the Edinburgh meeting. In this Assembly he proposed that "a confession of faith, a catechism, a directory for all the parts of the public worship, and a platform of government, wherein possibly England and we might agree," should be drawn up. This was unanimously approved of, and the laborious undertaking was left in Henderson's hands; but the "notable motion" did not lead to any immediate results. During Charles's second State-visit to Scotland, in the autumn of 1641, Henderson acted as his chaplain, and managed to get the funds, formerly belonging to the bishopric of Edinburgh, applied to the metropolitan university. In 1642 Henderson, whose policy was to keep Scotland neutral in the war which had now broken out between the king and the parliament, corresponded with England on ecclesiastical topics; and, shortly afterwards, he was sent to Oxford to mediate between the king and his parliament; but his mission proved a failure.

At the meeting of the General Assembly held in Aug. 1643, Henderson was elected moderator for the third time. He presented a draft of the famous "Solemn League and Covenant," which was received with enthusiasm. Unlike the "National Covenant" of 1638, which applied to Scotland only, this document was common to the two kingdoms. Henderson, Baillie, Rutherford and others were sent up to London to represent Scotland in the Assembly at Westminster. The "Solemn League and Covenant" passed the two Houses of parliament and the Westminster Assembly, and thus became law for the two kingdoms. As Scottish commissioner to the Westminster Assembly, Henderson was in England from Aug. 1643 till Aug. 1646; his principal work was the drafting of the directory for public worship. Early in 1645 he was sent to Uxbridge to aid the commissioners of the two parliaments in negotiating with the king; but nothing came of the conference. In 1646 the king joined the Scottish army; and, after retiring with them to Newcastle, he sent for Henderson, and discussed with him the two systems of church government in a number of papers. Meanwhile Henderson was failing in health He sailed to Scotland, and eight days after his arrival died, on Aug 19, 1646. He was buried in Greyfriars churchyard, Edinburgh; and his death was the occasion of national mourning in Scotland. A document was published in London purporting to be a "Declaration of Mr. Alexander Henderson made upon his death-bed"; and, although this paper was disowned, denounced and shown to be false in the General Assembly of Aug. 1648, the document was used by Clarendon as giving the impression that Henderson had recanted. Its foundation was probably certain expressions lamenting Scottish interference in English affairs.

Henderson is one of the greatest men in the history of Scotland and, next to Knox, is certainly the most famous of Scottish ecclesiastics. He had great political genius; and his statesmanship was so influential that "he was," as Masson well observes, "a cabinet minister without office." He has made a deep mark on the history, not only of Scotland, but of England; and the existing Presbyterian churches in Scotland are largely indebted to him for the forms of their dogmas and their ecclesiastical organization. He is thus justly considered the second founder of the Reformed Church in Scotland.

See J. Aiton, *Life and Times of Alexander Henderson* (1836); T. McCrie, *Life of Alexander Henderson* (1836); J. P. Thomson, *Alexander Henderson, the Covenanter* (1912); R. L. Orr, *Alexander Henderson, Churchman and Statesman* 1919); also *The Letters and Journals of Robert Baillie* (1841–42), an exceedingly valuable work from an historical point of view; J. H. Burton, *History of Scotland* (2nd ed., 8 vols., 1873); D. Masson, *Drummond of Hawthornden* (1873) and *Life of Milton* (7 vols., 1859–94); Andrew Lang, *History of Scotland*, (vol. iii., 1907). Henderson's own works are chiefly contributions to current controversies, speeches and sermons.

HENDERSON, ARTHUR (1863–), British politician, was born in Glasgow of working-class parents on Sept. 15, 1863; but his work and interests subsequently lay at Newcastle (where he served an apprenticeship as moulder at Robert Stephenson & Co.'s works), and in the county of Durham. He became prominent in the trade union movement. He was for some years a member of the Newcastle city council and the Darlington borough council. He was mayor in 1903; and was made a magistrate for the county of Durham. He entered parliament for Barnard Castle, as a Labour member, at a by-election in 1903, and soon made his mark. In 1908 he was elected chairman of the party, a post which he held for two years and to which he was re-elected after the outbreak of war in 1914, when the then chairman, Ramsay MacDonald, had to resign owing to his pacifist views. As chairman, at the opening of the new session in that autumn, Henderson promised the full support of organized Labour in maintaining the "splendid unity" of the nation.

When the first Coalition Ministry was formed by H. H. Asquith in 1915, Henderson was included in the cabinet mainly as adviser of the Government on labour questions arising out of the World War, with the office, first of president of the board of education, and afterwards of paymaster general. He showed himself resolved on a strenuous prosecution of the war, strongly advocating both the Munitions Bill and the Registration Bill, and having no hesitation in taking the further step of compulsory service. He followed up this action by urging the Labour Party to rally in Dec. 1916 to Lloyd George, and by accepting himself the position of an original member of the war cabinet of four without portfolio. In the spring of 1917 he visited Russia, just after the Revolution, on behalf of the British Government, and found the then provisional Government at St. Petersburg (Leningrad) strongly in favour of an international labour and socialist conference, which was to meet at Stockholm under the auspices of the International Socialist Bureau. He came to the conclusion that, provided the conference were merely consultative, it would be better that British representatives should go, rather than permit Russian rep-

resentatives to meet German representatives there alone; and accordingly, on his return to England, being still secretary of the Labour Party as well as a member of the war cabinet, he promoted the participation of British Labour therein. Two Labour Party conferences endorsed his attitude, but the Sailors and Firemen's Union refused to carry the delegates; and most other Labour Parties in allied countries did not follow his lead Mr. Lloyd George and his fellow cabinet ministers indicated publicly their dissent from his policy, in terms which immediately led to his resignation.

Henderson espoused the Labour decision of the latter part of 1918 to take the Labour men out of the government and to appeal for support on a purely Labour platform. This cost him his seat in Parliament at the general election of Dec 1918. Indeed, ill-luck pursued him also at the next two general elections, in 1922 and 1923; but in all three cases he returned to the House of Commons a few months later at a by-election. In the parliament of 1923–4 he had the satisfaction of having two sons as fellow members, though they were both defeated in the autumn of 1924 In MacDonald's ministry he was secretary of state for home affairs. He actively endorsed the policy of his party in 1925–6 in severing themselves definitely from the Communists.

HENDERSON, EBENEZER (1784–1858), a Scottish divine, was born at the Linn near Dunfermline on Nov. 17, 1784, and died at Mortlake on May 17, 1858. He spent his life in missionary work in northern and eastern Europe, becoming in 1806 pastor at Elsinore. From this time till about 1817 he was engaged in encouraging the distribution of Bibles in northern Europe, as an agent of the British and Foreign Bible society

On Oct 6, 1811 he formed the first Congregational church in Sweden In 1818, after a visit to England, Henderson travelled in company with Paterson through Russia as far south as Tiflis. In 1822 he was invited by Prince Alexander (Galitzin) to assist the Russian Bible society in translating the Scriptures into various languages spoken in the Russian empire In 1825 Henderson was appointed tutor of the Mission college, Gosport, and thereafter worked in his own country

See T. S Henderson, *Memoirs of Ebenezer Henderson* (1859); *Congregational Year Book* (1859).

HENDERSON, GEORGE FRANCIS ROBERT (1854–1903), British soldier and military writer, was born in Jersey in 1854. He entered the army in 1878, and served in the Egyptian campaign of 1882. In garrison at Gibraltar, in Bermuda and in Nova Scotia, he studied military art and history in spite of the difficulties of research, and in 1889 appeared (anonymously) his first work, *The Campaign of Fredericksburg*. In the same year he became instructor in tactics, military law and administration at Sandhurst. From this post he proceeded as professor of military art and history to the staff college (1892–99), and there exercised a profound influence on the younger generation of officers. His study on *Spicheren* had been begun some years before, and in 1898 appeared, as the result of eight years' work, his masterpiece, *Stonewall Jackson and the American Civil War*. In the South African War Lieutenant-Colonel Henderson served on the staff of Lord Roberts as director of intelligence. He was to have written the official history of the war, but failing health obliged him to go to Egypt, where he died at Aswan on March 5, 1903.

Various lectures and papers by Henderson were collected and published in 1905 by Captain Malcolm, D.S.O., under the title *The Science of War;* to this collection a memoir was contributed by Lord Roberts *See* also Journal of the Royal United Service Institution, vol xlvii. No. 302.

HENDERSON, JOHN (1747–1785), English actor, of Scottish descent, was born in London. He made his first appearance on the stage at Bath on Oct. 6, 1772 as Hamlet His success in this and other Shakespearian parts led to his being called the "Bath Roscius." He appeared at the Haymarket, London, in 1777 as Shylock. Sheridan then engaged him to play at Drury Lane, where he remained for two years. When the companies joined forces he went to Covent Garden, appearing as Richard III. in 1778, and creating original parts in many of the plays of Cumberland, Shirley, Jephson and others. His last appearance was in 1785 as Horatius in *The Roman Father*, and he died on Nov. 25 of that year and was buried in Westminster abbey. Henderson was a close friend of Gainsborough, who painted his portrait, as did also Stewart and Romney.

HENDERSON, WILLIAM JAMES (1855–), American music critic and author, was born at Newark (N.J.), on Dec. 4, 1855. Graduating at Princeton (1876), he was on the New York *Times* (1883–1902) and the New York *Sun* (from 1902 onward) as music critic, and was associate editor of the *Standard Dictionary*, 1892–93. With Richard Aldrich, James Huneker and Henry E. Krehbiel, he established himself as one of the foremost American critics of his day and on his 70th birthday he was hailed as the *doyen* of New York music writers. He adapted a number of operetta librettos, including *Le Petit Duc*, produced at the Casino theatre, and the libretto for Walter Damrosch's *Cyrano de Bergerac;* he wrote *The Little Duke* in collaboration with H. C. Bunner; also a number of books on music and the sea.

HENDERSON, a city of north-western Kentucky, U.S.A., on the Ohio river, 12m. below Evansville, Ind ; the county seat of Henderson county It is on Federal highways 41 and 60, and is served by the Illinois Central, the Louisville and Nashville, and the Louisville, Henderson and St. Louis railways The population was 12,169 in 1920 (24% negroes) and was estimated locally at 14,500 in 1928 The city is built on the high bank of the river, well above flood level. Coal is mined in the region and there are three mines within the city limits. The county produces especially hogs, corn and fruit. The city has many tobacco-stemming plants, a large cotton mill, and various other manufacturing industries. The factory output in 1925 was valued at $4,811,182. Henderson (originally called Red Banks) was settled in 1784, named after Richard Henderson (1734–85), laid out by his company in 1797, incorporated as a town in 1810, and chartered as a city in 1854.

HENDERSON, a city of North Carolina, U.S.A., 44m. N. by E. of Raleigh; the county seat of Vance county. It is on Federal highway 1, and is served by the Seaboard Air Line and the Southern railways. The population was 5,222 in 1920 (39% negroes). It has large cotton mills (100,000 spindles in 1928), and is an important market for cotton and leaf tobacco.

HENDIADYS, a rhetorical figure in which two words connected by a conjunction are used of a single idea; usually the figure takes the form of two substantives instead of a substantive and adjective, as in the classical example *pateris libamus et auro* (Virgil, *Georgics*, ii. 192), "we pour libations in cups and gold" for "cups of gold."

HENDON, an urban district of Middlesex, England, on the river Brent, 8 m. N.W. of St. Paul's cathedral, London. Pop. (1921) 56,013 The church of St. Mary is mainly Perpendicular, and contains a Norman font. To the north of the village, now a residential suburb of the metropolis, is Mill Hill, with a Roman Catholic Missionary college, opened in 1871, and a public school founded by Nonconformists in 1807. The manor belonged at an early date to the abbot of Westminster.

HENDRICKS, THOMAS ANDREWS (1819–1885), American political leader, vice-president of the United States in 1885, was born near Zanesville, O., on Sept. 7, 1819. He graduated at Hanover college, Hanover, Ind., in 1841, and began in 1843 a successful career at the bar. Identifying himself with the democratic party, he served in the State house of representatives in 1848, and was a prominent member of the convention for the revision of the State constitution in 1850–51, a representative in Congress (1851–55), commissioner of the U.S. General Land Office (1855–59), a U.S. senator (1863–69), and governor of Indiana (1873–77). From 1868 until his death he was put forward for nomination for the presidency at every national democratic convention save in 1872. Both in 1876 and 1884, after his failure to receive the nomination for the presidency, he was nominated by the democratic convention for vice-president. In 1876, with S. J. Tilden, he lost the disputed election by the decision of the electoral commission, but he was elected with Grover Cleveland in 1884. He died at Indianapolis on Nov. 25, 1885.

HENGELO or HENGELOO, a town in the province of Overyssel, Holland, and a junction station 5 m. by rail N.W. of Enschede.

Pop. (1926) 30,036. The town is the centre of the flourishing industries of the Twente district. The manufacture of cotton in all its branches is carried on, and there are dye-works and breweries, besides the engineering works of the state railway company.

HENGEST and **HORSA,** the brother chieftains who led the first Saxon bands which settled in England. They were apparently called in by the British king Vortigern (*q.v.*) to defend him against the Picts. Their landing place is said to have been Ebbsfleet in Kent. Its date is not certainly known, 450–455 being given by the English authorities, 428 by the Welsh (*see* KENT). The settlers of Kent are described by Bede as Jutes (*q.v.*), and there are traces in Kentish custom of differences from the other Anglo-Saxon kingdoms. Hengest and Horsa were given the island of Thanet as a home, but soon quarrelled with their British allies, and gradually acquired what became the kingdom of Kent. In 455 the Saxon Chronicle records a battle between Hengest and Horsa and Vortigern at a place called Aegaels threp, in which Horsa was slain. Thenceforward Hengest reigned in Kent, together with his son Aesc (Oisc). Both the *Saxon Chronicle* and the *Historia Brittonum* record three subsequent battles, though they disagree as to their issue. There is no doubt, however, that the net result was the expulsion of the Britons from Kent. According to the *Chronicle*, probably based on a lost list of Kentish kings, Hengest died in 488, while his son Aesc continued to reign until 512.

Bede, *Hist. Eccl.* (Plummer, 1896), i 15, ii. 5; *Saxon Chronicle* (Earle and Plummer, 1899), s.a. 449, 455, 457, 465, 473; Nennius, *Historia Brittonum* (San Marte, 1844), §§ 31, 37, 38, 43–46, 58.

HENGSTENBERG, ERNST WILHELM (1802–1869), German Lutheran divine and theologian, was born at Frondenberg, Westphalia, on Oct. 20, 1802. He studied at the universities of Bonn and Berlin, and in 1826 became professor extraordinarius and in 1828 professor of theology at Berlin. In July 1827 he started the *Evangelische Kirchenzeitung*, a strictly orthodox journal. In 1830 an anonymous article (by E. L. von Gerlach) appeared in this journal which charged Wilhelm Gesenius and J. A. L. Wegscheider with infidelity and profanity, and advocated the interposition of the civil power, thus giving rise to the *Hallische Streit*. He died on May 28, 1869.

His principal work is *Christologie des Alten Testaments* (1829–35; 2nd ed., 1854–57; Eng. trans. by R. Keith, 1835–39, also in Clark's "Foreign Theological Library," by T. Meyer and J. Martin, 1854–58). Of his other works, the chief are: *Beiträge zur Einleitung in das Alte Testament* (1831–39, Eng. trans. 1848), *Commentar über die Psalmen* (1842–47; Eng. trans. 1844–48); *Die Offenbarung Johannis erläutert* (1849–51; Eng. trans., 1851–52) and *Das Evangelium Johannis erläutert* (1861–63).

See J. Bachmann's *Ernst Wilhelm Hengstenberg* (3 vols., 1876–92); also his article in Herzog-Hauck, *Realencyklopadie* (1899); and F. Lichtenberger, *Hist. of German Theology in the Nineteenth Century* (1889).

HENKE, HEINRICH PHILIPP KONRAD (1752–1809), German theologian, was born at Hehlen, Brunswick, on July 3, 1752. He studied at Helmstädt, and from 1778 to 1809 he was professor, first of philosophy, then of theology, in that university. He died on May 2, 1809. Henke belonged to the rationalistic school. His principal work (*Allgemeine Geschichte der christl. Kirche*, 6 vols., 1788–1804; 2nd ed., 1795–1806) is commended by F. C. Baur for fullness, accuracy and artistic composition.

HENLE, FRIEDRICH GUSTAV JAKOB (1809–1885), German pathologist and anatomist, was born on July 9, 1809, at Fürth, in Franconia. After studying medicine at Heidelberg and at Bonn, where he took his doctor's degree in 1832, he became prosector in anatomy to Johannes Müller at Berlin. During the six years he spent in that position he published three anatomical monographs on new species of animals and papers on the structure of the lacteal system, the distribution of epithelium in the human body, the structure and development of the hair, the formation of mucus and pus, etc. In 1840 he became professor of anatomy at Zürich, and in 1844 he was called to Heidelberg, where he taught not only anatomy, but physiology and pathology. About this period he was engaged on his complete system of general anatomy, which formed the sixth volume of the new edition of S. T. von Sömmerring's treatise, published at Leipzig between 1841 and 1844. While at Heidelberg he published a zoological monograph on the sharks and rays, in conjunction with his master, Müller, and in 1840 his famous *Manual of Rational Pathology* began to appear. This book marked the beginning of a new era in pathological study, since in it physiology and pathology were treated, in Henle's own words, as "branches of one science," and the facts of disease were systematically considered with reference to their physiological relations. In 1852 he moved to Gottingen, whence he issued three years later the first instalment of his great *Handbook of Systematic Human Anatomy*, the last volume of which was not published till 1873. During the latter half of his life Henle's researches were mainly histological in character, his investigations embracing the minute anatomy of the blood vessels, serous membranes, kidney, eye, nails, central nervous system, etc. He died at Gottingen on May 13, 1885.

HENLEY, JOHN (1692–1759), English clergyman, commonly known as "Orator Henley," was born on Aug. 3, 1692, at Melton Mowbray, where his father was vicar. He graduated from St. John's College, Oxford, and, after holding various cures, was presented in 1723 to the rectory of Chelmondiston, Suffolk; but residence being insisted on, he resigned, and on July 3, 1726, opened what he called an "oratory" in Newport Market, London, which he licensed under the Toleration Act. In 1729 he transferred the scene of his operations to Lincoln's Inn Fields. Into his services he introduced many peculiar alterations: he drew up a "Primitive Liturgy," in which he substituted for the Nicene and Athanasian creeds two creeds taken from the Apostolical Constitutions; for his "Primitive Eucharist" he made use of unleavened bread and mixed wine; he distributed at the price of one shilling medals of admission to his oratory, with the device of a sun rising to the meridian, with the motto *Ad summa*, and the words *Inveniam viam aut faciam* below. But the most original element in the services was Henley himself, who is described by Pope in the *Dunciad* as

"Preacher at once and zany of his age."

His services were much frequented by the "free-thinkers," and he himself expressed his determination "to die a rational." For some time he edited the *Hyp Doctor*, a weekly paper established in opposition to the *Craftsman*. He died on Oct. 13, 1759.

Henley is the subject of several of Hogarth's prints. His life, professedly written by A. Welstede, but in all probability by himself, was inserted by him in his *Oratory Transactions* (1728). *See* J. Nichols, *History of Leicestershire* 4 vols. (1795–1815); I. Disraeli, *Calamities of Authors*, 2 vols. (1812, new ed. by the Earl of Beaconsfield, 1881).

HENLEY, WILLIAM ERNEST (1849–1903), British poet, critic and editor, was born at Gloucester and educated at the Crypt grammar school where he had the good fortune to have T. E. Brown (*q.v.*) as headmaster for a time. Henley contracted tuberculosis as a child, and one foot had to be amputated. He was placed in Edinburgh infirmary in 1874, to be under Lister's care, and from his bed there he sent to the *Cornhill Magazine* poems in irregular rhythms, describing with poignant force his experiences in hospital. Leslie Stephen, then editor, being in Edinburgh, took Robert Louis Stevenson, another recruit of the *Cornhill*, to see him in hospital. This meeting was the beginning of a famous friendship. In 1877 Henley went to London and began a long and distinguished journalistic career. He edited *London* (1877–82), the *Magazine of Art* (1882–86), and in 1888 became literary editor and in 1889 editor of the *Scots Observer*, transferred to London as the *National Observer*. In this paper appeared Kipling's *Barrack Room Ballads*. In 1880 appeared Henley's own *Book of Verse*, which included the verses written in hospital at Edinburgh, and in 1890 *Views and Reviews*. The criticisms, covering a wide range of authors (except Heine and Tolstoy, all English and French), though wilful and often one-sided were terse, trenchant and picturesque. There followed *The Song of the Sword* (1892), another volume of verse renamed in 1893 *London Voluntaries;* three plays in 1892 written with Stevenson—*Beau Austin, Deacon Brodie* and *Admiral Guinea;* and *Macaire* (1895). In 1898 Henley published a collection of his *Poems* and in 1901 a second volume of collected

poetry with the title *Hawthorn and Lavender*. He projected the excellent series of "Tudor Translations" and was engaged on the preface to the Authorized Version of the Bible in that edition when he died. He also prepared, with T. F. Henderson, the centenary edition of the poems of Robert Burns, contributing an essay on the poet to the last volume. He died on July 11, 1903. A portrait-bust of him by Rodin was presented by his widow to the National Portrait Gallery in 1913 His fame rests on his poetry. He excelled alike in his delicate experiments in complicated metres, and the strong impressionism of *Hospital Sketches* and *London Voluntaries*. The influence of Heine may be discerned in these "unrhymed rhythms"; but he was perhaps a truer and more successful disciple of Heine in his snatches of passionate song, the best of which should retain their place in English literature.

See also references in *Stevenson's Letters; Cornhill Magazine* (1903) (Sidney Low); *Fortnightly Review* (Aug 1892) (Arthur Symons); and for bibliography, *English Illustrated Magazine,* vol. xxix. p. 548.

HENLEY-ON-THAMES, a market town and municipal borough of Oxfordshire, England, on the left bank of the Thames, the terminus of a branch of the Great Western railway, by which it is 35¾ m W of London, while it is 57½ m. by river. Pop. (1921) 6,836. It is situated at the foot of the Chiltern hills. The river is crossed by a stone bridge of five arches, constructed in 1786. The parish church (Decorated and Perpendicular) possesses a tower of intermingled flint and stone, attributed to Cardinal Wolsey, but more probably erected by Bishop Longland. The grammar school, founded in 1605, is incorporated with a Blue Coat school. Henley is celebrated for the annual Henley Royal Regatta, the principal gathering of amateur oarsmen in England, first held in 1839 and usually taking place in July

Henley-on-Thames (Hanlegang, Henle, Handley) was a manor of the crown and was granted (1337) to John de Molyns, whose family held it for about 250 years. It is said that members for Henley sat in parliaments of Edward I. and Edward III., but no writs have been found. The town was incorporated in 1570–71. Henley suffered from both parties in the Civil War. William III. on his march to London (1688) rested here and received a deputation from the Lords. The period of prosperity in the 17th and 18th centuries was due to manufactures of glass and malt, and to trade in corn and wool. It is now a centre for market-gardening The existing Thursday market was granted by a charter of John and the existing Corpus Christi fair by a charter of Henry VI.

HENNA, the Persian name for a small shrub found in India, Persia, the Levant and along the African coasts of the Mediterranean, where it is frequently cultivated. It is the *Lawsonia inermis* of botanists, so called because young trees are spineless, while older ones have the branchlets hardened into spines. It forms a slender shrubby plant of from 8 ft. to 10 ft. high, with opposite lance-shaped smooth leaves, which are entire at the margins, and bears small white four-petalled sweet-scented flowers disposed in panicles. Its Egyptian name is *Khenna*, its Arabic name *Al Khanna*, its Indian name *Mendee*, while in England it is called *Egyptian privet*, and in the West Indies, where it is naturalized, *Jamaica mignonette*.

Henna or Henné is of ancient repute as a cosmetic. This consists of the leaves of the *Lawsonia* powdered and made up into a paste; this is employed by the Egyptian women, and also by the Mohammedan women in India, to dye their finger-nails and other parts of their hands and feet an orange-red colour, which is considered to add to their beauty. The colour lasts for three or four weeks, when it requires to be renewed. It is moreover used for dyeing the hair and beard, and even the manes of horses; and the same material is employed for dyeing skins and morocco-leather a reddish-yellow, but it contains no tannin. The practice of dyeing the nails was common amongst the Egyptians, and not to conform to it would have been considered indecent. It has descended from very remote ages, as is proved by the evidence afforded by Egyptian mummies, the nails of which are most commonly stained a reddish hue. Henna is also said to have been held in repute amongst the Hebrews, being considered to be the plant referred to as camphire in the Bible (Song of Solomon i. 14, iv. 13). "The custom of dyeing the nails and palms of the hands and soles of the feet of an iron-rust colour with henna," observes Dr. J. Forbes Royle, "exists throughout the East from the Mediterranean to the Ganges, as well as in northern Africa. In some parts the practice is not confined to women and children, but is also followed by men, especially in Persia. In dyeing the beard the hair is turned to red by this application, which is then changed to black by a preparation of indigo. In dyeing the hair of children, and the tails and manes of horses and asses, the process is allowed to stop at the red colour which the henna produces." Mohammed, it is said, used henna as a dye for his beard, and the fashion was adopted by the caliphs.

The preparation of henna consists in reducing the leaves and young twigs to a fine powder, catechu or lucerne leaves in a pulverized state being sometimes mixed with them. When required for use, the powder is made into a pasty mass with hot water, and is then spread upon the part to be dyed, where it is generally allowed to remain for one night The distilled water from the flowers is used as a perfume.

HENNEBONT, a town of western France, in the department of Morbihan, 6 m. N E. of Lorient Pop. (1926) 6,243. Hennebont is famed for the resistance which it made, under the widow of Jean de Montfort, when besieged in 1342 by the armies of Philip of Valois and Charles of Blois during the War of the Succession in Brittany (*see* BRITTANY). It is near the mouth of the Blavet, which divides it into the Ville Close, the mediaeval military town, and the Ville Neuve on the left bank and the Vieille Ville on the right bank. The Villa Close, surrounded by ramparts and entered by a massive gateway flanked by machicolated towers, consists of narrow streets bordered by 16th and 17th century houses. The Ville Neuve, nearer the river, developed during the 17th century The Gothic church of Notre-Dame de Paradis (16th century) has a tower with ornamented stone spire. There are scanty remains of the old fortress. Hennebont has a small but busy river-port accessible for small vessels. Hennebont is a market town for grain, cheese and agricultural produce; it has an important foundry manufacturing tin plate. Other industries are tanning, distilling and the manufacture of earthenware Granite is worked in the neighbourhood

HENNEPIN, LOUIS (1640– ?), Belgian missionary and explorer, was born in Ath, Belgium, about 1640. While quite young he joined the Franciscan order. In 1675 he went to Canada in company with a Recollet mission, crossing in the same ship with La Salle and Bishop De Laval. From Quebec, Hennepin carried on his missionary work (in 1677 among the Iroquois). The next year (1678) he accompanied La Salle on his expedition to the West They reached the present site of Peoria (Jan. 1, 1680), when La Salle was compelled to return to Ft Frontenac for supplies; Hennepin and the remainder of the party were despatched to explore the upper Mississippi. They reached the falls of St. Anthony, where the modern Minneapolis stands, in July 1680, and were soon afterwards captured by Sioux Indians. Hennepin was rescued in June 1681 by Graysolon du Lhut (Duluth) and went to Quebec. In 1683 Hennepin was in France where he published a *Description de la Louisiane,* a full account of his exploits, but in 1697, La Salle having died, he brought out a revised copy of his earlier book, *Nouvelle Découverte,* in which he claimed to have explored the Mississippi to its mouth. This bold assumption was soon discredited and Hennepin's otherwise valuable contributions to the history of New France and American ethnology are looked upon with suspicion. He incurred the displeasure of his order by refusing to return to America and as a result his last years were spent in obscurity.

See J. G. Shea, *A Description of Louisiana by Father Louis Hennepin* (1880); "Father Louis Hennepin" in vol. iv. of Justin Winsor's *Narrative and Critical History of America* (1889). A complete bibliography of Hennepin's works is found in C. R. Remington's *The Shipyard of the Griffin* (Buffalo, 1891).

HENNER, JEAN JACQUES (1829–1905), French painter, was born on March 5, 1829, at Bernweiler (Alsace), the son of a peasant. He first studied at Altkirch in 1841. In 1844 he worked at Strasbourg under Gabriel Guérin, and in 1846 he entered the Ecole des Beaux Arts in Paris under M. Drolling. He returned to his native place for two years in 1855 to paint portraits, a col-

lection of which are now at the Sundgau Museum at Altkirch. In 1857 he joined the studio of Picot in Paris, and took the Prix de Rome with a painting of "Adam and Eve finding the Body of Abel" (1858). At Rome he was guided by Flandrin, and, among other works, painted four pictures for the gallery at Colmar. He first exhibited at the Salon in 1863 a "Bather Asleep," and subsequently contributed more or less regularly until 1903. He died in Paris on July 23, 1905. He is best known for his paintings of nude figures posed in ideal landscape enveloped in a golden clare-obscure suggestive of Correggio. He also painted a number of portraits. A self portrait is in the Uffizi at Florence. There are nine pictures by him in the Luxembourg gallery and 31 in the Palais des Beaux Arts (Salle Henner). In 1924 the Henner museum, comprising about 200 paintings, drawings and lithographs, bequeathed by the artist's nephew, was inaugurated in the Avenue de Villiers in Paris.

HENOGAMY, a term used to denote the custom by which one, and only one, member of a family or stock is permitted to marry, or is required to marry according to definite rules which are not binding on other members of the family Thus, among the Nabuthiri Brahmins of Malabar "the eldest son alone marries. The accepted practice, as well as the recognized principle among them, seems to be in consonance with the directions expounded by Manu, viz, immediately on the birth of his firstborn male child, a man is the father of a son, and is free from the debt to the Manes. That son is, therefore, worthy to receive the whole estate. That son alone, on whom he throws his debt, is begotten for (the fulfilment of) the law. And the next they consider the offspring of desire . . . Should a Nambuthiri eldest son die, the next marries and so on." (E. Thurston, *Tribes and Castes of Southern India,* 1909, vol. v., p. 175.)

This custom, it is observed, has long been in force to keep the family property intact and to prevent its disintegration by partition which the marriage of the younger sons might necessitate (A. N. Krishna Iyer, *The Cochin Tribes and Castes,* 1912, vol ii., p. 183). Polygamy "is often indulged in by the Nabuthiris, owing partly to their desire to have a son to perform funeral and other ceremonies for the spirits of the departed, and partly to dispose of the superfluous number of girls." (*Ibid,* p 210.) The younger males contract alliances with Nayar women. Their children belong to the *Tarwad,* a matrilineal group of their mothers and pollute their Brahmin fathers. This dislocation of the social order extends far down in Malabar society, and is ultimately traceable to the practice of henogamy among the patrilineal Brahmins The belief in direct and specific reincarnation which is embodied in the teaching of Manu is connected with customs in the Punjab, where "the position of the firstborn is probably due to the fact that, if a son, his father is born again in him, so that the father is supposed to die at his birth, and in certain Khatri sections, *e g.,* the Kochhar, his funeral rites are actually performed—in the fifth month of the mother's pregnancy. Probably herein lies the explanation of the *dev-kaj,* or divine nuptials, a ceremony which consists in a formal re-marriage of the parents after the birth of their first son" (*Punjab. Census Report,* 1901, part I. p. 215).

Among the matrilineal Garos (*q v.*) the youngest daughter is reserved for marriage with her father's brother's son, after he has married her own mother who, under the dual system, is also his paternal aunt (A. Playfair, *The Garos,* 1909, p. 67; *Assam Census Report,* 1891, p. 229). The elder daughters make their own arrangements for marriage.

There are other instances in India and elsewhere of rules by which special status—as regards inheritance and succession—is conferred by marriage between specified persons, as if one mode or set of rites gave peculiar dignity and validity. These devices mark decisively a change from a social order in which inheritance and succession are determined by the principle of social equivalence, as in the levirate (*q.v.*) or sororate (*q.v.*), which is expressed in terms of a classificatory system, to that order in which one line is selected, one son preferred, for transmission. The economic results which in history have accrued from the emergence of the principle of unilinealism have been, and still are, considerable. The custom of henogamy, if extended to cover the case where special rites and conditions are used for the marriage of the eldest son, is of wide occurrence, and the survival in India of the strict logical form has, therefore, special interest.

HENRI, ROBERT (1865–), American painter, was born in Cincinnati, O., in 1865. In 1886 he entered the Pennsylvania Academy of Fine Arts, Philadelphia. Proceeding to Paris in 1888, he studied at Julien's and the École des Beaux Arts and visited Spain and Italy. Returning to the United States he became in 1891 an instructor at the Women's School of Design, Philadelphia. From 1896 to 1900 he was again in Paris, and exhibited at the Salon. During an extremely active life as a painter, he found time to teach and exercised considerable influence by the vigour and independence of his style as a portrait painter. From 1915–23 he taught at the Art Students' League, New York.

Of his works, "La Neige" was purchased in 1899 for the Luxembourg in Paris; "The Equestrian," Carnegie Art Institute, Pittsburgh; "Young Woman in Black," Art Institute, Chicago; "The Spanish Gypsy," Metropolitan Museum, New York, and "Indian Girl in White Ceremonial Blanket," in the Corcoran Gallery, Washington, D.C. He wrote *The Art Spirit* (1923).

HENRIETTA MARIA (1609–1666), queen of Charles I. of England, daughter of Henry IV. of France, was born on Nov. 25, 1609 The first serious overtures for her hand were made in the spring of 1624, on behalf of Charles, prince of Wales. Her brother, Louis XIII., consented to the marriage on the condition that the English Roman Catholics were relieved from the operation of the penal laws. She was married on May 11, 1625, in Paris, the duke of Chevreuse acting as proxy for Charles, who was now king, and she set out for England in June.

The early years of their married life were unhappy. Charles soon found an excuse for breaking his promise to relieve the English Catholics. His young wife was deeply offended, and the favourite Buckingham stirred the flames of his master's discontent. After the assassination of Buckingham (1628) the barrier between the married pair was broken down, and Charles caused much discontent by his favourable treatment of the Catholic subjects whom he had formerly persecuted. The children of the marriage were Charles II. (b. 1630), Mary, princess of Orange (b. 1631), James II. (b. 1633) Elizabeth (b. 1636), Henry, duke of Gloucester (b. 1640), and Henrietta, duchess of Orleans (b. 1644).

For some years Henrietta Maria's chief interests lay in the amusements of a brilliant court, and she took no part in politics. Her participation in the private rehearsals of the *Shepherd's Pastoral,* written by her favourite Walter Montague, probably drew down upon her the savage attack of Prynne. Her co-religionists found little aid from her till 1636 She had then recently opened a diplomatic communication with the see of Rome, and under the influence of a papal agent, a Scotsman named George Conn, accredited to her, thwarted Laud's proclamation against the Catholic recusants.

When the Scottish troubles broke out in 1639, she raised money from her fellow-Catholics to support the king's army on the borders. During the session of the Short Parliament in the spring of 1640, the queen urged the king to oppose himself to the House of Commons in defence of the Catholics. She was at the time generally believed to be the instigator of the Army Plot, in which the English people saw only an attempt to establish Catholic supremacy, but she was probably acting on the suggestion of her adviser Henry Jermyn. She threw herself heart and soul into the schemes for rescuing Strafford and coercing the parliament, and the impeachment of the five members on the charge of treason was brought about by her influence over the king.

In Feb. 1642 the queen went to the Continent to try to raise support in arms and money. In Feb. 1643 she landed at Bridlington quay with a large sum of money, but no foreign troops. She placed herself at the head of a force of loyalists, and in spite of some opposition marched through England to join the king near Oxford, which they entered together on July 14. By July 1644, however, her position had become so insecure that she was persuaded again to take refuge in France, where she received a pension of 12,000 crowns a month from the queen regent. As long

as her husband was alive the queen never ceased to make plans and raise funds to encourage his resistance, and she continued to hope for success until she heard of his execution in 1649.

She brought up her youngest child Henrietta in her own faith, but failed to induce her youngest son, the duke of Gloucester, to take the same course. When after the Restoration (Oct. 1660) she returned to England, she found that she had no place in the new world She received from parliament a grant of £30,000 a year in compensation for the loss of her dower-lands, and the king added a similar yearly sum. In Jan. 1661 she returned to France to be present at the marriage of her daughter Henrietta to the duke of Orleans. She set out again for England in July 1662, and took up her residence once more at Somerset House. In 1665 she returned to France, and died on August 31, 1666, at Colombes, not far from Paris.

See I. A. Taylor, *The Life of Queen Henrietta Maria* (1905).

HENRY, "prince of the house" (Fr. *Henri;* Span *Enrique;* Ger. *Heinrich*) The name of many European sovereigns.

HENRY (HENRY BENEDICT MARIA CLEMENT STUART) (1725–1807), usually known as Cardinal York, the last prince of the royal house of Stuart, younger son of James Stuart, was born in the Palazzo Muti at Rome on March 6, 1725. He was created duke of York by his father soon after his birth, and by this title he was always alluded to by Jacobite adherents of his house In support of the Young Pretender's campaign in Scotland, Henry was despatched in the summer of 1745 to France, where he was placed in nominal command of French troops at Dunkirk, with which the marquis d'Argenson had some idea of invading England. Seven months after Charles's return from Scotland Henry, who had joined his brother in Paris, secretly left for Rome and, with his father's approval, but to his brother's disgust, was created a cardinal deacon under the title of the cardinal of York by Pope Benedict XIV. on July 3, 1747. In the following year he was ordained priest, and nominated arch-priest of the Vatican Basilica In 1759 he was consecrated archbishop of Corinth *in partibus,* and in 1761 bishop of Frascati (the ancient Tusculum) in the Alban Hills near Rome, where he founded an ecclesiastical seminary. In 1763 he became vice-chancellor of St. Peter's. Henry Stuart held sinecure benefices in France, Spain and Spanish America, so that he became one of the wealthiest churchmen of the period, his annual revenue being said to amount to £30,000 sterling. On the death of his father, James Stuart, Henry tried unsuccessfully to induce Pope Clement XIII. to acknowledge his brother Charles as legitimate king of Great Britain. On Charles's death in 1788 Henry issued a manifesto asserting his hereditary right to the British crown. At the outbreak of the French Revolution he lost two rich French livings and his pension from Spain, and in Feb. 1798, at the approach of the invading French forces, he was forced to fly to Naples, whence he sailed to Messina. At this time he disposed of his family heirlooms to help the pope raise the tribute demanded by Napoleon. From Messina he proceeded by sea in order to be present at the expected conclave at Venice, where he arrived in the spring of 1799, aged, ill and almost penniless. George III., on the recommendation of Prince Augustus Frederick, duke of Sussex, gave a pension of £4,000 a year to the last of the royal Stuarts. Henry received this assistance gratefully, and subsequently left by his will certain British crown jewels in his possession to the prince regent. In 1800 Henry was able to return to Rome, and in 1803, being senior cardinal bishop, he became *ipso facto* dean of the sacred college and bishop of Ostia and Velletri. He died at Frascati on July 13, 1807, and was buried in the *Grotte Vaticane* of St Peter's in an urn bearing the title "Henry IX."; he is also commemorated in Canova's well-known monument to the royal Stuarts (*see* JAMES). The Stuart archives, once the property of Cardinal York, were presented by Pope Pius VII. to the prince regent, who placed them in the royal library at Windsor Castle.

See B. W. Kelly, *Life of Cardinal York;* H. M. Vaughan, *Last of the Royal Stuarts;* A. Shield, *Henry Stuart, Cardinal of York, and his Times* (1908); T. F. Henderson, *The Royal Stuarts* (1914).

HENRY II. (973–1024), surnamed the "Saint," Roman emperor, son of Henry II., the Quarrelsome, duke of Bavaria, and Gisela, daughter of Conrad, king of Burgundy, or Arles (d. 993), and great-grandson of the German king Henry I., was born on May 6, 973, and was educated at Hildesheim and at Regensburg. He became duke of Bavaria on his father's death in 995, and about 1001 married Kunigunde (d. 1037), daughter of Siegfried, count of Luxemburg. When Otto III. died childless in 1002, Henry was chosen German king by the Franks and Bavarians on June 7, 1002, and subsequently crowned by Willigis, archbishop of Mainz. He purchased the allegiance of the Thuringians and the Saxons; and when shortly afterwards the nobles of Lorraine did homage and Hermann of Swabia, his rival, submitted, he was generally recognized as king. An incipient war with Boleslaus I., the Great, king of Poland, who had extended his authority over Meissen and Lusatia, seized Bohemia, and allied himself with some discontented German nobles, including the king's brother, Bruno, bishop of Augsburg, was abandoned in favour of an expedition into Italy, where Arduin, margrave of Ivrea, had been elected king. Crossing the Alps Henry met with no resistance from Arduin, and in May 1004 was crowned king of the Lombards at Pavia. He then freed Bohemia from the rule of the Poles, led an expedition into Friesland, and compelled Boleslaus to sue for peace in 1005. A struggle with Baldwin IV, count of Flanders, in 1006 and 1007 was followed by trouble with the king's brothers-in-law, Dietrich and Adalbero of Luxemburg, who had seized respectively the bishopric of Metz and the archbishopric of Trier (Treves). In 1013, peace was made with Boleslaus and later in the year, the king went to Rome where, having recognized Benedict VIII. as the rightful pope, he was crowned emperor on Feb. 14, 1014. But the struggle with the Poles broke out afresh, and in 1015 and 1017 Henry led formidable armies against Boleslaus. On Jan. 30, he made peace at Bautzen, Boleslaus retaining Lusatia As early as 1006 Henry had concluded a succession treaty with his uncle Rudolph III., the childless king of Burgundy, or Arles; but when Rudolph desired to abdicate in 1016 Henry's efforts to secure possession of the crown were resisted by the nobles. In 1020 the emperor was visited at Bamberg by Pope Benedict, in response to whose entreaty for assistance against the Greeks of southern Italy he crossed the Alps in 1021 for the third time. With the aid of the Normans he crippled the Greeks, but was compelled by pestilence among his troops to return to Germany in 1022. He died on July 13, 1024 at Grona near Göttingen

Henry was an enthusiast for church reform, and under the influence of his friend Odilo, abbot of Cluny, sought to further the principles of the Cluniacs, and seconded the efforts of Benedict VIII. to prevent clerical marriage and the sale of spiritual dignities. Nevertheless he appointed bishops without the formality of an election, and sometimes attacked clerical privileges. He held numerous diets and issued frequent ordinances for peace, but feuds among the nobles were common, and the frontiers of the empire were insecure. Henry, who was the last emperor of the Saxon house, was the first to use the title "King of the Romans." He was canonized in 1146 by Eugenius III.

See Adalbold of Utrecht, *Vita Heinrici II.,* Thietmar of Merseburg, *Chronicon,* both in the *Monum. Germ. hist. Scriptores,* iii. and iv. (1826 *seq.*); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit* (Leipzig, 1881–90); S. Hirsch, *Jahrbücher des deutschen Reichs unter Kaiser Heinrich II.* (Leipzig, 1874); A Cohn, *Kaiser Heinrich II* (Halle, 1867); H. Zeissberg, *Die Kriege Kaiser Heinrichs II. mit Boleslaw I. von Polen* (Vienna, 1868); and G. Matthaei, *Die Klosterpolitik Kaiser Heinrichs II.* (Göttingen, 1877). Further bibliography in *Camb. Mediaeval Hist.* vol. iii.

HENRY III. (1017–1056), surnamed the "Black," Roman emperor, only son of the emperor Conrad II., and Gisela, widow of Ernest I., duke of Swabia, was born on Oct. 28, 1017, designated as his father's successor in 1026, and crowned German king at Aix-la-Chapelle on April 14, 1028. In 1027 he was appointed duke of Bavaria, where he had been educated under Bruno, bishop of Augsburg and under Egilbert, bishop of Freising. In 1032 he took part in a campaign in Burgundy; in 1033 led an expedition against Ulalrich, prince of the Bohemians; and in June 1036 married Gunhilda, afterwards called Kunigunde, daughter of Canute, king of Denmark and England. In 1038 the emperor

formally handed over to him the kingdom of Burgundy, or Arles, and appointed him duke of Swabia.

When Conrad died in June 1039, Henry became sole ruler of the empire. A struggle soon broke out with Bretislaus, prince of the Bohemians, who revived the idea of an independent Slavonic state, and conquered various Polish towns. After suffering two defeats in 1040, in the following year Henry was able to compel Bretislaus to sue for peace and to do homage for Bohemia. In 1042 he received the homage of the Burgundians and his attention was then turned to the Hungarians, who had driven out their king Peter, and set up one Aba Samuel, or Ovo, who attacked eastern Bavaria. During 1043–45 Henry restored Peter, and brought Hungary completely under the German king.

In 1038 Queen Kunigunde had died and in 1043 the king married Agnes, daughter of William V., duke of Guienne. In 1044 Gothelon (Gozelo), duke of Lorraine, died, and some disturbance arose over Henry's refusal to grant the whole of the duchy to his son Godfrey, called the Bearded. Godfrey took up arms, but after a short imprisonment was confirmed in the possession of Upper Lorraine in 1046 which, however, he failed to secure. About this time, the rival popes were deposed, and the king secured the election of Suidger, bishop of Bamberg, who crowned Henry emperor on Dec. 25, 1046. He was immediately recognized by the Romans as *Patricius*, an office which carried with it at this time the right to appoint the pope. Supreme in church and state alike, ruler of Germany, Italy and Burgundy, overlord of Hungary and Bohemia, Henry occupied a commanding position. He made a victorious progress in southern Italy, where he restored Pandulph IV. to the principality of Capua, and asserted his authority over the Normans in Apulia and Aversa. Returning to Germany in 1047 he appointed two popes, Damasus II. and Leo IX., in quick succession, and faced a threatening combination in the west of the empire, where Godfrey of Lorraine was again in revolt, and with Baldwin V., count of Flanders and Dirk IV., count of Holland, who had previously caused trouble, was ravaging the emperor's lands in Lorraine. Assisted by the kings of England and Denmark, Henry subdued the rebels in 1050. Godfrey was deposed; but Baldwin in 1054 again revolted.

Meanwhile a reaction against German influence had taken place in Hungary. King Peter had been replaced in 1046 by Andreas I., and inroads into Bavaria followed. A brief peace was secured in 1053, but the emperor, occupied elsewhere, soon lost his authority in the east. On pope Leo's death, Henry nominated Gebhard, bishop of Eichstädt, to the vacant chair. In 1055 the emperor went a second time to Italy, where his authority was threatened by Godfrey of Lorraine, who had married Beatrice, widow of Boniface III., margrave of Tuscany, and was ruling her vast estates. Godfrey fled, however, on the appearance of Henry, who only remained a short time in Italy, during which he granted the duchy of Spoleto to the pope. During his absence, the deposed Conrad III., duke of Bavaria, Welf, duke of Carinthia, and Gebhard III., bishop of Regensburg, formed an unsuccessful conspiracy against him. The emperor died at Bodfeld on Oct. 5, 1056. He was a peace-loving prince, who favoured church reform and sought to suppress private warfare. But he alienated the sympathies of the nobles as a class, and, by allowing the southern duchies to pass into other hands, restored a power which was not always friendly to the royal house. Henry was a patron of learning, a founder of schools, and completed cathedrals at Spires, Worms and Mainz.

The chief original authorities are the *Chronicon* of Herimann of Reichenau, the *Annales Sangallenses majores*, the *Annales Hildesheimenses*, all in the *Monumenta Germaniae historica. Scriptores* (1826 fol.). *See* W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Bd. ii. (Leipzig, 1888); M. Perlbach, "Die Kriege Heinrichs III. gegen Böhmen," in *Forschungen zur deutschen Geschichte*, vol. x. (Göttingen, 1862–86); E. Steindorff, *Jahrbücher des deutschen Reichs unter Heinrich III.* (Leipzig, 1874–81); F. Steinhoff, *Das Konigthum und Kaiserthum Heinrichs III.* (Göttingen, 1865); E. Mueller, *Das Itinerar Kaiser Heinrichs III.* (1901) and further bibliography in *Camb. Mediaeval Hist.* vol. 3.

HENRY IV. (1050–1106), Roman emperor, son of the emperor Henry III. and Agnes, daughter of William V., duke of Guienne, was born on Nov. 11, 1050, chosen German king at Tribur in 1053, and crowned at Aix-la-Chapelle on July 17, 1054. In 1055 he was appointed duke of Bavaria, and on his father's death in 1056 inherited the kingdoms of Germany, Italy and Burgundy. These territories were governed in his name by his mother, who was compelled in 1062 to hand over her control to Anno, archbishop of Cologne, and to Adalbert, archbishop of Bremen. In March 1065 Henry was declared of age, and in the following year married Bertha, daughter of Otto, count of Savoy.

In 1069 the king led expeditions against the Liutii, and against Dedo or Dedi II., margrave of a district east of Saxony; and soon afterwards quarrelled with Rudolph, duke of Swabia, and Berthold, duke of Carinthia. His struggle with Otto of Nordheim, duke of Bavaria, who was accused in 1070 of being privy to a plot to murder the king, ended in the duke's submission in 1071. Henry aroused the hostility of the Thuringians by supporting Siegfried, archbishop of Mainz, in his efforts to exact tithes from them, and the enmity of the Saxons by ordering a restoration of all crown lands in Saxony, by ravaging the country to supply the needs of his courtiers, and by holding its duke Magnus a prisoner. In 1073 the Thuringians joined the Saxons, and the war, which lasted with slight intermissions until 1088, exercised a potent influence upon Henry's fortunes elsewhere (*see* SAXONY). For Henry's dispute with Hildebrand (Pope Gregory VII.), his excommunication and his famous visit to Canossa *see* GREGORY VII.

Henry left Italy to find that in his absence Rudolph, duke of Swabia, had been chosen German king; and although Hildebrand had taken no part in this election, Henry sought to prevent the pope's journey to Germany, and tried to recover his former position. Though supported by most of the German bishops and by the Lombards and recognized in Burgundy, Bavaria and Franconia, Henry suffered defeat at Mellrichstadt in 1078 and at Flarchheim in 1080. Gregory's attitude remained neutral, in spite of appeals from both sides, until March 1080, when he again excommunicated Henry. At Henry's initiative, Gregory was declared deposed on three occasions, and an anti-pope was elected in the person of Wibert, archbishop of Ravenna, who took the name of Clement III.

The death of Rudolph, the rival German king, in Oct. 1080, left the king at liberty to go to Italy early in 1081. He found considerable support in Lombardy; placed Matilda, marchioness of Tuscany, the faithful friend of Gregory, under the imperial ban; took the Lombard crown at Pavia; and secured the recognition of Clement by a council. After two unsuccessful attacks, he took Rome in 1082, and a treaty was concluded with the Romans, who agreed that the quarrel between king and pope should be decided by a synod, and secretly bound themselves to induce the pope to crown Henry as emperor, or to choose another pope. The synod was a failure, and in March 1084 Gregory was declared deposed and Clement was recognized by the Romans. On March 31, 1084 Henry was crowned emperor by Clement, and received the patrician authority. His next step was to attack the fortresses still in the hands of the pope, but the advance of Robert Guiscard, duke of Apulia, compelled him to return to Germany.

Meanwhile the German rebels had chosen a fresh anti-king, Hermann, count of Luxemburg. In 1086 Henry was defeated near Würzburg, but in 1088 Hermann abandoned the struggle and the emperor was generally recognized in Saxony. Although Henry's power was in the ascendent, a few powerful nobles adhered to the cause of the new pope, Urban II. Among them was Welf, son of the deposed duke of Bavaria, whose marriage with Matilda of Tuscany rendered him formidable. The emperor accordingly returned to Italy in 1090, where Mantua and Milan were taken, and Pope Clement was restored to Rome.

Henry's first wife had died in 1087, and in 1089 he had married a Russian princess Praxedis, afterwards called Adelaide. Her conduct soon aroused his suspicions, and his own eldest son, Conrad, who had been crowned German king in 1087, was thought to be a partner in her guilt. Adelaide fled to Henry's enemies and brought charges against him; and the papal party induced Conrad to desert his father and to be crowned king of Italy at Monza in 1093. After five years of inactivity Henry returned to Germany where his position was stronger than ever. Welf had submitted

and had been restored to Bavaria; the diet assembled at Mainz in 1098 declared Conrad deposed, and chose the emperor's second son, Henry, afterwards the emperor Henry V., as German king, and the crusade of 1096 had freed Germany from many turbulent spirits. But the younger Henry, in 1104, encouraged by the adherents of the pope, declared he owed no allegiance to an excommunicated father. Saxony and Thuringia were soon in arms and in 1105, the emperor became a prisoner in the hands of his son. A diet at Mainz in December compelled him to abdicate, but contrary to the conditions, he was detained at Ingelheim and denied his freedom. Escaping to Cologne, he entered into negotiations with England, France and Denmark, and was engaged in collecting an army when he died at Liége on Aug. 7, 1106.

After a licentious youth, Henry displayed much diplomatic ability, and his abasement at Canossa may fairly be regarded as a move of policy to weaken the pope's position at the cost of a personal humiliation to himself. He was a friend of the lower orders, was capable of generosity, and showed considerable military skill. Unfortunate in the troubles with which he had to contend, he ably resisted the pretensions both of the papacy and of the ambitious feudal lords of Germany.

The authorities are Lambert of Hersfeld, *Annales;* Bernold of Reichenau, *Chronicon;* Ekkehard of Aura, *Chronicon;* and Bruno, *De bello Saxonico,* all in the *Monumenta Germaniae historica. Scriptores,* v. and vi. (1826–92). An anonymous *Vita Heinrici IV.* was edited by W. Wattenbach (Hanover, 1876). *See* G. Meyer von Knonau, *Jahrbücher des deutschen Reiches unter Heinrich IV.* (Leipzig, 1890); H. Floto, *Kaiser Heinrich IV.* (Stuttgart, 1855); E. Kilian, *Itinerar Kaiser Heinrichs IV.* (Karlsruhe, 1886); K. W. Nitzsch, "Das deutsche Reich und Heinrich IV.," in the *Historische Zeitschrift,* Band xlv. (Munich, 1859); H. Ulmann, *Zum Verstandniss der sächsischen Erhebung gegen Heinrich IV.* (Hanover, 1886), W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit* (Leipzig, 1881–90); B. Gebhardt, *Handbuch der deutschen Geschichte* (1901); E. Hoehne, *Kaiser Heinrich IV.* (1906); C. Labarum, *The Victory of Henry IV. at Canossa* (1913) and B. Schmeidler, *Kaiser Heinrich IV. und seine Helfer im Investiturstreit* (1927). Further bibliography in Dahlmann-Waitz, *Quellenkunde der deutschen Geschichte* (Göttingen, 1894); and in *Camb. Mediaeval Hist.,* vol. 5.

HENRY V. (1081–1125), Roman emperor, son of the emperor Henry IV., was born on Jan. 8, 1081, and after the deposition of his elder brother, the German king Conrad (d. 1101), was chosen as his successor in 1098. In spite of his oath to take no part in the business of the empire during his father's lifetime, Henry was induced by his father's enemies to revolt in 1104, and some of the princes did homage to him at Mainz in Jan. 1106. In August of the same year the elder Henry died, when his son became sole ruler. In 1107 a campaign to restore Bořiwoj II. to the dukedom of Bohemia was partially successful, and in the year following the king led his forces into Hungary, where he failed to take Pressburg. In 1109 he was unable to compel the Poles to renew their accustomed tribute, but in 1110 he succeeded in securing the dukedom of Bohemia for Ladislaus I.

The main interest of Henry's reign centres in the controversy over lay investiture which had been thrice prohibited by Paschal II. In 1110 Henry went to Italy with a large army, and at Sutri concluded an arrangement with Paschal by which he renounced the right of investiture in return for a promise of coronation, and the restoration to the empire of all lands given by kings, or emperors, to the German church since the time of Charlemagne. The king presented himself at St. Peter's on Feb. 12, 1111, for his coronation and the ratification of the treaty. The words commanding the clergy to restore the fiefs of the Crown to Henry were read amid a tumult of indignation, whereupon the pope refused to crown the king, who in return declined to renounce the right of investiture. Henry then left the city carrying the pope with him; and Paschal's failure to obtain assistance drew from him a confirmation of the king's right of investiture and a promise to crown him emperor.

In 1112 Lothair, duke of Saxony, rose against Henry, but was easily quelled. In 1113, however, a quarrel over the succession to the counties of Weimar and Orlamünde gave occasion for a fresh outbreak on the part of Lothair, whose troops were defeated at Warnstädt. Having been married in 1114 to Matilda, or Maud, daughter of Henry I. of England, the emperor was confronted with a further rising, initiated by the citizens of Cologne, who were soon joined by the Saxons and others. Henry's forces were defeated at Welfesholz in 1115, and complications in Italy compelled him to leave Germany to the care of Frederick II. of Hohenstaufen, duke of Swabia, and his brother Conrad. After the departure of Henry from Rome in 1111 a council declared the privilege of lay investiture, which had been extorted from Paschal, to be invalid, and Guido, archbishop of Vienne, excommunicated the emperor, but the pope refused to ratify this sentence. The quarrel entered upon a new stage in 1115 when Matilda, daughter and heiress of Boniface, margrave of Tuscany, died leaving her vast estates to the papacy. Crossing the Alps in 1116, Henry took possession of Matilda's lands. By this time Paschal had withdrawn his consent to lay investiture and the excommunication had been published. The pope was compelled to fly and the emperor was crowned a second time by Burdinas, archbishop of Braga. Paschal was succeeded by Gelasius II. in Jan. 1118, but Henry secured the election of an antipope who took the name of Gregory VIII. Finally in the concordat of Worms (Sept. 1122) Henry renounced the right of investiture with ring and crozier, recognized the freedom of election of the clergy and promised to restore all church-property. The new pope Calixtus II. agreed to allow elections to take place in presence of the imperial envoys, and the investiture with the sceptre to be granted by the emperor as a symbol that the estates of the church were held under the Crown. Henry was received again into the communion of the church, after he had abandoned his nominee, Gregory, to defeat. The emperor's concluding years were occupied with a campaign in Holland, and with a quarrel over the succession to the margraviate of Meissen In 1124 he led an expedition against King Louis VI of France and turned his arms against the citizens of Worms. He died at Utrecht on May 23, 1125.

See W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit,* Bd. iii. (Leipzig, 1881–90); L. von Ranke, *Weltgeschichte,* pt. vii. (Leipzig, 1886) M. Manitius, *Deutsche Geschichte* (Stuttgart, 1889); C. Stutzer, "Zur Kritik der Investiturverhandlungen im Jahre 1119," in the *Forschungen zur deutschen Geschichte,* Bd. xviii. (Gottingen, 1862–86); T. von Sickel and H. Bresslau, "Die kaiserliche Ausfertigung des Wormser Konkordats," in the *Mittheilungen des Instituts für österreichische Geschichtsforschung* (Innsbruck, 1880); B. Gebhardt, *Handbuch der deutschen Geschichte,* Bd. i. (1901), and E. Bernheim, *Zur Geschichte des Wormser Konkordats* (Göttingen, 1878).

HENRY VI. (1165–1197), Roman emperor, son of the emperor Frederick I. and Beatrix, daughter of Renaud III., count of upper Burgundy, was educated under Conrad of Querfurt, afterwards bishop of Hildesheim and Würzburg. Chosen German king at Bamberg in June 1169, he was crowned at Aix-la-Chapelle on Aug. 15, 1169, and invested with lands in Germany in 1179. In 1184 his father sought to procure his coronation from Pope Lucius III., but the pope refused because of the marriage arranged between Henry and Constance, daughter of the late king of Sicily, Roger I., a step which threatened to unite Sicily with Germany. This marriage took place at Milan in Jan. 1186, and soon afterwards Henry was crowned king of Italy. Having been recognized by the pope as Roman emperor elect, Henry returned to Germany, where a campaign against Henry the Lion, duke of Saxony, was followed by a peace made at Fulda in July 1190.

A promise of his coronation from Pope Clement III. led Henry to cross the Alps in the winter of 1190. He purchased the support of the cities of northern Italy, but on reaching Rome found Clement was dead and his successor, Celestine III., disinclined to carry out the coronation. However, the strength of the German army and a treaty made between the king and the Romans induced him to crown Henry on April 14, 1191. Meanwhile a party in Sicily had chosen Tancred, an illegitimate son of Roger, son of King Roger II., as king. Henry marched to Naples, but was compelled to raise the siege and return to Germany. There the Welfs and their earlier opponents were united against the emperor, vacancies in various bishoprics added to the confusion, and Henry was suspected of being implicated in the murder of Albert, bishop of Liége. His salvation came from the captivity of Richard I., king of England, and the skill with which he used this event to make peace with his foes. When Henry the Lion came to terms in March 1194, order was restored to Germany.

In the following May, Henry went again to Italy, where Pope Celestine had espoused the cause of Tancred. When he reached Sicily he found Tancred dead, and, meeting with little resistance, entered Palermo, where he was crowned king on Dec. 25, 1194. Leaving his wife, Constance, as regent, he returned to Germany in June 1195.

Having established his position in Germany and Italy, Henry began to cherish ideas of universal empire. Richard of England had already owned his supremacy, and declaring he would compel the king of France to do the same Henry sought to stir up strife between France and England. Nor did the Spanish kingdoms escape his notice. Tunis and Tripoli were claimed, and when the eastern emperor, Isaac Angelus, asked his help, he demanded in return the cession of the Balkan peninsula. The kings of Cyprus and Armenia asked for investiture at his hands. To complete his scheme two steps were necessary, a reconciliation with the pope and the recognition of his young son, Frederick, as his successor in the empire. The first was easily accomplished; the second was more difficult.

Henry met the princes at Worms in Dec. 1195 and by threats or negotiations won the consent of about 50 of them; but though the diet which met at Würzburg in April 1196 agreed to the scheme, the vigorous opposition of Adolph, archbishop of Cologne, and others rendered it inoperative. In June 1196 Henry went again to Italy to persuade the pope to crown his son who had been chosen king of the Romans at Frankfort. Celestine refused, and the emperor then went to the south, where the oppression of his German officials had caused an insurrection, which was put down with terrible cruelty. At Messina on Sept. 28, 1197, Henry died from a cold caught whilst hunting.

Henry's poems appeared in F. H. von der Hagen's *Minnesinger* (Leipzig, 1838). The chief authorities for his life are Otto of Freising, *Chronicon*, continued by Otto of St. Blasius; Godfrey of Viterbo, *Gesta Friderici I.* and *Gesta Heinrici VI.*; Giselbert of Mons, *Chronicon Hanoniense*, all of which appear in the *Monum. Germ. hist. Scriptores*, Bde. xx., xxi., xxii. (1826–92). *See* also W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Bd. iv. (Brunswick, 1877); T. Toeche, *Kaiser Heinrich VI.* (Leipzig, 1867); H. Bloch, *Forschungen zur Politik Kaiser Heinrichs VI.* (1892); K. A. Kneller, *Des Richard Löwenherz deutsche Gefangenschaft* (Freiburg, 1893); F. Gerlich, *Das Testament Heinrichs VI.* (1907); V. Pfaff, *Kaiser Heinrichs VI. höchstes Angebot an die römische Kurie, 1196* (1927), and *Camb. Mediaeval Hist.* vol. 5.

HENRY VII. (*c.* 1269–1313), Roman emperor, son of Henry III., count of Luxemburg, passed his early days under French influences. In 1288 he succeeded his father, and four years later married Margaret (d. 1311), daughter of John I., duke of Brabant. After the death of the German king, Albert I., he was elected to the vacant throne on Nov. 27, 1308. The Rhenish archbishops were pacified by the restoration of the Rhine tolls, negotiations were begun with Philip IV., king of France, and with Robert, king of Naples, and the Habsburgs were confirmed in their possessions. At this time Bohemia was ruled by Henry V., duke of Carinthia, but the prevailing disorder induced some of the Bohemians to offer the crown, together with the hand of Elizabeth, daughter of the late king Wenceslas II., to John, the son of the German king. Henry accepted the offer, and in Aug. 1310 John was invested with Bohemia and his marriage was celebrated.

Meanwhile Henry had crossed the Alps, with the hope of reuniting Germany and Italy, and of restoring the empire of the Hohenstaufen. Having entered Milan he placed the Lombard crown upon his head on Jan. 6, 1311. But trouble soon showed itself. His poverty compelled him to exact money from the citizens; the peaceful professions of the Guelphs were insincere, and Robert, king of Naples, watched his progress with suspicion. Risings took place and, after the capture of Brescia, Henry marched to Rome only to find the city in the hands of the Guelphs and the troops of King Robert. The king, unable to obtain possession of St. Peter's, was crowned emperor on June 29, 1312, in the church of St. John Lateran by some cardinals who declared they acted under compulsion. Failing to subdue Florence, the emperor allied himself with Frederick III., king of Sicily, and, with the Venetians, set out to attack Robert of Naples. On the march he was taken ill, and died at Buonconvento near Siena on Aug. 24, 1313. Henry was hailed by Dante as the deliverer of Italy, and in the *Paradiso* the poet reserved for him a place marked by a crown.

Many of the contemporary documents for the life of Henry VII. are found in the *Rerum Italicarum scriptores*, ed. L. A. Muratori (Milan, 1723–51), in *Fontes rerum Germanicarum*, ed. J. F. Böhmer (Stuttgart, 1843–68), and in *Die Geschichtsschreiber der deutschen Vorzeit*, Bde. 79 and 80 (Leipzig, 1884). *See* also *Acta Henrici VII. imperatoris Romanorum*, ed. G. Dönniges (1839); F. Bonaini, *Acta Henrici VII. Romanorum imperatoris* (Florence, 1877); T. Lindner, *Deutsche Geschichte unter den Habsburgern und Luxemburgern* (Stuttgart, 1888–93); J. Heidemann, "Die Königswahl Heinrichs von Luxemburg," in the *Forschungen zur deutschen Geschichte*, Bd. xi. (Göttingen, 1862–86); B. Thomas, *Zur Königswahl des Grafen Heinrich von Luxemburg* (Strasbourg, 1875); D. König, *Kritische Erörterungen zu einigen italienischen Quellen fur die Geschichte des Römerzuges Königs Heinrich VII.* (Göttingen, 1874); K. Wenck, *Clemens V. und Heinrich VII.* (Halle, 1882); F. W. Barthold, *Der Römerzug König Heinrichs von Lutzelburg* (Königsberg, 1830–31); R. Pöhlmann, *Der Römerzug König Heinrichs VII. und die Politik der Kurie* (Nuremberg, 1875); W. Dönniges, *Kritik der Quellen fur die Geschichte Heinrichs VII. des Luxemburgers* (1841), G. Sommerfeldt, *Die Romfahrt Kaiser Heinrichs VII.* (Königsberg, 1888), C. Graefe, *Die Persönlichkeit Kaiser Heinrichs VII.* (1911); and F. Schneider, *Kaiser Heinrichs VII.* (1924).

HENRY (*c.* 1174–1216), emperor of Romania, or Constantinople, was a younger son of Baldwin, count of Flanders and Hainaut (d. 1195). Having joined the Fourth Crusade about 1201, he distinguished himself at the siege of Constantinople in 1204 and elsewhere, and soon became prominent among the princes of the new Latin empire of Constantinople. When his brother, the emperor Baldwin I., was captured at the battle of Adrianople in April 1205, Henry was chosen regent of the empire, succeeding to the throne when the news of Baldwin's death arrived. He was crowned on Aug 20, 1205. Henry was a wise ruler, whose reign was largely passed in successful struggles with the Bulgarians and with his rival, Theodore Lascaris I., emperor of Nicaea. Henry appears to have been brave but not cruel, and tolerant but not weak; possessing "the superior courage to oppose, in a superstitious age, the pride and avarice of the clergy." He died, poisoned, it is said, by his Greek wife, on June 11, 1216.

See Gibbon's *Decline and Fall of the Roman Empire*, vol. vi. (ed. J. B. Bury, 1898).

HENRY I. (1207?–1217), king of Castile, son of Alphonso VIII. of Castile and Eleanor of Aquitaine, daughter of Henry II. of England, born *c.* 1207. He was killed by the fall of a tile.

HENRY II. OF TRASTAMARA (1333–1379), king (1369) of Castile, eldest son of Alphonso XI. and his mistress, Leonora de Guzman. His father endowed him with great lordships in northern Spain, and made him count of Trastamara. After the accession of Alphonso's legitimate son, Peter the Cruel, Henry fled (1356) to France. In 1366 he persuaded the mercenary soldiers paid off by the kings of England and France to join him on an expedition to drive out Peter. The expedition was successful, but the Black Prince intervened on behalf of Peter and defeated Henry at Nájera (April 3, 1367). Henry fled to Aragon, returned with French soldiers of fortune under du Guesclin, besieged Peter in Montiel (La Mancha), tempted him out and killed him on March 23, 1369. Through his ten years' reign Henry remained a strong ally of the French king in his wars with the English, who supported the claims of Peter's natural daughters. To support his own, he made vast grants and concessions to nobles and cities, hence his title *El de las Mercedes* —he of the largesse.

HENRY III. (1379–1406), king (1390) of Castile, "El Doliente" (the Sufferer), was the son of John I., of Castile and Leon, and Beatrice, daughter of Ferdinand of Portugal. Though delicate and a minor, he succeeded, by the generous support of the cities, in regaining (1393) his crown lands from the nobles. In 1394 he summoned the Cortes at Madrid, and established a practically despotic royal authority, based on the consent of the commons. His marriage with Catherine, grand-daughter of Peter the Cruel united the rival claims of the descendants of Peter and of Henry of Trastamara. He died on Dec. 25, 1406.

HENRY IV. (1425–1474), king of Castile, "the Impotent," was the son of John II. of Castile and Leon and of Mary, daughter of Ferdinand I. of Aragon and Sicily. Born at Valladolid on

Jan. 6, 1425, he was weak and vacillating in character, and his reign was marked by incidents of the most ignominious kind. He divorced (1453) his wife Blanche of Navarre on the ground of mutual impotence, married Joan of Portugal in 1468, repudiated the daughter that she bore him, then claimed her for his own. Deposed in favour of his brother Alphonso in 1468, he was restored at the latter's death in the same year. He died at Madrid on Dec. 12, 1474.

HENRY I. (1068–1135), king of England, nicknamed Beauclerk, the fourth and youngest son of William I. by his queen Matilda of Flanders, was born in 1068 on English soil. Of his life before 1086, when he was solemnly knighted by his father at Westminster, we know little. He was his mother's favourite, and she bequeathed to him her English estates, which, however, he was not permitted to hold in his father's lifetime. Henry was given an excellent education, of which in later life he was proud. His attainments included Latin, which he could both read and write; he knew something of the English laws and language, and it may have been from an interest in natural history that he collected, during his reign, the Woodstock menagerie which was the admiration of his subjects. But from 1087 his life was one of action and vicissitudes which left him little leisure. Receiving, under the Conqueror's last dispositions, a legacy of 5,000 pounds of silver, but no land, he traded upon the pecuniary needs of Duke Robert of Normandy, from whom he purchased, for the small sum of £3,000, the district of the Cotentin. He negotiated with Rufus to obtain the possession of their mother's inheritance, but only incurred thereby the suspicions of the duke, who threw him into prison. In 1090 the prince vindicated his loyalty by suppressing, on Robert's behalf, a revolt of the citizens of Rouen which Rufus had fomented. But when his elder brothers were reconciled in the next year they combined to evict Henry from the Cotentin. He dissembled his resentment for a time, and lived for nearly two years in the French Vexin in great poverty. He then accepted from the citizens of Domfront an invitation to defend them against Robert of Bellême; and subsequently, coming to an agreement with Rufus, assisted the king in making war on their elder brother Robert. When Robert's departure for the First Crusade left Normandy in the hands of Rufus (1096) Henry took service under the latter, and he was in the royal hunting train on the day of Rufus's death (Aug. 2, 1100).

Had Robert been in Normandy the claim of Henry to the English crown might have been effectually opposed. But Robert only returned to the duchy a month after Henry's coronation. In the meantime the new king, by issuing his famous charter, by recalling Anselm, and by choosing the Anglo-Scottish princess Edith-Matilda, daughter of Malcolm III., king of the Scots, as his future queen, had cemented that alliance with the church and with the native English which was the foundation of his greatness. Anselm preached in his favour, English levies marched under the royal banner both to repel Robert's invasion (1101) and to crush the revolt of the Montgomeries headed by Robert of Bellême (1102). The alliance of crown and church was subsequently imperilled by the question of Investitures (1103–1106). Henry was sharply criticized for his ingratitude to Anselm (*q.v.*), in spite of the marked respect which he showed to the archbishop. At this juncture a sentence of excommunication would have been a dangerous blow to Henry's power in England. But the king's diplomatic skill enabled him to satisfy the church without surrendering any rights of consequence (1106); and he skilfully threw the blame of his previous conduct upon his counsellor, Robert of Meulan. Although the *Peterborough Chronicle* accuses Henry of oppression in his early years, the nation soon learned to regard him with respect. William of Malmesbury, about 1125, already treats Tinchebrai (1106) as an English victory and the revenge for Hastings. Henry was disliked but feared by the baronage, towards whom he showed gross bad faith in his disregard of his coronation promises. In 1110 he banished the more conspicuous malcontents, and from that date was safe against the plots of his English feudatories.

With Normandy he had more trouble, and the military skill which he had displayed at Tinchebrai was more than once put to the test against Norman rebels. His Norman, like his English administration, was popular with the non-feudal classes, but doubtless oppressive towards the barons. The latter had abandoned the cause of Duke Robert, who remained a prisoner in England till his death (1134); but they embraced that of Robert's son William the Clito, whom Henry in a fit of generosity had allowed to go free after Tinchebrai. The Norman conspiracies of 1112, 1118 and 1123–24 were all formed in the Clito's interest. Both France and Anjou supported this pretender's cause from time to time; he was always a thorn in Henry's side till his untimely death at Alost (1128), but more especially after the catastrophe of the White Ship (1120) deprived the king of his only lawful son. But Henry emerged from these complications with enhanced prestige. His campaigns had been uneventful, his chief victory (Brémule, 1119) was little more than a skirmish. But he had held his own as a general, and as a diplomatist he had shown surpassing skill. The chief triumphs of his foreign policy were the marriage of his daughter Matilda to the emperor Henry V. (1114) which saved Normandy in 1124; the detachment of the pope, Calixtus II., from the side of France and the Clito (1119), and the Angevin marriages which he arranged for his son William Aetheling (1119) and for the widowed empress Matilda (1129) after her brother's death. This latter match, though unpopular in England and Normandy, was a fatal blow to the designs of Louis VI., and prepared the way for the expansion of English power beyond the Loire. After 1124 the disaffection of Normandy was crushed. The severity with which Henry treated the last rebels was regarded as a blot upon his fame; but the only case of merely vindictive punishment was that of the poet Luke de la Barre, who was sentenced to lose his eyes for a lampoon upon the king, and only escaped the sentence by committing suicide

Henry's English government was severe and grasping; but he "kept good peace" and honourably distinguished himself among contemporary statesmen in an age when administrative reform was in the air. He spent more time in Normandy than in England. But he showed admirable judgment in his choice of subordinates; Robert of Meulan, who died in 1118, and Roger of Salisbury, who survived his master, were statesmen of no common order; and Henry was free from the mania of attending in person to every detail, which was the besetting sin of mediaeval sovereigns. As a legislator Henry was conservative. He issued few ordinances; the unofficial compilation known as the *Leges Henrici* shows that, like the Conqueror, he made it his ideal to maintain the "law of Edward." His itinerant justices were not altogether a novelty in England or Normandy. It is characteristic of the man that the exchequer should be the chief institution created in his reign. The eulogies of the last *Peterborough Chronicle* on his government were written after the anarchy of Stephen's reign had invested his predecessor's "good peace" with the glamour of a golden age. Henry was respected and not tyrannous. He showed a lofty indifference to criticism such as that of Eadmer in the *Historia novorum*, which was published early in the reign. He showed, on some occasions, great deference to the opinions of the magnates. But dark stories, some certainly unfounded, were told of his prison-houses. Men thought him more cruel and more despotic than he actually was.

Henry was twice married. After the death of his first wife, Matilda (1080–1118), he took to wife Adelaide, daughter of Godfrey, count of Louvain (1121), in the hope of male issue. But the marriage proved childless, and the empress Matilda was designated as her father's successor, the English baronage being compelled to do her homage both in 1126, and again, after the Angevin marriage, in 1131. He had many illegitimate sons and daughters by various mistresses. Of these bastards the most important is Robert, earl of Gloucester, upon whom fell the main burden of defending Matilda's title against Stephen.

Henry died near Gisors on Dec. 1, 1135, in the 36th year of his reign, and was buried in the abbey of Reading which he himself had founded.

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Series, 1884); William of Malmesbury, *Gesta regum* and *Historia novella* (ed. Stubbs, Rolls Series, 1887–1889); Henry of Huntingdon, *Historia Anglorum* (ed. Arnold, Rolls Series, 1879); Simeon of Durham (ed. Arnold, Rolls Series, 1882–85); Orderic Vitalis, *Historia ecclesiastica* (ed. le Prévost, Paris, 1838–1855); Robert of Torigni, *Chronica* (ed. Howlett, Rolls Series, 1889), and *Continuatio Willelmi Gemmeticensis* (ed. Duchesne, *Hist. Normannorum scriptores*, pp. 215–317, Paris, 1619). *See* also the Pipe Roll of 31 H. I. (ed. Hunter, *Record Commission*, 1833); the documents in W. Stubbs's *Select Chapters* (1895); the *Leges Henrici* in Liebermann's *Gesetze der Angel-Sachsen* (Halle, 1898, etc.); and the same author's monograph, *Leges Henrici* (Halle, 1901); the treaties, etc., in the Record Commission edition of Thomas Rymer's *Foedera*, vol. i. (1816).

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HENRY II. (1133–1189), king of England, son of Geoffrey Plantagenet, count of Anjou, by Matilda, daughter of Henry I., was born at Le Mans on March 25, 1133. He was brought to England during his mother's conflict with Stephen (1142), and was placed under the charge of a tutor at Bristol. He returned to Normandy in 1146. He next appeared on English soil in 1149[1] when he came to court the help of Scotland and the English baronage against King Stephen. The second visit was of short duration. In 1150 he was invested with Normandy by his father, whose death in the next year made him also count of Anjou. In 1152 by a marriage with Eleanor of Aquitaine, the divorced wife of the French king Louis VII., he acquired Poitou, Guienne and Gascony; but in doing so incurred the ill-will of his suzerain from which he suffered not a little in the future. Lastly in 1153 he was able, through the aid of the Church and his mother's partisans, to extort from Stephen the recognition of his claim to the English succession; and this claim was asserted without opposition immediately after Stephen's death (Oct. 25, 1154).

The first years of the reign were largely spent in restoring the public peace and recovering for the crown the lands and prerogatives which Stephen had bartered away. Amongst the older partisans of the Angevin house the most influential were Archbishop Theobald, whose good will guaranteed to Henry the support of the Church, and Nigel, bishop of Ely, who presided at the exchequer. But Thomas Becket, archdeacon of Canterbury, a younger statesman whom Theobald had discovered and promoted, soon became all-powerful. Becket lent himself entirely to his master's ambitions, which at this time centred round schemes of territorial aggrandizement. In 1155 Henry asked and obtained from Adrian IV. a licence to invade Ireland, which the king contemplated bestowing upon his brother, William of Anjou. This plan was dropped; but Malcolm of Scotland was forced to restore the northern counties which had been ceded to David; North Wales was invaded in 1157; and in 1159 Henry made an attempt, which was foiled by the intervention of Louis VII., to assert his wife's claims upon Toulouse. After vainly invoking the aid of the emperor Frederick I., the young king came to terms with Louis (1160), whose daughter was betrothed to Henry's namesake and heir. The peace proved unstable, and there was desultory skirmishing in 1161. The following year was chiefly spent in reforming the government of the continental provinces. In 1163 Henry returned to England, and almost immediately embarked on that quarrel with the Church which is the keynote to the middle period of the reign.

Henry had good cause to complain of the ecclesiastical courts, and had only awaited a convenient season to correct abuses which were admitted by all reasonable men. But he allowed the question to be complicated by personal issues. He was bitterly disappointed that Becket, on whom he bestowed the primacy, left vacant by the death of Theobald (1162), at once became the champion of clerical privilege; he and the archbishop were no longer on speaking terms when the Constitutions of Clarendon came up for debate. The king's demands were not intrinsically irreconcilable with the canon law, and the papacy would probably have allowed them to take effect *sub silentio*, if Becket (*q.v.*) had not been goaded to extremity by persecution in the forms of law. After Becket's flight (1164), the king put himself still further in the wrong by impounding the revenues of Canterbury and banishing at one stroke a number of the archbishop's friends and connections. He showed, however, considerable dexterity in playing off the emperor against Alexander III. and Louis VII., and contrived for five years, partly by these means, partly by insincere negotiations with Becket, to stave off a papal interdict upon his dominions. When, in July 1170, he was forced by Alexander's threats to make terms with Becket, the king contrived that not a word should be said of the Constitutions. He undoubtedly hoped that in this matter he would have his way when Becket should be more in England and within his grasp. For the murder of Becket (Dec. 29, 1170) the king cannot be held responsible, though the deed was suggested by his impatient words. It was a misfortune to the royal cause; and Henry was compelled to purchase the papal absolution by a complete surrender on the question of criminous clerks (1172). When he heard of the murder he was panic-stricken; and his expedition to Ireland (1171), although so momentous for the future, was originally a mere pretext for placing himself beyond the reach of Alexander's censures.

Becket's fate, though it supplied an excuse, was certainly not the real cause of the troubles with his sons which disturbed the king's later years (1173–1189). But Henry's misfortunes were largely of his own making. Queen Eleanor, whom he alienated by his faithlessness, stirred up her sons to rebellion; and they had grievances enough to be easily persuaded. Henry was an affectionate but a suspicious and close-handed father. The titles which he bestowed on them carried little power, and served chiefly to denote the shares of the paternal inheritance which were to be theirs after his death. The excessive favour which he showed to John, his youngest-born, was another cause of heart-burning; and Louis, the old enemy, did his utmost to foment all discords. It must, however, be remembered in Henry's favour, that the supporters of the princes, both in England and in the foreign provinces, were animated by resentment against the soundest features of the king's administration; and that, in the rebellion of 1173, he received from the English commons such hearty support that any further attempt to raise a rebellion in England was considered hopeless. Henry, like his grandfather, gained in popularity with every year of his reign. In 1183 the death of Prince Henry, the heir-apparent, while engaged in a war against his brother Richard and their father, secured a short interval of peace. But in 1184 Geoffrey of Brittany and John combined with their father's leave to make war upon Richard, now the heir-apparent. After Geoffrey's death (1186) the feud between John and Richard drove the latter into an alliance with Philip Augustus of France. The ill-success of the old king in this war aggravated the disease from which he was suffering; and his heart was broken by the discovery that John, for whose sake he had alienated Richard, was in secret league with the victorious allies. Henry died at Chinon on July 6, 1189, and was buried at Fontevraud. By Eleanor of Aquitaine the king had five sons and three daughters. His eldest son, William, died young; his other sons, Henry, Richard, Geoffrey and John, are all mentioned above. His daughters were: Matilda (1156–1189), who became the wife of Henry the Lion, duke of Saxony; Eleanor (1162–1214), who married Alphonso III., king of Castile; and Joanna, who, after the death of William of Sicily in 1189, became the wife of Raymund VI., count of Toulouse, having previously accompanied her brother, Richard, to Palestine. He had also three illegitimate sons: Geoffrey, archbishop of York; Morgan; and William Longsword, earl of Salisbury.

Henry's power impressed the imagination of his contemporaries, who credited him with aiming at the conquest of France and the acquisition of the imperial title. But his ambitions of conquest were comparatively moderate in his later years. He attempted to secure Maurienne and Savoy for John by a marriage-alliance, for which a treaty was signed in 1173. But the project failed through the death of the intended bride; nor did

[1] For a supposed visit in 1147, *see* J. H. Round in *English Historical Review*, v. 747.

the marriage of his third daughter, the princess Joanna (1165–1199), with William II., king of Sicily (1177) lead to English intervention in Italian politics. Henry once declined an offer of the empire, made by the opponents of Frederick Barbarossa; and he steadily supported the young Philip Augustus against the intrigues of French feudatories. The conquest of Ireland was carried out independently of his assistance, and perhaps against his wishes. He asserted his suzerainty over Scotland by the treaty of Falaise (1175), but not so stringently as to provoke Scottish hostility. This moderation was partly due to the embarrassments produced by the ecclesiastical question and the rebellions of the princes. But Henry, despite a violent and capricious temper, had a strong taste for the work of a legislator and administrator. He devoted infinite pains and thought to the reform of government both in England and Normandy. The legislation of his reign was probably in great part of his own contriving. His supervision of the law courts was close and jealous; he transacted a great amount of judicial business in his own person, even after he had formed a high court of justice which might sit without his personal presence. To these activities he devoted his scanty intervals of leisure. His government was stern; he over-rode the privileges of the baronage without regard to precedent; he persisted in keeping large districts under the arbitrary and vexatious jurisdiction of the forest-courts. But it is the general opinion of historians that he had a high sense of his responsibilities and a strong love of justice; despite the looseness of his personal morals, he commanded the affection and respect of Gilbert Foliot and Hugh of Lincoln, the most upright of the English bishops.

ORIGINAL AUTHORITIES.—Henry's laws are printed in W. Stubbs's *Select Charters* (Oxford, 1895). The chief chroniclers of his reign are William of Newburgh, Ralph de Diceto, the so-called Benedict of Peterborough, Roger of Hoveden, Robert de Torigni (or de Monte), Jordan Fantosme, Giraldus Cambrensis, Gervase of Canterbury; all printed in the Rolls Series. The biographies and letters contained in the 7 vols. of *Materials for the History of Thomas Becket* (ed. J. C. Robertson, Rolls Series, 1875–85) are valuable for the early and middle part of the reign. For Irish affairs the *Song of Dermot* (ed. Orpen, Oxford, 1892), for the rebellions of the princes the metrical *Histoire de Guillaume le Maréchal* (ed. Paul Meyer, 3 vols., Paris, 1891, etc.) are of importance. Henry's legal and administrative reforms are illustrated by the *Tractatus de legibus* attributed to Ranulph Glanville, his chief justiciar (ed. G. Phillips, Berlin, 1828); by the *Dialogus de scaccario* of Richard fitz Nigel (Oxford, 1902); the *Pipe Rolls*, printed by J. Hunter for the Record Commission (1844) and by the Pipe-Roll Society (1884, etc.) supply valuable details. The works of John of Salisbury (ed. Giles, 1848), Peter of Blois (ed. Migne), Walter Map (Camden Society, 1841, 1850) and the letters of Gilbert Foliot (ed. J. A. Giles, 1845) are useful for the social and Church history of the reign.

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HENRY III. (1207–1272), king of England, was the eldest son of King John by Isabella of Angoulême. Born on Oct. 1, 1207, the prince was but nine years old at the time of his father's death. The greater part of eastern England being in the hands of the French pretender, Louis, afterwards Louis VIII., and the rebel barons, Henry was crowned by his supporters at Gloucester, the western capital. John had committed his son to the protection of the Holy See; and a share in the government was accordingly allowed to the papal legates, Gualo and Pandulf, both during the civil war and for some time afterwards. But the title of regent was given by the loyal barons to William Marshal, the aged earl of Pembroke; and Peter des Roches, the Poitevin bishop of Winchester, received the charge of the king's person. The cause of the young Henry was fully vindicated by the end of 1217. Defeated both by land and sea, the French prince renounced his pretensions and evacuated England, leaving the regency to deal with the more difficult questions raised by the lawless insolence of the royal partisans. Henry remained a passive spectator of the measures by which William Marshal (d. 1219) and his successor, the justiciar Hubert de Burgh, asserted the royal prerogative against native barons and foreign mercenaries. In 1223 Honorius III. declared the king of age, but this was a mere formality, intended to justify the resumption of the royal castles and demesnes which had passed into private hands during the civil war.

The personal rule of Henry III. began in 1227, when he was again proclaimed of age. Even then he remained for some time under the influence of Hubert de Burgh, whose chief rival, Peter des Roches, found it expedient to quit the kingdom for four years. But Henry was ambitious to recover the continental possessions which his father had lost. Against the wishes of the justiciar he planned and carried out an expedition to the west of France (1230) and, when it failed, laid the blame upon his minister. Other differences arose soon afterwards. Hubert was accused, with some reason, of enriching himself at the expense of the crown, and of encouraging popular riots against the alien clerks for whom the papacy was providing at the expense of the English Church. He was disgraced in 1232; and power passed for a time into the hands of Peter des Roches, who filled the administration with Poitevins. So began the period of misrule by which Henry III. is chiefly remembered. The Poitevins fell in 1234; they were removed at the demand of the barons and the primate Edmund Rich, who held them responsible for the tragic fate of the rebellious Richard Marshal. But the king replaced them with a new clique of servile and rapacious favourites. Disregarding the wishes of the Great Council, and excluding all the more important of the barons and bishops from office, he acted as his own chief minister and never condescended to justify his policy except when he stood in need of subsidies. When these were refused, he extorted aids from the towns, the Jews or the clergy, the three most defenceless bodies in the kingdom. Always in pecuniary straits through his extravagance, he pursued a foreign policy which would have been expensive under the most careful management. He hoped not only to regain the French possessions but to establish members of his own family as sovereigns in Italy and the Empire. These plans were artfully fostered by the Savoyard kinsmen of Eleanor, daughter of Raymond Berenger, count of Provence, whom he married at Canterbury on Jan. 14, 1236, and by his half-brothers, the sons of Queen Isabella and Hugo, count of la Marche. These favourites, not content with pushing their fortunes in the English court, encouraged the king in the wildest designs. In 1242 he led an expedition to Gascony which terminated disastrously with the defeat of Taillebourg; and hostilities with France were intermittently continued for 17 years. The Savoyards encouraged his natural tendency to support the Papacy against the Empire; early in the period of misrule he entered into a close alliance with Rome, which resulted in heavy taxation of the clergy and gave great umbrage to the barons. A cardinal-legate was sent to England at Henry's request, and during four years (1237–41) administered the English Church in a manner equally profitable to the king and the pope. After the recall of the legate Otho the alliance was less open and less cordial. Still the pope continued to share the spoils of the English clergy with the king, and the king to enforce the demands of Roman tax-collectors.

Circumstances favoured Henry's schemes. Archbishop Edmund Rich was timid and inexperienced; his successor, Boniface of Savoy, was a kinsman of the queen; Grosseteste, the most eminent of the bishops, died in 1253, when he was on the point of becoming a popular hero. Among the lay barons, the first place naturally belonged to Richard of Cornwall who, as the king's brother, was unwilling to take any steps which might impair the royal prerogative; while Simon de Montfort, earl of Leicester, the ablest man of his order, was regarded with suspicion as a foreigner, and linked to Henry's cause by his marriage with the princess Eleanor. Although the Great Council repeatedly protested against the king's misrule and extravagance, their remonstrances came to nothing for want of leaders and a clear-cut policy. But between 1248 and 1252 Henry alienated Montfort from his cause by taking the side of the Gascons, whom the earl had provoked to rebellion through his rigorous administration of their

duchy. A little later, when Montfort was committed to opposition, Henry foolishly accepted from Innocent IV. the crown of Sicily for his second son Edmund Crouchback (1255). Sicily was to be conquered from the Hohenstaufen at the expense of England; and Henry pledged his credit to the papacy for enormous subsidies, although years of comparative inactivity had already overwhelmed him with debts. On the publication of the ill-considered bargain the baronage at length took vigorous action. They forced upon the king the Provisions of Oxford (1258), which placed the government in the hands of a feudal oligarchy; they reduced expenditure, expelled the alien favourites from the kingdom, and insisted upon a final renunciation of the French claims. The king submitted for the moment, but at the first opportunity endeavoured to cancel his concessions. He obtained a papal absolution from his promises; and he tricked the opposition into accepting the arbitration of the French king, Louis IX., whose verdict was a foregone conclusion. But Henry was incapable of protecting with the strong hand the rights which he had recovered by his double-dealing. Ignominiously defeated by Montfort at Lewes (1264) he fell into the position of a cipher, equally despised by his opponents and supporters. He acquiesced in the earl's dictatorship; left to his eldest son, Edward, the difficult task of reorganizing the royal party; marched with the Montfortians to Evesham; and narrowly escaped sharing the fate of his gaoler. After Evesham (1265) he is hardly mentioned by the chroniclers. The compromise with the surviving rebels was arranged by his son in concert with Richard of Cornwall and the legate Ottobuono; the statute of Marlborough (1267), which purchased a lasting peace by judicious concessions, was similarly arranged between Edward and the earl of Gloucester. Edward was king in all but name for some years before the death of his father, by whom he was alternately suspected and adored.

Henry had in him some of the elements of a fine character. His mind was cultivated; he was a discriminating patron of literature, and Westminster Abbey is an abiding memorial of his artistic taste. His personal morality was irreproachable, except that he inherited the Plantagenet taste for crooked courses and dissimulation in political affairs; even in this respect the king's reputation has suffered unduly at the hands of Matthew Paris, whose literary skill is only equalled by his malice. The ambitions which Henry cherished, if extravagant, were never sordid; his patriotism, though seldom attested by practical measures, was thoroughly sincere. Some of his worst actions as a politician were due to a sincere, though exaggerated, gratitude for the support which the Papacy had given him during his minority. But he had neither the training nor the temper of a statesman. His dreams of autocracy at home and far-reaching dominion abroad were anachronisms in a century of constitutional ideas and national differentiation. Above all he earned the contempt of Englishmen and foreigners alike by the instability of his purpose. Matthew Paris said that he had a heart of wax; Dante relegated him to the limbo of ineffectual souls; and later generations have endorsed these scathing judgments.

Henry died at Westminster on Nov. 16, 1272; his widow, Eleanor, took the veil in 1276 and died at Amesbury on June 25, 1291. Their children were: the future king Edward I.; Edmund, earl of Lancaster; Margaret (1240–75), wife of Alexander III., of Scotland; Beatrice; and Katherine.

ORIGINAL AUTHORITIES.—Roger of Wendover, *Flores historiarum* (ed. H. O. Coxe, 4 vols., 1841–44); and Matthew of Paris, *Chronica majora* (ed. H. R. Luard, Rolls Series, 7 vols., 1872–83) are the chief narrative sources. *See* also the *Annales monastici* (ed. H. R. Luard, Rolls Series, 5 vols., 1864–69); the collection of *Royal and other Historical Letters* ed. by W. Shirley (Rolls Series, 2 vols., 1862–66); the Close and Patent Rolls ed. for the Record Commission and the Master of the Rolls; the *Epistolae Roberti Grosseteste* (ed. H. R. Luard, Rolls Series, 1861); the *Monumenta Franciscana*, vol. i. (ed. J. S. Brewer, Rolls Series, 1858); the documents in the new *Foedera*, vol. i. (Record Commission, 1816).

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HENRY IV. (1367–1413), king of England, son of John of Gaunt, by Blanche, daughter of Henry, duke of Lancaster, was born on April 3, 1367, at Bolingbroke in Lincolnshire. As early as 1377 he is styled earl of Derby, and in 1380 he married Mary de Bohun (d. 1394) one of the co-heiresses of the last earl of Hereford. In 1387 he supported his uncle Thomas, duke of Gloucester, in his armed opposition to Richard II. and his favourites. Afterwards, probably through his father's influence, he changed sides. He was already distinguished for his knightly prowess, and for some years devoted himself to adventure. He thought of going on the crusade to Barbary; but instead, in July 1390, went to serve with the Teutonic knights in Lithuania. He came home in the following spring, but next year went again to Prussia, whence he journeyed by way of Venice to Cyprus and Jerusalem. After his return to England he sided with his father and the king against Gloucester, and in 1397 was made duke of Hereford. In Jan. 1398 he quarrelled with the duke of Norfolk, who charged him with treason. The dispute was to have been decided in the lists at Coventry in September; but at the last moment Richard intervened and banished them both.

When John of Gaunt died in Feb. 1399 Richard, contrary to his promise, confiscated the estates of Lancaster. Henry then felt himself free, and made friends with the exiled Arundels. Early in July, whilst Richard was absent in Ireland, he landed at Ravenspur in Yorkshire. He was at once joined by the Percies; and Richard, abandoned by his friends, surrendered at Flint on Aug. 19. On Richard's abdication Henry claimed the crown by right of blood from King Henry III., and through his right to recover the realm which was in point to be undone for default of governance and good law. Parliament formally accepted him, and thus Henry became king, "not so much by title of blood as by popular election" (Capgrave). The new dynasty had consequently a constitutional basis. But though the revolution of 1399 was popular in form, its success was due to an oligarchical faction. From the start Henry was embarrassed by the power and pretensions of the Percies. Nor was his hereditary title so good as that of the Mortimers. To domestic troubles was added the complication of disputes with Scotland and France. The first danger came from the friends of Richard, who plotted prematurely, and were crushed in Jan. 1400. During the summer of 1400 Henry made a not over-successful expedition to Scotland. The French court would not accept his overtures, but in the summer of 1401 a truce was patched up by the restoration of Richard's child-queen, Isabella of Valois. Meantime in 1400 and again in each of the two following autumns Henry tried in vain to subdue the revolt of Owen Glendower (*q.v.*). The success of the Percies over the Scots at Homildon Hill (Sept. 1402) was no advantage. Henry Percy (Hotspur) and his father, the earl of Northumberland, thought their services ill-requited, and finally made common cause with the partisans of Mortimer and the Welsh. The plot was frustrated by Hotspur's defeat at Shrewsbury (July 21, 1403); and Northumberland for the time submitted. Henry had, however, no one on whom he could rely outside his own family, except Archbishop Arundel. The Welsh were unsubdued; the French were plundering the southern coast; Northumberland was fomenting trouble in the north. In 1405 a plot to carry off the young Mortimers was defeated; but Mowbray, the earl marshal, who had been privy to it, raised a rebellion in the north supported by Archbishop Scrope of York. Mowbray and Scrope were taken and beheaded; Northumberland escaped into Scotland. For the execution of the archbishop Henry was personally responsible, and he could never free himself from its odium. Popular belief regarded his subsequent illness as a judgment for his impiety. Apart from ill-health and unpopularity Henry had succeeded—relations with Scotland were secured by the capture of James, the heir to the crown; Northumberland was at last crushed at Bramham Moor (Feb. 1408); and a little later the Welsh revolt was mastered.

Henry, stricken with sore disease, was unable to reap the advantage. His necessities had all along enabled the Commons to extort concessions in parliament, until in 1406 he was forced to nominate a council and govern by its advice. However, with Archbishop Arundel as his chancellor, Henry still controlled the government. But in Jan. 1410 Arundel had to give way to the king's half-brother, Thomas Beaufort. Beaufort and his brother Henry, bishop of Winchester, were opposed to Arundel and supported by the prince of Wales. For two years the real government rested with the prince and the council. Under the prince's influence the English intervened in France in 1411 on the side of Burgundy. In this, and in some matters of home politics, the king disagreed with his ministers. There is good reason to suppose that the Beauforts had gone so far as to contemplate a forced abdication on the score of the king's ill-health. However, in Nov. 1411 Henry showed that he was still capable of vigorous action by discharging the prince and his supporters. Arundel again became chancellor, and the king's second son, Thomas, took his brother's place. The change was further marked by the sending of an expedition to France in support of Orleans. But Henry's health was failing steadily. On March 20, 1413, whilst praying in Westminster Abbey he was seized with a fainting fit, and died that same evening in the Jerusalem Chamber. He was buried at Canterbury.

By Mary de Bohun Henry had four sons: his successor Henry V., Thomas, duke of Clarence, John, duke of Bedford, and Humphrey, duke of Gloucester; and two daughters, Blanche, who married Louis III., elector palatine of the Rhine, and Philippa, who married Eric XIII., king of Sweden. Henry's second wife was Joan, or Joanna (*c.* 1370–1437), daughter of Charles the Bad, king of Navarre, and widow of John IV. or V., duke of Brittany, who survived until July 1437. By her he had no children.

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(C. L. K.)

HENRY V. (1387–1422), king of England, son of Henry IV. by Mary de Bohun, was born at Monmouth, in Aug. 1387. On his father's exile in 1398 Richard II. took the boy into his own charge, and treated him kindly. Next year the Lancastrian revolution forced Henry into precocious prominence as heir to the throne. From Oct. 1400 the administration of Wales was conducted in his name; less than three years later he was in actual command of the English forces and fought against the Percies at Shrewsbury. The Welsh revolt absorbed his energies till 1408. Then through the king's ill-health he began to take a wider share in politics. (*See* HENRY IV.) In Nov. 1411 the king discharged the prince from the council. The quarrel of father and son was political only. It may be to that political enmity that the tradition of Henry's riotous youth, immortalized by Shakespeare, is partly due. To that tradition Henry's strenuous life in war and politics is a sufficient general contradiction. The most famous incident, his quarrel with the chief-justice, has no contemporary authority and was first related by Sir Thomas Elyot in 1531. The story of Falstaff originated partly in Henry's early friendship for Oldcastle (*q.v.*). That friendship, and the prince's political opposition to Archbishop Arundel, perhaps encouraged Lollard hopes. If so, their disappointment may account for the statements of ecclesiastical writers, like Walsingham, that Henry on becoming king was changed suddenly into a new man.

Henry succeeded his father on March 20, 1413. He had to deal with three main problems—the restoration of domestic peace, the healing of schism in the Church and the recovery of English prestige in Europe. Henry grasped them all together, and gradually built upon them a yet wider policy. From the first he made it clear that past differences were to be forgotten. Richard II. was honourably re-interred; the young Mortimer was taken into favour; the heirs of those who had suffered in the last reign were restored gradually to their titles and estates. With Oldcastle Henry used his personal influence in vain, and the gravest domestic danger was Lollard discontent. But the king's firmness nipped the movement in the bud (Jan. 1414), and made his own position as ruler secure. Save for the abortive Scrope and Cambridge plot in favour of Mortimer in July 1415, the rest of his reign was free from serious trouble at home.

Henry could now turn his attention to foreign affairs. Old commercial disputes and the support which the French had lent to Glendower gave a pretext for war with France. The campaign of 1415, with its brilliant conclusion at Agincourt (Oct. 25), was only the first step. Two years of patient preparation followed. The command of the sea was secured by driving the Genoese allies of the French out of the Channel. A successful diplomacy detached the emperor Sigismund from France, and by the Treaty of Canterbury paved the way to end the schism in the Church. In 1417 the war was renewed on a larger scale. Lower Normandy was quickly conquered, Rouen cut off from Paris and besieged. The French were paralysed by the disputes of Burgundians and Armagnacs. Henry skilfully played them off one against the other, without relaxing his warlike energy. In Jan. 1419 Rouen fell. By August the English were outside the walls of Paris. The intrigues of the French parties culminated in the assassination of John of Burgundy by the dauphin's partisans at Montereau (Sept. 10, 1419). Philip, the new duke, and the French court threw themselves into Henry's arms After six months' negotiation Henry was, by the Treaty of Troyes, recognized as heir and regent of France, and on June 2, 1420, married Catherine, the king's daughter. He was now at the height of his power. His eventual success in France seemed certain. He shared with Sigismund the credit of having ended the Great Schism by obtaining the election of Pope Martin V. All the states of western Europe were being brought within the web of his diplomacy. The headship of Christendom was in his grasp, and schemes for a new crusade began to take shape. He actually sent an envoy to collect information in the East; but his plans were cut short by death. A visit to England in 1421 was interrupted by the defeat of Clarence at Baugé. The hardships of the longer winter siege of Meaux broke down his health, and he died at Bois de Vincennes on Aug. 3, 1422.

Henry's last words were a wish that he might live to rebuild the walls of Jerusalem. They are significant. His ideal was founded consciously on the models of Arthur and Godfrey as national king and leader of Christendom. So he is the typical mediaeval hero. For that very reason his schemes were doomed to end in disaster, since the time was come for a new departure. Yet he was not reactionary. His policy was constructive: a firm central government supported by parliament; church reform on conservative lines; commercial development; and the maintenance of national prestige. His aims in some respects anticipated those of his Tudor successors, but he would have accomplished them on mediaeval lines as a constitutional ruler. His success was due to the power of his personality. He could train able lieutenants, but at his death there was no one who could take his place as leader. War, diplomacy and civil administration were all dependent on his guidance. His dazzling achievements as a general have obscured his more sober qualities as a ruler, and even the sound strategy, with which he aimed to be master of the narrow seas. If he was not the founder of the English navy he was one of the first to realize its true importance. Henry had so high a sense of his own rights that he was merciless to disloyalty. But he was scrupulous of the rights of others, and it was his eager desire to further the cause of justice that impressed his French contemporaries. He has been charged with cruelty as a religious persecutor; but in fact he had as prince opposed the harsh policy of Archbishop Arundel, and as king sanctioned a more moderate course. Lollard executions during his reign had more often a political than a religious reason. To be just with sternness was in

his eyes a duty. In his personal conduct Henry was chaste, temperate and sincerely pious. He delighted in sport and all manly exercises. He was cultured with a taste for literature, art and music. Henry lies buried in Westminster Abbey. His tomb was stripped of its splendid adornment during the Reformation. The shield, helmet and saddle, which formed part of the original funeral equipment, still hang above it.

BIBLIOGRAPHY.—Of original authorities the best on the English side is the *Gesta Henrici Quinti* (down to 1416), printed anonymously for the English Historical Society, but probably written by Thomas Elmham, one of Henry's chaplains. Two lives edited by Thomas Hearne under the names of Elmham and Titus Livius Forojuliensis come from a common source; the longer, which Hearne ascribed incorrectly to Elmham, is perhaps the original work of Livius, who was an Italian in the service of Humphrey of Gloucester, and wrote about 1440. Other authorities are the Chronicles of Walsingham and Otterbourne the *English Chronicle* or *Brut*, and the various *London Chronicles*. On the French side the most valuable are Chronicles of Monstrelet and St. Rémy (both Burgundian) and the *Chronique du religieux de S. Denys* (the official view of the French court). For documents and modern authorities *see* under HENRY IV. *See* also C. L. Kingsford, *Henry V., the Typical Mediaeval Hero* (New York, 1901); and J. H. Wylie, *The Reign of Henry V.* (2 vols. 1914–19).

HENRY VI. (1421–1471), king of England, son of Henry V. and Catherine of Valois, was born at Windsor on Dec. 6, 1421. He became king of England on Sept. 1, 1422, and a few weeks later, on the death of his grandfather Charles VI, was proclaimed king of France also. Henry V. had directed that Richard Beauchamp, earl of Warwick (*q.v.*), should be his son's preceptor. As early as 1423 the baby king was made to appear at public functions and take his place in parliament. He was knighted by his uncle Bedford at Leicester in May 1426, and on Nov. 6, 1429, was crowned at Westminster. Early in the next year he was taken over to France, and after long delay crowned in Paris on Dec 16, 1431. His return to London Feb. 14, 1432 was celebrated with a great pageant devised by Lydgate.

During these early years Bedford ruled France wisely and at first with success, but he could not prevent the mischief which Humphrey of Gloucester (*q.v.*) caused both at home and abroad. Even in France the English lost ground steadily after the victory of Joan of Arc before Orleans in 1429 The climax came with the death of Bedford, and defection of Philip of Burgundy in 1435. This closed the first phase of Henry's reign. There followed 15 years of vain struggle in France, and growing disorder at home. The determining factor in politics was the conduct of the war. Cardinal Beaufort, and after him Suffolk, sought by working for peace to secure at least Guienne and Normandy. Gloucester courted popularity by opposing them throughout; with him was Richard of York, who stood next in succession to the crown. Beaufort controlled the council, and it was under his guidance that the king began to take part in the government. Thus it was natural that as Henry grew to manhood he seconded heartily the unpopular and difficult peace policy. Henry was unfortunate in his advisers. The cardinal was old, his nephews John and Edmund Beaufort were incompetent, Suffolk was tactless. Suffolk, however, achieved a great success by negotiating the marriage of Henry to Margaret of Anjou (*q.v.*) in 1445. Humphrey of Gloucester and Cardinal Beaufort both died early in 1447. Suffolk was now all-powerful in the favour of the king and queen. But his home administration was unpopular, whilst the incapacity of Edmund Beaufort ended in the loss of all Normandy and Guienne. Suffolk's fall in 1450 left Richard of York the foremost man in England. Henry's reign then entered on its last phase of dynastic struggle. Cade's rebellion suggested first that popular discontent might result in a change of rulers. But York, as heir to the throne, could bide his time. The situation was altered by the mental derangement of the king, and the birth of his son in 1453. York after a struggle secured the protectorship, and for the next year ruled England. Then Henry was restored to sanity, and the queen and Edmund Beaufort, now duke of Somerset, to power. Open war followed (*see* WARS OF THE ROSES), with the defeat and death of Somerset at St. Albans on May 22, 1455. Nevertheless a hollow peace was patched up, which continued during four years with lack of all governance. In 1459 war broke out again. On July 10, 1460 Henry was taken prisoner at Northampton, and forced to acknowledge York as heir, to the exclusion of his own son. Richard of York's death at Wakefield (Dec. 29, 1460), and the queen's victory at St. Albans (Feb. 17, 1461), brought Henry his freedom and no more. Edward of York had himself proclaimed king, and by his decisive victory at Towton on March 29, put an end to Henry's reign. For over three years Henry was a fugitive in Scotland. He returned to take part in an abortive rising in 1464. A year later he was captured in the north, and brought a prisoner to the Tower. For six months in 1470–1471 he emerged to hold a shadowy kingship as Warwick's puppet. Edward's final victory at Tewkesbury was followed by Henry's death on May 21, 1471, certainly by violence, perhaps at the hands of Richard of Gloucester.

Henry was the most hapless of monarchs. He was so honest and well-meaning that he might have made a good ruler in quiet times. But he was crushed by the burden of his inheritance. He had not the genius to find a way out of the French entanglement or the skill to steer a constitutional monarchy between rival factions. Henry's very virtues added to his difficulties. He was so trusting that any one could influence him, so faithful that he would not give up a minister who had become impossible. Thus even in the middle period he had no real control of the Government. Religious observances and study were his chief occupations. For education he was really zealous. The planning of his great foundations at Eton (1440) and King's college, Cambridge (1441), was the one thing which absorbed his interest. To both he was more than a royal founder, and the credit of the whole scheme belongs to him.

Henry's only son was Edward, Prince of Wales (1453–1471), who, having shared the many journeys and varying fortunes of his mother, Margaret, was killed after the battle of Tewkesbury (May 4, 1471) by some noblemen in attendance on Edward IV.

BIBLIOGRAPHY.—There is a life of Henry by his chaplain John Blakman (printed at the end of Hearne's edition of Otterbourne); but it is concerned only with his piety and patience in adversity. English chronicles for the reign are scanty; the best are the *Chronicles of London* (ed. C. L. Kingsford), with the analogous *Gregory's Chronicle* (ed. J. Gairdner for Camden Soc.) and *Chronicle of London* (ed. Sir H. N. Nicolas). *The Paston Letters*, with James Gairdner's valuable introductions, are indispensable. Other useful authorities are Joseph Stevenson's *Letters and Papers illustrative of the Wars of the English in France during the Reign of Henry VI.*; and *Correspondence of T. Bekynton* (both in the "Rolls" series). For the French war the chief sources are the *Chronicles* of Monstrelet, D'Escouchy and T. Basin. For other documents and modern authorities *see* under HENRY IV. For Henry's foundations *see* Sir H. C. Maxwell-Lyte, *History of Eton College* (1899), and J. B. Mullinger, *History of the University of Cambridge* (1888). (C. L. K.)

HENRY VII. (1457–1509), king of England, grandson of John of Gaunt and Catherine Swynford, whose issue born before their marriage had been legitimated by parliament, was the first king of the Tudor (*q.v.*) dynasty. He was the son of Edmund, earl of Richmond, and Margaret Beaufort, only daughter of John, duke of Somerset, and was born in Pembroke castle on Jan. 28, 1457, two months after his father's death. During the reign of Edward IV. the child Henry was hidden in various castles until his uncle Jasper took him to Brittany. There he was joined by many Englishmen driven abroad by the cruelties of Richard III. An invasion of England was planned in 1483 in concert with the duke of Buckingham's rising; but stormy weather defeated the movement. A second expedition, two years later, aided this time by France, was successful. Henry landed at Milford Haven among his Welsh allies and defeated Richard at the battle of Bosworth (Aug. 22, 1485). He was crowned at Westminster on Oct. 30, and in fulfilment of pledges to his Yorkist supporters, married Elizabeth (1465–1503), eldest daughter and heiress of Edward IV. (Jan. 18, 1486), whose two brothers had been murdered by Richard III. Thus the Red and White Roses were united and the pretexts for civil war done away with.

Nevertheless, Henry's reign was much disturbed by a succession of Yorkist conspiracies. Of the two most notable impostors, the first, Lambert Simnel (*q.v.*) personated the earl of Warwick, son of the duke of Clarence, but the rebellion in his favour was put down at the battle of Stoke, near Newark (June 16, 1487).

This movement had been greatly assisted by the Irish and by Margaret, duchess dowager of Burgundy, sister of Edward IV. The second pretender, Perkin Warbeck (*q.v.*), who impersonated (1492) Richard duke of York, one of the princes murdered in the Tower, was also much indebted to foreign support. Anxious as Henry was to avoid foreign wars, he was committed to war with France, partly by his desire of an alliance with Spain, and partly by desire to prevent the incorporation of Brittany with France. Moreover, the French king gave assistance to Perkin Warbeck. Henry gave Brittany defensive aid; but after the duchess Anne had married Charles VIII. of France, he felt bound to fulfil his obligations to Ferdinand and Isabella of Spain, and also to the German king Maximilian, by an invasion of France in 1492. After besieging Boulogne for some little time, he made peace with France at Etaples (Nov. 3, 1492).

Meanwhile Margaret of Burgundy received Perkin Warbeck as her nephew, and Maximilian, now estranged from Henry, recognized him (1494) as king of England. Perkin Warbeck attempted to land at Deal, but sailed to Ireland and then to Scotland, where James IV. received him (Nov. 1495), married him to an earl's daughter and made a futile invasion (1496) of England with him. But in 1497 he thought best to dismiss him, and Perkin, after an unsuccessful visit to Ireland, landed with a small body of men in Cornwall, where shortly before an insurrection on account of the taxation imposed for repelling the Scottish invasion, had been put down. Perkin, after a futile siege of Exeter and an advance to Taunton, took sanctuary at Beaulieu in Hampshire, and surrendered (Sept. 1497). Imprisoned near the earl of Warwick, in the Tower, he inveigled that simple-minded youth into a project of escape. For this, both were executed (1499) and during the rest of Henry's reign no further insurrections occurred.

The king was now seeking alliances for his children. While the eldest, Arthur, was still an infant, a marriage had been proposed for him with Catherine, daughter of Ferdinand of Aragon. Catherine was now brought to England and they were married on Nov. 14, 1501. On Arthur's death in the following April, Catherine was betrothed to the king's second son, Henry. Meanwhile Henry's eldest daughter Margaret was married (1503) to James IV. of Scotland—a match intended to confirm the treaty of peace signed in July 1499 and to make possible the ultimate union of England and Scotland, which actually resulted from it. Henry's queen died on Feb. 11, 1503, and during the remainder of his reign he made fruitless proposals for a second marriage—proposals in which political objects were the chief consideration.

In his latter years the king became unpopular from the extortions practised by his two instruments, Empson and Dudley, under the authority of antiquated statutes. From the beginning of his reign he had accumulated money, mainly for his own security against intrigues and conspiracies, and avarice had grown upon him. When he died in April 1509 he was undoubtedly the richest prince in Christendom. Before his death, however, he had finished the hospital of the Savoy and made provision for the magnificent chapel at Westminster which bears his name.

Henry not only terminated a disastrous civil war, put down the Scottish invasion and reduced Ireland to obedience, but after the profitable Treaty of Etaples, remained on good terms with France, with the duchy of Brittany and with Spain, and was able to mollify Maximilian. With Maximilian's son, the archduke Philip, governor of the Netherlands, Henry made a special effort to keep peace because of the commercial advantages involved. With the papacy also his diplomacy and orthodoxy kept him in friendly relations. During the 24 years of Henry's reign only seven parliaments met, the second one instituting the famous court of the Star Chamber for the correction of irregularities in the administration of justice due to the breakdown of the jury system. The question of wages, hours of labour and standards of commerce and manufacture, were also taken up by parliament, and internal trade became less local. When Henry died his position was strong both in England and on the Continent.

See W. Campbell, *Materials for a Hist. of the Reign of Henry VII.* in Rolls Series (2 vols. 1873–77); Francis Bacon, *Life of Henry VII.* (ed. Lumby, Cambridge 1881); J. Gairdner, *Henry the Seventh* (1889); H. A. L. Fisher in vol. v. (2nd ed. 1913) of the *Political Hist. of England;* A. F. Pollard, *The Reign of Henry VII. from Contemporary sources* (3 vols. 1913–14); Gladys Temperley, *Henry VII.* (1914) and W. D. Bushell, *The Lady Margaret Beaufort and Henry VII.* (1916).

HENRY VIII. (1491–1547), king of England and Ireland, the third child and second son of Henry VII. and Elizabeth of York, was born at Greenwich on June 28, 1491. He was the first English monarch to be educated under the influence of the Renaissance, and his tutors included the poet Skelton; he became an accomplished scholar, linguist, musician and athlete, and by the death of his brother Arthur in 1502 and of his father on April 22, 1509 Henry VIII. succeeded to the throne.

He had been betrothed to his brother's widow Catherine of Aragon, and in spite of the protest which he had been made to register against the marriage, and of the doubts expressed by Julius II. and Archbishop Warham as to its validity, it was completed in the first few months of his reign. This step was largely due to the pressure brought to bear by Catherine's father Ferdinand upon Henry's council; he regarded England as a tool in his hands and Catherine as his resident ambassador. The young king himself at first took little interest in politics, and for two years affairs were managed by the pacific Richard Fox (*q.v.*) and Warham. Then Wolsey became supreme, while Henry was immersed in the pursuit of sport and other amusements. He took, however, the keenest interest from the first in learning and in the navy, and his inborn pride easily led him to support Wolsey's and Ferdinand's war-like designs on France. He followed an English army across the Channel in 1513, and personally took part in the successful sieges of Thérouanne and Tournay and the battle of Guinegate which led to the peace of 1514. Ferdinand, however, deserted the English alliance, and amid the consequent irritation against everything Spanish, there was talk of a divorce between Henry and Catherine (1514), whose issue had hitherto been attended with fatal misfortune. But the renewed antagonism between England and France which followed the accession of Francis I. (1515) led to a rapprochement with Ferdinand; the birth of the lady Mary (1516) held out hopes of the male issue which Henry so much desired; and the question of a divorce was postponed. Ferdinand died in that year (1516) and the emperor Maximilian in 1519. Their grandson Charles V. succeeded them both in all their realms and dignities in spite of Henry's hardly serious candidature for the empire; and a lifelong rivalry broke out between him and Francis I. Wolsey used this antagonism to make England arbiter between them; and both monarchs sought England's favour in 1520, Francis at the Field of Cloth of Gold and Charles V. more quietly in Kent. At the conference of Calais in 1521 English influence reached its zenith; but the alliance with Charles destroyed the balance on which that influence depended. Francis was overweighted, and his defeat at Pavia in 1525 made the emperor supreme. Feeble efforts to challenge his power in Italy provoked the sack of Rome in 1527; and the peace of Cambrai in 1529 was made without any reference to Wolsey or England's interests.

Meanwhile Henry had been developing a serious interest in politics, and he could brook no superior in whatever sphere he wished to shine. He began to adopt a more critical attitude towards Wolsey's policy, foreign and domestic; and to give ear to the murmurs against the cardinal and his ecclesiastical rule. Parliament had been kept at arm's length since 1515 lest it should attack the church; but Wolsey's expensive foreign policy rendered recourse to parliamentary subsidies indispensable. When it met in 1523 it refused Wolsey's demands, and forced loans were the result which increased the cardinal's unpopularity. Nor did success abroad now blunt the edge of domestic discontent. His fate, however, was sealed by his failure to obtain a divorce for Henry from the papal court.

The king's hopes of male issue had been disappointed, and by 1526 it was fairly certain that Henry could have no male heir to the throne while Catherine remained his wife. There was Mary, but no queen regnant had yet ruled in England; Margaret Beaufort had been passed over in favour of her son in 1485, and there was a popular impression that women were excluded from the

throne. No candidate living could have secured the succession without a recurrence of civil war. Moreover the unexampled fatality which had attended Henry's issue revived the theological scruples which had always existed about the marriage; and the breach with Charles V. in 1527 provoked a renewal of the design of 1514. All these considerations were magnified by Henry's passion for Anne Boleyn, though she certainly was not the sole or the main cause of the divorce. That the succession was the main point is proved by the fact that Henry's efforts were all directed to securing a wife and not a mistress. Wolsey persuaded him that the necessary divorce could be obtained from Rome, as it had been in the case of Louis XII. of France and Margaret of Scotland. For a time Clement VII. was inclined to concede the demand, and Campeggio in 1528 was given ample powers. But the prospect of French success in Italy which had encouraged the pope proved delusive, and in 1529 he had to submit to the yoke of Charles V. This involved a rejection of Henry's suit, not because Charles cared anything for his aunt, but because a divorce would mean disinheriting Charles's cousin Mary, and perhaps the eventual succession of the son of a French princess to the English throne.

Wolsey fell when Campeggio was recalled, and his fall involved the triumph of the anti-ecclesiastical party in England. Laymen who had resented their exclusion from power were now promoted to offices such as those of lord chancellor and lord privy seal which they had rarely held before; and parliament was encouraged to propound lay grievances against the church. On the support of the laity Henry relied to abolish papal jurisdiction and reduce clerical privilege and property in England; and by a close alliance with Francis I. he insured himself against the enmity of Charles V. But it was only gradually that the breach was completed with Rome. Henry had defended the papacy against Luther in 1521 and had received in return the title "defender of the faith." He never liked Protestantism, and he was prepared for peace with Rome on his own terms. Those terms were impossible of acceptance by a pope in Clement VII.'s position; but before Clement had made up his mind to reject them, Henry had discovered that the papacy was hardly worth conciliating. His eyes were opened to the extent of his own power as the exponent of national antipathy to papal jurisdiction and ecclesiastical privilege; and his appetite for power grew. With Cromwell's help he secured parliamentary support, and its usefulness led him to extend parliamentary representation to Wales and Calais, to defend the privileges of Parliament, and to yield rather than forfeit its confidence. He had little difficulty in securing the Acts of Annates, Appeals and Supremacy which completed the separation from Rome, or the dissolution of the monasteries which, by transferring enormous wealth from the church to the crown, really, in Cecil's opinion, ensured the reformation.

The abolition of the papal jurisdiction removed all obstacles to the divorce from Catherine and to the legalization of Henry's marriage with Anne Boleyn (1533). But the recognition of the royal supremacy could only be enforced at the cost of the heads of Sir Thomas More, Bishop Fisher and a number of monks and others among whom the Carthusians signalized themselves by their devotion (1535–1536). Anne Boleyn fared no better than the Catholic martyrs; she failed to produce a male heir to the throne, and her conduct afforded a jury of peers, over which her uncle, the duke of Norfolk, presided, sufficient excuse for condemning her to death on a charge of adultery (1536). Henry then married Jane Seymour, who was obnoxious to no one, gave birth to Edward VI., and then died (1537). The dissolution of the monasteries had meanwhile evoked a popular protest in the north, and it was only by skilful and unscrupulous diplomacy that Henry was enabled to suppress so easily the Pilgrimage of Grace. Foreign intervention was avoided through the renewal of war between Francis and Charles; and the insurgents were hampered by having no rival candidate for the throne and no means of securing the execution of their programme.

Nevertheless their rising warned Henry against further doctrinal charges. He had authorized the English Bible and some approach towards Protestant doctrine in the Ten Articles. He also considered the possibility of a political and theological alliance with the Lutheran princes of Germany. But in 1538 he definitely rejected their theological terms, while in 1539–1540 they rejected his political proposals. By the statute of Six Articles (1539) he took his stand on Catholic doctrine; and when the Lutherans had rejected his alliance, and Cromwell's nominee, Anne of Cleves, had proved both distasteful on personal grounds and unnecessary because Charles and Francis were not really projecting a Catholic crusade against England, Anne was divorced and Cromwell beheaded. The new queen Catherine Howard represented the triumph of the reactionary party under Gardiner and Norfolk; but there was no idea of returning to the papal obedience, and even Catholic orthodoxy as represented by the Six Articles was only enforced by spasmodic outbursts of persecution and vain attempts to get rid of Cranmer.

The secular importance of Henry's activity has been somewhat obscured by his achievements in the sphere of ecclesiastical politics; but no small part of his energies was devoted to the task of expanding the royal authority at the expense of temporal competitors. Feudalism was not yet dead, and in the north and west there were mediaeval franchises in which the royal writ and common law hardly ran at all. Wales and its marches were brought into legal union with the rest of England by the statutes of Wales (1534–1536); and after the Pilgrimage of Grace the Council of the North was set up to bring into subjection the extensive jurisdictions of the northern earls. Neither they nor the lesser chiefs who flourished on the lack of common law and order could be reduced by ordinary methods, and the Councils of Wales and of the North were given summary powers derived from the Roman civil law similar to those exercised by the Star Chamber at Westminster and the court of Castle Chamber at Dublin. Ireland had been left by Wolsey to wallow in its own disorder; but disorder was anathema to Henry's mind, and in 1535 Sir William Skeffington was sent to apply English methods and artillery to the government of Ireland. Sir Anthony St. Leger continued his policy from 1540; Henry, instead of being merely lord of Ireland dependent on the pope, was made by an Irish act of parliament king, and supreme head of the Irish church. Conciliation was also tried with some success; plantation schemes were rejected in favour of an attempt to Anglicize the Irish; their chieftains were created earls and endowed with monastic lands; and so peaceful was Ireland in 1542 that the lord-deputy could send Irish kernes and gallowglasses to fight against the Scots.

Henry, however, seems to have believed as much in the coercion of Scotland as in the conciliation of Ireland. Margaret Tudor's marriage had not reconciled the realms; and as soon as James V. became a possible pawn in the hands of Charles V., Henry bethought himself of his old claims to suzerainty over Scotland. At first he was willing to subordinate them to an attempt to win over Scotland to his anti-papal policy, and he made various efforts to bring about an interview with his nephew. But James V. was held aloof by Beaton and two French marriages; and France was alarmed by Henry's growing friendliness with Charles V , who was mollified by his cousin Mary's restoration to her place in the succession to the throne. In 1542 James madly sent a Scottish army to ruin at Solway Moss; his death a few weeks later left the Scottish throne to his infant daughter Mary Stuart, and Henry set to work to secure her hand for his son Edward and the recognition of his own suzerainty. A treaty was signed with the Scottish estates; but it was torn up a few months later under the influence of Beaton and the queen-dowager Mary of Guise, and Hertford was sent in 1544 to punish this breach of promise by sacking Edinburgh.

Perhaps to prevent French intervention in Scotland Henry joined Charles V. in invading France, and captured Boulogne (Sept. 1544). But Charles left his ally in the lurch and concluded the peace of Crépy that same month; and in 1545 Henry had to face alone a French invasion of the Isle of Wight. This attack proved abortive, and peace between England and France was made in 1546. Charles V.'s desertion inclined Henry to listen to the proposals of the threatened Lutheran princes, and the last two years of his reign were marked by a renewed tendency to advance

in a Protestant direction. Catherine Howard had been brought to the block (1542) on charges in which there was probably a good deal of truth, and her successor, Catherine Parr, was a patroness of the new learning. An act of 1545 dissolved chantries, colleges and other religious foundations; and in the autumn of 1546 the Spanish ambassador was anticipating further anti-ecclesiastical measures. Gardiner had almost been sent to the Tower, and Norfolk and Surrey were condemned to death, while Cranmer asserted that it was Henry's intention to convert the mass into a communion service. An opportunist to the last, he would readily have sacrificed any theological convictions he may have had in the interests of national uniformity. He died on Jan. 28, 1547, and was buried in St. George's Chapel, Windsor.

The atrocity of many of Henry's acts, the novelty and success of his religious policy, the apparent despotism of his methods, or all combined, have made it difficult to estimate calmly the importance of Henry's work or the conditions which made it possible. Henry's egotism was profound, and personal motives underlay his public action. While political and ecclesiastical conditions made the breach with Rome possible—and in the view of most Englishmen desirable—Henry VIII. was led to adopt the policy by private considerations. He worked for the good of the state because he thought his interests were bound up with those of the nation; and it was the real coincidence of this private and public point of view that made it possible for so selfish a man to achieve so much for his country. The royal supremacy over the church and the means by which it was enforced were harsh and violent expedients; but it was of the highest importance that England should be saved from religious civil war, and it could only be saved by a despotic government. It was necessary for the future development of England that its governmental system should be centralized and unified, that the authority of the monarchy should be more firmly extended over Wales and the western and northern borders, and that the still existing feudal franchises should be crushed; and these objects were worth the price paid in the methods of the Star Chamber and of the Councils of the North and of Wales. Henry's work on the navy requires no apology; without it Elizabeth's victory over the Spanish Armada, the liberation of the Netherlands and the development of English colonies would have been impossible; and "of all others the year 1545 best marks the birth of the English naval power" (Corbett, *Drake*, i. 59). His judgment was more at fault when he conquered Boulogne and sought by violence to bring Scotland into union with England. But at least Henry appreciated the necessity of union within the British Isles; and his work in Ireland relaid the foundations of English rule. No less important was his development of the parliamentary system. Representation was extended to Wales, Cheshire, Berwick and Calais; and parliamentary authority was enhanced, largely that it might deal with the church, until men began to complain of this new parliamentary infallibility. The privileges of the two Houses were encouraged and expanded, and parliament was led to exercise ever wider powers. This policy was not due to any belief on Henry's part in parliamentary government, but to opportunism, to the circumstance that parliament was willing to do most of the things which Henry desired, while competing authorities, the church and the old nobility, were not. Nevertheless, to the encouragement given by Henry VIII. parliament owed not a little of its future growth, and to the aid rendered by parliament Henry owed his success.

He has been described as a "despot under the forms of law"; and it is apparently true that he committed no illegal act. His despotism consists not in any attempt to rule unconstitutionally, but in the extraordinary degree to which he was able to use constitutional means in the furtherance of his own personal ends. His industry, his remarkable political insight, his lack of scruple, and his combined strength of will and subtlety of intellect enabled him to utilize all the forces which tended at that time towards strong government throughout western Europe. In Michelet's words, "le nouveau Messie est le roi"; and the monarchy alone seemed capable of guiding the state through the social and political anarchy which threatened all nations in their transition from mediaeval to modern organization. The king was the emblem, the focus and the bond of national unity; and to preserve it men were ready to put up with vagaries which to other ages seem intolerable. Henry could thus behead ministers and divorce wives with comparative impunity, because the individual appeared to be of little importance compared with the state. This impunity provoked a licence which is responsible for the unlovely features of Henry's reign and character. The elevation and the isolation of his position fostered a detachment from ordinary virtues and compassion, and he was a remorseless incarnation of Machiavelli's *Prince*. He had an elastic conscience which was always at the beck and call of his desire, and he cared little for principle. But he had a passion for efficiency, and for the greatness of England and himself. His mind, in spite of its clinging to the outward forms of the old faith, was intensely secular; and he was as devoid of a moral sense as he was of a genuine religious temperament. His greatness consists in his practical aptitude, in his political perception, and in the self-restraint which enabled him to confine within limits tolerable to his people an insatiable appetite for power.

BIBLIOGRAPHY.—The original materials for Henry VIII.'s biography are practically all incorporated in the monumental *Letters and Papers of the Reign of Henry VIII.* (21 vols.), edited by Brewer and Gairdner and completed after fifty years' labour in 1910. A few further details may be gleaned from such contemporary sources as Hall's *Chronicle*, Cavendish's *Life of Wolsey*, W. Thomas's *The Pilgrim* and others; and some additions have been made to the documentary sources contained in the *Letters and Papers* by recent works, such as Ehses' *Römische Dokumente*, and Merriman's *Life and Letters of Thomas Cromwell*. Lord Herbert of Cherbury's *Life and Reign of Henry VIII.* (1649), while good for its time, is based upon a very partial knowledge of the sources and somewhat antiquated principles of historical scholarship. Froude's famous portraiture of Henry is coloured by the ideas of hero-worship and history which the author imbibed from Carlyle, and the rival portraits in Lingard, R. W. Dixon's *Church History* and Gasquet's *Henry VIII. and the Monasteries* by strong religious feeling. A more discriminating estimate is attempted by H. A. L. Fisher in Messrs. Longmans' *Political History of England*, vol. v. (1906). *See* also C. Bémont, *Premier divorce de Henry VIII. et le Schisme d'Angleterre* (1917).

Of the numerous paintings of Henry none is by Holbein, who, however, executed the striking chalk-drawing of Henry's head, now at Munich, and the famous but decaying cartoon at Devonshire House. The well-known three-quarter length at Windsor, usually attributed to Holbein, is by an inferior artist. The best collection of Henry's portraits was exhibited at the Burlington Fine Arts Club in 1909, and the catalogue of that exhibition contains the best description of them; several are reproduced in Pollard's *Henry VIII.* (Goupil) (1902), the letterpress of which was published by Longmans in a cheaper edition (1905). Henry composed numerous state papers still extant; his only book was his *Assertio septem sacramentorum contra M. Lutherum* (1521), a copy of which, signed by Henry himself, is at Windsor. His songs and ballads were edited (1912) by Lady M. Trefusis for the Roxburghe Club.

HENRY I. (1008–1060), king of France, son of King Robert and his queen, Constance of Aquitaine, and grandson of Hugh Capet, succeeded his father in 1031, although in 1027 he had already been anointed king at Reims and associated in the government with his father. His mother formed a powerful league with her younger son Robert, against him, and he was forced to take refuge with Robert II., duke of Normandy. In the civil war which resulted, Henry finally defeated his opponents in 1032. Constance died in 1034, and Robert was given the duchy of Burgundy, thus founding that great collateral line which was to rival the kings of France for three centuries. From 1033 to 1043 Henry was involved in a life and death contest with those nobles whose territory adjoined the royal domains, especially with the house of Blois and the counts of Champagne. Henry's success was largely due to the help given him by Robert of Normandy, but upon the accession of Robert's son William (the Conqueror), Normandy itself became the chief danger. From 1047 until his death, Henry was almost constantly at war with William, who held his own against two royal invasions, in 1055 and 1058. Henry's reign marks the height of feudalism, Normandy, Champagne and Burgundy being only nominally subject to royal authority. Yet Henry maintained the independence of the clergy against the pope Leo IX., and claimed Lorraine from the emperor Henry III. In 1059 he had his eldest son Philip crowned as joint king, and died the following year. Henry married in 1043 Maud, niece of the emperor Henry III., who died childless in 1044. In 1051 Henry married the Rus-

sian princess Anne, daughter of Yaroslav I., grand duke of Kiev. She bore him two sons, Philip, his successor, and Hugh, count of Vermandois.

See the *Historiae* of Rudolph Glaber, edited by M. Prou (Paris, 1886); F. Sochnée, *Catalogue des actes d'Henri Ier* (1907); de Caiz de Saint Aymour, *Anne de Russie, reine de France* (1896); E. Lavisse, *Histoire de France,* tome ii. (1901), and the article on Henry I. in *La Grande Encyclopédie* by M. Prou.

HENRY II. (1519–1559), king of France, the second son of Francis I. and Claude, succeeded to the throne in 1547. When only seven years old he was sent by his father, with his brother the dauphin Francis, as a hostage to Spain in 1526, whence they returned after the conclusion of the peace of Cambrai in 1530. Henry was too young to have carried away any abiding impressions, yet throughout his life his character, dress and bearing were far more Spanish than French. In 1533 his father married him to Catherine de' Medici, and he became dauphin by the death of his elder brother Francis in 1536. From that time he was under the domination of two women—Diane de Poitiers, his mistress, and Anne de Montmorency, his mentor. His younger brother, Charles of Orleans, was his father's favourite; and the rivalry of Diane and the duchesse d'Étampes widened the breach between the king and the dauphin. Henry supported the constable Montmorency when he was disgraced in 1541; protested against the treaty of Crépy in 1544; and at the end of the reign held himself completely aloof. After his accession in 1547 Diane, Montmorency and the Guises were all-powerful, and dismissed Cardinal de Tournon, de Longueval, the duchesse d'Étampes and all the late king's friends and officials. At that time Henry was twenty-eight years old. He was a robust man, and inherited his father's love of violent exercise; but his character was weak and his intelligence mediocre, and he had none of the superficial and brilliant gifts of Francis I. He was cold, haughty, melancholy and dull. He was a bigoted Catholic, and showed to the Protestants even less mercy than his father. During his reign the royal authority became more severe and more absolute than ever. Resistance to the financial extortions of the government was cruelly chastised, and the "Chambre Ardente" was instituted against the Reformers. Abroad, the struggle was continued against Charles V. and Philip II., which ended in the much-discussed treaty of Cateau-Cambrésis. Some weeks afterwards high feast was held on the occasion of the double marriage of the king's daughter Elizabeth with the king of Spain, and of his sister Margaret with the duke of Savoy. On June 30, 1559, when tilting with the count of Montgomery, Henry was wounded in the temple by a lance; he died on July 10. By his wife Catherine de' Medici he had seven children living: Elizabeth, queen of Spain; Claude, duchess of Lorraine; Francis (II.), Charles (IX.) and Henry (III.), all of whom came to the throne; Marguerite, who became queen of Navarre in 1572; and Francis, duke of Alençon and afterwards of Anjou, who died in 1584.

The bulk of the documents for the reign of Henry II. are unpublished, and are in the Bibliothèque Nationale, Paris. Of the published documents, *see* especially the correspondence of Catherine de' Medici (ed. by de la Ferrière, Paris, 1880), of Diane de Poitiers (ed. by Guiffrey, Paris, 1866), of Antoine de Bourbon and Jeanne d'Albret (ed. by Rochambeau, Paris, 1877), of Odet de Selve, ambassador to England (ed. by Lefèvre-Pontalis, Paris, 1888) and of Dominique du Gabre, ambassador to Venice (ed. by Vitalis, Paris, 1903); Ribier, *Lettres et mémoires d'estat* (Paris, 1666); *Relations des ambassadeurs vénitiens,* etc. *See* also H. Lemonnier, "La France sous Henri II." (Paris, 1904), in the *Histoire de France,* by E. Lavisse, which contains a fuller bibliography of the subject.

HENRY III. (1551–1589), king of France, third son of Henry II. and Catherine de' Medici, was born at Fontainebleau on Sept. 19, 1551. As duke of Anjou, he won, under the direction of Tavannes, the battles of Jarnac and Moncontour over Condé and Coligny in 1569, and he assisted his mother in organizing the massacre (1572) of St. Bartholomew. He was Catherine's favourite son, and she now (1573) secured his election to the throne of Poland. But next year the death of his brother, Charles IX., brought him back post-haste to assume the crown of France. His accession meant a fresh lease of power for Catherine, from whose authority he never emancipated himself. His indolence and his vicious and corrupt life scandalized both the Huguenots and the Catholic party. For the civil conflicts of his reign, *see* FRANCE: *History.*

A revolt (May 12, 1588) in Paris, the "day of the barricades," forced Henry to take refuge at Chartres. He then secured the murder of Henry of Guise and his brother, the cardinal, at Blois (Dec. 23, 1588). Early in January, Catherine de' Medici died. "Now I am king," cried Henry. But Paris was in the hands of the partisans of Guise, many of the provinces were in revolt, and Henry was driven into alliance with Henry of Navarre. Together they were investing Paris, when the Leaguers avenged the Guise murders through the instrumentality of a fanatic monk, Jacques Clément, who stabbed the king at an audience on Aug. 1, 1589. Henry died a few hours later, naming Henry of Navarre as his successor. By his wife, Louise de Mercoeur, he left no children, and with him the male line of the house of Valois became extinct.

See Correspondence of Catherine de' Medici and of Henry IV. (in the *Collection de documents inédits*), and of the Venetian ambassadors, etc.; P. Matthieu, *Histoire de France,* vol. i. (1631); Scipion Dupleix, *Histoire de Henri III.* (1633); Robiquet, *Paris et la Ligue* (1886); and J. H. Mariéjol, "La Réforme et la Ligue," in the *Histoire de France,* by E. Lavisse (Paris, 1904), which contains a more complete bibliography.

HENRY IV. (1553–1610), king of France, the son of Antoine de Bourbon, duke of Vendôme, head of the younger branch of the Bourbons, descendant of Robert of Clermont, sixth son of St. Louis, and of Jeanne d'Albret, queen of Navarre, was born at Pau (Basses Pyrénées) on Dec. 14, 1553. He was educated as a Protestant, and in 1557 was sent to the court at Amiens. In 1561 he entered the Collège de Navarre at Paris, returning in 1565 to Béarn. During the third war of religion in France (1568–1570) he was taken by his mother to Gaspard de Coligny, leader of the Protestant forces since the death of Louis I., prince of Condé, at Jarnac, and distinguished himself at the battle of Arnay-le-Duc in Burgundy in 1569. On his mother's death in 1572 Henry became king of Navarre and married Margaret de Valois (*q.v.*) sister of Charles IX. of France. He escaped the massacre of St. Bartholomew by a feigned abjuration. On Feb. 2, 1576, after several vain attempts, he escaped from the court, joined the combined forces of Protestants and of opponents of the king, and obtained by the treaty of Beaulieu (1576) the government of Guienne. In 1577 he secured the treaty of Bergerac, which foreshadowed the edict of Nantes. As a result of quarrels with his wife, and the unwelcome intervention of Henry III., he undertook the seventh war of religion, seized Cahors on May 5, 1580, and signed the treaty of Fleix on Nov. 26, 1580. The death (1584) of the duke of Anjou, brother of King Henry III., made Henry of Navarre heir presumptive to the throne of France. Excluded from it by the treaty of Nemours (1585) he began the "war of the three Henrys" by a campaign in Guienne (1586) and defeated Anne, duc de Joyeuse, at Coutras on Oct. 20, 1587. Then Henry III., driven from Paris by the League on account of his murder of the duke of Guise at Blois (1588), sought the aid of the king of Navarre to win back his capital, recognizing him as his heir. The assassination of Henry III. on Aug. 1, 1589 left Henry king of France; but he had to struggle for ten more years against the League and against Spain before he won his kingdom. The main events in that long struggle were the victory of Arques (1589) over Charles, duke of Mayenne; of Ivry (1590); the siege of Paris (1590); of Rouen (1592); the meeting of the Estates of the League (1593), which the *Satire Ménippée* turned to ridicule; and finally the conversion of Henry IV. to Catholicism in July 1593—an act of political wisdom, since it brought about the collapse of all opposition. Paris gave in to him on March 22, 1594 and province by province yielded to arms or negotiations; while the victory of Fontaine-Française (1595) and the capture of Amiens forced Philip II. of Spain to sign the peace of Vervins on May 2, 1598. On April 13 of that year Henry IV. had promulgated the Edict of Nantes.

Then Henry set to work to pacify and restore prosperity to his kingdom. Convinced by the experience of the wars that France needed an energetic central power, he pushed at times his royal prerogatives to excess, raising taxes in spite of the Estates, interfering in the administration of the towns, reforming their consti-

tutions, and holding himself free to reject the advice of the notables if he consulted them. Aided by his faithful friend Maximilien de Béthune, baron de Rosny and duc de Sully (*q.v.*), he reformed the finances, repressed abuses, suppressed useless offices, extinguished the formidable debt and realized a reserve of eighteen millions. To alleviate the distress of the people he undertook to develop both agriculture and industry: planting colonies of Dutch and Flemish settlers to drain the marshes of Saintonge, issuing prohibitive measures against the importation of foreign goods (1597), introducing the silk industry, encouraging the manufacture of cloth, of glass-ware, of tapestries (Gobelins), and under the direction of Sully—named *grand-voyer de France*—improving and increasing the routes for commerce. A complete system of canals was planned, that of Briare partly dug. New capitulations were concluded with the sultan Ahmed I. (1604) and treaties of commerce with England (1606), with Spain and Holland. Attempts were made in 1604 and 1608 to colonize Canada (*see* CHAMPLAIN, SAMUEL DE). The army was reorganized, its pay raised and assured, a school of cadets formed to supply it with officers, artillery constituted and strongholds on the frontier fortified. While lacking the artistic tastes of the Valois, Henry beautified Paris, building the great gallery of the Louvre, finishing the Tuileries, building the Pont Neuf, the Hôtel-de-Ville and the Place Royale.

The foreign policy of Henry IV. was directed against the Habsburgs. Without declaring war, he did all possible harm to them by alliances and diplomacy. In Italy he gained the grand duke of Tuscany—marrying his niece Marie de' Medici in 1600—the duke of Mantua, the republic of Venice and Pope Paul V. The duke of Savoy, who had held back from the treaty of Vervins in 1598, signed the treaty of Lyons in 1601; in exchange for the marquisate of Saluzzo, France acquired Bresse, Bugey, Valromey and the bailliage of Gex. In the Low Countries, Henry sent subsidies to the Dutch in their struggle against Spain. He concluded alliances with the Protestant princes in Germany, with the duke of Lorraine, the Swiss cantons (treaty of Soleure, 1602) and with Sweden. In 1609, the opening of the question of the succession of John William the Good, duke of Cleves, of Jülich and of Berg, led Henry, in spite of his own hesitations and those of his German allies, to declare war on the emperor Rudolph II. But he was assassinated by Ravaillac (*q.v.*) on May 14, 1610, upon the eve of his great enterprise, leaving his policy to be followed up later by Richelieu. Sully in his *Économies royales* attributes to his master the "great design" of constituting, after having defeated Austria, a vast European confederation of fifteen states—a "Christian Republic"—directed by a general council of sixty deputies reappointed every three years. But this "design" has been attributed rather to the imagination of Sully himself than to the more practical policy of the king.

No figure in France has been more popular than that of "Henry the Great." He was affable, quick-witted, good-hearted and generally indulgent. His courage amounted almost to recklessness. He was a better soldier than strategist. Although at bottom authoritative he surrounded himself with admirable advisers (Sully, Sillery, Villeroy, Jeannin) and profited from their co-operation. His numerous love affairs (of which the most famous are those with Gabrielle d'Estrées and Henriette d'Entragues), did not affect his policy, in which he was guided only by an exalted ideal of his royal office, and by a certain sympathy—perhaps exaggerated in popular tradition—for the common people.

Henry IV. had no children by his first wife, Margaret of Valois. By Marie de' Medici he had Louis, later Louis XIII.; Gaston, duke of Orleans; Elizabeth, who married Philip IV. of Spain; Christine, duchess of Savoy; and Henrietta, wife of Charles I. of England. Among his bastards the most famous were the children of Gabrielle d'Estrées—Caesar, duke of Vendôme, Alexander of Vendôme, and Catherine Henriette, duchess of Elbeuf. Several portraits of Henry are preserved at Paris, in the Bibliothèque Nationale (*cf.* Bouchot, *Portraits au crayon*, p. 189), at the Louvre (by Probus, bust by Barthélemy Prieur) at Versailles, Geneva (Henry at the age of fifteen), at Hampton Court, at Munich and at Florence.

For the sources of the history of his reign *see* the *Recueil des lettres missives de Henri IV.*, published from 1839 to 1853 by B. de Xivrey, in the *Collection de documents inédits relatifs à l'histoire de France*, and the various researches of Galitzin, Bautiot, Halphen, Dussieux and others. Besides their historic interest, the letters written personally by Henry, whether love notes or letters of state, reveal a charming writer. Mention should be made of Auguste Poirson's *Histoire du règne de Henri IV.* (2nd ed., 4 vols., Paris, 1862–67) and of J. H. Mariéjol's volume (vi.) in the *Histoire de France*, edited by Ernest Lavisse (Paris, 1905), where main sources and literature are given with each chapter. A *Revue Henri IV.* has been founded at Paris (1905). Finally, a complete survey of the sources for the period 1494–1610 is given by Henri Hauser in vol. vii. of *Sources de l'histoire de France* (Paris, 1906) in continuation of A. Molinier's collection of the sources for French history during the middle ages.

HENRY I. (876?–936), surnamed the "Fowler," German king, son of Otto the Illustrious, duke of Saxony, shared in early life in various campaigns for the defence of Saxony. He married Hatburg, a daughter of Irwin, count of Merseburg, but as she had taken the veil on the death of a former husband this union was declared illegal by the church, and in 909 he married Matilda, daughter of a Saxon count named Thiederich, and a reputed descendant of the hero Widukind. On his father's death in 912 he became duke of Saxony, which he defended against the Slavs (*see* SAXONY). In 918 the German king Conrad I. advised the nobles to make the Saxon duke his successor. The Franks and the Saxons met at Fritzlar in May 919 and chose Henry as German king. The new king refused to allow his election to be sanctioned by the church. His authority, save in Saxony, was merely nominal; but he secured a recognition of his sovereignty from the Bavarians and the Swabians. In 921 Charles III. of France recognized Henry as king of the East Franks, and when in 923 the French king was taken prisoner by Herbert, count of Vermandois, Lorraine came under Henry's authority, and Giselbert, who married his daughter Gerberga, was recognized as duke. Henry reduced various Slavonic tribes in the east to subjection, took Brennibor, the modern Brandenburg, from the Hevelli, and secured both banks of the Elbe for Saxony. In 923 he had bought a truce for ten years with the Hungarians, by a promise of tribute, and on its expiration he gained two great victories over them in 933 at Jechaburg and Riade. The Danes were defeated, and territory as far as the Eider secured for Germany; and the king sought further to extend his influence by entering into relations with the kings of England, France and Burgundy. He died at Memleben on July 2, 936. By his first wife, Hatburg, he left a son, Thankmar, who was excluded from the succession as illegitimate; and by Matilda he left three sons, the eldest of whom, Otto (afterwards the emperor Otto the Great), succeeded him, and two daughters. Henry undertook only such enterprises as he was able to carry through. Laying more stress on his position as duke of Saxony than king of Germany, he conferred great benefits on his duchy. The founder of her town life and the creator of her army, he ruled in harmony with her nobles and secured her frontiers from attack.

See Widukind of Corvei, "Res gestae Saxonicae," ed. G. Waitz in the *Monumenta Germaniae historica. Scriptores*, Band iii. (Hanover and Berlin, 1826 *seq.*); "Die Urkunde des deutschen Königs Heinrichs I.," edited by T. von Sickel in the *Monumenta Germaniae historica. Diplomata* (Hanover, 1879); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Bände i., ii. (Leipzig, 1881); G. Waitz, *Jahrbücher des deutschen Reichs unter König Heinrich I.* (Leipzig, 1885); and F. Löher, *Die deutsche Politik König Heinrich I.* (Munich, 1857).

HENRY VII. (1211–1242), German king, son of the emperor Frederick II. and his first wife Constance, daughter of Alphonso II., king of Aragon, was crowned king of Sicily in 1212 and made duke of Swabia in 1216. Pope Innocent III. had favoured his coronation as king of Sicily in the hope that the union of Sicily with the Empire would be dissolved, and had obtained a promise from Frederick to this effect. Nevertheless Henry was chosen king of the Romans, or German king, at Frankfort in April 1220, and crowned at Aix-la-Chapelle on May 8, 1222 by his guardian Engelbert, archbishop of Cologne. He appears to have spent most of his youth in Germany, and in 1225 was married to Margaret (d. 1267), daughter of Leopold VI., duke of Austria. The murder of Engelbert in 1225 was followed by an increase of disorder in Germany, and in 1227 Henry took part in a quarrel which had

arisen on the death of Henry V., the childless count palatine of the Rhine. Relations between Frederick and his son began to be strained. The emperor had favoured the Austrian marriage because Margaret's brother, Duke Frederick II., was childless; but Henry took up a hostile attitude towards his brother-in-law and wished to put away his wife and marry Agnes, daughter of Wenceslaus I., king of Bohemia. In 1231 Henry refused to appear at the diet at Ravenna, and opposed the privileges granted by Frederick to the princes at Worms. In 1232 he submitted to his father, but in 1233 he issued a manifesto to the princes, and in 1234 raised the standard of revolt at Boppard. He succeeded in forming an alliance with the Lombards in December 1234, but his few supporters fell away when the emperor reached Germany in 1235, and, after a vain attack on Worms, Henry submitted and was kept for some time as a prisoner in Germany. His formal deposition as German king was not considered necessary, as he had broken the oath taken in 1232. He was removed to San Felice in Apulia, and afterwards to Martirano in Calabria, where he died, probably by his own hand, on Feb. 12, 1242. His two sons, Frederick and Henry, died in Italy about 1251.

See J. Rohden, *Der Sturz Heinrichs VII.* (Göttingen, 1883); F. W. Schirrmacher, *Die letzten Hohenstaufen* (Göttingen, 1871); E. Winkelmann, *Kaiser Friedrich II.* (Leipzig, 1889); P. Reinhold, *Die Empörung König Heinrichs gegen seinen Vater* (1911).

HENRY I. (*c.* 1210–1274), surnamed *le Gros*, king of Navarre and count of Champagne, was the youngest son of Theobald I. king of Navarre by Margaret of Foix, and succeeded his eldest brother Theobald III. as king of Navarre and count of Champagne in December 1270. His proclamation at Pamplona, however, did not take place till March of the following year, and his coronation was delayed until May 1273. At his death in 1274 the male line of the counts of Champagne and kings of Navarre became extinct. He married in 1269 Blanche, daughter of Robert, count of Artois, and niece of King Louis IX. and was succeeded by his only legitimate child, Jeanne or Joanna, by whose marriage to Philip IV. afterwards king of France in 1284, the crown of Navarre was united to that of France.

HENRY II. (1503–1555), titular king of Navarre, was the eldest son of Jean d'Albret (d. 1516) by his wife Catherine de Foix, sister and heiress of Francis Phoebus, king of Navarre, and was born at Sanquesa in April 1503. When Catherine died in exile in 1517 Henry succeeded her in her claim on Navarre, which was disputed by Ferdinand I. king of Spain; and under the protection of Francis I. of France he assumed the title of king. After ineffectual conferences at Noyon in 1516 and at Montpellier in 1518, an active effort was made in 1521 to establish him in the *de facto* sovereignty; but the French troops which had seized the country were ultimately expelled by the Spaniards. In 1525 Henry was taken prisoner at the battle of Pavia, but he contrived to escape, and in 1526 married Margaret, the sister of Francis I. and widow of Charles, duke of Alençon. By her he was the father of Jeanne d'Albret (d. 1572), and was consequently the grandfather of Henry IV. of France. Henry, who had some sympathy with the Huguenots, died at Pau on May 25, 1555.

HENRY I. (1512–1580), king of Portugal, third son of Emanuel the Fortunate, was born in Lisbon on Jan. 31, 1512. In 1532 he was made archbishop of Braga. In 1542 he received the cardinal's hat, and in 1578 when he was called to succeed his grandnephew Sebastian on the throne, he held the archbishoprics of Lisbon and Coimbra as well as that of Braga, in addition to the wealthy abbacy of Alcobazar. As a sovereign he proved weak, timid and incapable. On his death in 1580, the male line of the royal family which traced its descent from Henry, first count of Portugal (*c.* 1100), came to an end.

HENRY, PRINCE OF BATTENBERG: *see* BATTENBERG and MOUNTBATTEN.

HENRY II. (1489–1568), duke of Brunswick-Wolfenbüttel, son of Duke Henry I., was born on Nov. 10, 1489. He began to reign in 1514, but his brother William objected to the indivisibility of the duchy which had been decreed by the elder Henry, and it was only in 1535, after an imprisonment of 11 years, that William recognized his brother's title. In 1525 he assisted Philip, landgrave of Hesse, to crush the rising of the peasants in north Germany, and in 1528 took help to Charles V. in Italy, where he narrowly escaped capture. He joined the Catholic princes in concerting measures for opposing the Reformation. Henry was attacked by Luther with unmeasured violence in a writing *Wider Hanns Worst*. The duke soon came into collision with the Protestant towns of Goslar and Brunswick, against the former of which a sentence of restitution had been pronounced by the imperial court of justice (*Reichskammergericht*). Charles V. had suspended the execution of this sentence, a proceeding which Henry declared was *ultra vires*. The league of Schmalkalden, led by Philip of Hesse and John Frederick, elector of Saxony, took up arms to defend the towns; and in 1542 Brunswick was overrun and the duke forced to flee. In September 1545 he tried to regain his duchy, but was taken prisoner by Philip, and only released in April 1547. After his return to Brunswick he quarrelled with his subjects on political and religious questions, while his duchy was ravaged by Albert Alcibiades, prince of Bayreuth. Henry joined the league of princes against Albert, and after the death of Maurice, elector of Saxony, at Sievershausen in July 1553, he commanded the allied troops and defeated Albert in two engagements. In his later years he was reconciled with his Protestant subjects. He died at Wolfenbüttel on June 11, 1568. The duke was twice married, firstly in 1515 to Maria (d. 1541), sister of Ulrich of Württemberg, and secondly in 1556 to Sophia (d. 1575) daughter of Sigismund I., king of Poland. He had a romantic attachment to Eva von Trott, whom he represented as dead and afterwards kept concealed at Staufenburg. He was succeeded by his only surviving son, Julius (1528–1589).

See F. Koldewey, *Heinz von Wolfenbüttel* (Halle, 1883); and F. Bruns, *Die Vertreibung Herzog Heinrichs von Braunschweig durch den Schmalkaldischen Bund* (Marburg, 1889).

HENRY (1108?–1139), surnamed the "Proud," duke of Saxony and Bavaria, second son of Henry the Black, duke of Bavaria, and Wulfhild, daughter of Magnus Billung, duke of Saxony, was a member of the Welf family. His father and mother both died in 1126, and as his elder brother Conrad had entered the church, Henry became duke of Bavaria and shared the family possessions in Saxony, Bavaria and Swabia with his younger brother, Welf. In 1127 he married Gertrude, the only child of the German king, Lothair the Saxon, and at once took part in the warfare between the king and the Hohenstaufen brothers, Frederick II., duke of Swabia, and Conrad, afterwards the German king Conrad III. Simultaneously he suppressed a rising in Bavaria, led by Frederick, count of Bogen, during which both duke and count sought to establish their own candidates in the bishopric of Regensburg. Frederick submitted in 1133, and two years later the Hohenstaufen brothers made their peace with Lothair. In 1136 Henry accompanied Lothair to Italy, and taking command of one division of the German army marched into southern Italy, devastating the land as he went. It was probably about this time that he was invested with the margraviate of Tuscany and the lands of Matilda, the late margravine. After the Italian campaign Henry was appointed by the emperor as his successor in the dukedom of Saxony. When Lothair died in 1137 Henry's wealth and position made him a formidable candidate for the German throne; but his ambition aroused the jealousy of the princes, and prevented his election. The new king, Conrad III., demanded the imperial *insignia* which were in Henry's possession, and the duke in return asked for his investiture with the Saxon duchy. Conrad refused to assent on the pretext that it was unlawful for two duchies to be in one hand. Attempts at a settlement failed, and in July 1138 the duke was placed under the ban, and Saxony was given to Albert the Bear, afterwards margrave of Brandenburg. War broke out in Saxony and Bavaria, but was cut short by Henry's sudden death, whether by poison or not cannot be ascertained, at Quedlinburg on Oct. 20, 1139. Henry was a man of great ability, and his early death alone prevented him from playing an important part in German history.

See S. Riezler, *Geschichte Bayerns*, Band i. (Gotha, 1878); W. Bernhardi, *Lothar von Supplinburg* (Leipzig, 1879); W. von Giesebrecht, *Geschichte der deutschen Kaiserzeit*, Band iv. (Brunswick, 1877); and A. L. Poole in *Cambridge Mediaeval History*, vol. v.

HENRY (1129–1195), surnamed the "Lion," duke of Saxony and Bavaria, only son of Henry the Proud, duke of Saxony and Bavaria, and Gertrude, daughter of the emperor Lothair the Saxon, was born at Ravensburg, and was a member of the family of Welf. In May 1142 Henry was invested as duke of Saxony at Frankfort, and Bavaria was given to Henry II., Jasomirgott, margrave of Austria, who married his mother. In 1147 Henry married Clementia, daughter of Conrad, duke of Zähringen (d. 1152). He made an expedition against the Abotrites, or Obotrites, in 1147, and won much land beyond the Elbe, in which were re-established the bishoprics of Mecklenburg, Oldenburg and Ratzeburg. Henry maintained, against Hartwig archbishop of Bremen, his right to invest these bishops, a privilege afterwards confirmed by the emperor Frederick I. In 1147 he made a formal claim on the duchy of Bavaria, and in 1151 made an unsuccessful attempt to take possession. The situation was changed in his favour when Frederick I. succeeded Conrad as German king in 1152. In 1154 he recognized the claim of Henry, who accompanied him on his first Italian campaign and suppressed a rising at Rome. Henry's formal investiture as duke of Bavaria took place in 1156. Two years later, Adolph II., count of Holstein, was compelled to cede Lübeck to him; campaigns in 1163 and 1164 broke the resistance of the Abotrites; and Saxon garrisons were established in the conquered lands. He had also helped Frederick I. in his expedition of 1157 against the Poles, and in 1159 had gone to his assistance in Italy.

In 1166 a coalition was formed against Henry at Merseburg under the leadership of Albert the Bear, margrave of Brandenburg, and Archbishop Hartwig. After indecisive fighting Frederick intervened, and made peace in 1168. Having obtained a divorce from his first wife in 1162, Henry was married in 1168 to Matilda (1156–89), daughter of Henry II. of England, and was soon afterwards sent by the emperor Frederick I. on an embassy to England and France. A war with Valdemar of Denmark, caused by a quarrel over the booty from the conquest of Rügen, lasted until 1171, when, in pursuance of a peace treaty Henry's daughter, Gertrude, married the Danish prince, Canute. During his pilgrimage to Jerusalem in 1172, Henry was received with great respect by the eastern emperor Manuel Comnenus at Constantinople.

A variety of reasons were leading to a rupture between Frederick and Henry, who showed little inclination to sacrifice his interests in Germany to help the imperial cause in Italy. He was displeased when his uncle, Welf, bequeathed his Italian and Swabian lands to the emperor, and the crisis came after Frederick's check before Alessandria in 1175. Henry declined to help the emperor in 1176, and though the peace of Venice provided for the restoration of Ulalrich to his see of Halberstadt, Henry refused to give up the lands which he had seized belonging to the bishopric. This provoked a war in which Ulalrich was joined by Philip, archbishop of Cologne. The dispute was to be settled at Worms, but Henry's failure to appear to answer the charges preferred against him, led to his being placed under the imperial ban at Würzburg in 1180, and deprived of his lands.

Meanwhile the war with Ulalrich continued, but after his victory at Weissensee Henry's cause began to decline. When Frederick took the field in 1181, Henry sought peace. He was granted the counties of Lüneburg and Brunswick, but was banished under oath not to return without the emperor's permission. He went to Normandy, and afterwards to England, returning to Germany with Frederick's permission in 1185. He was soon regarded once more as a menace to peace, and of the three alternatives offered by the emperor in 1188 he rejected the idea of making a formal renunciation of his claim, or of participating in the crusade, and chose exile, going again to England in 1189. A few months later, he returned to Saxony, asserting that his lands had not been defended according to the emperor's promise. He found many allies, won Lübeck, and soon almost the whole of Saxony was in his power. King Henry VI. took the field against him, and in 1190 a peace was arranged at Fulda, by which he retained Brunswick and Lüneburg, received half the revenues of Lübeck, and gave two of his sons as hostages. In 1193 he revolted against Henry VI., but the captivity of his brother-in-law Richard I., king of England, led to a reconciliation. Henry passed his later years in intellectual and artistic pursuits at Brunswick, where he died on Aug. 6, 1195. One of his sons was Otto, afterwards the emperor Otto IV., and another was Henry (d. 1227) count palatine of the Rhine.

Henry won his surname of "Lion" by his intrepidity. His influence on the fortunes of Saxony and northern Germany was considerable. He colonized the whole of northern Germany down to the Elbe; he founded numerous towns in Germany and sought to spread Christianity by introducing the Cistercians, founding bishoprics, and building churches and monasteries. Lane Poole, in the *Cambridge Medieval History* says of him, "He ruled an *imperium in imperio*, but he did not abuse his privileged position; his rule for the 20 years which followed the settlement of Ratisbon was beneficial to Germany, if it was detrimental to the interests of individual princes. Henry threw himself with all his energy into the work of German expansion, the promotion of commercial enterprise, the development of municipal life."

The authorities for the life of Henry the Lion are those dealing with the reign of the emperor Frederick I., and the early years of his son King Henry VI. The chief modern works are G. Prutz, *Heinrich der Löwe* (Leipzig, 1866); M. Philippson, *Geschichte Heinrichs des Löwen* (Leipzig, 1867, 2nd ed. 1918); and L. Weiland, *Das sächsische Herzogthum unter Lothar und Heinrich dem Löwen* (Greifswald 1866); F. Güterbock, *Der Prozess Heinrichs des Lowen* (1909); A. L. Poole, *Henry the Lion* (1912) and E. Gronen, *Die Machtpolitik H. des Löwen* (1919).

HENRY, JAMES (1798–1876), Irish classical scholar, was born in Dublin on Dec. 13, 1798 and died on July 14, 1876. His chief publication was the *Aeneidea* (1873–92), of which only the notes on the first book were published during the author's lifetime. As a textual critic Henry was exceedingly conservative.

See obituary notice by J. P. Mahaffy in the *Academy* of Aug. 12, 1876, where a list of his works, nearly all of which were privately printed, is given.

HENRY, JOSEPH (1797–1878), American physicist and scientific administrator, was born in Albany, N.Y., on Dec. 17, 1797; of Scottish ancestry. Henry attended a country district school to the age of 13; showing little interest in study, he was apprenticed to a watchmaker. A popular book on natural history picked up in his 16th year awoke his ambition, so that he resumed his education, attending Albany academy, teaching in country schools and tutoring to pay his way; completing the prescribed course, he continued his studies in chemistry, anatomy and physiology with a view to practising medicine. An unexpected appointment in 1825 to survey a route for a State road from the Hudson river to Lake Erie changed his goal to engineering, and it was with some reluctance that in 1826 he accepted an appointment to teach mathematics and natural philosophy in the Albany academy.

But his decision proved a most happy one. Beginning experiments in electromagnetism, Henry was the first to insulate wire for the magnetic coil; he invented the "spool" or "bobbin" winding; he discovered the necessary law of proportion between the electromotive force in the battery and the resistance of the magnet. He thus worked out for the first time the differing functions of two entirely different kinds of electromagnets; the one surrounded by numerous coils of no great length revolutionized the feeble electromagnet of Sturgeon. The other surrounded by a continuous coil of very great length made possible for the first time the transmission of a current over a great distance with little loss. Every electrical dynamo or motor uses the electromagnet in practically the form in which it was left by Henry in 1829. The principles involved in the "intensity" magnet constitute the indispensable basis of every form of the electromagnetic telegraph since invented, and Henry himself invented and demonstrated what appears to have been the first practical electromagnetic telegraph in 1830–31 at Albany. It consisted of a mile of copper bell-wire interposed in a circuit between a small Cruickshanks battery and an "intensity" magnet of continuous fine coil. A permanent magnet pivoted to swing hori-

zontally like the compass needle, was arranged so that one end remained in contact with a leg of the soft iron core, while the other end was near an office bell. At each excitation of the electromagnet the suspended magnet was repelled from one leg and attracted by the other, so that its free end tapped the bell. This was the first instance of magnetizing iron at a great distance, or of a suitable combination of magnet and battery being so arranged as to be capable of such action. Reporting his achievements in *Silliman's Journal* in 1831 Henry pointed out that the way was now clear for the invention of the commercial electromagnetic telegraph. In 1835, after his transfer to Princeton, he added a step in the invention of the "relay" by which a relatively feeble current operated an electromagnet which in turn controlled the local circuit of a more powerful magnet. This invention is extensively used in the field of electrical control, known as distant control. It was also in 1835 that Henry first used the earth as a return conductor. But in 1829 he had devised and constructed the first electromagnetic motor, an oscillating machine with automatic pole-changer, publishing a description of it in 1831. This machine was the forerunner of all electric motors. In the same period he made two other fundamental discoveries. The honour for the discovery of self-induction which he announced in 1832 has been universally conceded to him, and it was chiefly in recognition of this achievement that the International Congress of Electricians in Chicago in 1893 gave his name to the standard unit of inductive resistance. The other discovery, that of electromagnetic induction, was made independently and at the same period by both Henry and Faraday, and since the latter published first, the credit is rightfully given to him.

Professorship at Princeton.—In 1832 Henry was appointed to fill the chair of natural philosophy at Princeton. In addition to courses in physics and mathematics he lectured in chemistry, mineralogy, geology; later adding astronomy and architecture. Continuing his physical researches, he discovered that a current of low potential could induce a current of high potential by a suitable arrangement of the coils. He elucidated the laws upon which the electrical transformer of to-day is constructed. He found, also, that a second induced current could induce a third; the third a fourth; and so on, indefinitely; and that these currents could be induced at a distance. Some of his experiments in induction involved the transmission of electric force without wires through the floors and walls of buildings, and in one case he magnetized a needle by the transmission from a lightning flash 8 m. away. This appears to be the earliest record of the action of ether waves of the type employed in radio telegraphy and telephony to-day. The discovery of the oscillatory character of the electrical discharge came in 1842. Outside the field of electricity, Henry showed that liquids and solids generally have the same amount of cohesion. He showed, by means of a thermo-galvanometer, that sun spots radiate less heat than the general solar surface. He invented a new method for determining the velocity of projectiles. And in 1844 he presented a theoretical paper foreshadowing the principle of the conservation of energy.

Secretaryship at Smithsonian Institution.—In Dec. 1846 the second great period of Henry's life began with his election as first secretary of the newly formed Smithsonian Institution. The plan of organization which he drew up for it was so far beyond the average intelligence of his day as to meet with bitter opposition. But scientific men turned to the institution as a rallying and guiding centre. Under his leadership branches of science hitherto unworked in the United States were taken up; activity in all fields was tremendously stirred; scientific exploration was made a beneficiary of the military exploration and commercial exploitation of the West; the Government's support of scientific activity was enlisted and given direction.

Creation of U.S. Weather Service.—While at Albany he had devoted much attention to meteorology, realizing the need for much more data, and one of his first acts at the Smithsonian was to organize a corps of volunteer observers spread over the continent. He introduced standard instruments from abroad, prepared tables of instructions, and for 30 years maintained the investigations, collecting, reducing and publishing results which now form a considerable portion of the foundation of meteorological science. In this connection he was the first to use the telegraph to transmit weather reports; the first to indicate daily atmospheric conditions on a map; the first to embrace a continent under a single system; the first to make weather forecasts from the data obtained. The success of the Smithsonian meteorological work resulted in the creation of the U.S. weather bureau.

A second main achievement while at the Smithsonian was to supply American science with the first great agency for free publication of results. Of almost equal importance was the system Henry inaugurated of distribution of these publications to libraries and scientific bodies throughout the world. This soon developed into the system of international exchanges by which scientific and later government publications were exchanged between the rest of the world and America through the Smithsonian.

Other Scientific Work.—In 1852 Henry became a member of the lighthouse board, serving as chairman from 1871 till his death. This gave him the incentive to make his classical researches on sound in relation to fog signalling which provided his country with the most serviceable system of fog signals known to maritime powers. His researches also enabled the Government to exchange sperm oil for lard oil and later lard oil for mineral oil as an illuminant, greatly increasing the efficiency of light beacons. He directed the mobilization of scientific effort during the Civil War and was a prime mover in the organization of the National Academy of Sciences of which he was the second president. He also took a leading part in the organization of the American Association for the Advancement of Science and of the Philosophical Society of Washington.

Henry was by general consent the foremost of American physicists; his influence, not only upon the development of scientific work in the United States, but upon its character, cannot be overestimated. He was a man of varied culture, of large breadth and liberality of views, of generous impulses, of great gentleness and courtesy of manner, combined with equal firmness of purpose and energy of action. He died in Washington on May 13, 1878. (C. G. A.)

HENRY, MATTHEW (1662–1714), English nonconformist divine, was born on the confines of Flintshire and Shropshire, on Oct. 8, 1662. He was the son of Philip Henry, who had, two months earlier, been ejected by the Act of Uniformity. In 1687 Matthew Henry became minister of a Presbyterian congregation at Chester, removing in 1712 to Mare street, Hackney. Two years later (June 22, 1714), he died suddenly at Nantwich. Henry's well-known *Exposition of the Old and New Testaments* (1708–10) is a commentary of a practical and devotional rather than of a critical kind.

See biographies by W. Tong (1816), C. Chapman (1859), J. B. Williams (1828, new ed. 1865); and M. H. Lee, *Diaries and Letters of Philip Henry* (1883).

HENRY, O. (1862–1910), American short-story writer, was born in Greensboro (N.C.), Sept. 11, 1862. His real name was William Sydney Porter. Until 15 he attended school. Then he served for five years as a clerk in his uncle's drug store. For his health he spent two years on a friend's ranch in La Salle county, Texas, absorbing the colour and robust life of the south-west. In 1884 he moved to Austin, Texas, where he worked as a bookkeeper and then spent four years in the General Land Office. About the time of his marriage (1887) he began to send paragraphs and humorous sketches to newspapers. During 1891 he was teller in the First National Bank of Austin. In 1894 he bought Brann's *Iconoclast*, a satiric weekly, and transformed it into an extraordinarily humorous farrago of skit and burlesque, illustrated by himself; the venture was not a financial success, and in 1895 he joined the staff of the Houston *Post*, writing a daily column. In 1896 he was indicted on a charge of having embezzled funds (amounting to about $1,150) from the bank in Austin. This affair has never been cleared up. While waiting for trial he had the first news of the acceptance of some of his stories by important magazines. In 1898 he was sentenced to five years' imprisonment in the Ohio penitentiary. His term was reduced to three years and three months for good behaviour. In

prison he seriously settled down to story-writing. In 1903 he contracted to do a short story a week for the New York *World*, at $100 each. His first book, *Cabbages and Kings*, was published in 1904. In 1907 he married Sarah Coleman, a boyhood friend. He died in New York, June 5, 1910, and was buried in Asheville, North Carolina.

O. Henry's varied life is reflected in his stories. The extraordinary productivity of his eight years in New York brought him rapid fame, though he himself lived in seclusion. The sale of his books has been enormous, and they have been translated into many languages. The genial magic of his fine imagination, humour and brilliant narrative skill, triumph over the occasional journalism of his method, and he remains endlessly and enchantingly re-readable. His New York stories are the most famous, but it is probable that some of the southern and western tales, in which there is less strain for glittering effect, are of more lasting value. The tragedy of his own life taught him a chivalrous tenderness for the unlucky. Some of the greatest native endowments a writer can have were undeniably his; of him, as much as of any modern writer, it can be said that he had "no talent, only genius."

BIBLIOGRAPHY.—Published volumes by O. Henry include the following: *Cabbages and Kings* (1904); *The Four Million* (1906); *The Trimmed Lamp* (1907); *Heart of the West* (1907); *The Gentle Grafter* (1908); *The Voice of the City* (1908); *Roads of Destiny* (1909); *Options* (1909); *Whirligigs* (1910); *Let Me Feel Your Pulse* (1910); *The Two Women* (1910); *Strictly Business* (1910); *The Gift of the Wise Men* (1911); *Sixes and Sevens* (1911); *Rolling Stones* (1912); *Waifs and Strays* (1917); *O. Henryana* (1920); *Letters to Lithopolis* (1922); *Postcripts* (1923). His *Complete Writings* were published in 1917. *See* C. Alphonso Smith, *O. Henry* (1916) and "The Age of O. Henry" in F. L. Pattee, *Side-Lights on American Literature* (1922), also A. J. Jennings, *Through the Shadows with O. Henry* (1921). (C. M.)

HENRY, PATRICK (1736–1799), American politician and orator, was born at Studley, Hanover county, Va., on May 29, 1736. He was the son of John Henry, a well-educated Scotsman, who served in Virginia as county surveyor, colonel and judge of a county court. His mother was one of a family named Winston of Welsh descent, noted for conversational and musical talent. A mediocre student in the country school and under his father's tutorship, Patrick proved equally unsuccessful in business. In seven years he failed twice as a storekeeper and once as a farmer. In the meantime he acquired a taste for reading history and decided to study law. After a brief period of preparation he was admitted to the bar at the age of 24 and rapidly acquired a considerable practice. Then in 1763 was delivered his speech in "The Parson's Cause," a suit brought about by the custom of paying the clergy in money or tobacco according to the state of the market, which made Henry the idol of the common people of Virginia and procured for him an enormous clientele. In 1765 he was elected a member of the Virginia legislature, where he became in the same year the author of the "Virginia Resolutions," which, being no less than a declaration of resistance to the Stamp Act and an assertion of the right of the colonies to legislate for themselves independently of the control of the British parliament, gave a most powerful impetus to the movement resulting in the American Revolution. In a speech urging their adoption appear the often-quoted words, said to have been uttered in tones of thrilling solemnity, "Caesar had his Brutus, Charles the First his Cromwell, and George the Third (here he was interrupted by cries of 'Treason') and George the Third may profit by their example! If this be treason, make the most of it."

In the House of Burgesses he was prominent as a radical in all measures in opposition to the British Government, and was a member of the first Virginia committee of correspondence. In 1774 and 1775 he was a delegate to the continental congress. In 1775, in the second revolutionary convention of Virginia, Henry, regarding war as inevitable, presented resolutions for arming the Virginia militia, supporting them in a speech with the dramatic peroration, "I know not what course others may take, but as for me, give me liberty or give me death!" The resolutions were passed and their author was made chairman of the committee for which they provided. The chief command of the forces of Virginia was also given to him, but he was so checked by the Committee of Public Safety, that he resigned on Feb. 28, 1776. In the Virginia convention of 1776 he favoured the postponement of a declaration of independence until a firm union of the colonies and the friendship of France and Spain had been secured. In the same convention he served on the committee which drafted the first constitution for Virginia, and was elected governor of the State, being re-elected in 1777 and 1778, thus serving as long as the new constitution allowed any man to serve continuously. As governor he gave Washington able support and sent out the expedition under George Rogers Clark (*q.v.*) into the Illinois country.

In 1778 he was chosen a delegate to Congress, but declined to serve. From 1780 to 1784 and from 1787 to 1790 he was again a member of his State legislature; and from 1784 to 1786 was again governor. Until 1786 he was a leading advocate of a stronger central government, but when chosen a delegate to the Philadelphia constitutional convention of 1787, he declined to serve and he led the opposition to ratification in Virginia, contending that the proposed Federal Constitution was dangerous to the liberties of the country. This change of attitude is thought to have been due chiefly to his suspicion of the North aroused by John Jay's proposal to surrender to Spain for 25 or 30 years the navigation of the Mississippi. From 1794 until his death he declined in succession the following offices: U.S. senator (1794), secretary of State in Washington's cabinet (1795), chief justice of the U.S. Supreme Court (1795), governor of Virginia (1796), to which office he had been elected by the assembly, and envoy to France (1799). In 1799, however, he consented to serve again in his State legislature, where he wished to combat the Virginia Resolutions; he never took his seat, since he died, on his Red Hill estate, on June 6 of that year. Henry was twice married, first to Sarah Skelton and second to Dorothea Dandridge.

See M. C. Tyler, *Patrick Henry* (1887); and Wm. Wirt Henry (Patrick Henry's grandson), *Patrick Henry, Life, Correspondence and Speeches* (1890–91); these supersede the very unsatisfactory biography by William Wirt, *Sketches of the Life and Character of Patrick Henry* (1817). *See* also George Morgan, *The True Patrick Henry* (1907).

HENRY, VICTOR (1850–1907), French philologist, was born at Colmar in Alsace on Aug. 17, 1850. Having held appointments at Douai and Lille, he was appointed professor of Sanskrit and comparative grammar in the University of Paris. A prolific and versatile writer, he is probably best known by the English translations of his *Précis de Grammaire comparée de l'anglais et de l'allemand* and *Précis . . . du Grec et du Latin*. Important works by him on India and Indian languages are: *Manuel pour étudier le Sanscrit védique* (with A. Bergaigne, 1890); *Eléments de Sanscrit classique* (1902); *Précis de grammaire Pâlie* (1904); *Les Littératures de l'Inde: Sanscrit, Pâli, Prâcrit* (1904); *La Magie dans l'Inde antique* (1904); *Le Parsisme* (1905); *L'Agnistoma* (1906). Obscure languages (such as Innok, Quichua, Greenland) and local dialects (*Lexique étymologique du Breton moderne; Le Dialecte Alaman de Colmar*) also claimed his attention. *Le Langage Martien* is a curious book. It contains a discussion of some 40 phrases (amounting to about 300 words), which a certain Mademoiselle Hélène Smith (a well-known spiritualist medium of Geneva), while on a hypnotic visit to the planet Mars, learnt and repeated and even wrote down during her trance as specimens of a language spoken there, explained to her by a disembodied interpreter.

HENRY, WILLIAM (1775–1836), English chemist, son of Thomas Henry (1734–1816), an apothecary and writer on chemistry, was born at Manchester on Dec. 12, 1775. One of his best-known papers (*Phil. Trans.*, 1803) describes experiments on the quantity of gases absorbed by water at different temperatures and under different pressures, the conclusion he reached ("Henry's law") being that "water takes up of gas condensed by one, two or more additional atmospheres, a quantity which, ordinarily compressed, would be equal to twice, thrice, etc., the volume absorbed under the common pressure of the atmosphere." His *Elements of Experimental Chemistry* (1799) went through 11 editions in 30 years. He died at Pendlebury, near Manchester, on Sept. 2, 1836.

HENRYETTA, a city of Okmulgee county, Okla., U.S.A., 80m. E. of Oklahoma City, on Federal highways 75 and 266 and

served by the Frisco and the Kansas, Oklahoma and Gulf railways. It has a landing field for aeroplanes. In 1910 the population was 1,671; in 1920, 5,889 (92·6% native white), and in 1928 it was estimated locally at 13,000. The city is surrounded by oil and gas wells, coal and zinc mines, and farms producing chiefly cotton, corn, live stock, strawberries and other small fruits. Its industries include smelters, carbon and gasolene plants, and cotton gins. Henryetta was settled in 1901 and incorporated in 1903.

HENRY FITZ HENRY (1155–1183), second son of Henry II., king of England, by Eleanor of Aquitaine, became heir to the throne on the death of his brother William (1156), and at the age of five was married to Marguerite, the infant daughter of Louis VII. In 1170 he was crowned at Westminster by Roger of York. The protests of Becket against this usurpation of the rights of Canterbury were the ultimate cause of the primate's murder. The young king soon quarrelled with his father, who allowed him no power and a wholly inadequate revenue, and headed the great baronial revolt of 1173. He was assisted by his father-in-law, to whose court he had repaired; but, failing to shake the old king's power either in Normandy or England, made peace in 1174. Despite the generous terms which he received, he continued to intrigue with Louis VII., and was in consequence jealously watched by his father. In 1182 he and his younger brother Geoffrey took up arms, on the side of the Poitevin rebels, against Richard Coeur de Lion, apparently from resentment at the favour which Henry II. had shown to Richard in giving him the government of Poitou while they were virtually landless. Henry II. took the field in aid of Richard; but the young king and Geoffrey continued to aid the Aquitanian rising until the young king died (June 11, 1183). His death was bitterly regretted by his father. Though of a fickle and treacherous nature, he had all the personal fascination of his family, and is extolled by his contemporaries as a mirror of chivalry.

The original authorities for Henry's life are Robert de Torigni, *Chronica;* Giraldus Cambrensis, *De instructione principum, Guillaume le Maréchal* (ed. P. Meyer, Paris, 1891, etc.); Benedict, *Gesta Henrici,* William of Newburgh. *See* also Kate Norgate, *England under the Angevin Kings* (1887); Sir James Ramsay, *Angevin Empire* (1903); and C. E. Hodgson, *Jung Heinrich, König von England* (Jena, 1906).

HENRY OF ALMAIN (1235–1271), so called from his father's German connections, was the son of Richard, earl of Cornwall and king of the Romans. As a nephew of both Henry III. and Simon de Montfort he wavered between the two at the beginning of the Barons' War, but finally took the royalist side and was among the prisoners taken by Montfort at Lewes (1264). In 1268 he took the cross with his cousin Edward, who, however, sent him back from Sicily to pacify the unruly province of Gascony. Henry took the land route with the kings of France and Sicily. While attending mass at Viterbo (March 13, 1271) he was attacked by Guy and Simon de Montfort, sons of Earl Simon, and foully murdered. This revenge was the more outrageous since Henry had personally exerted himself on behalf of the Montforts after Evesham. The deed is mentioned by Dante, who put Guy de Montfort in the seventh circle of hell.

See W. H. Blaauw, *The Barons' War* (ed. 1871); Ch. Bémont, *Simon de Montfort* (1884).

HENRY OF BLOIS, bishop of Winchester (1101–1171), was the son of Stephen, count of Blois, by Adela, daughter of William I., and brother of King Stephen. Educated at Cluny, he was brought to England by Henry I. and made abbot of Glastonbury. In 1129 he was given the bishopric of Winchester and allowed to hold his abbey in conjunction with it. His hopes of the see of Canterbury were disappointed, but he obtained in 1139 a legatine commission which gave him a higher rank than the primate. Indeed, one of the ecclesiastical councils over which he presided formally declared that the election of the king in England was the special privilege of the clergy. Stephen owed his crown to Henry (1135), but they quarrelled when Stephen refused to give Henry the primacy; and the bishop took up the cause of Roger of Salisbury (1139). After the battle of Lincoln (1141) Henry declared for Matilda; but finding his advice treated with contempt, rejoined his brother's side, and his successful defence of Winchester against the empress (Aug.–Sept. 1141) was the turning-point of the civil war. The expiration of his legatine commission in 1144 deprived him of much of his power. At the accession of Henry II. (1154) he retired from the world. He died in 1171.

AUTHORITIES.—Original: William of Malmesbury, *De gestis regum;* the *Gesta Stephani.* Modern: Sir James Ramsay, *Foundations of England,* vol. ii.; Kate Norgate's *England under the Angevin Kings;* Kitchin's *Winchester.*

HENRY OF GHENT (HENRICUS DE GANDAVO) (d. 1293), scholastic philosopher, known as "Doctor Solemnis," was born in Ghent, where he studied before going to Cologne. In 1267 he was a canon of Tournai and in 1276 archdeacon of Bruges. By 1277 he was a master of theology at Paris, where he strongly opposed the mendicants.

Henry's philosophy, with its strong Augustinian colouring of peripatetic elements, closely resembles that of the early Franciscans. Thus, like them, he maintains that matter has its own actuality and by the Divine power could exist apart from form, that there is no real distinction between essence and existence or between the soul and its faculties, that a *forma corporeitatis* in man must be assumed if the independent natures of body and soul are to be ensured, that divine illumination is necessary for true knowledge, and that an eternal creation is impossible. Duns Scotus, whose formal distinction and voluntaristic leanings Henry anticipates, attacks his more original contributions, including his theory of negation as the principle of individuation, his rejection of the *species intelligibiles* in cognition, his stress on the activity of the intellect, his philosophy of conscience, and his theories that the Divine essence under a *relatio rationis* to a creature is the form in which God knows things and that creatures existed *secundum esse essentiae* in the Divine mind from all eternity.

BIBLIOGRAPHY.—Henry's *Quodlibeta* was published at Paris (1518) and at Venice (1608 and 1613), and his *Summa theologiae* at Paris (1520) and at Ferrara (1646). His *Comm. on the Physics,* his *Quaestiones on the Metaphysics* and a logical treatise are still in manuscript. The *De Scriptoribus ecclesiasticis* is probably not by him. *See* F. Ehrle, "Beitr. zu den Biographien berühmter Scholastiker" in *Archiv. für Lit. u. Kirchengeschichte des Mittelalters* (1885); H. Delehaye, *Nouvelles Recherches sur Henri de Gand* (1886); C. Werner, *Heinrich von Gent als Repräsentant des christlichen Platonismus* (Vienna, 1878); De Wulf, *Hist. de la phil. scholastique dans les Pays-Bas* (1895); G. Hagemann, *De Henrici Gandavensis quem vocant ontologismo* (1898); J. Lichterfeld, *Die Ethik Heinrichs v. Gent* (1906); R. Braun, *Die Erkenntnislehre Heinrichs v. Gent* (1916).

HENRY OF HUNTINGDON, English chronicler of the 12th century, was born, apparently, between the years 1080 and 1090. At an early age Henry entered the household of Bishop Robert Bloet, who appointed him in 1110 archdeacon of Hertford and Huntingdon. Henry was on familiar terms with his patron; and also, it would seem, with Bloet's successor, by whom he was encouraged to undertake the writing of an English history from the time of Julius Caesar. This work, undertaken before 1130, was first published in that year; the author subsequently published in succession four more editions, of which the last ends in 1154 with the accession of Henry II. The only recorded fact of the chronicler's later life is that he went with Archbishop Theobald to Rome in 1139.

The *Historia Anglorum* was first printed in Savile, *Rerum Anglicarum scriptores post Bedam* (1596), given in *Monumenta historica Britannica,* vol. i. (ed. H. Petrie and Sharpe, London, 1848). The standard edition is that of T. Arnold in the Rolls Series (1879). There is a translation by T. Forester in Bohn's *Antiquarian Library* (1853). The *Historia* is of little independent value before 1126. Arnold prints, in an appendix, a minor work from Henry's pen, the *Epistola ad Walterum de contemptu mundi,* which was written in 1135. It is a moralizing tract, but contains some interesting anecdotes about contemporaries. A book, *De miraculis,* composed of extracts from Bede, was appended along with three epistles to the later recensions of the *Historia.* Henry composed eight books of Latin epigrams; two books survive in the Lambeth ms., No. 118.

HENRY OF LAUSANNE (variously known as of Bruys, of Cluny, of Toulouse, and as the Deacon), French heresiarch of the first half of the 12th century. Practically nothing is known of his origin or early life, but if St. Bernard's reproach (*Ep.* 241) be true, Henry was an apostate monk.

In 1134 Henry appeared before Innocent III. at the council

of Pisa, where he was compelled to abjure his errors and was imprisoned. Towards 1139, Peter the Venerable, abbot of Cluny, wrote his *Epistola seu tractatus adversus Petrobrusianos* (Migne, *Patr. Lat.* 189) against the disciples of Peter of Bruys and Henry of Lausanne, whom he calls Henry of Bruys, and whom, at the moment of writing, he accuses of preaching heresy in the south of France. In 1145, at the instance of the legate Alberic, St. Bernard set out for the heretical towns of Bergerac, Périgueux, Sarlat, Cahors and Toulouse. At his approach Henry quitted Toulouse, leaving Bernard by his eloquence and miracles to make many converts and to restore Toulouse and Albi to orthodoxy. After inviting Henry to a disputation, which he refused to attend, St. Bernard returned to Clairvaux. Soon afterwards the heresiarch was arrested, brought before the bishop of Toulouse, and probably imprisoned for life.

See E. Vacandard, "Les Origines de l'hérésie albigeoise," *Revue des questions historiques* (1894), and *Vie de S. Bernard* (vol. ii., 1895).

HENRY OF PORTUGAL, surnamed the "Navigator" (1394–1460), duke of Viseu, governor of the Algarve, was born at Oporto on March 4, 1394. He was the third surviving son of John (João) I., the founder of the Aviz dynasty, under whom Portugal, victorious against Castile and against the Moors of Morocco, began to take a prominent place among European nations; his mother was Philippa, daughter of John of Gaunt. When Ceuta, the "African Gibraltar," was taken in 1415, Prince Henry performed the most distinguished service of any Portuguese leader, and received knighthood; he was now created duke of Viseu and lord of Covilham, and about the same time began his explorations, which, however, limited in their original conception, certainly developed into a search for a better knowledge of the western ocean and for a sea-way along the unknown coast of Africa to the supposed western Nile (our Senegal), to the rich negro lands beyond the Sahara desert, to the half-true, half-fabled realm of Prester John, and so ultimately to the Indies.

In 1415, the year of Ceuta, the prince sent out one John de Trasto on a voyage which brought the Portuguese to Grand Canary. There was no discovery here, for the whole Canarian archipelago was now well known to French and Spanish mariners. But in 1418 Zarco rediscovered Porto Santo, and in 1420 Madeira, which had originally been discovered in the 14th century. In 1424–25 Prince Henry attempted to purchase the Canaries, and began the colonization of the Madeira group, both in Madeira itself and in Porto Santo, for which he obtained charters (1430 and 1433) from the Portuguese Crown. In 1427, again, with his father King John, he sent out the pilot Diogo de Sevill, followed in 1431 by Gonçalo Velho Cabral, to explore the Azores. This rediscovery of the far western archipelago suggests that Henry had in mind the possibility of such a western route to Asia as Columbus attempted in 1492. Meantime, in 1418, Henry had gone in person to relieve Ceuta from an attack of Morocco and Granada Mussulmans; had accomplished his task, and had planned, though he did not carry out, a seizure of Gibraltar. At this time, it is probable that he was gathering information from the Moors with regard to the coast of "Guinea" and the interior of Africa. In 1419, after his return to Portugal, he was created governor of the "kingdom" of Algarve, the southernmost province of Portugal; and his connection now began with what afterwards became known as the "Infante's Town" (*Villa do Iffante*) at Sagres, close to Cape St. Vincent; where, before 1438, a *Tercena Nabal* or naval arsenal grew up and where, from 1438, after the Tangier expedition, the prince often resided.

In 1433 King John died, exhorting his son not to abandon his schemes; and in 1434 one of Henry's ships, commanded by Gil Eannes, at length doubled Cape Bojador. In 1435 Baldaya, the prince's cup-bearer, passed 50 leagues beyond; and by 1436 the Portuguese had almost reached Cape Blanco. Plans of further conquest in Morocco, resulting in 1437 in the disastrous attack upon Tangier, and followed in 1438 by the death of King Edward (Duarte) and the domestic troubles of the minority of Affonso V., now interrupted Atlantic and African exploration down to 1441, except in the Azores, where rediscovery and colonization progressed, as is shown by the royal licence of July 2, 1439, to people "the seven islands" of the group then known. In 1441 exploration began again in earnest with the venture of Antam Gonçalvez, who brought to Portugal the first slaves and gold-dust from the Guinea coasts beyond Bojador; while Nuno Tristam in the same year pushed on to Cape Blanco. These successes produced a great effect; the cause of discovery became popular; and many volunteers, especially merchants and seamen from Lisbon and Lagos, came forward. In 1442 Nuno Tristam reached the Bay or Bight of Arguim, where the infante erected a fort in 1448, and where for years the Portuguese carried on vigorous slave-raiding. Meantime the prince, who was now a knight of the Garter of England, proceeded with his Sagres buildings, which formed the nucleus of the "Infante's Town," and which had been begun about 1437.

In 1444–46 there was a burst of maritime and exploring activity; more than 30 ships sailed with Henry's licence to Guinea; and several of their commanders achieved notable success. Thus Diniz Diaz, Nuno Tristam, and others reached the Senegal in 1445; Diaz rounded Cape Verde in the same year; and in 1446 Alvaro Fernandez pushed on almost to our Sierra Leone, to a point 110 leagues beyond Cape Verde. This was perhaps the most distant point reached before 1461. In 1444, moreover, the island of St. Michael in the Azores was sighted (May 8), and in 1445 its colonization was begun. During this latter year also Juan Fernandez (*q.v.*) spent seven months among the natives of the Arguim coast, and brought back the first trustworthy first-hand European account of the Sahara hinterland. Slave-raiding continued ceaselessly; by 1446 the Portuguese had carried off nearly a thousand captives from the newly surveyed coasts; but between this time and the voyages of Cadamosto (*q.v.*) in 1455–1456, the prince altered his policy, forbade the kidnapping of the natives and endeavoured to promote their peaceful intercourse with his men. In 1445–46, again, Dom Henry renewed his earlier attempts to purchase or seize the Canaries, which brought Portugal to the verge of war with Castile; but the home Government refused to support him, and the project was again abandoned. Azurara's narrative ceases in 1448; one of the latest expeditions noticed by him is that of a foreigner in the prince's service, "Vallarte the Dane," which ended in destruction near the Gambia, after passing Cape Verde in 1448. After this the chief matters in Dom Henry's life are, first, the progress of discovery and colonization in the Azores; secondly, the rapid progress of civilization in Madeira, evidenced by its timber, sugar, corn and honey, and above all by its wine; and thirdly, the explorations of Cadamosto and Diogo Gomez (*q.v.*).

Cadamosto in 1455 and 1456, explored part of the courses of the Senegal and the Gambia, discovered the Cape Verde islands (1456), named and mapped more carefully than before a considerable section of the coast beyond Cape Verde, and gave much new information on the trade-routes of north-west Africa and on the native races; while Gomez, in his first important venture (after 1448 and before 1458), though not accomplishing the full Indian purpose of his voyage (he took a native interpreter with him for use "in the event of reaching India"), explored and observed in the Gambia valley and along the adjacent coasts with fully as much care and profit. As a result of these expeditions the infante seems to have sent out in 1458 a mission to convert the Gambia negroes. Gomez' second voyage, resulting in another "discovery" of the Cape Verde islands, was probably in 1462, after the death of Prince Henry; it is likely that among the infante's last occupations were the necessary measures for the equipment and despatch of this venture, as well as of Pedro de Sintra's important expedition of 1461.

The infante's share in home politics was considerable, especially in the years of Affonso V.'s minority (1438, etc.) while his elder brother Pedro was regent. When Dom Pedro rose in revolt (1447), Henry stood by the king and allowed his brother to be crushed. In the Morocco campaigns of his last years, especially at the capture of Alcazar the Little (1458), he restored his military fame which brought him invitations from the pope, the emperor and the kings of Castile and England, to take command of their armies. The prince was also grand master of the Order of Christ, the

successor of the Templars in Portugal; and most of his Atlantic and African expeditions sailed under the flag of his order, whose revenues were at the service of his explorations, in whose name he asked and obtained the official recognition of Pope Eugenius IV. for his work, and on which he bestowed privileges in the new lands. As "protector of Portuguese studies," Dom Henry founded a professorship of theology, and perhaps also chairs of mathematics and medicine, in Lisbon. To instruct his captains, pilots and other pioneers more fully in the art of navigation and the making of maps and instruments he procured the aid of one Master Jacome from Majorca, together with that of certain Arab and Jewish mathematicians. We hear also of one Master Peter, who inscribed and illuminated maps for the infante; the mathematician Pedro Nunes declares that the prince's mariners were well taught and provided with instruments and rules of astronomy and geometry "which all map-makers should know"; Cadamosto tells us that the Portuguese caravels in his day were the best sailing ships afloat; while, from several matters recorded by Henry's biographers, it is clear that he devoted great attention to the study of earlier charts and of any available information he could gain upon the trade-routes of north-west Africa. Thus we find an Oran merchant corresponding with him about events happening in the negro-world of the Gambia basin in 1458. Even if there were never a formal "geographical school" at Sagres, or elsewhere in Portugal, founded by Prince Henry, it appears certain that his court was the centre of active and useful geographical study, as well as the source of the best practical exploration of the time.

The prince died on Nov. 13, 1460, in his town near Cape St. Vincent, and was buried in the church of St. Mary in Lagos, but a year later his body was removed to the superb monastery of Batalha. His great-nephew, King Dom Manuel, had a statue of him placed over the centre column of the side gate of the church of Belem, and in 1840 a monument was erected to him at Sagres.

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HENRY RASPE (1202?–1247), German king and landgrave of Thuringia, was the second surviving son of Hermann I., landgrave of Thuringia, and Sophia, daughter of Otto I., duke of Bavaria. When his brother the landgrave Louis IV. died in Italy in 1227, Henry seized the government of Thuringia and expelled his brother's widow, St. Elisabeth of Hungary, and her son Hermann. With some trouble Henry made good his position, although his nephew Hermann II. was nominally the landgrave until his death in 1242. In 1236 Henry accompanied the emperor Frederick II. on a campaign against Frederick II., duke of Austria, and took part in the election of his son Conrad as German king at Vienna in 1237. But he did not appear at the diet of Verona in 1238; possibly he disliked the betrothal of his nephew Hermann to the emperor's daughter Margaret. At all events, when the projected marriage had been broken off the landgrave supported the emperor in 1239 in opposition to a plan formed by various princes to elect an anti-king. In 1241 Henry's loyalty again wavered, and he was himself mentioned as a possible anti-king. Frederick's visit to Germany in 1242 prevented this step for a time. In April 1246 Pope Innocent IV. wrote to the German princes advising them to choose Henry as their king in place of Frederick who had just been declared deposed. Henry was elected at Veitshöchheim on May 22, 1246, and became known as the *Pfaffenkönig*, or parsons' king. Collecting an army, he defeated King Conrad near Frankfort on Aug. 5, 1246, and then, after holding a diet at Nuremberg, undertook the siege of Ulm. He died at the Wartburg on Feb. 17, 1247. Henry married Gertrude, sister of Frederick II., duke of Austria, but left no children, and on his death the male line of his family became extinct.

See T. Knochenhauer, *Geschichte Thüringens zur Zeit des ersten Landgrafenhauses* (Gotha, 1871); and R. Malsch, *Heinrich Raspe, Landgraf von Thüringen und deutscher König* (1911).

HENRYSON, ROBERT (*fl.* 1470–1500), Scottish poet, was born probably about 1425. It has been surmised that he was connected with the family of Henderson of Fordell, but of this there is no evidence. He is described, on the title-page of the 1570 edition of his *Fables*, as "scholemaister of Dunfermeling," probably of the grammar school of the Benedictine abbey there. As Dunbar (*q.v.*) refers to him as deceased in his *Lament for the Makaris*, his death may be dated about 1500.

Henryson's longest, and in many respects his most original and effective work, is his *Morall Fabillis of Esope*, a collection of 13 fables, chiefly based on the versions of Anonymus, Lydgate and Caxton. The outstanding merit of the work is its freshness of treatment. The old themes are retold with such vivacity, such fresh lights on human character, and with so much local "atmosphere," that they deserve the credit of original productions. They are certainly unrivalled in English fabulistic literature. The earliest available texts are the Charteris text printed by Lekpreuik in Edinburgh in 1570 and the Harleian ms. No. 3,865 in the British Museum.

In the *Testament of Cresseid* Henryson supplements Chaucer's tale of Troilus with the story of the tragedy of Cresseid. Here again his literary craftsmanship saves him from the disaster which must have overcome another poet in undertaking to continue the part of the story which Chaucer had intentionally left untold. The description of Cresseid's leprosy, of her meeting with Troilus, of his sorrow and charity, and of her death, give the poem a high place in writings of this *genre*.

The poem entitled *Orpheus and Eurydice*, which is drawn from Boethius, contains some good passages, especially the lyrical lament of Orpheus, with the refrains "Quhar art thow gane, my luf Erudices?" and "My lady quene and luf, Erudices." It is followed by a long *moralitas*, in the manner of the *Fables*.

Thirteen shorter poems have been ascribed to Henryson. Of these the pastoral dialogue "Robene and Makyne," perhaps the best known of his work, is the most successful. Its model may perhaps be found in the *pastourelles*, but it stands safely on its own merits.

The ms. authorities for the text are the Asloan, Bannatyne, Maitland Folio, Makculloch, Gray and Riddell. *The Testament of Cresseid* was printed by the Cambridge University Press (1926). The best edition, containing all the texts, is that of the Scottish Text Society (ed. G. Gregory Smith), the first volume of the text (vol. ii. of the work) appearing in 1906, vol. iii. in 1908, and vol. i., with an introduction, in 1914. *The Poems of Robert Henryson*, a revised text with notes and introduction, was edited by W. M. Metcalfe (Paisley, 1917).

HENSCHEL, SIR GEORGE (Isidor Georg) (1850–), English musician (naturalized 1890), of German family, was born at Breslau, and educated as a pianist, making his first public appearance in Berlin in 1862. He subsequently, however, took up singing, having developed a fine baritone voice. In 1877 he began a successful career in England and in 1881 he married the American soprano, Lillian Bailey (d. 1901), who was associated with him in a number of vocal recitals. He was also prominent as a conductor, started the London Symphony Concerts in 1886 and both in England and America (where he was the first conductor of the Boston Symphony Concerts, 1881) he did admirable work in this way, giving programmes always of the highest type. In 1907 he married as his second wife, Amy Louis, also a musician, of New York, while he continued singing and teaching until long past his 70th year. Among his compositions may be mentioned a fine *Stabat Mater* (Birmingham Festival 1894), an opera *Nubia* (Dresden, 1899) and many admirable songs.

See Sir George Henschel, *Musings and Memories of a Musician* (1918).

HENSELT, ADOLF VON (1814–1889), German composer, was born at Schwabach, Bavaria, May 12, 1814. When three years old he began to learn the violin, and at five the pianoforte under Frau v. Fladt. With financial help from King Louis I. he went to study under Hummel in Weimar, and thence in 1832 to Vienna, where, besides studying composition under Simon Sechter, he made a great success as a concert pianist. In 1837 he settled at Breslau, where he had married, but in the following year he migrated to St. Petersburg, where he became court pianist, acquired a great position, and was ennobled. He died at Warmbrünn, Silesia, on Oct. 10, 1889. The characteristic of Henselt's playing was a combination of Liszt's sonority with Hummel's smoothness and he was justly regarded as one of the greatest pianists of his time. His best known works are the concerto in F minor and a number of charming studies and salon pieces.

HENSLOW, JOHN STEVENS (1796–1861), English botanist and geologist, was born at Rochester on Feb. 6, 1796. He was educated at St. John's college, Cambridge, and in 1819, during a tour in the Isle of Wight with Adam Sedgwick, developed an interest in geology. His paper on the geology of the Isle of Man appeared in *Trans. Geol. Soc.* (1821), and on the geology of parts of Anglesey in *Trans. of the Cambridge Philosophical Society* (1821), a society founded by Sedgwick and Henslow. In 1822 Henslow became professor of mineralogy at Cambridge, and two years later took holy orders. In the following year he resigned the chair of mineralogy to succeed to that of botany. To him Darwin largely owed his attachment to natural history, and also his introduction to Captain Fitzroy of H.M.S. "Beagle." In 1832 Henslow was appointed vicar of Cholsey-cum-Moulsford, Berkshire, and in 1837 rector of Hitcham, Suffolk. Henslow died at Hitcham on May 16, 1861. His publications included *A Catalogue of British Plants* (1829; 2nd ed., 1835); *Principles of Descriptive and Physiological Botany* (1835); *Flora of Suffolk* (1860, with E. Skepper).

See the *Memoir*, by L. Jenyns (1862).

HENSLOWE, PHILIP (d. 1616), English theatrical manager, was the son of Edmund Henslowe of Lindfield, Sussex, master of the game in Ashdown forest and Broil park. He appears to have been in the service of the bailiff to Viscount Montague, and settled in Southwark before 1577. He married the bailiff's widow, and, with the fortune he got with her, he became a considerable owner of Southwark property. He started his connection with the stage when he bought (March 24, 1584) land near the southern end of Southwark bridge, on which stood the Little Rose playhouse, afterwards rebuilt as the Rose. Successive companies played in it under Henslowe's financial management between 1592 and 1603. The theatre at Newington Butts was also under him in 1594. A share of the control in the Swan theatre, which like the Rose was on the Bankside, fell to Henslowe before the close of the 16th century. With the actor Edward Alleyn, who married his step-daughter Joan Woodward, he built in Golden lane, Cripplegate Without, the Fortune playhouse, opened in Nov. 1600. In Dec. 1594 they had secured the Paris garden, a place for bear-baiting, on the Bankside, and in 1604 they bought the office of master of the royal game of bears, bulls and mastiffs from the holder, and obtained a patent. Alleyn sold his share to Henslowe in Feb. 1610, and three years later Henslowe formed a new partnership with Jacob Meade and built the Hope playhouse, designed for stage performances as well as bull and bear-baiting, and managed by Meade.

In the theatres in which Henslowe had a share were first produced many plays by the famous Elizabethan dramatists. His relations to the companies who acted in his theatres were very complicated. In the case of the "Admiral's Men" he was not their manager or director, but practically their banker, in which capacity he probably influenced policy and certainly had a hold on playwrights and actors to whom he made advances. What is known as "Henslowe's Diary" contains some accounts referring to Ashdown forest between 1576 and 1581, entered by John Henslowe, while the later entries by Philip Henslowe from 1592 to 1609 are a principal source of information for the theatrical history of the time, and for the biography of individual playwrights and actors.

"Henslowe's Diary" passed into the hands of Edward Alleyn, and thence into the Library of Dulwich college, where the manuscript remained intact for more than 150 years. In 1780 Malone tried to borrow it, but it had been mislaid; in 1790 it was discovered and given into his charge. He was then at work on his *Variorum Shakespeare*. Malone had a transcript made of certain portions, and collated it with the original; and this transcript, with various notes and corrections by Malone, is now in the Dulwich library. An abstract of this transcript he also published with his *Variorum Shakespeare*. The ms. of the diary was eventually returned to the library in 1812 by Malone's executor. In 1840 it was lent to J. P. Collier, who in 1845 printed for the Shakespeare Society what purported to be a full edition, but it was afterwards shown by G. F. Warner (*Catalogue* of the Dulwich library, 1881) that a number of forged interpolations have been made, the responsibility for which rests on Collier.

See *Henslowe's Diary*, ed. J. P. Collier (Shakespeare Soc., 1845); *Henslowe's Diary*, ed. W. W. Greg (1904–08); *Henslowe Papers, being Documents Supplementary to Henslowe's Diary*, ed. W. W. Greg (1907); E. K. Chambers, *The Elizabethan Stage* (vol. i., 1923).

HENSON, HERBERT HENSLEY (1863–), English divine, was born in London on Nov. 8, 1863. As an unattached student at Oxford he graduated in 1884 and was elected a fellow of All Souls college. He was ordained in 1887, and after being head of Oxford House at Bethnal Green for a year, he was given the living of Barking, Essex. He was incumbent of St. Mary's hospital, Ilford 1895–1900, canon of Westminster and rector of St. Margaret's 1900–12, and dean of Durham 1912–18, when he was promoted to the bishopric of Hereford in succession to Dr. Percival. Owing to his pronounced liberal opinions in theology, and to his insistence on the validity of Nonconformist orders, his elevation to the bench of bishops aroused some controversy. In 1920 he was translated to the bishopric of Durham.

HENTY, GEORGE ALFRED (1832–1902), English war-correspondent and author, was born at Trumpington, near Cambridge, and educated at Westminster school and Caius college, Cambridge. He served in the Crimea in the Purveyor's department, and after the peace filled various posts in the department in England and Ireland, but he found the routine little to his taste, and drifted into journalism for the London *Standard*. He volunteered as special correspondent for the Austro-Italian War of 1866, accompanied Garibaldi in his Tirolese campaign, followed Lord Napier through the mountain gorges to Magdala, and Lord Wolseley across bush and swamp to Kumasi. Next he reported the Franco-German War, starved in Paris through the siege of the Commune and then turned south to rough it in the Pyrenees during the Carlist insurrection. He was in Asiatic Russia at the time of the Khiva expedition, and later saw the desperate hand-to-hand fighting of the Turks in the Serbian war. He found his real vocation in middle life, when he began to write excellent books of adventure for boys, many of which had a good historical background. His first boys' book *Out on the Pampas* dates from 1868; the last two, posthumously published, were *With Kitchener to the Sudan* (1903), and *With the Allies to Pekin* (1904). There are some 80 of these stories. Henty died on board his yacht in Weymouth harbour on Nov. 16, 1902.

HENWOOD, WILLIAM JORY (1805–1875), English mining geologist, was born at Perron Wharf, Cornwall, on Jan. 16, 1805. He was assay-master and supervisor of tin in the duchy of Cornwall from 1832 to 1838. In 1840 he was elected F.R.S. In 1843 he went to take charge of the Gongo-Soco mines in Brazil; afterwards he proceeded to India to report on certain metalliferous deposits for the Indian Government. The mineral Henwoodite was named after him. He died at Penzance on Aug. 5, 1875.

HENZADA, a town and district of Lower Burma, formerly in the Pegu, but now in the Irrawaddy division. Area, 2,872 sq.m. Pop. (1921) 550,920. The district lies to the west of the Irrawaddy and stretches to the crest of the Arakan Yomas which forms the boundary between Henzada and the Sandoway district

of Arakan. The district thus comprises a tract of hilly, forested country on the west and a portion of the plain of the Irrawaddy on the east. The town of Henzada itself is usually regarded as lying at the southern end of the Irrawaddy valley proper and at the head of the delta. The low-lying eastern portions of the district are protected from inundation by immense embankments, so that almost the whole is suitable for rice cultivation. Tobacco is also an important crop. The hills in the western part are forested. The chief town of the district is Henzada, which had in 1921 a population of 23,651. Other towns in the district are Myan-aung, with a population of 7,793; and Kyangin with a population of 7,064 according to the 1921 census. The river towns are served by the steamers of the Irrawaddy Flotilla Company and a branch of the Burma Railway runs from Kyangin to Henzada and from Henzada to Bassein.

The district was once a portion of the Talaing kingdom of Pegu, afterwards annexed to the Burmese empire in 1753, and has no history of its own.

HEPATICA (*Hepatica americana*), a North American plant of the buttercup family (Ranunculaceae), called also liverleaf, liverwort and squirrel-cup, native in woods from Nova Scotia to Manitoba and south to Florida and Missouri. It is a low, almost stemless perennial, about 3 in. high, often growing in tufts, with thick, evergreen, three-lobed basal leaves on very hairy stalks, and delicate blue, purple or white flowers, about $\frac{7}{8}$ in. broad, composed of 6 to 12 sepals, and borne singly on hairy stalks. Immediately beneath the flower are three leaflets (involucre) simulating a calyx. The very similar sharp-lobed hepatica (*H. acutiloba*), with pointed instead of rounded leaf lobes, found from Quebec to Minnesota and south in the Alleghanies to Georgia and in the interior to Missouri, is rare or absent near the Atlantic coast. The hepaticas are among the earliest and best-known woodland wild flowers of eastern North America, the two species occurring together in many localities. The leaves that last over winter are deep olive green or bronzy above and reddish-purple or liver-coloured beneath. By some botanical authorities the genus *Hepatica* is included in the genus *Anemone*. The Old World hepatica or liverleaf (*Hepatica triloba* or *Anemone Hepatica*), widely distributed in Asia and Europe, and often cultivated, is not found native in the British Isles. (*See* ANEMONE; RANUNCULACEAE.)



BY COURTESY OF WILD FLOWER PRESERVATION SOCIETY

HEPATICA (HEPATICA AMERICANA), OFTEN CALLED LIVER-LEAF, BECAUSE OF ITS ROUND-LOBED LEAF, SOMEWHAT RESEMBLING A LIVER

HEPATOSCOPY, one of the oldest and most widespread methods of divining the future, both among primitive people and among several of the civilizations of antiquity, was by the reading of omens in the signs noted on the liver of the animal offered as a sacrifice to some deity. In ancient Babylonia it can be traced back to the 3rd millennium B.C. From the Etruscans it made its way to the Romans. Among the Greeks it was introduced at a very early period and persisted to a late day. It is still found in S.E. Asia, Borneo and in Africa.

The rite everywhere rests on the belief that the liver was at one time regarded as the seat of vitality. Filled with blood it was natural to regard it as the seat of the blood, which was everywhere in antiquity associated with life. It was a natural and short step to identify the liver with the soul as well as with the seat of life, and therefore as the centre of all manifestations of vitality and activity.

The theory underlying hepatoscopy consists of the belief (1) that the liver is the seat of life, or the soul of the animal; and (2) that the liver of the sacrificial animal, by virtue of its acceptance on the part of the god, took on the same character as the soul of the god to whom it was offered. If, therefore, one understood the signs noted on a particular liver, one entered, as it were, into the mind (as one of the manifestations of soul-life) of the deity who had assimilated the being of the animal to his own being. To know the mind of the god was equivalent to knowing what the god in question proposed to do. Hence, when one approached a deity with an enquiry as to the outcome of some undertaking, the reading of the signs on the liver afforded a direct means of determining the course of future events, which was, according to current beliefs, in the control of the gods. Hepatoscopy represents the starting-point for the study of animal anatomy in general. We find in the Babylonian-Assyrian omen-texts special designations for the three main lobes of the sheep's liver; the groove separating the right lobe into two sections; the two appendixes attached to the upper lobe or *lobus pyramidalis;* the gall-bladder; and the cystic duct (compared, apparently, to a "penis") to which it is joined, as well as the hepatic duct (pictured as an "outlet") and the *ductus choleductus,* the depression separating the two lower lobes from the *lobus caudatus* and known as the *porta hepatis.* Lastly, to pass over unnecessary details, the markings of various kinds observed on the lobes of the livers of freshly slaughtered animals, which are due mainly to the traces left by the subsidiary hepatic ducts and hepatic veins on the liver surface, also had their special designations. The constantly varying character of these markings (no two livers being alike in this respect) furnished a particularly large field for the fancy of the *bārū*-priest. In the interpretation of these signs the two chief factors were association of ideas and association of words. For example, a long cystic duct would point to a long reign of the king. If the gall-bladder was swollen, it pointed to an extension or enlargement of some kind. If the *porta hepatis* was torn it prognosticated a plundering of the enemy's land. As among most people, a sign on the right side was favourable, but the same sign on the left side unfavourable. Past experience constituted an important factor in establishing the interpretation of signs noted. If, for example, on a certain occasion when the liver of a sacrificial animal was examined, certain events of a favourable character followed, the conclusion was drawn that the signs observed were favourable, and hence the recurrence of these signs on another occasion suggested a favourable answer to the question put to the priests. With this in view, omens given in the reigns of prominent rulers were preserved with special care as guides to the priests. In the course of time the collections of signs and their interpretation made by the *bārū*-priests grew in number until elaborate series were produced in which the endeavour was made to exhaust, so far as possible, all the varieties and modifications of the many signs, so as to furnish a complete handbook both for purposes of instruction and as a basis for the practical work of divination.

HEPBURN, SIR JOHN (*c.* 1598–1636), Scottish soldier in the Thirty Years' War, was a son of George Hepburn of Athelstaneford near Haddington. In 1620 and in the following years he served in Bohemia, on the lower Rhine and in the Netherlands, and in 1623 he entered the service of Gustavus Adolphus, who, two years later, appointed him colonel of a Scottish regiment of his army. He took part with his regiment in Gustavus's Polish wars, and in 1631, a few months before the battle of Breitenfeld he was placed in command of the "Scots" or "Green" brigade of the Swedish army. At Breitenfeld it was Hepburn's brigade which delivered the decisive stroke. He remained with Gustavus until the battle of the Alte Veste near Nuremberg. He then entered the French service, and raised two thousand men in Scotland for the French army, to which force was added in France the historic Scottish archer bodyguard of the French kings. The Royal Scots (Lothian) regiment (late 1st Foot) represents in the British army of to-day Hepburn's French regiment, and indirectly, through the amalgamation referred to, the Scottish contingent of the Hundred Years' War. Hepburn's claim to the right of the line of battle was bitterly resented by the senior French regiments. In 1633, Hepburn took part in the campaigns in Alsace and Lorraine (1634–36). In 1635 Bernhard of Saxe-Weimar, on entering the French service, brought with him Hepburn's former Swedish regiment, which was at once amalgamated with the French "régiment d'Hébron," the latter thus attaining the unusual strength of 8,300 men. Sir John Hepburn was killed at the siege of Saverne on

July 8, 1636. He was buried in Toul cathedral. Hepburn was a sincere Roman Catholic, and is said to have left Gustavus owing to a jest about his religion.

See James Grant, *Memoirs of Sir John Hepburn* (1851).

HEPHAESTION, a Macedonian general, celebrated as the friend of Alexander the Great, who called Hephaestion his Patroclus. In the later campaigns in Bactria and India, he superintended the founding of cities and colonies, and built the fleet intended to sail down the Indus. He was rewarded with a golden crown and the hand of Drypetis, the sister of Alexander's wife Stateira (324 B.C.). In the same year he died suddenly at Ecbatana. Mourning was ordered throughout Asia; at Babylon a funeral pile was erected and temples were built in his honour (*see* ALEXANDER THE GREAT).

HEPHAESTION, a grammarian of Alexandria who flourished in the age of the Antonines. His manual of Greek metres (Ἐγχειρίδιον περὶ μέτρων), which he abridged from his larger work, is the only complete treatise on the subject that has been preserved. The concluding chapter (Περὶ ποιήματος) discusses the various kinds of poetical composition. It is written in a simple style, and was much used as a school-book.

Editions by T. Gaisford (1855, with the valuable scholia), R. Westphal (1886, in *Scriptores metrici Graeci*) and M. Consbruch (1906); translation by T. F. Barham (1843); *see* also W. Christ, *Gesch. der griech. Litt.* (1898); M. Cornsbruch, *De veterum Περὶ ποιήματος doctrina* (1890); J. E. Sandys, *Hist. Class. Schol.* (1921), i.

HEPHAESTUS (Gr. *Hēphaistos*), in Greek mythology, the god of fire. As the distribution of his shrines testifies, he was originally a deity of that Anatolian population known to the Greeks as Carians. The home of his worship seems to have been the Lycian Olympus, where a quantity of natural gas still escapes from the soil. This was in antiquity "at once the sanctuary and the image" of the god (Max. Tyr. *Dissert.* ii., 8). Hence the cult spread to other places in Asia Minor and to some islands, especially Lemnos and Moschylus, which it reached very early. Hephaestus became the god of fire in general, and consequently the divine smith and patron of craftsmen. His cult reached Athens not later than about 600 B.C., and was carried at an early but unknown date to the volcanic Liparaean Islands off Sicily, whence it spread sporadically to Sicily and Campania. Crete it never reached, and Greece proper, with the exception of Attica, hardly at all. Natural fires, volcanic or gaseous, were often considered to be the workshops of Hephaestus.

In Homer the fire-god was the son of Zeus and Hera, cast out from heaven, either by Zeus, when he fell on Lemnos, or by Hera, who threw him down immediately after his birth in disgust at his lameness, when he was received by the sea-goddesses Eurynome and Thetis (*Iliad*, i. 590; xviii. 395).

The subsequent return of Hephaestus to Olympus is a favourite theme in early art. His wife was Charis, (in the *Iliad*) or Aphrodite (in the *Odyssey*). The connexion of the rough Hephaestus with these goddesses is curious; it may be due to the beautiful works (χαριέντα ἔργα) of the smith-god, but it is possibly derived from the supposed fertilizing and productive power of fire, in which case Hephaestus is a natural mate of Charis, a goddess of spring, and Aphrodite, the goddess of love. In Homer, the skill of Hephaestus in metallurgy is often mentioned; his forge was on Olympus, where he was served by images of golden handmaids that he had animated. Similar myths are found in relation to the Finnish smith-god Ilmarinen and the Teutonic Wieland; a belief in the magical power of metal-workers is a common survival from an age in which their art was new and mysterious. In epic poetry Hephaestus is rather a comic figure, and his limping gait provokes "Homeric laughter" among the gods. It has been suggested that in an early stage of society the trade of a smith would be suitable for the lame; Hephaestus and the lame Wieland would thus conform to the type of their human counterparts.

At Athens, with its large industrial population, Hephaestus was an important god. He finds a place in the local myths (*see* ERECHTHEUS). His temple has been identified, not improbably, with the so-called "Theseum." It contained a statue of Athena, and the two deities are often associated, in literature and cult, as the joint givers of civilization to the Athenians. The class of artisans was under their special protection; and the joint festival of the two divinities—the *Chalceia*—commemorated the invention of bronze-working by Hephaestus. In the *Hephaisteia* (the particular festival of the god) there was a torch race, a ceremonial not indeed confined to fire-gods like Hephaestus and Prometheus, but probably in its origin connected with them, whether its object was to purify and quicken the land, or (according to another theory) to transmit a new fire with all possible speed to places where the fire was polluted. The relation between Hephaestus and Prometheus is in some respects close, though the distinction between these gods is clearly marked. The fire, as an element, belongs to the Olympian Hephaestus; the Titan Prometheus, a more human character, steals it for the use of man. Prometheus resembles the Polynesian Maui, who went down to fetch fire from the volcano of Mahuika, the fire-god. Hephaestus is a culture-god mainly in his secondary aspect as the craftsman, whereas Prometheus originates all civilization with the gift of fire. But Prometheus despite his Greek name, in actual cult, was largely superseded by Hephaestus.

In archaic art Hephaestus is generally represented as bearded, though occasionally a younger beardless type is found, as on a vase (in the British Museum), on which he appears as a young man assisting Athena in the creation of Pandora. At a later time the bearded type prevails. The god is usually clothed in a short sleeveless tunic and wears a round close-fitting cap. His face is that of a middle-aged man, with unkempt hair. He is in fact represented as an idealized Greek craftsman, with the hammer, and sometimes the pincers. In art no attempt was made, as a rule, to indicate the lameness of Hephaestus; but one sculptor (Alcamenes) is said to have suggested the deformity without spoiling the statue.

See L. R. Farnell, *Cults of the Greek States*, v. (1909); and the classical dictionaries, especially L. Malten in Pauly-Wissowa, s.v. (1912). *See* also VULCAN.

HEPPENHEIM, a town of Germany, in the republic of Hesse, on the Bergstrasse, between Darmstadt and Heidelberg, 21 m. N. of the latter by rail. Pop. (1925) 7,693. The ruins of the castle of Starkenburg, built by the abbot, Ulrich von Lorsch, about 1064 and destroyed during the Seven Years' War, are near. Hops, wine and tobacco are grown, and there are large stone quarries, and several small industries in the town.

HEPPLEWHITE, GEORGE (d. 1786), one of the most famous English cabinet-makers of the 18th century. The only certain facts known about him are that he was apprenticed to Gillow at Lancaster, that he carried on business in the parish of St. Giles, Cripplegate, and that administration of his estate was granted to his widow Alice on June 27, 1786. After his death the business was continued by his widow under the style of A. Hepplewhite and Co. Our only approximate means of identifying his work are *The Cabinet-Maker and Upholsterer's Guide*, first published in 1788, and ten designs in *The Cabinet-maker's London Book of Prices* (1788), issued by the London Society of Cabinet-Makers. It is, however, exceedingly difficult to earmark any given piece of furniture as being the actual work or design of Hepplewhite, since to a very large extent the name represents rather a fashion than a man. Lightness, delicacy and grace are the distinguishing characteristics of Hepplewhite work, which depended for its effect more upon inlay than upon carving. If Hepplewhite was not the originator he appears to have been the most constant and successful user of the shield back for chairs. Where Chippendale had used the cabriole and the square leg with a good deal of carving, the Hepplewhite manner preferred a slighter leg, plain, fluted or reeded, tapering to a spade foot which often became the "spider leg" that characterized much of the late 18th-century furniture; this form of leg was not confined to chairs but was used also for tables and sideboards. Hepplewhite, or those who worked with him, appears to have originated, or at all events popularized, the winged easy-chair, in which the sides are continued to the same height as the back. The backs of Hepplewhite chairs were

often adorned with galleries and festoons of wheat-ears or pointed fern leaves, and not infrequently with the prince of Wales's feathers in some decorative form. It has been objected as an artistic flaw in Hepplewhite's chairs that they have the appearance of fragility. They are, however, constructionally sound as a rule. The painted and japanned work has been criticized on safer grounds. This delicate type of furniture, often made of satinwood, and painted with wreaths and festoons, with amorini and musical instruments or floral motives, has no elements of decorative permanence. With comparatively little use the paintings wear off and have to be renewed. A large proportion of Hepplewhite furniture is inlaid with the exotic woods which had come into high favour by the third quarter of the 18th century.

It was not in chairs alone that the Hepplewhite manner excelled. It made, for instance, a speciality of seats for the tall, narrow Georgian sash windows. These window-seats had ends rolling over outwards, and no backs, and display an elegant simplicity. Elegance, in fact, was the note of a style which on the whole was more distinctly English than that which preceded or immediately followed it. The smaller Hepplewhite pieces are much prized by collectors. Among these may be included urn-shaped knife-boxes in mahogany and satinwood, charming in form and decorative in the extreme; inlaid tea-caddies, varying greatly in shape and material; delicate little fire-screens with shaped poles; painted work-tables, and inlaid stands. Hepplewhite's bedsteads with carved and fluted pillars were very handsome and attractive. If we were dealing with a less elusive personality it would be just to say that Hepplewhite's work varies from the extreme of elegance and the most delicious simplicity to an unimaginative commonplace, and sometimes to actual ugliness. As it is, this summary may well be applied to the style as a whole—a style which was assuredly not the creation of any one man, but owed much alike of excellence and of defect to a school of cabinet-makers who were under the influence of conflicting tastes and changing ideals. *See* references under FURNITURE, EUROPEAN.

HEPTARCHY, a word which is frequently used to designate the period of English history between the coming of the Anglo-Saxons in 449 and the supremacy established by Egbert of Wessex early in the ninth century. It is derived from Gr. ἕπτα, seven, and ἀρχή rule, and was first used during the 16th century because of the belief held by Camden and other older historians, that during this period there were exactly seven kingdoms in England, *i.e.*, Northumbria, Mercia, East Anglia, Essex, Kent, Sussex, and Wessex. This belief is erroneous, as the number of kingdoms varied considerably from time to time; nevertheless the word still serves a useful purpose to denote the period.

HEPTASTYLE, an architectural term applied to a building or colonnade with seven columns in front.

HERA, in Greek mythology, the sister and wife of Zeus and queen of the Olympian gods; she was identified by the Romans with Juno. The derivation of the name is obscure and it seems likely that she is a pre-hellenic deity. Various ancient and modern theorists identify her with the air, earth, or moon. Whatever may have been her origin, to the historic Greeks (except a few poets or philosophers) she was a purely anthropomorphic goddess. In literature, from the times of Homer and Hesiod, she played an important part, appearing most frequently as the jealous and resentful wife of Zeus. In this character she pursues with vindictive hatred the heroines, such as Alcmene, Leto, and Semele, who were beloved by Zeus, and also their children. This character belongs to literature rather than to cult, in which the dignity and power of the goddess is naturally more emphasized.

The worship of Hera is found, in different degrees of prominence, throughout the Greek world. It was especially important in the ancient centres, Argos, Mycenae and Sparta, which she claims in the *Iliad* (iv. 51.) as her three dearest cities. Whether Hera was also worshipped by the early Dorians is uncertain; after the Dorian invasion she remained the chief deity of Argos, but her cult at Sparta was not so conspicuous. She received honour, however, in other parts of the Peloponnese, in central Greece, and in the islands, particularly Samos, where, according to the local tradition, she was born. As Hera Lacinia (from her Lacinian temple near Croton) she was extensively worshipped in Magna Graecia.

The connection of Zeus and Hera was probably not primitive, since Dione seems to have preceded Hera as the wife of Zeus at Dodona. But it certainly is early. The close relation of the two deities appears in a frequent community of altars and sacrifices, and also in the ἱερὸς γάμος, a dramatic representation of their sacred marriage. For instance, at the Daedala, as the festival was called at Plataea, an effigy was made from an oak-tree, dressed in bridal attire, and carried in a cart with a woman who acted as bridesmaid. The image was called Daedale, and the ritual was explained by a myth: Hera had left Zeus in her anger; in order to win her back, Zeus announced that he was about to marry, and dressed up a puppet to imitate a bride; Hera met the procession, tore the veil from the false bride, and, on discovering the ruse, became reconciled to her husband. The image was put away after each occasion; every 60 years a large number of such images, which had served in previous celebrations, were carried in procession to the top of Mount Cithaeron and were burned on an altar together with animals and the altar itself. As Frazer notes (*Golden Bough* [3rd ed.] ii. 140, *et seq.*; *cf.* Nilsson in *Journ. Hell. Stud.* xliii. 144), this festival appears to belong to the large class of mimetic charms designed to quicken the growth of vegetation; the marriage of Zeus and Hera would, in this case, represent the union of the king and queen of May. But it by no means follows that Hera was therefore originally a goddess of the earth or of vegetation, for we have no proof that she or Zeus had originally anything to do with it. At Samos the image of Hera was annually concealed on the seashore and solemnly discovered. There is nothing here to suggest a marriage of heaven and earth, or of two vegetation-spirits; as Dr. Farnell points out, the ritual appears to connect with certain local marriage customs. It is at least remarkable that, except at Argos, Hera had little to do with agriculture, and was not closely associated with such deities as Cybele, Demeter, Persephone, and Dionysus, whose connection with the earth, or with its fruits, is beyond doubt.



HERA, OR JUNO, QUEEN OF THE GODS, DESCENDING FROM OLYMPUS
A Roman statue found in the Villa Albani, in Rome

In her general cult Hera was worshipped in two main capacities: (1) as the consort of Zeus and queen of heaven; (2) as the goddess who presided over marriage, and, in a wider sense, over the various phases of a woman's life. The marriage-goddess naturally became the protectress of women in child-bed, and bore the title of the birth-goddess (*Eileithyia*), at Argos and Athens. In Homer (*Il.* xi. 270) and Hesiod (*Theog.* 922) she is the mother of the *Eileithyiai*, or the single *Eileithyia*. Her cult-titles παρθένος (or παῖς), τελεία and χήρα the "maiden," "wife," and "widow" (or "divorced") express the different conditions in the lives of her human worshippers. The Argives believed that Hera recovered her virginity every year by bathing in a certain spring (Paus. viii. 22, 2), a belief which probably reflects the custom of ceremonial purification after marriage (*see* Frazer, *Adonis*, p. 176). Although Hera was not the bestower of feminine charm to the same extent as Aphrodite, she was the patron of a contest for beauty in a Lesbian festival (καλλιστεῖα). It is this relation to women which gives some slight plausibility to her identification with the moon, which is constantly associated with them.

Among her particular worshippers, at Argos and Samos, Hera was much more than the queen of heaven and the marriage-goddess. As the patron of these cities (πολιοῦχος) she held a place corresponding to that of Athena in Athens. In Argos the agricul-

tural character of her ritual is well marked; the first oxen used in ploughing were dedicated to her as Ζευξιδία ("lady of the yoke"); and the sprouting ears of corn were called "the flowers of Hera." She was worshipped as the goddess of flowers (ἀνθεία); girls served in her temple under the name of "flower-bearers," and a flower festival ('Ηροσανθεία, 'Ηροάνθια) was celebrated by Peloponnesian women in spring. These rites recall our May day observance and give colour to the earth-goddess theory. On the other hand, it must be remembered that the patron deity of a Greek state had very wide functions; and it is not surprising to find that Hera (whatever her origin may have been) assumed an agricultural character among her own people, whose occupations were largely agricultural. So, although the warlike character of Hera was not elsewhere prominent, she assumed a militant aspect in her two chief cities; a festival called the Shield was part of the Argive cult, and there was an armed procession in her honour at Samos. The city-goddess, whether Hera or Athena, must be chief alike in peace and war.

The cow was the animal especially sacred to Hera both in ritual and in mythology. The Homeric epithet βοῶπις may have meant "cow-faced" to the earliest worshippers of Hera (*see* Io) though by Homer and the later Greeks it was understood as "large-eyed," like the cow. A car drawn by oxen seems to have been widely used in the processions of Hera, and the cow was her most frequent sacrifice. The cuckoo was also sacred to Hera, who, according to the Argive legend, was wooed by Zeus in the form of the bird. In later times the peacock, which was still unfamiliar to the Greeks in the 5th century, was her favourite, especially at Samos.

Cult-statues.—A log at Thespiae, a plank at Samos, a pillar at Argos served to represent the goddess. In the archaic period of sculpture the ξόανον or wooden statue of the Samian Hera by Smilis was famous. The most celebrated statue of Hera was the chryselephantine work of Polycleitus, made for the Heraion at Argos soon after 423 B.C. Polycleitus seems to have fixed the type of Hera as a youthful matron, but unfortunately the exact character of her head cannot be determined. A majestic and rather severe beauty marks the conception of Hera in later art, of which the Farnese bust at Naples and the Ludovisi Hera are the most conspicuous examples.

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HERACLEIA (Gr. Ἡράκλεια) or, in the Latin form, **HERACLEA,** the name of a large number of ancient cities founded by the Greeks.

1. Heraclea, an ancient city of Lucania, near the modern Policoro, 3 m. from the coast of the gulf of Tarentum, between the rivers Aciris (Agri) and Siris (Sinni) about 13 m. S.S.W. of Metapontum. It was a Greek colony founded by the Tarentines who had been defeated by the Thurians in 433 B.C. Here Pyrrhus, king of Epirus, defeated the consul Laevinus in 280 B.C., after he had crossed the river Siris. In 278 B.C., probably in order to detach it from Tarentum, the Romans made a special treaty with Heraclea, on such favourable terms that in 89 B.C. the Roman citizenship given to the inhabitants by the Lex Plautia Papiria was only accepted after considerable hesitation. Having accepted Roman citizenship, it became a *municipium*; part of a copy on bronze of the Lex Iulia Municipalis of 46 B.C. found between Heraclea and Metapontum, is of the highest importance for our knowledge of that law. It was still of importance under the empire; a branch road from Venusia joined the coast road here: but the site is now marked by a few heaps of ruins. Its mediaeval representative was Anglona, once a bishopric, but now itself a heap of ruins.

There was another Heraclea to which Herodotus (v. 46) refers, near Mount Eryx, founded by Dorieus not long after 500 B.C. and soon destroyed by the Carthaginians and Egesteans.

2. Heraclea Minoa, an ancient town on the south coast of Sicily, at the mouth of the river Halycus (modern *Platani*) some 20 m. W.N.W. of Girgenti. It was founded by Selinus and was always a border town between Carthaginian and Greek territory. It was taken by the Lacedaemonian colonists under Euryleon shortly before 500 but must have fallen into Carthaginian hands before Acragas (406). They lost it temporarily to Agathocles and Pyrrhus, but used it as a base in the first Punic war.

3. Heraclea Pontica (mod. *Bender Eregli*), an ancient city on the coast of Bithynia in Asia Minor, at the mouth of the Kilijsu. It was founded by a Megarian colony, which soon subjugated the native Mariandynians and extended its power over a considerable territory. The prosperity of the city was utterly destroyed in the Mithridatic war. It was the birthplace of Heracleides Ponticus. The modern town is best known for its lignite coal-mines, from which Constantinople receives a good part of its supply.

4. Heraclea Sintica, a town in Thracian Macedonia, to the south of the Strymon, the site of which was sought by Leake at the village of Zervokhori, and identified by the discovery of local coins, while other authorities place it further north, to the west of Demir Hissar.

5. Heraclea, a town on the borders of Caria and Ionia, near the foot of Mount Latmus. A temple and a rock cut theatre were visible a century ago. In its neighbourhood was the burial cave of Endymion.

6. Heraclea-Cybistra (mod. *Eregli* in the vilayet of Konia), under the name Cybistra, had some importance in Hellenistic times owing to its position near the point where the road to the Cilician Gates enters the hills. It lay in the way of armies and was more than once sacked by the Arab invaders of Asia Minor (A.D. 805 and 832). It became Turkish (Seljuk) in the 11th century. Modern Eregli had grown from a large village to a town since the railway reached it from Konia and Karaman in 1904; and it has now an hotel and good shops. Three hours' ride S. is the famous "Hittite" rock-relief of Ivriz, representing a king (probably of neighbouring Tyana) adoring a god (*see* Hittites). This was the first "Hittite" monument discovered in modern times (early 18th century, by the Swede Otter, an emissary of Louis XIV.).

7. Heraclea Lyncestis (mod. *Monastir*) was a town in Macedonia, on the Via Egnatia.

For Heraclea Trachinia *see* Trachis, and for Heraclea Perinthus *see* Perinthus.

Heraclea was also the name of one of the Sporades, between Naxos and Ios, which is still called Raklia, and bears traces of a Greek township with temples to Tyche and Zeus Lophites.

HERACLEIDES PONTICUS, Greek philosopher, born at Heracleia in Pontus, flourished in the 4th century B.C. He was a pupil of Plato. According to Suidas, Plato, on his departure for Sicily, left his school in charge of Heracleides. Fantastic stories about him are told in Diogenes Laertius, v. c. 6. He is said to have written brilliant works on a wide range of subjects, ethical, grammatical, musical, rhetorical, historical, as well as geometrical and dialectical treatises. He is famous in the history of astronomy for having been the first to maintain that the apparent daily rotation of the heavens is accounted for, not by the motion of the stars round the earth, but by the rotation of the earth itself about its own axis; he also took a notable step towards the Copernican hypothesis by declaring that the planets Mercury and Venus revolve in circles round the sun as centre like satellites.

For details of his life and work *see* Otto Voss, *De Heraclidis Pontici vita et scriptis* (1896). (T. L. H.).

HERACLEON, a Gnostic who flourished *c.* A.D. 125, probably in the south of Italy. He appears to have regarded the divine nature as a vast abyss in whose *pleroma* were aeons of different orders,—emanations from the source of being. Midway between the supreme God and the material world was the Demiurgus, who created the latter, and under whose jurisdiction the animal soul of man proceeded after death, while his celestial soul returned to its origin. Origen, who treats Heracleon as a notable exegete, has preserved fragments of his commentary on the fourth gospel (brought together by Grabe in vol. ii. of his *Spicilegium*), while Clement of Alexandria quotes what appears to be a passage from a commentary on Luke. These writings are intensely mystical and allegorical.

HERACLEONAS, East Roman emperor (Feb.–Sept. 641), was the son of Heraclius (*q.v.*) and Martina. At the end of Heraclius' reign he obtained through his mother's influence the title of Augustus (638), and after his father's death was proclaimed joint emperor with his half-brother Constantine III. The premature death of Constantine, in May 641, left Heracleonas sole ruler. But a suspicion that he and Martina had murdered Constantine led soon after to a revolt, and to the mutilation and banishment of the supposed offenders. Nothing is known about Heracleonas after 641.

HERACLIDAE, the general name for the numerous descendants of Heracles (Hercules); the name is especially used in antiquity for Hyllus and his descendants, the leaders of the Dorian invasion of the Peloponnese. The Dorian invasion and the collapse of the Heroic civilization is represented in Greek tradition as the "return of the Heraclids," seeking their father's inheritance, primarily Argos, of which he had been defrauded by Eurystheus. The legend appears to have been reduced to order by Ephorus, and the date fixed at 1104 B.C. It is difficult to give a coherent account of the story owing to the variations in even the earliest tradition, and the intrusion into the story of a mass of quite worthless legend in later writings.

The two main traditions may be summarized thus—chiefly from Herodotus and Pindar. The first centres round Echemus, king of Arcadia, who defeated the Heraclidae at the Isthmus before the Trojan war. They covenanted to stay away for three generations. At the end of this period the three sons of Aristomachus returned to Peloponnesus, captured it and divided the territory, Temenus taking Argus, the sons of Aristodemus Sparta and Crēsphontes Messene. The second, implicit in Herodotus' account of the coming of the Dorians, tells of the adoption by Aegimius, the Thessalian ancestor of the Dorians, of Hyllus as co-heir with his own sons (hence the Dorian tribes, Hylleis, Pamphyloi and Dymanes); and of the subsequent conquest of Peloponnesus by the three and their followers. It is difficult to reconcile these traditions, and, considered separately, each presents problems. It is probable that Messene was never Dorian until its conquest by Sparta.

There are further complications in addition to the confusion introduced by later writers; for instance, there is a Heraclid called Aletes (the Wanderer) who appears in Peloponnesus in one of the stories; he may have come from Rhodes. And Herodotus has a story of a Heraclid dynasty in Lydia, who ruled for the 505 years before the Mermnadae dynasty (685), the last being Candaules, who was killed by Gyges the founder of the Mermnad house.

See, for the historical bearing of these stories, art. DORIANS. The main ancient authorities in addition to Herodotus (*passim* and esp. i. 56; ix. 26) are Pindar, *Pyth,* ix., *Olymp.* vii. *See* also Müller's *Dorians*; and Busolt, *Griechische Gesch.*, i. 2, 7.

HERACLITUS (*c.* 540–475 B.C.), Greek philosopher, was born at Ephesus of distinguished parentage. Of his early life we know nothing except perhaps that he declined the nominal position of Basileus. (*See* ARCHON.) From his lonely life, from the extreme profundity of his philosophy and from his contempt for mankind he was called the "Dark Philosopher" in contrast to Democritus, the "Laughing Philosopher."

Heraclitus is in a sense the founder of metaphysics. Starting from the physical standpoint of the Ionian school, he accepted their idea of the unity of nature, but denied their theory of being. For him, all things are one, and this one is also the many, the "opposite tension" of the opposites constituting the unity of the one. Hot and cold, good and evil, night and day, etc., are the same in the sense that they are inseparable halves of one and the same thing. This primary substance is fire. In nature the sole actuality is change. All things are becoming, but they appear to remain the same, for while fire (of which even the soul is made) is transformed into the other elements, these also are transformed into fire. This rhythm of events and order in change is the reason or *logos* of the universe. There is no evidence to show that Heraclitus believed in a general conflagration. Knowledge consists in comprehending the all-pervading harmony as embodied in the manifold of perception. Virtue consists in the subordination of the individual to the laws of this harmony as the universal reason wherein alone true freedom is to be found. "The law of things is a law of Reason Universal; but most men live as though they had a wisdom of their own." Ethics here stands to sociology in a close relation.

Though much popular theology pervades his ethical teaching, he attacks the ceremonies of popular religion. After his death, the chief disciple of Heraclitus' teaching was Cratylus.

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HERACLIUS (Ἡράκλειος) (*c.* 575–642), East Roman emperor, was born in Cappadocia. His father held high military command under the emperor Maurice, and as governor of Africa maintained his independence against the usurper Phocas (*q.v.*). When invited to head a rebellion against the latter, he sent his son with a fleet which reached Constantinople unopposed, and precipitated the dethronement of Phocas. Proclaimed emperor (610), Heraclius set himself to reorganize the utterly disordered administration. At first he found himself helpless before the Persian armies (*see* PERSIA: *Ancient History;* and CHOSROËS II.) of Chosroës II., which conquered Syria and Egypt and since 616 had encamped opposite Constantinople; in 618 he even proposed to abandon his capital and seek a refuge in Carthage, but at the entreaty of the patriarch he took courage. By securing a loan from the Church and suspending the corn-distribution at Constantinople, he raised sufficient funds for war, and after making a treaty with the Avars, who had nearly surprised the capital during an incursion in 619, he was at last able to take the field against Persia. During his first expedition (622) he failed to secure a footing in Armenia, whence he had hoped to take the Persians in flank, but by his unwearied energy he restored the discipline and efficiency of the army. In his second campaign (624–26) he penetrated into Armenia and Albania, and beat the enemy in the open field. After a short stay at Constantinople, which his son Constantine had successfully defended against renewed incursions by the Avars, Heraclius resumed his attacks upon the Persians (627). Though deserted by the Khazars, with whom he had made an alliance upon entering into Pontus, he gained a decisive advantage by a brilliant march across the Armenian highlands into the Tigris plain, and a hard-fought victory over Chosroës' general, Shahrbaraz, in which Heraclius distinguished himself by his personal bravery. A subsequent revolution at the Persian court led to the dethronement of Chosroës in favour of his son Kavadh II. (*q.v.*); the new king promptly made peace with the emperor, whose troops were already advancing upon the Persian capital Ctesiphon (628). Having secured his eastern frontier, Heraclius returned to Constantinople with the true cross, which in 629 he brought back in person to Jerusalem. On the northern frontier of the empire he kept the Avars in check by inducing the Serbs to migrate from the Carpathians to the Balkan lands so as to divert the attention of the Avars.

The triumphs which Heraclius had won did not bring him lasting popularity. In his civil administration he followed out his own ideas without deferring to the nobles or the Church, and the opposition which he encountered from these quarters went far to paralyse his attempts at reform. Worn out by continuous fighting and weakened by dropsy, Heraclius failed to show sufficient energy against the new peril that menaced his eastern provinces

towards the end of his reign. In 629 the Saracens made their first incursion into Syria (*see* CALIPHATE, section A, § 1); in 636 they won a notable victory on the Yermuk (Hieromax), and in the following years conquered all Syria, Palestine and Egypt. Heraclius made no attempt to retrieve the misfortunes of his generals, but evacuated his possessions in sullen despair. The remaining years of his life he devoted to theological speculation and ecclesiastical reforms. His religious enthusiasm led him to oppress his Jewish subjects; on the other hand he sought to reconcile the Christian sects, and to this effect propounded in his *Ecthesis* a conciliatory doctrine of monothelism. Heraclius died of dropsy in 642. He had been twice married; his second union, with his niece Martina, was frequently made a matter of reproach to him. In spite of his partial failures, Heraclius must be regarded as one of the greatest of Byzantine emperors, and his early campaigns were the means of saving the realm from almost certain destruction.

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HERALD; for the mediaeval and modern functions of a herald, *see* HERALDRY.

Greek Heralds, So-called.—The word "herald" is commonly used to translate Gr. *κῆρυξ*, which has various meanings. (1) In Homer, a *κῆρυξ* is mostly a trusted attendant or retainer of a chieftain, one might almost say a gentleman of the bedchamber. We several times hear of them attending and waiting on their lords, performing confidential services for them, and so forth. But they also have official and public functions; they proclaim and execute the king's will—in which capacity it would seem that their persons are inviolable—and summon and keep order at the folk-moot. (2) These functions continue at later times, and we find heralds acting as inviolable messengers between states, even in time of war, proclaiming meetings of a senate, popular assembly, or court of law, reciting the formulae of prayer, etc., thereat, and summoning persons to attend. Hermes, himself the herald of the gods, is their patron and carries a herald's staff (*caduceus, κηρύκειον*; *see* HERMES). (3) Besides these paid functionaries of the State, there was a clan of *kerykes* at Eleusis, who had certain duties in connection with the mysteries. (4) The word, however, often means no more than a crier, whether at the Olympian or other games or simply at a sale or the like.

Latin "Heralds."—Setting aside the misuse of "herald" to translate *praeco* (crier, auctioneer), or *apparitor* (summoner, attendant on a magistrate), we may notice the real equivalent of the Greek *κῆρυξ* in his capacity as an inviolable messenger, *the fetialis*. A college of *fetiales* existed from very early times; such an institution was by no means confined to Rome, and parallels to it are found among quite low savages, giving us the right to suppose that it had long been recognized in Italy before our earliest historical documents. At Rome, if a breach of international law by a neighbouring state was alleged, two *fetiales* at least were appointed, the *pater patratus*, who was the senior member of the deputation, and the *Verbenarius*, or carrier of the sacred herbs (*verbenae, sagmina*), which apparently represented the Roman territory. These went to the State in question and thrice solemnly demanded redress (*clarigeratio*); if this was not obtained within 30 days, they reported the matter at Rome; when war was voted they returned to the frontier, and flung a javelin, made of cornel-wood and having either an iron point or one end sharpened and hardened by fire (this clearly is the older form), into the hostile territory, calling on the gods to witness the justice of their cause. In later times, a plot of land in Rome, containing the famous *columna bellica* or pillar of war, was by a legal fiction made to represent hostile territory, and the javelin cast into it, thus avoiding the long journeys overseas to perform the ceremony. They also made treaties of peace, when the terms had been agreed upon and ratified. For this purpose, the deputation carried flint knives, or a flint knife, which was the embodiment of Jupiter, and kept in one of his temples (*Iuppiter lapis*). They met the deputation of the other state; the terms of the treaty were read aloud; a pig was killed with the knife (hence the phrase *foedus ferire*, to smite a treaty-victim, for "to make a treaty," the Greeks said *ὅρκια τάμνειν*, to cut oath-victims, and had a very similar rite), and Jupiter was invoked to smite Rome in like manner, if Rome were the first wantonly to violate the treaty. The college of *fetiales*, though little is heard of it after 201 B.C., continued to exist throughout the empire.

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HERALDRY. Although the word heraldry properly belongs to all the business of the herald (*q.v.*), it has long attached itself to that which in earlier times was known as armory, the science of armorial bearings.

History of Armorial Bearings.—In all ages and in all quarters of the world distinguishing symbols have been adopted by tribes or nations, by families or by chieftains. Greek and Roman poets describe the devices borne on the shields of heroes, and many such painted shields are pictured on antique vases. Rabbinical writers have supported the fancy that the standards of the tribes set up in their camps bore figures devised from the prophecy of Jacob, the ravening wolf for Benjamin, the lion's whelp for Judah and the ship of Zebulon. In the East we have such ancient symbols as the five-clawed dragon of the Chinese empire and the chrysanthemum of the emperor of Japan. In Japan, indeed, the systematized badges borne by the noble clans may be regarded as akin to the heraldry of the West, and the circle with the three asarum leaves of the Tokugawa shoguns has been made as familiar to us by Japanese lacquer and porcelain as the red pellets of the Medici by old Italian fabrics. Before the landing of the Spaniards in Mexico the Aztec chiefs carried shields and banners, some of whose devices showed after the fashion of a phonetic writing the names of their bearers; and the eagle on the new banner of Mexico may be traced to the eagle that was once carved over the palace of Montezuma. That mysterious business of totemism, which students of folk-lore have discovered among most primitive peoples, must be regarded as another of the forerunners of true heraldry, the totem of a tribe supplying a badge which was sometimes displayed on the body of the tribesman in paint, scars or tattooing. Totemism so far touches our heraldry that some would trace to its symbols the white horse of Westphalia, the bull's head of the Mecklenburgers and many other ancient armories.

When true heraldry begins in Western Europe nothing is more remarkable than the suddenness of its development, once the idea of hereditary armorial symbols was taken by the nobles and knights. Its earliest examples are probably still to be discovered by research, but certain notes may be made which narrow the dates between which we must seek its origin. The older writers on heraldry, lacking exact archaeology, were wont to carry back the beginnings to the dark ages, even if they lacked the assurance of those who distributed blazons among the angelic host before the Creation. Even in our own times old misconceptions give ground slowly. Georg Ruexner's *Thurnier Buch* of 1522 is still cited for its evidence of the tournament laws of Henry the Fowler, by which those who would contend in tournaments were forced to show four generations of arms-bearing ancestors. Yet modern criticism has shattered the elaborated fiction of Ruexner. In England many legends survive of arms borne by the Conqueror and his companions. But nothing is more certain than that neither armorial banners nor shields of arms were borne on either side at Hastings. The famous record of the Bayeux tapestry shows shields which in some cases suggest rudely devised armorial bearings, but in no case can a shield be identified as one which is recognized in the generations after the Conquest. So far is the idea of personal arms from the artist, that the same warrior, seen in

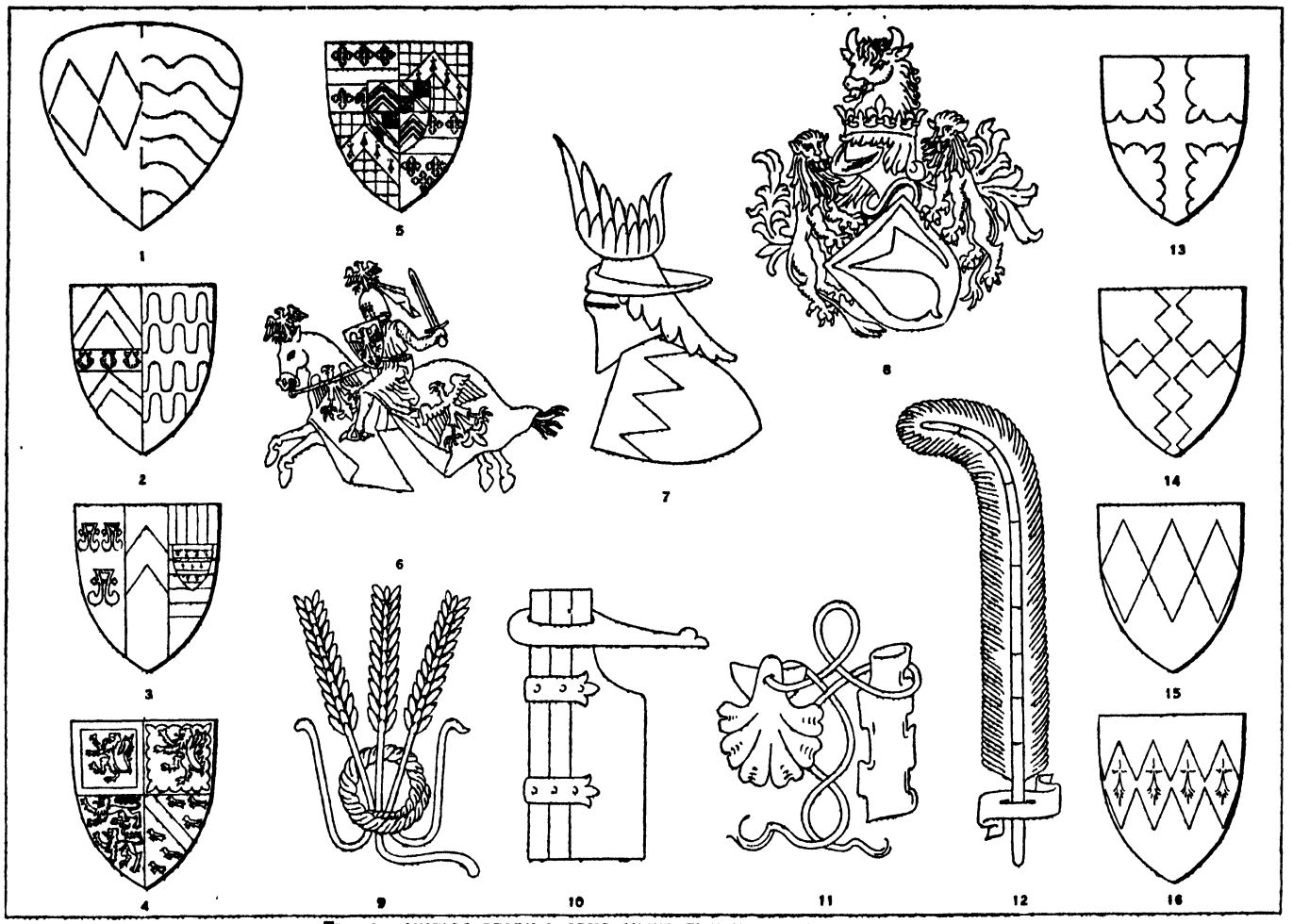

FIG. 1.—SHIELDS BEARING ARMS CHARACTERISTIC OF THE MIDDLE AGES

(1) Shield from seal of Robert de Pinkeny, an early example of parted arms. (2) Shield of Joan atte Pole, widow of Robt. Hemenhale, from her seal (1403), showing parted arms. (3) Shield of Beatrice Stafford from her seal (1404), showing her arms of Stafford between those of her husbands—Thomas, Lord Roos, and Sir Richard Burley. (4) Shield of John Talbot, first Earl of Shrewsbury (d. 1453), showing four coats quartered. (5) Shield of Richard Beauchamp, Earl of Warwick, from his garter stall-plate (after 1423). The arms are Beauchamp quartering Newburgh with a escocheon of Clare quartering Despenser. (6) Ralph de Monhermer (1301) showing shield of arms, helm with crest and mantle, horse-crest and armorial trappings. (7) Shield and crested helm with hat and mantle of Thomas Hengrave (1401). (8) Arms of William, Lord Hastings, from his seal (1477), showing shield, crowned and crested helm with mantle and supporters. (9) Badge of John of Wethamstede, abbot of St. Albans (d. 1465), from his tomb in the abbey church. (10) Rudder badge of Willoughby. (11) Badge of Dacre of Gilsland and Dacre of the North. (12) Ostrich feather badge of Beaufort, from a garter stall-plate of 1440. The silver feather has a quill of gobony silver and azure. (13 and 14) Mohun. (15) Montagu. (16) Dynham

different parts of the tapestry's history, has his shield with differing devices. A generation later, Anna Comnena, the daughter of the Byzantine emperor, describing the shields of the French knights who came to Constantinople, tells us that their polished faces were plain.

Of all men, kings and princes might be the first to be found bearing arms. Yet the first English sovereign who appears on his great seal with arms on his shield is Richard I. His seal of 1189 shows his shield charged with a lion ramping towards the sinister side. Since one half only is seen of the rounded face of the shield, English antiquaries have perhaps too hastily suggested that the whole bearing was two lions face to face. But the mounted figure of Philip of Alsace, count of Flanders, on his seal of 1164 bears a like shield charged with a like lion, and in this case another shield on the counterseal makes it clear that this is the single lion of Flanders. Therefore we may take it that, in 1189, King Richard bore arms of a lion rampant, while, nine years later, another seal shows him with a shield of the familiar bearings which have been borne as the arms of England by each one of his successors.

That seal of Philip of Alsace is the earliest known example of the arms of the great counts of Flanders. The ancient arms of the kings of France, the blue shield powdered with golden fleurs-de-lys, appear even later. Louis le Jeune, on the crowning of his son Philip Augustus, ordered that the young prince should be clad in a blue dalmatic and blue shoes, sewn with golden fleurs-de-lys, a flower whose name, as "Fleur de Loys," played upon that of his own, and possibly upon his epithet name of Florus. A seal of the same king has the device of a single lily. But the first French royal seal with the shield of the lilies is that of Louis VIII. (1223–1226). The eagle of the emperors may well be as ancient a bearing as any in Europe, seeing that Charlemagne is said, as the successor of the Caesars, to have used the eagle as his badge. The emperor Henry III. (1039–1056) has the sceptre on his seal surmounted by an eagle; in the 12th century the eagle was embroidered upon the imperial gloves. At Mölsen in 1080 the emperor's banner is said by William of Tyre to have borne the eagle, and with the beginning of regular heraldry this imperial badge would soon be displayed on a shield. The double-headed eagle is not seen on an imperial seal until after 1414, when the bird becomes the recognized arms of the king of the Romans.

There are, however, earlier examples of shields of arms than any of these. A document of the first importance is the description by John of Marmoustier of the marriage of Geoffrey of Anjou with Maude the empress, daughter of Henry I., when the king is said to have hung round the neck of his son-in-law a shield with golden "lioncels." Afterwards the monk speaks of Geoffrey in fight, "pictos leones preferens in clypeo." Two notes may be added to this account. The first is that the enamelled plate now in the museum at Le Mans, which is said to have been placed over the tomb of Geoffrey after his death in 1151, shows him bearing a

long shield of azure with six golden lioncels, thus confirming the monk's story. The second is the well-known fact that Geoffrey's bastard grandson, William with the Long Sword, undoubtedly bore these same arms of the six lions of gold in a blue field, even as they are still to be seen upon his tomb at Salisbury. Some ten years before Richard I. seals with the three leopards, his brother John, count of Mortain, is found using a seal upon which he bears two leopards, arms which later tradition assigns to the ancient dukes of Normandy and to their descendants the kings of England before Henry II., who is said to have added the third leopard in right of his wife, a legend of no value. Mr. Round has pointed out that Gilbert of Clare, earl of Hertford, who died in 1152, bears on his seal to a document sealed after 1138 and not later than 1146, the three cheverons afterwards so well known in England as the bearings of his successors. An old drawing of the seal of his uncle Gilbert, earl of Pembroke (*Lansdowne MS.* 203), shows a cheveronny shield used between 1138 and 1148. At some date between 1144 and 1150, Waleran, count of Meulan, shows on his seal a pennon and saddle-cloth with a checkered pattern: the house of Warenne, sprung from his mother's son, bore shields checky of gold and azure. In the inventory of Norman seals made by M. Demay, there is among the archives of the Manche a grant by Eudes, seigneur du Pont, sealed with a seal and counterseal of arms, to which M. Demay gives a date as early as 1128; but this is an error; the date should be 1218. Another type of seal common in this 12th century shows the personal device which had not yet developed into an armorial charge. A good example is that of Enguerrand de Candavène, count of St. Pol, where, although the shield of the horseman is uncharged, sheaves of oats, playing on his name, are strewn at the foot of the seal. Five of these sheaves were the arms of Candavène when the house came to display arms. In the same fashion three different members of the family of Armenteres in England show one, two or three swords upon their seals, but there is no evidence of a coat of arms derived from these devices.

From the beginning of the 13th century arms upon shields increase in number. Soon the most of the great houses of the west display them with pride. Leaders in the field, whether of a royal army or of a dozen spears, saw the military advantage of a custom which made shield and banner things that might be recognized in the press. Although it is probable that armorial bearings have their first place upon the shield, the charges of the shield are found displayed on the knight's long surcoat, his "coat of arms," on his banner or pennon, on the trapper of his horse and even upon the peaks of his saddle. An attempt has been made to connect the rise of armory with the adoption of the barrel-shaped close helm; but even when wearing the earlier Norman helmet with its long nasal the knight's face was not to be recognized. The Conqueror, as we know, had to bare his head before he could persuade his men at Hastings that he still lived. Armory satisfied a need which had long been felt. When fully armed, one galloping knight was like another; but friend and foe soon learned that the gold and blue checkers meant that Warenne was in the field and that the gold and red vair was for Ferrers. Earl Simon at Evesham sent up his barber to a spying place and, as the barber named in turn the banners which had come up against him, he knew that his last fight was at hand. In spite of these things the growth of the custom of sealing deeds and charters had at least as much influence in the development of armory as any military need. By this way, women and clerks, citizens and men of peace, corporations and colleges, came to share with the fighting man in the use of armorial bearings. Arms in stone, wood and brass decorated the tombs of the dead and the houses of the living; they were broidered in bed-curtains, coverlets and copes, painted on the sails of ships and enamelled upon all manner of goldsmiths' and silversmiths' work. And, even by warriors, the full splendour of armory was at all times displayed more fully in the fantastic magnificence of the tournament than in the rougher business of war.

There can be little doubt that ancient armorial bearings were chosen at will by the man who bore them, many reasons guiding his choice. Crosses in plenty were taken. Old writers have asserted that these crosses commemorate the badge of the crusaders, yet the fact that the cross is the symbol of the faith was reason enough. No symbolism can be found in such charges as bends and fesses; they are on the shield because a broad band, aslant or athwart, is a charge easily recognized. Mediaeval wisdom gave every noble and magnanimous quality to the lion, and therefore this beast is chosen by hundreds of knights as their bearing. We have already seen how the arms of a Candavène play upon his name. In ancient shields almost all beasts and birds other than the lion and the eagle play upon the bearer's name. No object is so humble that it is unwelcome to the knight seeking a pun for his shield. Trivet has a three-legged trivet. The legends which assert that certain arms were "won in the Holy Land" or granted by ancient kings for heroic deeds in the field are for the most part worthless fancies.

Tenants or neighbours of the great feudal lords were wont to make their arms by differencing the lord's shield or by bringing some charge of it into their own bearings. Thus a group of Kentish shields borrow lions from that of Leyborne, which is azure with six lions of silver. Shirland of Minster bore the same arms differenced with an ermine quarter. Detling had the silver lions in a sable field. The Vipont ring or annelet is in several shields of Westmorland knights, and the cheverons of Clare, the cinquefoil badge of Beaumont and the sheaves of Chester can be traced in the coats of many of the followers of those houses. Sometimes the lord himself set forth such arms in a formal grant, as when the baron of Greystock grants to Adam of Blencowe a shield in which his own three chaplets are charges. The Whitgreave family of Staffordshire still show a shield granted to their ancestor in 1442 by the earl of Stafford, in which the Stafford red cheveron on a golden field is four times repeated.

Differences.—By the custom of the middle ages the "whole coat," which is the undifferenced arms, belonged to one man only and was inherited whole only by his heirs. Younger branches differenced in many ways, following no rule. In modern armory the label is reckoned a difference proper only to an eldest son. But in older times, although the label was very commonly used by the son and heir apparent, he often chose another distinction during his father's lifetime, while the label is sometimes found upon the shields of younger sons. Changing the colours or varying the number of charges, drawing a bend or baston over the shield or adding a border are common differences of cadet lines. Beauchamp, earl of Warwick, bore "Gules with a fesse and six crosslets gold." His cousins are seen changing the crosslets for martlets or for billets. Bastards difference their father's arms, as a rule, in no more striking manner than the legitimate cadets. Towards the end of the 14th century we have the beginning of the custom whereby certain bastards of princely houses differenced the paternal arms by charging them upon a bend, a fesse or a chief, a cheveron or a quarter. Before his legitimation the eldest son of John of Gaunt by Katharine Swinford is said to have borne a shield party silver and azure with the arms of Lancaster on a bend. After his legitimation in 1397 he changed his bearings to the royal arms of France and England within a border gobony of silver and azure. Warren of Poynton, descended from the last earl Warenne and his concubine, Maude of Neirford, bore the checkered shield of Warenne with a quarter charged with the ermine lion of Neirford. By the end of the middle ages the baston under continental influence tended to become a bastard's difference in England and the jingle of the two words may have helped to support the custom. About the same time the border gobony began to acquire a like character. The "bar sinister" of the novelists is probably the baston sinister, with the ends couped, which has since the time of Charles II. been familiar on the arms of certain descendants of the royal house. But it has rarely been seen in England over other shields; and, although the border gobony surrounds the arms granted to a peer of Victorian creation, the modern heralds have fallen into the habit of assigning, in nineteen cases out of twenty, a wavy border as the standard difference for illegitimacy.

Although no general register of arms was maintained it is remarkable that there was little conflict between persons who had chanced to assume the same arms. The famous suit in which Scrope, Grosvenor and Carminow all claimed the blue shield with

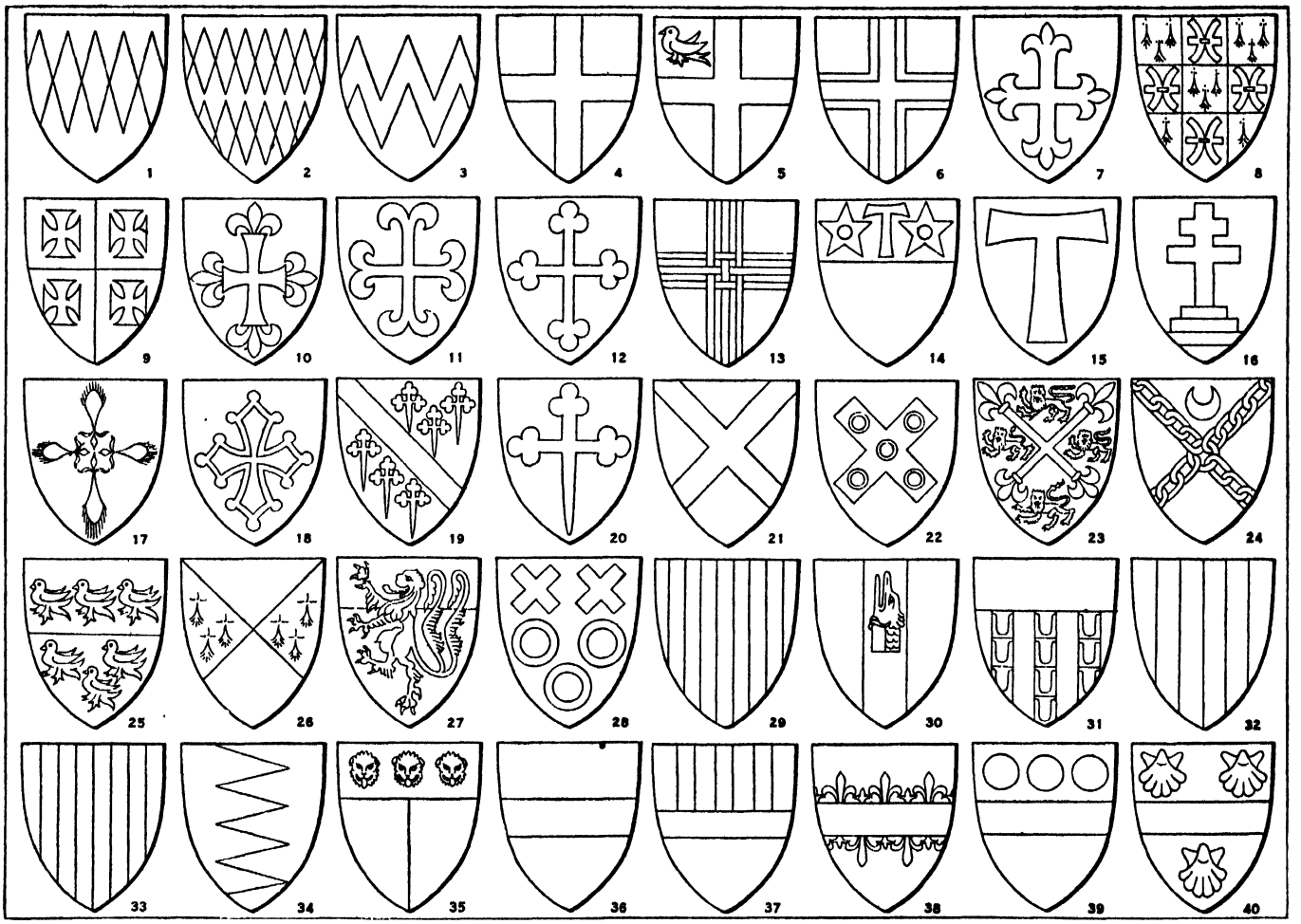

FIG. 2.—SHIELDS WITH THE ARMS OF ENGLISH KNIGHTS AND NOBLES
(1) Percy. (2) Fauconberg. (3) West. (4) St. George. (5) Harcla. (6) Crevequer. (7) Latimer. (8) Mill-rinds. (9) Chetwode. (10) Swynnerton. (11) Willoughby. (12) Brereiegh. (13) Skirlaw. (14) Drury. (15) St. Anthony's Cross. (16) Brytton. (17) Hurlestone. (18) Melton. (19) Howard. (20) Upton. (21) Nevill. (22) Upton. (23) Aynho. (24) Elwett. (25) Fenwick. (26) Restwolde. (27) Hastang. (28) Hilton. (29) Provence. (30) Gascoigne. (31) Ferlington. (32) Strelley. (33) Rothinge. (34) Bermingham. (35) Caldecote. (36) Coleville. (37) Fauconberg. (38) Cayvile. (39) Devereux. (40) Chamberlayne

the golden bend is well known, and there are a few cases in the 14th century of like disputes which were never carried to the courts. But the men of the middle ages would seem to have had marvellous memories for blazonry; and we know that rolls of arms for reference, some of them the records of tournaments, existed in great numbers. A few examples of these remain to us, with painted shields or descriptions in French blazon, some of them containing many hundreds of names and arms.

To women were assigned, as a rule, the undifferenced arms of their fathers. In the early days of armory married women—well-born spinsters of full age were all but unknown outside the walls of religious houses—have seals on which appear the shield of the husband or the father or both shields side by side. But we have some instances of the shield in which two coats of arms are parted or, to use the modern phrase, "impaled." Early in the reign of King John, Robert de Pinkeny seals with a parted shield. On the right or dexter side—the right hand of a shield is at the right hand of the person covered by it—are two fusils of an indented fesse: on the left or sinister side are three waves. The arms of Pinkeny being an indented fesse, we may see in this shield the parted arms of husband and wife—the latter being probably a Basset. In many of the earliest examples, as in this, the dexter half of the husband's shield was united with the sinister half of that of the wife, both coats being, as modern antiquaries have it, dimidiated. This "dimidiation," however, had its inconvenience. With some coats it was impossible. If the wife bore arms with a quarter for the only charge, her half of the shield would be blank. Therefore the practice was early abandoned by the majority of bearers of parted shields although there is a survival of it in the fact that borders and tressures continue to be "dimidiated" in order that the charges within them shall not be cramped. Parted shields came into common use from the reign of Edward II., and the rule is established that the husband's arms should take the dexter side. There are, however, several instances of the contrary practice. On the seal (1310) of Maude, wife of John Boutetort of Halstead, the engrailed saltire of the Boutetorts takes the sinister place. A twice-married woman would sometimes show a shield charged with her paternal arms between those of both of her husbands, as did Beatrice Stafford in 1404, while in 1412 Elizabeth, Lady of Clinton, seals with a shield paled with five coats—her arms of la Plaunche between those of four husbands. In most cases the parted shield is found on the wife's seal alone. Even in our own time it is recognized that the wife's arms should not appear upon the husband's official seal, upon his banner or surcoat or upon his shield when it is surrounded by the collar of an order. Parted arms, it may be noted, do not always represent a husband and wife. Richard II. parted with his quartered arms of France and England those ascribed to Edward the Confessor, and parting is often used on the continent where quartering would serve in England. In 1497 the seal of Giles Daubeney and Reynold Bray, fellow justices in eyre, shows their arms parted in one shield. English bishops, by a custom begun late in the 14th century, part the see's arms with their own. By modern English custom a husband and wife, where the wife is not an heir, use the parted coat on a shield, a widow bearing the same upon the lozenge on which, when a spinster, she displayed her father's coat alone. When the wife is an heir, her arms are now borne in a little scocheon above those of her husband. If the husband's arms be in

an unquartered shield the central charge is often hidden away by this scocheon.

The practice of marshalling arms by quartering spread in England by reason of the example given by Eleanor, wife of Edward I., who displayed the castle of Castile quartered with the lion of Leon. Isabel of France, wife of Edward II., seals with a shield in whose four quarters are the arms of England, France, Navarre and Champagne. Early in the 14th century Simon de Montagu, an ancestor of the earls of Salisbury, quartered with his own arms a coat of azure with a golden griffon. In 1340 we have Laurence Hastings, earl of Pembroke, quartering with the Hastings arms the arms of Valence, as heir of his great-uncle Aymery, earl of Pembroke. In the preceding year the king had already asserted his claim to another kingdom by quartering France with England, and, after this, quartered shields became common in the great houses whose sons were carefully matched with heirs female. When the wife was an heir the husband would quarter her arms with his own, displaying, as a rule, the more important coat in the first quarter. Marshalling becomes more elaborate with shields showing both quarterings and partings, as in the seal (1368) of Sibil Arundel, where Arundel (Fitzalan) is quartered with Warenne and parted with the arms of Montagu. In all, save one, of these examples the quartering is in its simplest form, with one coat repeated in the first and fourth quarters of the shield and another in the second and third. But to a charter of 1434 Sir Henry Bromflete sets a seal upon which Bromflete quarters Vesci in the second quarter, Aton in the third and St. John in the fourth, after the fashion of the much earlier seal of Edward II.'s queen Another development is that of what armorists style the "grand quarter," a quarter which is itself quartered, as in the shield of Reynold Grey of Ruthyn, which bears Grey in the first and fourth quarters and Hastings quartered with Valence in the third and fourth. Humphrey Bourchier, Lord Cromwell, in 1469, bears one grand quarter quartered with another, the first having Bourchier and Lovaine, the second Tatershall and Cromwell.

The last detail to be noted in mediaeval marshalling is the introduction into the shield of another surmounting shield called by old armorists the "innerscocheon" and by modern blazoners the "inescutcheon." John the Fearless, count of Flanders, marshalled his arms in 1409 as a quartered shield of the new and old coats of Burgundy. Above these coats a little scocheon, borne over the crossing of the quartering lines, had the black lion of Flanders, the arms of his mother. Richard Beauchamp, the adventurous earl of Warwick, who had seen most European courts during his wanderings, may have had this shield in mind when, over his arms of Beauchamp quartering Newburgh, he set a scocheon of Clare quartering Despenser, the arms of his wife Isabel Despenser, co-heir of the earls of Gloucester. The seal of his son-in-law, the King-Maker, shows four quarters—Beauchamp quartering Clare, Montagu quartering Monthermer, Nevill alone, and Newburgh quartering Despenser. An interesting use of the scocheon *en surtout* is that made by Richard Wydvile, Lord Rivers, whose garter stall-plate has a grand quarter of Wydvile and Prouz, quartering Beauchamp of Hache, the whole surmounted by a scocheon with the arms of Reviers or Rivers, the house from which he took the title of his barony. On the continent the common use of the scocheon is to bear the paternal arms of a sovereign or noble, surmounting the quarterings of his kingdoms, principalities, fiefs or seigniories. The prince of Wales bore the arms of Saxony above those of the United Kingdom differenced with his silver label. Marshalling takes its most elaborate form, the most removed from the graceful simplicity of the middle ages, in such shields as the "Great Arms" of the Austrian empire, wherein are nine grand quarters each marshalling in various fashions from three to eleven coats, six of the grand-quarters bearing scocheons *en surtout*, each scocheon ensigned with a different crown.

Crests.—The most important accessory of the arms is the crested helm. Like the arms it has its pre-heraldic history in the crests of the Greek helmets, the wings, the wild boar's and bull's heads of Viking headpieces. A little roundel of the arms of a Japanese house was often borne as a crest in the Japanese helmet, stepped in a socket above the middle of the brim. The 12th-century seal of Philip of Alsace, count of Flanders, shows a demi-lion painted or beaten on the side of the upper part of his helm, and upon his seal of 1198 King Richard Coeur de Lion's barrel-helm has a leopard upon the semicircular comb-ridge, the edge of which is set off with feathers arranged as two wings. Crests, however, came slowly into use in England, although before 1250 Roger de Quincy, earl of Winchester, is seen on his seal with a wyver upon his helm. Of the long roll of earls and barons sealing the famous letter to the pope in 1301 only five show true crests on their seals. Two of them are the earl of Lancaster and his brother, each with a wyver crest like that of Quincy. One, and the most remarkable, is John St. John of Halnaker, whose crest is a leopard standing between two upright palm branches. Ralph de Monhermer has an eagle crest, while Walter de Moncy's helm is surmounted by a fox-like beast. In three of these instances the crest is borne, as was often the case, by the horse as well as the rider. Others of these seals to the barons' letter have the fan-shaped crest without any decoration upon it. But as the furniture of tournaments grew more magnificent the crest gave a new field for display, and many strange shapes appear in painted and gilded wood, metal, leather or parchment above the helms of the jousters. The Berkeleys, great patrons of abbeys, bore a mitre as their crest painted with their arms, like crests being sometimes seen on the continent where the wearer was *advocatus* of a bishopric or abbey. The whole or half figures or the heads and necks of beasts and birds were employed by other families. Saracens' heads topped many helms, that of the great Chandos among them. Astley bore for his crest a silver harpy standing in marsh-sedge, a golden chain fastened to a crown about her neck. Dymoke played pleasantly on his name with a long-eared moke's scalp. Stanley took the eagle's nest in which the eagle is lighting down with a swaddled babe in his claws. Many early helms, as that of Sir John Loterel, painted in the Loterel psalter, repeat the arms on the sides of a fan-crest. Howard bore for a crest his arms painted on a pair of wings, while simple "bushes" of feathers are seen in great plenty. The crest of a cadet is often differenced like the arms, and thus a wyver or a leopard will have a label about its neck. The Montagu griffon on the helm of John, marquess of Montagu, holds in its beak the gimel ring with which he differenced his father's shield. His brother, the King-Maker, following a custom commoner abroad than at home, shows two crested helms on his seal, one for Montagu and one for Beauchamp—none for his father's house of Nevill. It is often stated that a man, unless by some special grace or allowance, can have but one crest. This, however, is contrary to the spirit of mediaeval armory in which a man, inheriting the coat of arms of another house than his own, took with it all its belongings, crest, badge and the like. The heraldry books, with more reason, deny crests to women and to the clergy, but examples are not wanting of mediaeval seals in which even this rule is broken. It is perhaps unfair to cite the case of the bishops of Durham who ride in full harness on their palatinate seals; but Henry Despenser, bishop of Norwich, has a helm on which the winged griffon's head of his house springs from a mitre, while Alexander Nevill, archbishop of York, seals with shield, supporters and crowned and crested helm like those of any lay magnate. A seal cut for the wife of Thomas Chetwode, a Cheshire squire, has a shield of her husband's arms parted with her own and surmounted by a crowned helm with the crest of a demi-lion; and this is not the only example of such bearings by a woman.

Before passing from the crest let us note that in England the juncture of crest and helm was commonly covered, especially after the beginning of the 15th century, by a torse or "wreath" of silk, twisted with one, two or three colours. Coronets or crowns and "hats of estate" often take the place of the wreath as a base for the crest, and there are other curious variants. With the wreath may be considered the mantle, a hanging cloth which, in its earliest form, is seen as two strips of silk or sendal attached to the top of the helm below the crest and streaming like pennants as the rider bent his head and charged. Such strips are often displayed from the conical top of an uncrested helm, and some ancient examples have the air of the two ends of a stole or of

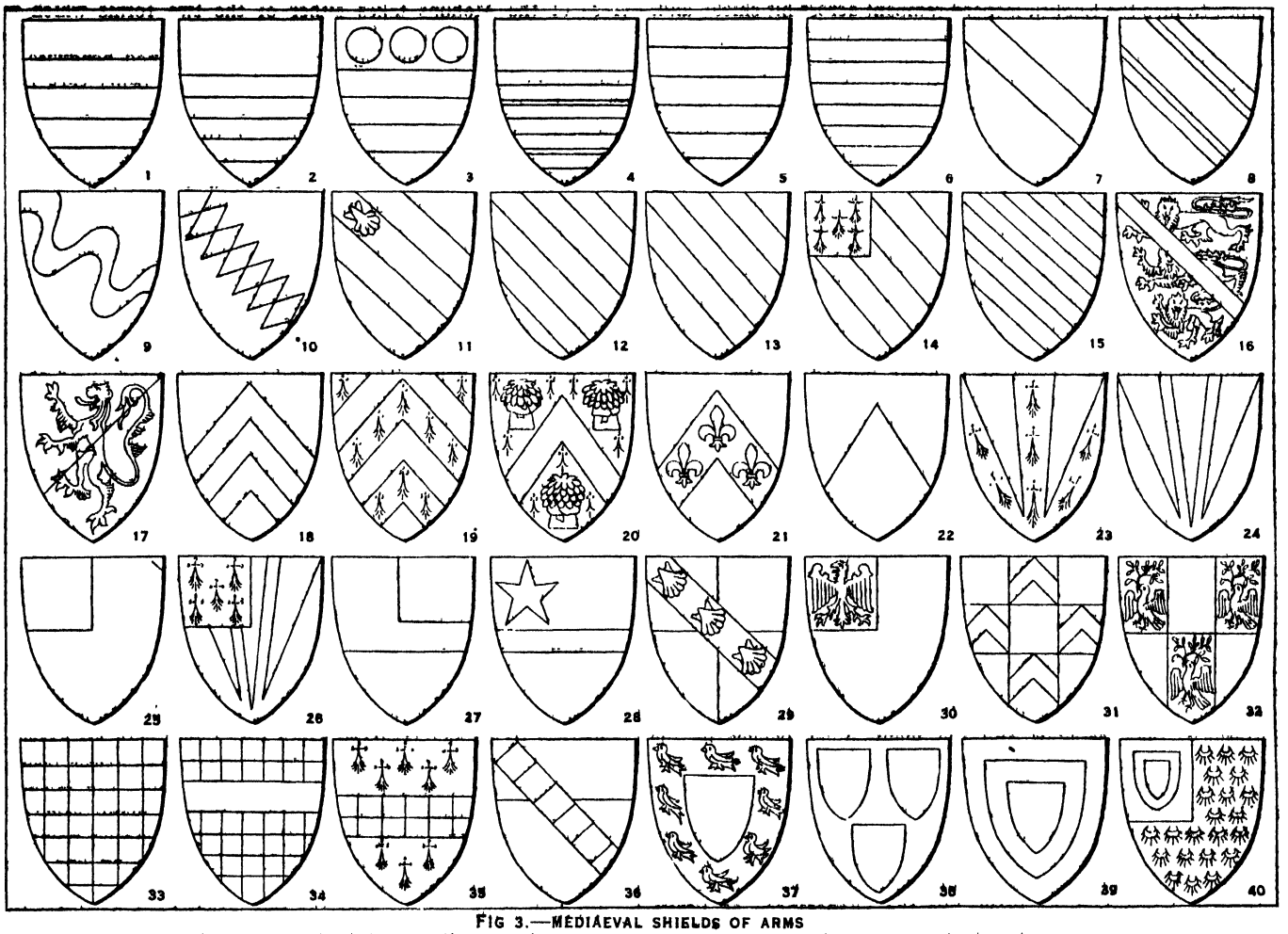

FIG 3.—MEDIAEVAL SHIELDS OF ARMS

(1) Harcourt. (2) Manners. (3) Wake. (4) Melsanby. (5) Grey. (6) Fitzalan of Bedale. (7) Mauley. (8) Harley. (9) Wallop. (10) Raleigh. (11) Tracy. (12) Bodrugan. (13) St. Philibert. (14) Bishopsdon. (15) Montfort. (16) Lancaster. (17) Fraunceys. (18) Chaworth. (19) Peyteoyn. (20) Sheffield. (21) Cobham. (22) Aston. (23) Hollis. (24) Bryene. (25) Blencowe. (26) Bassét. (27) Wydville. (28) Odingseles. (29) Ever. (30) Phelip, Lord Bardolf. (31) Whitgrave. (32) Tallow Chandlers. (33) Warenne. (34) Clifford. (35) Arderne. (36) Cromwell. (37) Erpingham. (38) Daviliers. (39) Balliol. (40) Surtees

the *infulae* of a bishop's mitre. The general opinion of antiquaries has been that the mantle originated among the crusaders as a protection for the steel helm from the rays of an Eastern sun; but the fact that mantles take in England their fuller form after our crusading days were over seems against this theory. When the fashion for slittering the edges of clothing came in, the edges of the mantle were slittered like the edge of the sleeve or skirt, and, flourished out on either side of the helm, it became the delight of the painter of armories and the seal engraver. Modern heraldry in England paints the mantle with the principal colour of the shield, lining it with the principal metal; this in cases where no old grant of arms is cited as evidence of another usage. The mantles of the king and of the prince of Wales are, however, of gold lined with ermine and those of other members of the royal house of gold lined with silver. In ancient examples there is great variety and freedom. Where the crest is the head of a griffon or bird the feathering of the neck will be carried on to cover the mantle. Other mantles will be powdered with badges or with charges from the shield, others checkered, barred or paled. More than thirty of the mantles enamelled on the stall-plates of the mediaeval Garter-knights are of red with an ermine lining, tinctures which in most cases have no reference to the shields below them.

Supporters.—Shields of arms, especially upon seals, are sometimes figured as hung round the necks of eagles, lions, swans and griffons, as strapped between the horns of a hart or to the boughs of a tree. Badges may fill in the blank spaces at the sides between the shield and the inscription on the rim, but in the later 13th and early 14th centuries the commonest objects so serving are sprigs of plants, lions, leopards, or, still more frequently, lithe-necked wyvers. John of Segrave in 1301 flanks his shields with two of the sheaves of the older coat of Segrave: William Marshal of Hingham does the like with his two marshal's staves. Henry of Lancaster at the same time shows on his seal a shield and a helm crested with a wyver, with two like wyvers ranged on either side of the shield as "supporters." It is uncertain at what time in the 14th century these various fashions crystallize into the recognized use of beasts, birds, reptiles, men or inanimate objects, definitely chosen as "supporters" of the shield, and not to be taken as the ornaments suggested by the fancy of the seal engraver. That supporters originate in the decoration of the seal there can be little doubt. Some writers, the learned Menêtrier among them, will have it that they were first the fantastically clad fellows who supported and displayed the knight's shield at the opening of the tournament. If the earliest supporters were wild men, angels or Saracens, this theory might be defended; but lions, boars and talbots, dogs and trees are guises into which a man would put himself with difficulty. By the middle of the 14th century we find what are clearly recognizable as supporters These, as in a lesser degree the crest, are often personal rather than hereditary, being changed generation by generation. The same person is found using more than one pair of them. The kings of France have had angels as supporters of the shield of the fleurs de lys since the 15th century, but the angels have only taken their place as the sole royal supporters since the time of Louis XIV. Sovereigns of England from Henry IV. to Elizabeth changed about between supporters of harts, leopards, antelopes, bulls, greyhounds, boars and dragons. James I. at his accession to the English throne brought the Scottish

unicorn to face the English leopard rampant across his shield, and, ever since, the "lion and unicorn" have been the royal supporters.

An old herald wrote as his opinion that "there is little or nothing in precedent to direct the use of supporters." Modern custom gives them, as a rule, only to peers, to knights of the Garter, the Thistle and St. Patrick, and to knights who are "Grand Crosses" or Grand Commanders of other orders. Royal warrants are sometimes issued for the granting of supporters to baronets, and, in rare cases, they have been assigned to untitled persons. But in spite of the jealousy with which official heraldry hedges about the display of these supporters once assumed so freely, a few old English families still assert their right by hereditary prescription to use these ornaments as their forefathers were wont to use them.

Badges.—The badge may claim a greater antiquity and a wider use than armorial bearings. The "Plantagenet" broom is an early example in England, sprigs of it being figured on the seal of Richard I. In the 14th and 15th centuries every magnate had his badge, which he displayed on his horse-furniture, on the hangings of his bed, his wall and his chair of state, besides giving it as a "livery" to his servants and followers. Such were the knots of Stafford, Bourchier and Wake, the scabbard-crampet of La Warr, the sickle of Hungerford, the swan of Toesni, Bohun and Lancaster, the dun bull of Nevill, the blue boar of Vere and the bear and ragged staff of Beauchamp, Nevill of Warwick and Dudley of Northumberland. So well known of all were these symbols that a political ballad of 1449 sings of the misfortunes of the great lords without naming one of them, all men understanding what signified the Falcon, the Water Bowge and the Cresset and the other badges of the doggerel. More famous still were the White Hart, the Red Rose, the White Rose, the Sun, the Falcon and Fetterlock, the Portcullis and the many other badges of the royal house. The Prince of Wales's feathers are as well known to-day as the royal arms. The Flint and Steel of Burgundy make a collar for the order of the Golden Fleece.

Mottoes.—The motto now accompanies every coat of arms in Great Britain. Few of these Latin aphorisms, these bald assertions of virtue, high courage, patriotism, piety and loyalty have any antiquity. Some few, however, like the "Espérance" of Percy, were the war-cries of remote ancestors. "I mak' sicker" of Kirkpatrick recalls pridefully a bloody deed done on a wounded man, and the "Dieu Ayde," "Agincourt" and "D'Accomplir Agincourt" of the Irish Montmorencys and the English Wodehouses and Dalisons, glorious traditions based upon untrustworthy genealogy. The often-quoted punning mottoes may be illustrated by that of Cust, who says "Qui Cust-odit caveat," a modern example and a fair one. Ancient mottoes, as distinct from the war or gathering cry of a house, are often cryptic sentences whose meaning might be known to the user and perchance to his mistress. Such are the "Plus est en vous" of Louis de Bruges, the Flemish earl of Winchester, and the "So have I cause" and "Till then thus" of two Englishmen. The word motto is of modern use, our forefathers speaking rather of their "word" or of their "reason."

Lines.—Eleven varieties of lines, other than straight lines, which divide the shield, or edge our cheverons, pales, bars and the like, are pictured in the heraldry books and named as engrailed, embattled, indented, invected, wavy or undy, nebuly, dancetty, raguly, potenté, dovetailed and urdy. As in the case of many other such lists of the later armorists these eleven varieties need some pruning and a new explanation. The most commonly found is the line engrailed, which for the student of mediaeval armory must be associated with the line indented. In its earliest form the line which a roll of arms will describe indifferently as indented or engrailed takes almost invariably the form to which the name indented is restricted by modern armorists.

The cross may serve as our first example. A cross, engrailed or indented, the words being used indifferently, is a cross so deeply notched at the edges that it seems made up of so many lozenge-shaped wedges or fusils. About the middle of the 14th century begins a tendency, resisted in practice by many conservative families, to draw the engrailing lines in the fashion to which modern armorists restrict the word "engrailed," making shallower indentures in the form of lines of half circles. Thus the engrailed cross of the Mohuns takes either of the two forms which we illustrate. Bends follow the same fashion, early bends engrailed or indented being some four or more fusils joined bendwise by their blunt sides, bends of less than four fusils being very rare. Thus also the engrailed or indented saltires, pales or cheverons, the exact number of the fusils which go to the making of these being unconsidered. For the fesse there is another law. The fesse indented or engrailed is made up of fusils as is the engrailed bend. But although early rolls of arms sometimes neglect this detail in their blazon, the fusils making a fesse must always be of an ascertained number. Montagu, earl of Salisbury, bore a fesse engrailed or indented of three fusils only, very few shields imitating this. Mediaeval armorists will describe his arms as a fesse indented of three indentures, as a fesse fusilly of three pieces, or as a fesse engrailed of three points or pieces, all of these blazons having the same value. The indented fesse on the red shield of the Dynhams has four such fusils of ermine. Four, however, is almost as rare a number as three, the normal form of a fesse indented being that of five fusils as borne by Percys, Pinkenys, Newmarches and many other ancient houses. Fesses of six fusils are not to be found. Note that bars indented or engrailed are, for a reason which will be evident, never subject to this counting of fusils. Fauconberg, for example, bore "Silver with two bars engrailed, or indented, sable." Displayed on a shield of the flat-iron outline, the lower bar would show fewer fusils than the upper, while on a square banner each bar would have an equal number —usually five or six.

While bends, cheverons, crosses, saltires and pales often follow, especially in the 15th century, the tendency towards the rounded "engrailing," fesses keep, as a rule, their bold indentures —neither Percy nor Montagu being ever found with his bearings in aught but their ancient form. Borders take the newer fashion as leaving more room for the charges of the field. But indented chiefs do not change their fashion, although many saw-teeth sometimes take the place of the three or four strong points of early arms, and parti-coloured shields whose parting line is indented never lose the bold zig-zag.

While bearing in mind that the two words have no distinctive force in ancient armory, the student and the herald of modern times may conveniently allow himself to blazon the sharp and saw-toothed line as "indented" and the scalloped line as "engrailed," especially when dealing with the debased armory in which the distinction is held to be a true one and one of the first importance. One error at least he must avoid, and that is the following of the heraldry-book compilers in their use of the word "dancetty." A "dancetty" line, we are told, is a line having fewer and deeper indentures than the line indented. But no dancetty line could make a bolder dash across the shield than do the lines which the old armorists recognized as "indented." In old armory we have fesses dancy—commonly called "dances"—bends dancy, or cheverons dancy; there are no chiefs dancy nor borders dancy, nor are there shields blazoned as parted with a dancy line. Waved lines, battled lines and ragged lines need little explanation that a picture cannot give. The word invecked or invected is sometimes applied by old-fashioned heraldic pedants to engrailed lines; later pedants have given it to a line found in modern grants of arms, an engrailed line reversed. Dovetailed and undy lines are mere modernisms. Of the very rare nebuly or clouded line we can only say that the ancient form, which imitated the conventional cloud-bank of the old painters, is now almost forgotten, while the bold "wavy" lines of early armory have the word "nebuly" misapplied to them.

CHARGES

The Ordinary Charges.—The writers upon armory have given the name of Ordinaries to certain conventional figures commonly charged upon shields. Also they affect to divide these into Honourable Ordinaries and Sub-Ordinaries without explaining the reason for the superior honour of the Saltire or for the subordination of the Quarter. Disregarding such distinctions, we may begin with the description of the "Ordinaries" most commonly to be found.

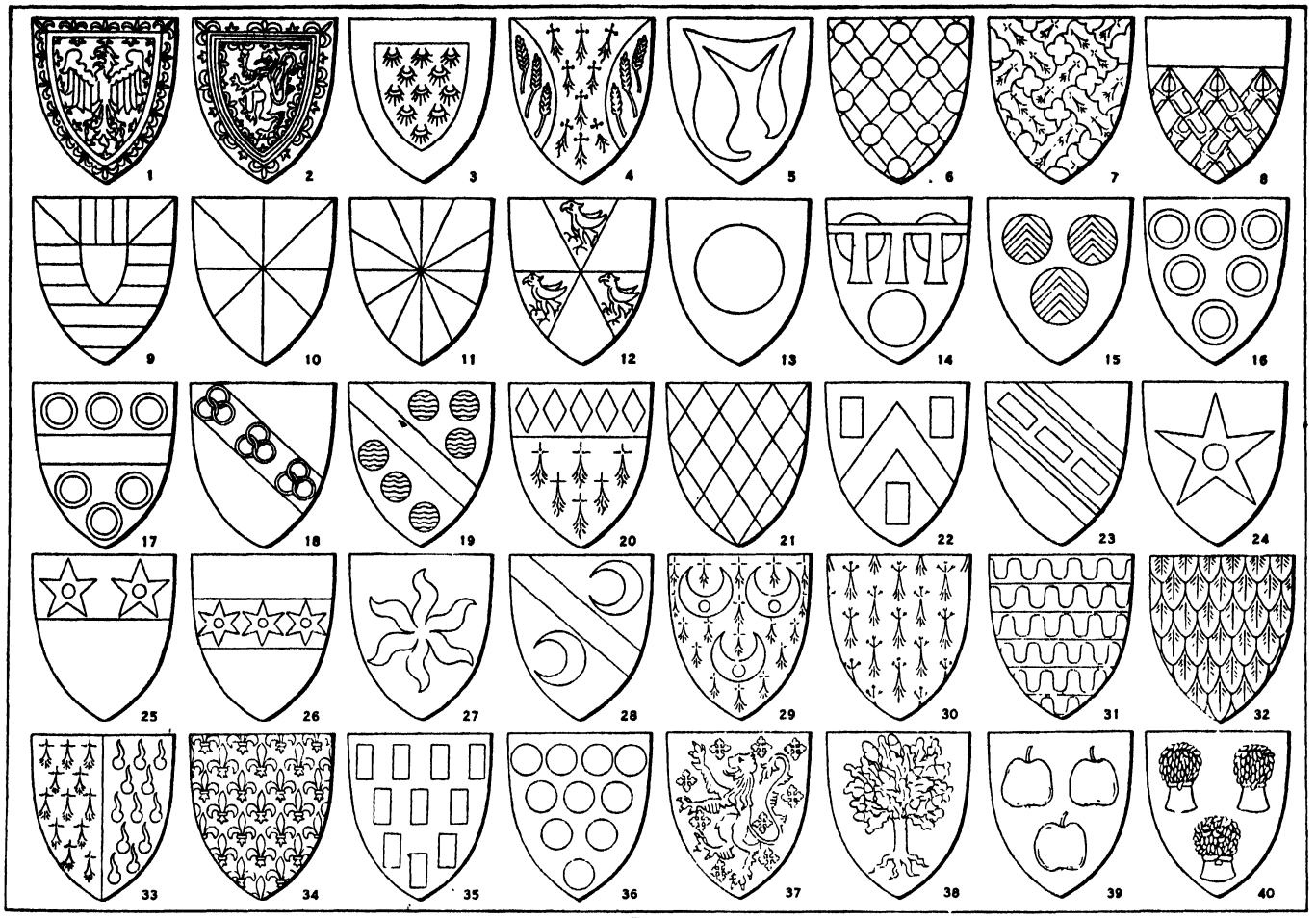

FIG. 4

(1) Vampage. (2) Scotland. (3) Hondescote. (4) Greyby. (5) Hastings. (6) Trussel. (7) Giffard. (8) Wyvile. (9) Mortimer. (10) Campbell. (11) Bassingbourne. (12) Stoker. (13) Burlay. (14) Courtenay. (15) Caraunt. (16) Vipont. (17) Avenel. (18) Hawberk. (19) Stourton. (20) Charles. (21) Fitzwilliam. (22) Mounchensy. (23) Haggerston. (24) Harpeden. (25) Gentil. (26) Grimston. (27) Ingilby. (28) Gobloun. (29) Longchamp. (30) Brittany. (31) Beauchamp. (32) Mydlam. (33) Grayndorge. (34) Mortimer. (35) Cowdray. (36) Zouche. (37) La Warr. (38) Cheyndut. (39) Applegarth. (40) Chester

From the first the Cross was a common bearing on English shields, "Silver a cross gules" being given early to St. George, patron of knights and of England, for his arms; and under St. George's red cross the English were wont to fight. Our armorial crosses took many shapes, but the "crosses innumerabill" of the Book of St. Albans and its successors may be left to the heraldic dictionary makers who have devised them. It is more important to define those forms in use during the middle ages, and to name them accurately after the custom of those who bore them in war, a task which the heraldry books have never as yet attempted with success.

The cross in its simple form needs no definition, but it will be noted that it is sometimes borne "voided" and that in a very few cases it appears as a lesser charge with its ends cut off square, in which case it must be clearly blazoned as "a plain Cross."

Andrew Harcla, the march-warden, whom Edward II. made an earl and executed as a traitor, bore the arms of St. George with a martlet sable in the quarter. Crevequer of Kent bore "Gold, a voided cross gules." Newsom (14th century) bore "Azure, a fesse silver with three plain crosses gules."

Next to the plain Cross may be taken the Cross paty, the *croiz patée* or *paté* of old rolls of arms. It has several forms, according to the taste of the artist and the age. So, in the 13th and early 14th centuries, its limbs curve out broadly, while at a later date the limbs become more slender and of even breadth, the ends somewhat resembling fleurs-de-lys. Each of these forms has been seized by the heraldic writers as the type of a distinct cross for which a name must be found, none of them, as a rule, being recognized as a cross paty, a word which has its misapplication elsewhere. Thus the books have "cross patonce" for the earlier form, while "cross clechée" and "cross fleurie" serve for the others. But the true identification of the various crosses is of the first importance to the antiquary, since without it descriptions of the arms on early seals or monuments must needs be valueless. Many instances of this need might be cited from the British Museum catalogue of seals, where, for example, the cross paty of Latimer is described twice as a "cross flory," six times as a "cross patonce," but not once by its own name, although there is no better known example of this bearing in England. Latimer bore "Gules, a cross paty gold."

The cross formy follows the lines of the cross paty save that its broadening ends are cut off squarely. Chetwode bore "Quarterly silver and gules with four crosses formy countercoloured"—that is to say, the two crosses in the gules are of silver and the two in the silver of gules.

The cross flory or flowered cross, the "cross with the ends flowered"—*od les boutes floretes* as some of the old rolls have it—is, like the cross paty, a mark for the misapprehension of writers on armory, who describe some shapes of the cross paty by its name. Playing upon discovered or fancied variants of the word, they bid us mark the distinctions between crosses "fleur-de-lisée," "fleury" and "fleurettée," although each author has his own version of the value which must be given these precious words. But the facts of the mediaeval practice are clear to those who take their armory from ancient examples and not from phrases plagiarized from the hundredth plagiarist. The flowered cross is one whose limbs end in fleur-de-lys, which spring sometimes from a knop or bud but more frequently issue from the square ends of a cross of the "formy" type. Swynnerton bore "Silver, a flowered cross sable."

The mill-rind, which takes its name from the iron of a mill-stone—*fer de moline*—must be set with the crosses. Some of the old rolls call it *croiz recercelé*, from which armorial writers have leaped to imagine a distinct type. Also they call the mill-rind itself a "cross moline" keeping the word mill-rind for a charge having the same origin but of somewhat differing form. Since this charge became common in Tudor armory it is perhaps better that the original mill-rind should be called for distinction a mill-rind cross. Willoughby bore "Gules, a mill-rind cross silver."

The crosslet, cross botonny or cross crosletted, is a cross whose limbs, of even breadth, end as trefoils or treble buds. It is rarely found in mediaeval examples in the shape—that of a cross with limbs ending in squarely cut plain crosses—which it took during the 16th-century decadence. As the sole charge of a shield it is very rare; otherwise it is one of the commonest of charges. Brerelegh bore "Silver, a crosslet gules."

Within these modest limits we have brought the greater part of that monstrous host of crosses which cumber the dictionaries. A few rare varieties may be noticed.

Dukinfield bore "Silver, a voided cross with sharpened ends." Skirlaw, bishop of Durham (d. 1406), the son of a basket-weaver, bore "Silver, a cross of three upright wattles sable, crossed and interwoven by three more." Drury bore "Silver, a chief vert with a St. Anthony's cross gold between two golden molets, pierced gules." Brytton bore "Gold, a patriarch's cross set upon three degrees or steps of gules."

The crosses paty and formy, and more especially the crosslets, are often borne fitchy, that is to say, with the lower limb somewhat lengthened and ending in a point, for which reason the 15th-century writers call these "crosses fixabill." In the 14th-century rolls the word "potent" is sometimes used for these crosses fitchy, the long foot suggesting a potent or staff. From this source modern English armorists derive many of their "crosses potent," whose four arms have the **T** heads of old-fashioned walking staves. Howard bore "Silver, a bend between six crosslets fitchy gules." Scott of Congerhurst in Kent bore "Silver, a crosslet fitchy sable."

The Saltire is the cross in the form of that on which St. Andrew suffered, whence it is borne on the banner of Scotland, and by the Andrew family of Northamptonshire. Nevile of Raby bore "Gules, a saltire silver." Nicholas Upton, the 15th-century writer on armory, bore "Silver, a saltire sable with the ends couped and five golden rings thereon." Aynho bore "Sable, a saltire silver, having the ends flowered, between four leopards gold."

The chief is the upper part of the shield and, marked out by a line of division, it is taken as one of the Ordinaries. Shields with a plain chief and no more are rare in England, but Tichborne of Tichborne has borne since the 13th century "Vair, a chief gold." According to the heraldry books the chief should be marked off as a third part of the shield, but its depth varies, being broader when charged with devices and narrower when, itself uncharged, it surmounts a charged field. Fenwick bore "Silver, a chief gules with six martlets countercoloured," and in this case the chief would be the half of the shield. Clinging to the belief that the chief must not fill more than a third of the shield, the heraldry books abandon the word in such cases, blazoning them as "party per fesse."

Hastang bore "Azure, a chief gules and a lion with a forked tail over all." Walter Kingston seals in the 13th century with a shield of "Two rings or annelets in the chief."

With the chief may be named the Foot, the nether part of the shield marked off as an Ordinary. So rare is this charge that we can cite but one example of it, that of the shield of John of Skipton, who in the 14th century bore "Silver with the foot indented purple and a lion purple." The foot, however, is a recognized bearing in France, whose heralds gave it the name of *champagne*.

The Pale is a broad stripe running the length of the shield. Of a single pale and of three pales there are several old examples. Four red pales in a golden shield were borne by Eleanor of Provence, queen of Henry III.; but the number did not commend itself to English armorists. When the field is divided evenly into six pales it is said to be paly; if into four or eight pales, it is blazoned as paly of that number of pieces. But paly of more or less than six pieces is rarely found.

The Yorkshire house of Gascoigne bore "Silver, a pale sable with a golden conger's head thereon, cut off at the shoulder." Ferlington bore "Gules, three pales vair and a chief gold."

When the shield or charge is divided palewise down the middle into two tinctures it is said to be "party." "Party silver and gules" are the arms of the Waldegraves. Bermingham bore "Party silver and sable indented." Such partings of the field often cut through charges whose colours change about on either side of the parting line. Thus Chaucer the poet bore "Party silver and gules with a bend countercoloured."

The Fesse is a band athwart the shield, filling, according to the rules of the heraldic writers, a third part of it. By ancient use, however, as in the case of the chief and pale, its width varies with the taste of the painter, narrowing when set in a field full of charges and broadening when charges are displayed on itself. When two or three fesses are borne they are commonly called Bars. "Ermine *four* bars gules" is given as the shield of Sir John Sully, a 14th-century Garter knight, on his stall-plate at Windsor; but the plate belongs to a later generation, and should probably have three bars only. Little bars borne in couples are styled Gemels (twins). The field divided into an even number of bars of alternate colours is said to be barry, barry of six pieces being the normal number. If four or eight divisions be found the number of pieces must be named; but with ten or more divisions the number is unreckoned and "burely" is the word.

Colevile of Bitham bore "Gold, a fesse gules." West bore "Silver, a dance (or fesse dancy) sable." Fauconberg bore "Gold, a fesse azure with three pales gules in the chief." Cayvile bore "Silver, a fesse gules, flowered on both sides." Devereux bore "Gules, a fesse silver with three roundels silver in the chief." Chamberlayne of Northamptonshire bore "Gules, a fesse and three scallops gold." Harcourt bore "Gules, two bars gold." Manners bore "Gold, two bars azure and a chief gules." Wake bore "Gold, two bars gules with three roundels gules in the chief."

The Bend is a band traversing the shield aslant, arms with one, two or three bends being common during the middle ages in England. Bendy shields follow the rule of shields paly and barry, but as many as ten pieces have been counted in them. The bend is often accompanied by a narrow bend on either side, these companions being called Cotices. A single narrow bend, struck over all other charges, is the Baston, which during the 13th and 14th centuries was a common difference for the shields of the younger branches of a family, coming in later times to suggest itself as a difference for bastards.

The Bend Sinister, the bend drawn from right to left beginning at the "sinister" corner of the shield, is reckoned in the heraldry books as a separate Ordinary, and has a peculiar significance accorded to it by novelists. Mediaeval English seals afford a group of examples of Bends Sinister or Bastons Sinister, but there seems no reason for taking them as anything more than cases in which the artist has neglected the common rule.

Mauley bore "Gold, a bend sable." Harley bore "Gold, a bend with two cotices sable." Wallop bore "Silver, a bend wavy sable." Bishopsdon bore "Bendy of six pieces, gold and azure, with a quarter ermine." Montfort of Whitchurch bore "Bendy of ten pieces gold and azure." Henry of Lancaster, second son of Edmund Crouchback, bore the arms of his cousin, the king of England, with the difference of "a baston azure." Adam Fraunceys (14th century) bore "Party gold and sable bendwise with a lion countercoloured." The parting line is here commonly shown as "sinister."

The Cheveron, a word found in mediaeval building accounts for the barge-boards of a gable, is an Ordinary whose form is explained by its name. Perhaps the very earliest of English armorial charges, and familiarized by the shield of the great house of Clare, it became exceedingly popular in England. Like the bend and the chief, its width varies in different examples. Likewise its angle varies, being sometimes so acute as to touch the top of the shield, while in post-mediaeval armory the point is often blunted beyond the right angle. One, two or three cheverons occur

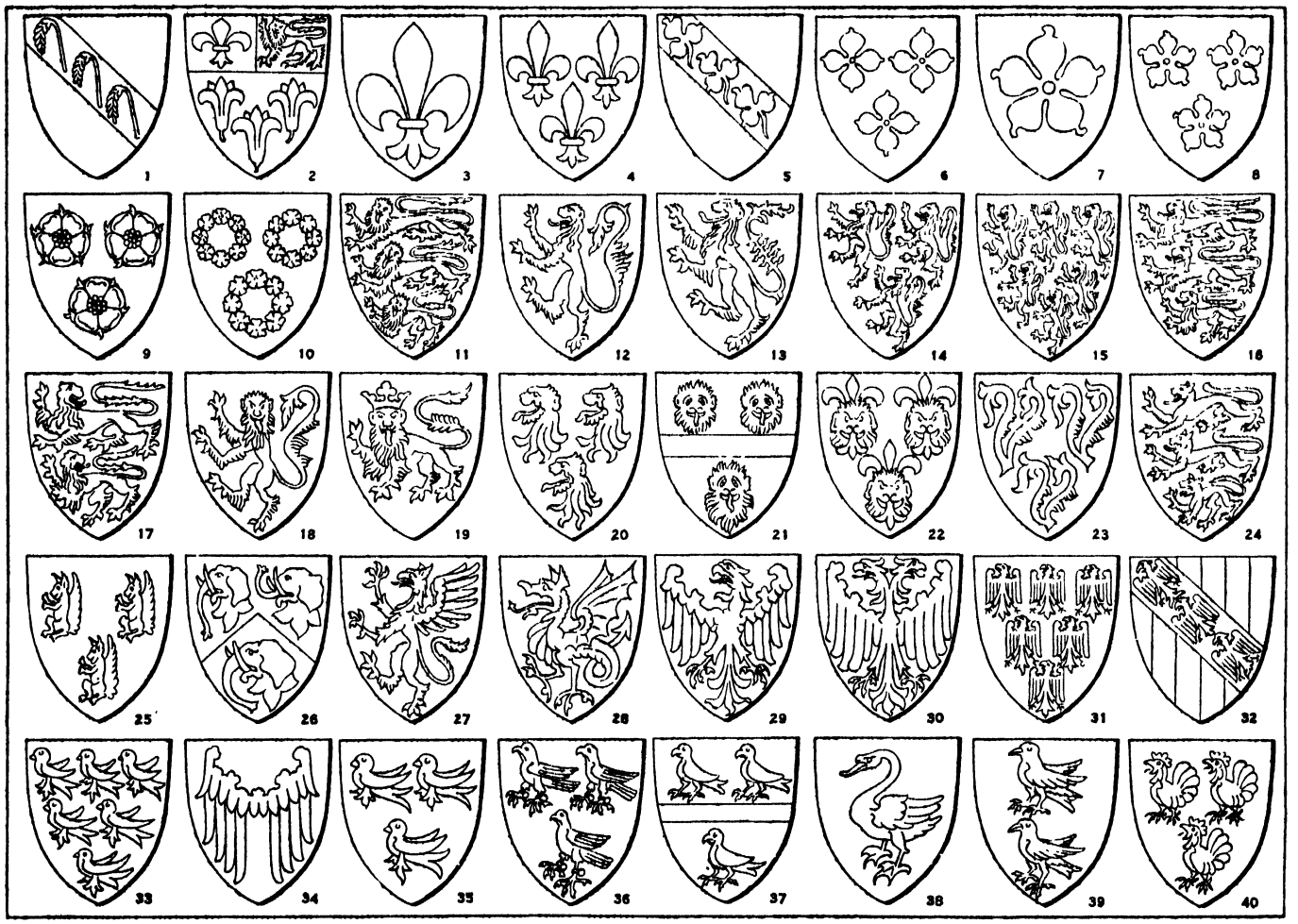

FIG. 5

(1) Rye. (2) Eton College. (3) Aguylon. (4) Peyferer. (5) Hervey. (6) Vincent. (7) Quincy. (8) Bardolf. (9) Cosington. (10) Hilton. (11) England. (12) Fitzalan. (13) Felbrigge. (14) Fiennes. (15) Leyburne. (16) Carew. (17) Fotheringhay. (18) Brocas. (19) Lisle. (20) Kenton. (21) Pole. (22) Cantelou. (23) Pynchebek. (24) Lovett. (25) Talbot. (26) Saunders. (27) Griffin. (28) Drake. (29) Monhermer. (30) Siggeston. (31) Gavaston. (32) Graunson. (33) Arundel. (34) Seymour. (35) Naunton. (36) Fauconer. (37) Twenge. (38) Asdale. (39) Corbet. (40) Cockfield

in numberless shields, and five cheverons have been found. Also there are some examples of the bearing of cheveronny.

The earls of Gloucester of the house of Clare bore "Gold, three cheverons gules" and the Staffords derived from them their shield of "Gold, a cheveron gules." Chaworth bore "Azure, two cheverons gold." Peytevyn bore "Cheveronny of ermine and gules." St. Quintin of Yorkshire bore "Gold, two cheverons gules and a chief vair." Sheffield bore "Ermine, a cheveron gules between three sheaves gold."

Shields parted cheveronwise are common in the 15th century, when they are often blazoned as having chiefs "enty" or grafted. Aston of Cheshire bore "Party sable and silver cheveronwise" or "Silver, a chief enty sable."

The Pile or stake (*estache*) is a wedge-shaped figure jutting from the chief to the foot of the shield, its name allied to the pile of the bridge-builder. A single pile is found in the notable arms of Chandos, and the black piles in the ermine shield of Hollis are seen as an example of the bearing of two piles. Three piles are more easily found, and when more than one is represented the points are brought together at the foot. In ancient armory piles in a shield are sometimes reckoned as a variety of pales, and a Basset with three piles on his shield is seen with three pales on his square banner. Chandos bore "Gold, a pile gules."

The Quarter is the space of the first quarter of the shield divided crosswise into four parts. As an Ordinary it is an ancient charge and a common one in mediaeval England, although it has all but disappeared from modern heraldry books, the "Canton," an alleged "diminutive," unknown to early armory, taking its place. Like the other Ordinaries, its size is found to vary with the scheme of the shield's charges, and this has persuaded those armorists who must needs call a narrow bend a "bendlet," to the invention of the "Canton," a word which in the sense of a quarter or small quarter appears for the first time in the latter part of the 15th century. Writers of the 14th century sometimes give it the name of the Cantel, but this word is also applied to the void space on the opposite side of the chief, seen above a bend.

Blencowe bore "Gules, a quarter silver." Basset of Drayton bore "Gold, three piles (or pales) gules with a quarter ermine." Wydvile bore "Silver, a fesse and a quarter gules" Odingseles bore "Silver, a fesse gules with a molet gules in the quarter."

Shields or charges divided crosswise with a downward line and a line athwart are said to be quarterly. An ancient coat of this fashion is that of Say who bore (13th century) "Quarterly gold and gules"—the first and fourth quarters being gold and the second and third red. Ever or Eure bore the same with the addition of "a bend sable with three silver scallops thereon"

With the 15th century came a fashion of dividing the shield into more than four squares, six and nine divisions being often found in arms of that age. The heraldry books, eager to work out problems of blazonry, decide that a shield divided into six squares should be described as "Party per fesse with a pale counterchanged," and one divided into nine squares as bearing "a cross quarter-pierced." It seems a simpler business to follow a 15th-century fashion and to blazon such shields as being of six or nine "pieces." Thus John Garther (15th century) bore "Nine pieces ermineas and ermine" and Whitgreave of Staffordshire "Nine pieces of azure and of Stafford's arms, which are gold with a cheveron gules." The Tallow Chandlers of London had a grant

in 1456 of "Six pieces azure and silver with three doves in the azure, each with an olive sprig in her beak."

Squared into more than nine squares the shield becomes checky or checkered and the number is not reckoned. Warenne's checker of gold and azure is one of the most ancient coats in England and checkered fields and charges follow in great numbers. Even lions have been borne checkered. Warenne bore "Checky gold and azure." Clifford bore the like with "a fesse gules." Cobham bore "Silver, a lion checky gold and sable." These checkered fesses, bars, bends, borders and the like, will commonly bear but two rows of squares, or three at the most. The heraldry writers are ready to note that when two rows are used "counter-compony" is the word in place of checky, and "compony-counter-compony" in the case of three rows. It is needless to say that these words have neither practical value nor antiquity to commend them. But bends and bastons, labels, borders and the rest are often coloured with a single row of alternating tinctures. In this case the pieces are said to be "gobony." Thus John Cromwell (14th century) bore "Silver, a chief gules with a baston gobony of gold and azure."

The scocheon or shield used as a charge is found among the earliest arms. Itself charged with arms, it served to indicate alliance by blood or by tenure with another house, as in the bearings of St. Owen whose shield of "Gules with a cross silver" has a scocheon of Clare in the quarter. In the latter half of the 15th century it plays an important part in the curious marshalling of the arms of great houses and lordships. Erpingham bore "Vert, a scocheon silver with an orle (or border) of silver martlets." Davillers bore at the battle of Boroughbridge "Silver, three scocheons gules."

The scocheon was often borne voided or pierced, its field cut away to a narrow border. Especially was this the case in the far North, where the Balliols, who bore such a voided scocheon, were powerful. The voided scocheon is wrongly named in all the heraldry books as an orle, a term which belongs to a number of small charges set round a central charge. Thus the martlets in the shield of Erpingham, already described, may be called an orle of martlets or a border of martlets. This misnaming of the voided scocheon has caused a curious misapprehension of its form, even Dr. Woodward, in his *Heraldry, British and Foreign,* describing the "orle" as "a narrow border detached from the edge of the shield." Following this definition modern armorial artists will, in the case of quartered arms, draw the "orle" in a first or second quarter of a quartered shield as a rectangular figure and in a third or fourth quarter as a scalene triangle with one arched side. Thereby the original voided scocheon changes into forms without meaning. Balliol bore "Gules, a voided scocheon silver." Surtees bore "Ermine, with a quarter of the arms of Balliol."

The *Tressure* or flowered tressure is a figure which is correctly described by Woodward's incorrect description of the orle as cited above, being a narrow inner border of the shield. It is distinguished, however, by the fleurs-de-lys which decorate it, setting off its edges. The double tressure which surrounds the lion in the royal shield of Scotland, and which is borne by many Scottish houses who have served their kings well or mated with their daughters, is carefully described by Scottish heralds as "flowered and counter-flowered," a blazon which is held to mean that the fleurs-de-lys show head and tail in turn from the outer rim of the outer tressure and from the inner rim of the innermost. But this seems to have been no essential matter with mediaeval armorists and a curious 15th-century enamelled roundel of the arms of Vampage shows that in this English case the flowering takes the more convenient form of allowing all the lily heads to sprout from the outer rim. Vampage bore "Azure, an eagle silver within a flowered tressure silver." The king of Scots bore "Gold, a lion within a double tressure flowered and counter-flowered gules."

The Border of the shield when marked out in its own tincture is counted as an Ordinary. Plain or charged, it was commonly used as a difference. As the principal charge of a shield it is very rare, so rare that in most cases where it apparently occurs we may, perhaps, be following mediaeval custom in blazoning the shield as one charged with a scocheon and not with a border. Thus Hondescote bore "Ermine, a border gules" or "Gules, a scocheon ermine." Somerville bore "Burely silver and gules and a border azure with golden martlets."

The Flaunches are the flanks of the shield which, cut off by rounded lines, are borne in pairs as Ordinaries. These charges are found in many coats devised by 15th-century armorists. "Ermine, two flaunches azure with six golden wheat-ears" was borne by John Greyby of Oxfordshire (15th century).

The Label is a narrow fillet across the upper part of the chief, from which hang three, four, five or more pendants, the pendants being, in most old examples, broader than the fillet. Reckoned with the Ordinaries, it was commonly used as a means of differencing a cadet's shield, and in the heraldry books it has become the accepted difference for an eldest son, although the cadets often bore it in the middle ages. John of Hastings bore in 1300 before Carlaverock "Gold, a sleeve (or maunche) gules," while Edmund his brother bore the same arms with a sable label. In modern armory the pendants are all but invariably reduced to three, which, in debased examples, are given a dovetailed form while the ends of the fillet are cut off.

The Fret, drawn as a voided lozenge interlaced by a slender saltire, is counted an Ordinary. A charge in such a shape is extremely rare in mediaeval armory, its ancient form when the field is covered by it being a number of bastons—three being the customary number—interlaced by as many more from the sinister side. Although the whole is described as a fret in certain English blazons of the 15th century, the adjective "fretty" is more commonly used. Trussel's fret is remarkable for its bezants at the joints, which stand, doubtless, for the golden nail-heads of the "trellis" suggested by his name. Curwen, Wyvile and other northern houses bearing a fret and a chief have, owing to their fashion of drawing their frets, often seen them changed by the heraldry books into "three cheverons braced or interlaced."

Huddlestone bore "Gules fretty silver." Trussel bore "Silver fretty gules, the joints bezanty." Hugh Giffard (14th century) bore "Gules with an engrailed fret of ermine."

Another Ordinary is the Giron or Gyron—a word now commonly mispronounced with a hard "g." It may be defined as the lower half of a quarter which has been divided bendwise. No old example of a single giron can be found to match the figure in the heraldry books. Gironny, or gyronny, is a manner of dividing the field into sections, by lines radiating from a centre point, of which many instances may be given. Most of the earlier examples have some twelve divisions although later armory gives eight as the normal number, as Campbell bears them.

Bassingbourne bore "Gironny of gold and azure of twelve pieces." William Stoker, who died Lord Mayor of London in 1484, bore "Gironny of six pieces azure and silver with three popinjays in the silver pieces." A pair of girons on either side of a chief were borne in the strange shield of Mortimer, commonly blazoned as "Barry azure and gold of six pieces, the chief azure with two pales and two girons gold, a scocheon silver over all." An early example shows that this shield began as a plain field with a gobony border.

With the Ordinaries we may take the Roundels or Pellets, disks or balls of various colours. Ancient custom gives the name of a bezant to the golden roundel, and the folly of the heraldic writers has found names for all the others, names which may be disregarded together with the belief that, while bezants and silver roundels, as representing coins, must be pictured with a flat surface, roundels of other hues must needs be shaded by the painter to represent rounded balls. Rings or Annelets were common charges in the North, where Lowthers, Musgraves and many more, differenced the six rings of Vipont by bearing them in various colours.

Burlay of Wharfdale bore "Gules, a bezant." Courtenay, earl of Devon, bore "Gold, three roundels gules with a label azure." Caraunt bore "Silver, three roundels azure, each with three cheverons gules." Vipont bore "Gold, six annelets gules." Avenel bore "Silver, a fesse and six annelets (*aunels*) gules." Stourton bore "Sable, a bend gold between six fountains." The fountain is a roundel charged with waves of white and blue.

The Lozenge is linked in the heraldry book with the Fusil. This

Fusil is described as a lengthened and sharper lozenge. But it will be understood that the Fusil, other than as part of an engrailed or indented bend, pale or fesse, is not known to true armory. Also it is one the notable achievements of the English writers on heraldry that they should have allotted to the lozenge, when borne voided, the name of Mascle. This "mascle" is the word of the oldest armorists for the unvoided charge, the voided being sometimes described by them as a lozenge, without further qualifications. Fortunately the difficulty can be solved by following the late 14th-century custom in distinguishing between "lozenges" and "voided lozenges" and by abandoning altogether this misleading word Mascle.

Thomas of Merstone, a clerk, bore on his seal in 1359 "Ermine, a lozenge with a pierced molet thereon." Braybroke bore "Silver, seven voided lozenges gules." Charles bore "Ermine, a chief gules with five golden lozenges thereon."

Billets are oblong figures set upright. Black billets in the arms of Delves of Cheshire stand for "delves" of earth and the gads of steel in the arms of the London Ironmongers' Company took a somewhat similar form. Sir Ralph Mounchensy bore in the 14th century "Silver, a cheveron between three billets sable."

With the Billet, the Ordinaries, uncertain as they are in number, may be said to end. But we may here add certain armorial charges which might well have been counted with them.

First of these is the Molet, a word corrupted in modern heraldry to Mullet, a fish-like change with nothing to commend it. This figure is as a star of five or six points, six points being perhaps the commonest form in old examples, although the sixth point is, as a rule, lost during the later period. Mediaeval armorists are not, it seems, inclined to make any distinction between molets of five and six points, but some families, such as the Harpedens and Asshetons, remained constant to the five-pointed form. It was generally borne pierced with a round hole, and then represents, as its name implies, the rowel of a spur. In ancient rolls of arms the word Rowel is often used, and probably indicated the pierced molet. That the piercing was reckoned an essential difference is shown by a roll of the time of Edward II., in which Sir John of Pabenham bears "Barry azure and silver, with a bend gules and three molets gold thereon," arms which Sir John his son differences by piercing the molets. Beside these names is that of Sir Walter Baa with "Gules a cheveron and three rowels silver," rowels which are shown on seals of this family as pierced molets. Probably an older bearing than the molet, which would be popularized when the rowelled spur began to take the place of the prick-spur, is the Star or Estoile, differing from the molet in that its five or six points are wavy. It is possible that several star bearings of the 13th century were changed in the 14th for molets. The star is not pierced in the fashion of the molet; but, like the molet, it tends to lose its sixth point in armory of the decadence. Suns, sometimes blazoned in old rolls as Sun-rays—*rays de soleil*—are pictured as unpierced molets of many points, which in rare cases are waved.

Harpeden bore "Silver, a pierced molet gules." Gentil bore "Gold, a chief sable with two molets goles pierced gules." Grimston bore "Silver, a fesse sable and thereon three molets silver pierced gules." Ingleby of Yorkshire bore "Sable, a star silver."

The Crescent is a charge which has to answer for many idle tales concerning the crusading ancestors of families who bear it. It is commonly borne with both points uppermost, but when representing the waning or the waxing moon—decrescent or increscent—its horns are turned to the sinister or dexter side of the shield. Peter de Marines (13th century) bore on his seal a shield charged with a crescent in the chief. William Gobioun (14th century) bore "A bend between two waxing moons."

Tinctures.—The tinctures or hues of the shield and its charges are seven in number—gold or yellow, silver or white, red, blue, black, green and purple. Mediaeval custom gave, according to a rule often broken, "gules," "azure" and "sable" as more high-sounding names for the red, blue and black. Green was often named as "vert," and sometimes as "synobill," a word which as "sinople" is used to this day by French armorists. The song of the siege of Carlaverock and other early documents have red, gules or "vermeil," sable or black, azure or blue, but gules, azure, sable and vert came to be recognized as armorists' adjectives, and an early 15th-century romance discards the simple words deliberately, telling us of its hero that

> His shield was black and blue, sanz fable,
> Barred of azure and of sable.

But gold and silver served as the armorists' words for yellows and whites until late in the 16th century, when, gold and silver made way for "or" and "argent," words which those for whom the interest of armory lies in its liveliest days will not be eager to accept. Likewise the colours of "sanguine" and "tenné" brought in by the pedants to bring the tinctures to the mystical number of nine may be disregarded.

A certain armorial chart of the duchy of Brabant, published in 1600, is the earliest example of the practice whereby later engravers have indicated colours in uncoloured plates by the use of lines and dots. Gold is indicated by a powdering of dots; silver is left plain. Azure is shown by horizontal shading lines; gules by upright lines; sable by cross-hatching of upright and horizontal lines. Diagonal lines from sinister to dexter indicate purple; vert is marked with diagonal lines from dexter to sinister. The practice, in spite of a certain convenience, has been disastrous in its cramping effects on armorial art, especially when applied to seals and coins.

Besides the two "metals" and five "colours," fields and charges are varied by the use of the furs ermine and vair. Ermine is shown by a white field flecked with black ermine tails, and vair by a conventional representation of a fur of small skins sewn in rows, white and blue skins alternately. In the 15th century there was a popular variant of ermine, white tails upon a black field. To this fur the books now give the name of "ermines"—a most unfortunate choice, since ermines is a name used in old documents for the original ermine. "Erminees," which has at least a 15th-century authority, will serve for those who are not content to speak of "sable ermined with silver." Vair, although silver and blue be its normal form, may be made up of gold, silver or ermine, with sable or gules or vert, but in these latter cases the colours must be named in the blazon. To the vairs and ermines of old use the heraldry books have added "erminois," which is a gold field with black ermine tails, "pean," which is "erminois" reversed, and "erminites," which is ermine with a single red hair on either side of each black tail. The vairs, mainly by misunderstanding of the various patterns found in old paintings, have been amplified with "countervair," "potent," "counter-potent" and "vair-en-point," no one of which merits description.

No shield of a plain metal or colour has ever been borne by an Englishman, although the knights at Carlaverock and Falkirk saw Amaneu d'Albret with his banner all of red having no charge thereon. Plain ermine was the shield of the duke of Brittany and no Englishman challenged the bearing. But Beauchamp of Hatch bore simple vair, Ferrers of Derby "Vairy gold and gules," and Ward "Vairy silver and sable."

Only one English example has hitherto been discovered of a field covered not with a fur but with overlapping feathers. A 15th-century book of arms gives "Plumetty of gold and purple" for "Mydlam in Coverdale."

Drops of various colours which variegate certain fields and charges are often mistaken for ermine tails when ancient seals are deciphered. A simple example of such spattering is in the shield of Grayndore, who bore "Party ermine and vert, the vert dropped with gold."

A very common variant of charges and fields is the sowing or "powdering" them with a small charge repeated many times. Mortimer of Norfolk bore "gold powdered with fleurs-de-lys sable" and Edward III. quartered for the old arms of France "Azure powdered with fleurs-de-lys gold," such fields being often described as flowered or flory. Golden billets were scattered in Cowdray's red shield, which is blazoned as "Gules billety gold," and bezants in that of Zouche, which is "Gules bezanty with a quarter ermine." The disposition of such charges varied with the users. Zouche as a rule shows ten bezants placed four, three, two and one on his shield, while the old arms of France in the

royal coat allows the pattern of flowers to run over the edge, the shield border thus showing halves and tops and stalk ends of the fleurs-de-lys. But the commonest of these powderings is that with crosslets, as in the arms of John la Warr "Gules crusily silver with a silver lion."

Trees, Leaves and Flowers.—Sir Stephen Cheyndut, a 13th-century knight, bore an oak tree, the *cheyne* of his first syllable, while for like reasons a Piriton had a pear tree on his shield. Three pears were borne (*temp.* Edward III.) by Nicholas Stivecle of Huntingdonshire, and about the same date is Applegarth's shield of three red apples in a silver field. Leaves of burdock are in the arms (14th century) of Sir John de Lisle and mulberry leaves in those of Sir Hugh de Morieus. Three roots of trees are given to one Richard Rotour in a 14th-century roll. Malherbe (13th century) bore the "evil herb"—a teazle bush. Pineapples are borne here and there, and it will be noted that armorists have not surrendered this, our ancient word for the "fir-cone," to the foreign *ananas*. Out of the cornfield English armory took the sheaf, three sheaves being on the shield of an earl of Chester early in the 13th century and Sheffield bearing sheaves for a play on his name. For a like reason Peverel's sheaves were sheaves of pepper. Rye bore three ears of rye on a bend, and Graindorge had barley-ears. Flowers are few in this field of armory, although lilies with their stalks and leaves are in the grant of arms to Eton College. Ousethorpe has water flowers, and now and again we find some such strange charges as those in the 15th-century shield of Thomas Porthelyne who bore "Sable, a cheveron gules between three 'popyebolles,' or poppy-heads vert."

The fleur-de-lys, a conventional form from the beginnings of armory, might well be taken amongst the "ordinaries." In England as in France it is found in great plenty Aguylon bore "Gules, a fleur-de-lys silver." Peyferer bore "Silver, three fleur-de-lys sable."

Trefoils are very rarely seen until the 15th century, although Hervey has them, and Gausill, and a Bosville coat seems to have borne them. They have always their stalk left hanging to them. Vincent, Hattecliffe and Massingberd all bore the quatrefoil, while the Bardolfs, and the Quincys, earls of Winchester, had cinqfoils. The old rolls of arms made much confusion between cinqfoils and sixfoils (*quintefoilles e sisfoilles*) and the rose. It is still uncertain how far that confusion extended amongst the families which bore these charges. The cinqfoil and sixfoil, however, are all but invariably pierced in the middle like the spur rowel, and the rose's blunt-edged petals give it definite shape soon after the decorative movement of the Edwardian age began to carve natural buds and flowers in stone and wood. Hervey bore "Gules, a bend silver with three trefoils vert thereon." Vincent bore "Azure, three quatrefoils silver."

Quincy bore "Gules, a cinqfoil silver." Bardolf of Wormegay bore "Gules, three cinqfoils silver." Cosington bore "Azure, three roses gold."

Beasts and Birds.—The book of natural history as studied in the middle ages lay open at the chapter of the lion, to which royal beast all the noble virtues were set down. What is the oldest armorial seal of a sovereign prince as yet discovered bears the rampant lion of Flanders. In England we know of no royal shield earlier than that first seal of Richard I. which has a like device. A long roll of English earls, barons and knights wore the lion on their coats—Lacy, Marshal, Fitzalan and Montfort, Percy, Mowbray and Talbot. By custom the royal beast is shown as rampant, touching the ground with but one foot and clawing at the air in noble rage. So far is this the normal attitude of a lion that the adjective "rampant" was often dropped, and we have leave and good authority for blazoning the rampant beast simply as "a lion," leave which a writer on armory may take gladly to the saving of much repetition. In France and Germany this licence has always been the rule, and the modern English herald's blazon of "Gules a lion rampant or" for the arms of Fitzalan, becomes in French *de gueules au lion d'or* and in German *in Rot ein goldener Loewe*. Other positions must be named with care and the prowling "lion passant" distinguished from the rampant beast, as well as from such rarer shapes as the couchant lion, the lion sleeping, sitting or leaping. Of these the lion passant is the only one commonly encountered. The lion standing with his forepaws together is not a figure for the shield, but for the crest, where he takes this position for greater stableness upon the helm, and the sitting lion is also found rather upon helms than in shields. For a couchant lion or a dormant lion one must search far afield, although there are some mediaeval instances. The leaping lion is in so few shields that no maker of a heraldry book has, it would appear, discovered an example. In the books this "lion salient" is described as with the hind paws together on the ground and the fore paws together in the air, somewhat after the fashion of a diver's first movement. But examples from seals and monuments of the Felbrigges and the Merks show that the leaping lion differed only from the rampant in that he leans somewhat forward in his eager spring. The compiler of the British Museum catalogue of mediaeval armorial seals, and others equally unfamiliar with mediaeval armory, invariably describe this position as "rampant," seeing no distinction from other rampings. As rare as the leaping lion is the lion who looks backward over his shoulder. This position is called "regardant" by modern armorists. The old French blazon calls it *rere regardant* or *turnaunte le visage arere*, "regardant" alone meaning simply "looking," and therefore we shall describe it more reasonably in plain English as "looking backward." The two-headed lion occurs in a 15th-century coat of Mason, and at the same period a monstrous lion of three bodies and one head is borne, apparently, by a Sharingbury.

The lion's companion is the leopard. What might be the true form of this beast was a dark thing to the old armorist, yet knowing from the report of grave travellers that the leopard was begotten in spouse-breach between the lion and the pard, it was felt that his shape would favour his sire's. But nice distinctions of outline, even were they ascertainable, are not to be marked on the tiny seal, or easily expressed by the broad strokes of the shield painter. The leopard was indeed lesser than the lion, but in armory, as in the Noah's arks launched by the old yards, the bear is no bigger than the badger. Then a happy device came to the armorist. He would paint the leopard like the lion at all points. But as the lion looks forward the leopard should look sidelong, showing his whole face. The matter was arranged, and until the end of the middle ages the distinction held and served. The disregarded writers on armory, Nicholas Upton, and his fellows, protested that a lion did not become a leopard by turning his face sidelong, but none who fought in the field under lion and leopard banners heeded this pedantry from cathedral closes. The English king's beasts were leopards in blazon, in ballad and chronicle, and in the mouths of liegeman and enemy. Henry V.'s herald, named from his master's coat, was Leopard Herald; and Napoleon's gazettes never fail to speak of the English leopards. In our own days, those who deal with armory as antiquaries and students of the past will observe the old custom for convenience sake. Those for whom the interest of heraldry lies in the nonsense-language brewed during post-mediaeval years may correct the mediaeval ignorance at their pleasure. The knight who saw the king's banner fly at Falkirk or Crécy tells us that it bore "Gules with three leopards of gold." The modern armorist will shame the uninstructed warrior with "Gules, three lions passant gardant in pale or."

As the lion rampant is the normal lion, so the normal leopard is the leopard passant, the adjective being needless. In a few cases only the leopard rises up to ramp in the lion's fashion, and here he must be blazoned without fail as a leopard rampant.

Parts of the lion and the leopard are common charges. Chief of these are the demi-lion and the demi-leopard, beasts complete above their slender middles, even to the upper parts of their lashing tails. Rampant or passant, they follow the customs of the unmaimed brute. Also the heads of lion and leopard are in many shields, and here the armorist of the modern handbooks stumbles by reason of his refusal to regard clearly marked mediaeval distinctions. The instructed will know a lion's head because it shows but half the face and a leopard's head because it

is seen full-face. But the handbooks of heraldry, knowing naught of leopards, must judge by absence or presence of a mane, speaking uncertainly of leopards' faces and lions' heads and faces. Here again the old path is the straighter. The head of a lion, or indeed of any beast, bird or monster, is generally painted as "razed," or torn away with a ragged edge which is pleasantly conventionalized. Less often it is found "couped" or cut off with a sheer line. But the leopard's head is neither razed nor couped, for no neck is shown below it. Likewise the lion's fore leg or paw—"gamb" is the book word—may be borne, razed or couped. Its normal position is raised upright, although Newdegate seems to have borne "Gules, three lions' legs razed silver, the paws downward." With the strange bearing of the lion's whip-like tail cut off at the rump, we may end the list of these oddments.

Fitzalan, earl of Arundel, bore "Gules, a lion gold." Simon de Montfort bore "Gules, a silver lion with a forked tail." Segrave bore "Sable, a lion silver crowned gold." Havering bore "Silver, a lion rampant gules with a forked tail, having a collar azure." Felbrigge of Felbrigge bore "Gold, a leaping lion gules." Esturmy bore "Silver, a lion sable (or purple) looking backward." Marmion bore "Gules, a lion vair." Mason bore "Silver, a two-headed lion gules." Lisle bore "Gules, a leopard silver crowned gold." Ludlowe bore "Azure, three leopards silver." Brocas bore "Sable, a leopard rampant gold."

John Hardrys of Kent seals in 1372 with arms of "a sitting leopard." John Northampton, Lord Mayor of London in 1381, bore "Azure, a crowned leopard gold with two bodies rampant against each other." Newenham bore "Azure, three demi-lions silver." A deed delivered at Lapworth in Warwickshire in 1466 is sealed with arms of "a molet between three demi-leopards."

The tiger is rarely named in collections of mediaeval arms. Deep mystery wrapped the shape of him, which was never during the middle ages standardized by artists. A crest upon a 15th-century brass shows him as a lean wolf-like figure, with a dash of the boar, gazing after his vain wont into a looking-glass; and the 16th-century heralds gave him the body of a lion with the head of a wolf, head and body being tufted here and there with thick tufts of hair. But it is noteworthy that the arms of Sir John Norwich, a well-known knight of the 14th century, are blazoned in a roll of that age as "party azure and gules with a tiger rampant ermine." Now this beast in the arms of Norwich has been commonly taken for a lion, and the Norwich family seem in later times to have accepted the lion as their bearing. But a portion of a painted roll of Sir John's day shows on careful examination that his lion has been given two moustache-like tufts to the nose. A copy made about 1600 of another roll gives the same decoration to the Norwich lion, and it is at least possible we have here evidence that the economy of the mediaeval armorist allowed him to make at small cost his lion, his leopard and his tiger out of a single beast form.

Take away the lions and the leopards, and the other beasts upon mediaeval shields are a little herd. In most cases they are here to play upon the names of their bearers. Thus Swinburne of Northumberland has the heads of swine in his coat and Bacon has bacon pigs. Three white bears were borne by Barlingham, and a bear ramping on his hind legs is for Barnard. Lovett of Astwell has three running wolves, Videlou three wolves' heads, Colfox three foxes' heads.

An elephant was brought to England in the days of Henry III., but he had no immediate armorial progeny, although Sanders of Northants may have borne before the end of the middle ages the elephants' heads which speak of Alysander the Great, patron of all Sanderses. Of dogs the greyhound and the talbot, or mastiff, are found most often. Thus Talbot of Cumberland had talbots, and Mauleverer, running greyhounds or "leverers" for his name's sake. The alaund, a big, crop-eared dog, is in the 15th-century shield of John Woode of Kent, and "kenets," or little tracking dogs, in a 13th-century coat of Kenet. The horse is not easily found as an English charge, but Moyle's white mule seems an old coat; horses' heads are in Horsley's shield, and ass heads make crests for more than one noble house. Askew has three asses in his arms. Three bats or flittermice are in the shield of Burninghill and in that of Heyworth of Whethamstede.

As might be looked for in a land where forest and greenwood once linked from sea to sea, the wild deer is a common charge in the shield. Downes of Cheshire bore a hart "lodged" or lying down. Hertford had harts' heads, Malebis, fawns' heads (*testes de bis*), Buckingham, heads of bucks. The harts in Rotherham's arms are the roes of his name's first syllable. Reindeer heads were borne by Bowet in the 14th century. Antelopes, fierce beasts with horns that have something of the ibex, show by their great claws, their lion tails and their boar muzzles and tusks that they are midway between the hart and the monster. The yale, eale or gall, is found among fifteenth century supporters, an antelope-like creature sometimes shown with one horn curving behind and the other curving to the front.

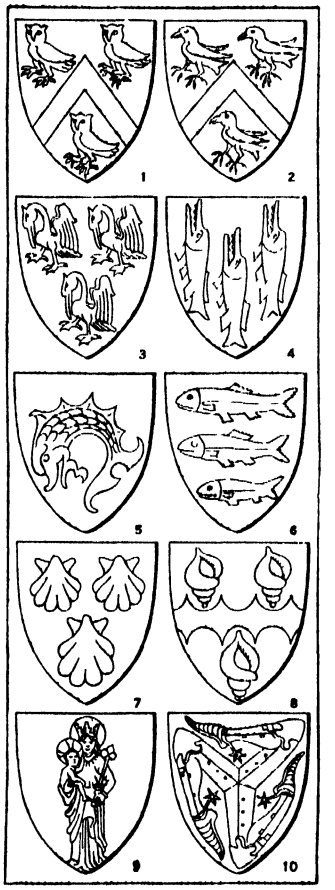

FIG. 6.—BRITISH SHIELDS OF ARMS (1) Burton. (2) Rokeby. (3) Pelham. (4) Lucy. (5) Fishacre. (6) Roche. (7) Daore. (8) Shelley. (9) See of Salisbury. (10) Isle of Man

Of the outlandish monsters the griffon is the oldest and the chief. With the hinder part of a lion, the rest of him is eagle, head and shoulders, wings and fore legs. The long tuft under the beak and his pointed ears mark him out from the eagle when his head alone is borne. At an early date a griffon rampant, his normal position, was borne by the great house of Montagu as a quartering, and another griffon played upon Griffin's name.

The wyver, who becomes wyvern in the 16th century, and takes a new form under the care of inventive heralds, was in the middle ages a lizard-like dragon, generally with small wings. Sir Edmund Mauley in the 14th century is found differencing the black bend of his elder brother by charging it with three wyvers of silver. During the middle ages there seems small distinction between the wyver and the still rarer dragon, which, with the coming of the Tudors, who bore it as their badge, is seen as a four-legged monster with wings and a tail that ends like a broad arrow. The monster in the arms of Drake, blazoned by Tudor heralds as a wyvern, is clearly a fire-drake or dragon in his origin.

The unicorn rampant was borne by Harlyn of Norfolk; unicorn's heads by the Cambridgeshire family of Paris. The mermaid with her comb and looking-glass makes a 14th-century crest for Byron, while "Silver, a bend gules with three silver harpies thereon" is found in the 15th century for Entyrdene.

Concerning beasts and monsters the heraldry books have many adjectives of blazonry which may be disregarded. Even as it was once the pride of the cook pedant to carve each bird on the board with a new word for the act, so it became the delight of the pedant herald to order that the rampant horse should be "forcené," the rampant griffon "segreant," the passant hart "trippant"; while the same hart must needs be "attired" as to its horns and "unguled" as to its hoofs. There is ancient authority for the nice blazonry which sometimes gives a separate colour to the tongue and claws of the lion, but even this may be set aside. Though a black lion in a silver field may be armed with red claws, and a golden leopard in a red field given blue claws and tongue, these trifles are but fancies which follow the taste of the painter, and are never of obligation. The tusks and hoofs of the

boar, and often the horns of the hart, are thus given in some paintings a colour of their own which elsewhere is neglected.

As the lion is among armorial beasts, so is the eagle among the birds. A bold convention of the earliest shield painters displayed him with spread wing and claw, the feat of a few strokes of the brush, and after this fashion he appears on many scores of shields. Like the claws and tongue of the lion, the beak and claws of the eagle are commonly painted of a second colour in all but very small representations. Thus the golden eagle of Lymesey in a red field may have blue beak and claws, and golden beak and claws will be given to Jorce's silver eagle upon red. A lure, or two wings joined and spread like those of an eagle, is a rare charge sometimes found. When fitted with the cord by which a falconer's lure is swung, the cord must be named.

Monhermer bore "Gold, an eagle vert." Siggeston bore "Silver, a two-headed eagle sable." Gavaston, earl of Cornwall, bore "Vert, six eagles gold." Bayforde of Fordingbridge sealed (in 1388) with arms of "An eagle bendwise, with a border engrailed and a baston." Graunson bore "Paly silver and azure with a bend gules and three golden eagles thereon."

Commoner than the eagle as a charge is the martlet, a humbler bird which is never found as the sole charge of a shield. In all but a few early representations the feathers of the legs are seen without the legs or claws. The martlet indicates both swallow and martin, and in the arms of the Cornish Arundels the martlets must stand for "hirundels" or swallows.

The falcon or hawk is borne as a rule with close wings, so that he may not be taken for the eagle. In most cases he is there to play on the bearer's name, and this may be said of most of the flight of lesser birds.

Naunton bore "Sable, three martlets silver." Heron bore "Azure, three herons silver." Fauconer bore "Silver, three falcons gules." Hauvile bore "Azure, a dance between three hawks gold." Twenge bore "Silver, a fesse gules between three popinjays (or parrots) vert." Cranesley bore "Silver, a cheveron gules between three cranes azure." Asdale bore "Gules, a swan silver." Dalston bore "Silver, a cheveron engrailed between three daws' heads razed sable." Corbet bore "Gold, two corbies sable." Sumeri (13th century) sealed with arms of "A peacock with his tail spread" John Pyeshale of Suffolk (14th century) sealed with arms of "Three magpies."

Fishes, Reptiles and Insects.—Like the birds, the fishes are borne for the most part to call to mind their bearers' names. Unless their position be otherwise named, they are painted as upright in the shield, as though rising towards the water surface. The dolphin is known by his bowed back, old artists making him a grotesquely decorative figure.

Lucy bore "Gules, three luces (or pike) silver." Heringaud bore "Azure, crusilly gold, with six golden herrings." Fishacre bore "Gules, a dolphin silver." La Roche bore "Three roach swimming." John Samon (14th century) sealed with arms of "Three salmon swimming."

Shell-fish would hardly have place in English armory were it not for the abundance of scallops which have followed their appearance in the banners of Dacre and Scales. The crest of the Yorkshire Scropes, playing upon their name, was a pair of crabs' claws. Dacre bore "Gules, three scallops silver." Shelley bore "Sable, a fesse engrailed between three whelk-shells gold."

Reptiles and insects are barely represented. The lizards in the crest and supporters of the Ironmongers of London belong to the 15th century. Gawdy of Norfolk may have borne the tortoise in his shield in the same age. "Silver, three toads sable" was quartered as a second coat for Botreaux of Cornwall in the 16th century—Botereau or Boterel signifying a little toad in the old French tongue—but the arms do not appear on the old Botreaux seals beside their ancient bearing of the griffon. Beston bore "Silver, a bend between six bees sable" and a 15th-century Harbottle seems to have sealed with arms of three bluebottle flies. Three butterflies are in the shield of Presfen of Lancashire in 1415, while the winged insect shown on the seal of John Mayre, a King's Lynn burgess of the age of Edward I., is probably a mayfly.

Human Charges.—Man and the parts of him play but a small part in English shields, and we have nothing to put beside such a coat as that of the German Manessen, on which two armed knights attack each other's hauberks with their teeth. But certain arms of religious houses and the like have the whole figure, the see of Salisbury bearing the Virgin and Child in a blue field. And old crests have demi-Saracens and falchion men, coal-miners, monks and blackamoors. Sowdan bore in his shield a turbaned soldan's head; Eady, three old men's "'eads"! Heads of maidens, the "winsome marrows" of the ballad, are in the arms of Marow. The Stanleys, as kings of Man, quartered the famous three armed legs whirling mill-sail fashion, and Tremayne of the west bore three men's arms in like wise. "Gules, three hands silver" was for Malmeyns as early as the 13th century, and Tynte of Colchester displayed hearts.

Miscellaneous Charges.—Other charges of the shield are less frequent but are found in great variety, the reason for most of them being the desire to play upon the bearer's name.

Weapons and the like are rare, having regard to the military associations of armory. Daubeney bore three helms; Philip Marmion took with his wife, the coheir of Kilpek, the Kilpek shield of a sword (*espek*). Tuck had a stabbing sword or "tuck." Bent bows were borne by Bowes, an arblast by Arblaster, arrows by Archer, birding-bolts or *bosouns* by Bosun, the mangonel by Mangnall. The three lances of Amherst is probably a mediaeval coat; Leweston had battle-axes.

Of horse-furniture we have the stirrups of Scudamore and Giffard, the horse-barnacles of Bernake and the horse-shoes borne by many branches and tenants of the house of Ferrers.

Of musical instruments there are pipes, trumps and harps for Pipe, Trumpington and Harpesfeld. Hunting horns are common among families bearing such names as Forester or Horne. Remarkable charges are the three organs of Grenville, who held of the house of Clare, the lords of Glamorgan.

The most notable of the charges derived from clothing is the hanging sleeve familiar in the arms of Hastings, Conyers and Mansel.

Chess-rooks, hardly to be distinguished from the *roc* or *roquet* at the head of a jousting-lance, were borne by Rokewode and by many more. Topcliffe had pegtops in his shield, while Ambesas had a cast of three dice which should each show the point of one, for "to throw ambesace" is an ancient phrase used of those who throw three aces.

Although the British are a sea-going people, there are few ships in British armory, most of these in the arms of sea-ports. Anchors are commoner.

Castles and towers, bridges, portcullises and gates have all examples, and a minster-church was the curious charge borne by the ancient house of Musters of Kirklington.

Letters of the alphabet are very rarely found in ancient armory; but three capital T's, in old English script, were borne by Toft of Cheshire in the 14th century. In the period of decadence whole words or sentences, commonly the names of military or naval victories, are often seen.

Blazonry.—An ill-service has been done to the students of armory by those who have pretended that the phrases in which the shields and their charges are described or blazoned must follow arbitrary laws devised by writers of the period of armorial decadence. One of these laws, and a mischievous one, asserts that no tincture should be named a second time in the blazon of one coat. Thus if gules be the hue of the field any charge of that colour must thereafter be styled "of the first." Obeying this law the blazoner of a shield of arms elaborately charged may find himself sadly involved among "of the first," "of the second" and "of the third." It is needless to say that no such law obtained among armorists of the middle ages. The only rule that demands obedience is that the brief description should convey to the reader a true knowledge of the arms described.

The examples of blazonry given in that part of this article which deals with armorial charges will be more instructive to the student than any elaborated code of directions. It will be observed that the description of the field is first set down, the

blazoner giving its plain tincture or describing it as burely, party, paly or barry, as powdered or sown with roses, crosslets or fleurs-de-lys. Then should follow the main or central charges, the lion or griffon dominating the field, the cheveron or the pale, the fesse, bend or bars, and next the subsidiary charges in the field beside the "ordinary" and those set upon it. Chiefs and quarters are blazoned after the field and its contents, and the border, commonly an added difference, is taken last of all. Where there are charges both upon and beside a bend, fesse or the like, a curious inversion is used by pedantic blazoners. The arms of Mr. Samuel Pepys of the Admiralty Office would have been described in earlier times as "Sable, a bend gold between two horses' heads razed silver, with three fleurs-de-lys sable on the bend." Modern heraldic writers would give the sentence as "Sable, on a bend or between two horses' heads erased argent, three fleurs-de-lys of the first." Nothing is gained by this inversion but the precious advantage of naming the bend but once. On the other side it may be said that, while the newer blazon couches itself in a form that seems to prepare for the naming of the fleurs-de-lys as the important element of the shield, the older form gives the fleur-de-lys as a mere postscript, and rightly, seeing that charges in such a position are very commonly the last additions to a shield by way of difference. In like manner when a crest is described it is better to say "a lion's head out of a crown" than "out of a crown a lion's head." The first and last necessity in blazonry is lucidity, which is cheaply gained at the price of a few syllables repeated.

Modern Heraldry.—With the accession of the Tudors armory began a rapid decadence. Heraldry ceased to play its part in military affairs, the badges and banners under which the mediaeval noble's retinue came into the field were banished, and even the tournament in its later days became a renascence pageant which did not need the painted shield and armorial trappers. Treatises on armory had been rare in the days before the printing press, but even so early a writer as Nicholas Upton had shown himself as it were unconcerned with the heraldry that any man might see in the camp and the street. From the Book of St. Albans onward the treatises on armory are informed with a pedantry which touches the point of crazy mysticism in such volumes as that of Sylvanus Morgan. Thus came into the books those long lists of "diminutions of ordinaries," the closets and escarpes, the endorses and ribands, the many scores of strange crosses, and such wild fancies as the rule, based on an early German pedantry, that the tinctures in peers' shields should be given the names of precious stones and those in the shields of sovereigns the names of planets. Blazon became cumbered with that vocabulary whose French of Stratford atte Bowe has driven serious students from a business which, to use a phrase as true as it is hackneyed, was at last "abandoned to the coachpainter and the undertaker."

With the false genealogy came in the assumption or assigning of shields to which the new bearers had often no better claim than lay in a surname resembling that of the original owner. The ancient system of differencing arms disappeared. Now and again we see a second son obeying the book-rules and putting a crescent in his shield or a third son displaying a molet, but long before our own times the practice was disregarded, and the most remote kinsman of a gentle house displayed the "whole coat" of the head of his family.

The art of armory had no better fate. An absurd rule current for some three hundred years has ordered that the helms of princes and knights should be painted full-faced and those of peers and gentlemen sidelong. Obeying this, the herald painters have displayed the crests of knights and princes as sideways upon a full-faced helm; the torse or wreath, instead of being twisted about the brow of the helm, has become a sausage-shaped bar see-sawing above the helm, and upon this will be balanced a crest which might puzzle the ancient craftsman to mould in his leather or parchment. A ship on a lee-shore with a thunder-storm lowering above its masts may stand as an example of such devices. "Tastes, of course, differ," wrote Dr. Woodward, "but the writer can hardly think that the épergne given to Lieut.-General Smith by his friends at Bombay was a fitting ornament for a helmet." As with the crest, so with the shield. It became crowded with ill-balanced figures devised by those who despised and ignored the ancient examples whose painters had followed instinctively a simple and pleasant convention. Landscapes and seascapes, musical lines, military medals and corrugated boiler-flues have all made their appearance in the shield. Even as on the signs of public houses, written words have taken the place of figures, and the often-cited arms exemplified to the first Earl Nelson marked, it may be hoped, the high watermark of these distressing modernisms. Of late years, indeed, official armory in England has shown a disposition to follow the lessons of the archaeologist, although the recovery of mediaeval use has not yet been as successful as in Germany, where for a long generation a school of vigorous armorial art has flourished.

OFFICERS OF ARMS

Officers of arms, styled kings of arms, heralds and pursuivants, make their appearance at an early period of the history of armory as the messengers both in peace and in war of princes and magnates. It is probable that from the first they bore in some wise their lord's arms as the badge of their office. In the 14th century we have heralds with the arms on a short mantle; witness the figure of the duke of Gelderland's herald painted in the *Armorial de Gelre*. The title of Blue Mantle pursuivant, as old as the reign of Edward III., suggests a like usage in England. When the tight-laced coat of arms went out of fashion among the knighthood the loose tabard of arms with its wide sleeves was at once taken in England as the armorial dress of both herald and cavalier, and the fashion of it has changed but little since those days. Clad in such a coat the herald was the image of his master and, although he himself was rarely chosen from any rank above that of the lesser gentry, his person, as a messenger, acquired an almost priestly sacredness. To injure or to insult him was to affront the coat that he wore.

We hear of kings of arms in the royal household of the 13th century, and we may compare their title with those of such officers as the King of the Ribalds and the King of the Minstrels; but it is noteworthy that, even in modern warrants for heralds' patents, the custom of the reign of Edward III. is still cited as giving the necessary precedents for the officers' liveries. Officers of arms took their titles from their provinces or from the titles and badges of their masters. Thus we have Garter, Norroy and Clarenceux, March, Lancaster, Windsor, Leicester, Leopard, Falcon and Blanc Sanglier as officers attached to the royal house; Chandos, the herald of the great Sir John Chandos; Vert Eagle of the Nevill earls of Salisbury, Esperance and Crescent of the Percys of Northumberland. The spirit of Henry VII.'s legislation was against such usages in baronial houses, and in the age of the Tudors the last of the private heralds disappears.

In England the royal officers of arms were made a corporation by Richard III. Nowadays the members of this corporation, known as the College of Arms or Heralds' College, are Garter Principal King of Arms, Clarenceux King of Arms South of Trent, Norroy King of Arms North of Trent, the heralds Windsor, Chester, Richmond, Somerset, York and Lancaster, and the pursuivants Rouge Croix, Bluemantle, Rouge Dragon and Portcullis. Another king of arms, not a member of this corporation, has been attached to the order of the Bath since the reign of George I., and an officer of arms, without a title, attends the order of St. Michael and St. George.

There is no college or corporation of heralds in Scotland or Ireland. In Scotland "Lyon-king-of-arms," "*Lyon rex armorum*," or "*Leo fecialis*," so called from the lion on the royal shield, is the head of the office of arms. When first the dignity was constituted is not known, but Lyon was a prominent figure in the coronation of Robert II. in 1371. The office was at first, as in England, attached to the earl marshal, but it has long been conferred by patent under the great seal, and is held direct from the crown. Lyon is also king-of-arms for the national order of the Thistle. He is styled "Lord Lyon," and the office has always been held by men of family, and frequently by a peer who would appoint a

"Lyon depute." He is supreme in all matters of heraldry in Scotland. Following him there are the Scottish heralds, Albany, Ross and Rothesay, with precedence according to date of appointment; and the pursuivants, Carrick, March and Unicorn. Heralds and pursuivants are appointed by Lyon.

In Ireland also there is but one king-of-arms, Ulster. The office was instituted by Edward VI. in 1553. The patent is given by Rymer, and refers to certain emoluments as "*praedicto officio . . . ab antiquo spectantibus.*" The allusion is to an Ireland king-of-arms mentioned in the reign of Richard II. and superseded by Ulster. Ulster holds office by patent, during pleasure; under him the Irish office of arms consists of two heralds, Cork and Dublin; and a pursuivant, Athlone. Ulster is king-of-arms to the order of St. Patrick. He held visitations in parts of Ireland from 1568 to 1620, and these and other records, including all grants of arms from the institution of the office, are kept in the Birmingham Tower, Dublin.

The armorial duties of the ancient heralds are not clearly defined. The patent of Edward IV., creating John Wrythe king-of-arms of England with the style of Garter, speaks vaguely of the care of the office of arms and those things which belong to that office. We know that the heralds had their part in the ordering of tournaments, wherein armory played its greatest part, and that their expert knowledge of arms gave them such duties as reckoning the noble slain on a battlefield. But it is not until the 15th century that we find the heralds following a recognized practice of granting or assigning arms, a practice on which John of Guildford comments, saying that such arms given by a herald are not of greater authority than those which a man has taken for himself. The Book of St. Albans, put forth in 1486, speaking of arms granted by princes and lords, is careful to add that "armys bi a mannys proper auctorite taken, if an other man have not borne theym afore, be of strength enogh," repeating, as it seems, Nicholas Upton's opinion which, in this matter, does not conflict with the practice of his day. It is probable that the earlier grants of arms by heralds were made by reason of persons uncunning in armorial lore applying for a suitable device to experts in such matters—and that such setting forth of arms may have been practised even in the 14th century.

The earliest known grants of arms in England by sovereigns or private persons are, as a rule, the conveyance of a right in a coat of arms already existing or of a differenced version of it. Thus in 1391 Thomas Grendale, a squire who had inherited through his grandmother the right in the shield of Beaumeys, granted his right in it to Sir William Moigne, a knight who seems to have acquired the whole or part of the Beaumeys manor in Sawtry. Under Henry VI. we have certain rare and curious letters of the crown granting nobility with arms "*in signum hujusmodi nobilitatis*" to certain individuals, some, and perhaps all of whom, were foreigners who may have asked for letters which followed a continental usage. After this time we have a regular series of grants by heralds who in later times began to assert that new arms, to be valid, must necessarily be derived from their assignments, although ancient use continued to be recognized.

An account of the genealogical function of the heralds, so closely connected with their armorial duties will be found in the article GENEALOGY. In spite of the work of such distinguished men as Camden and Dugdale they gradually fell in public estimation until Blackstone could write of them that the marshalling of coat-armour had fallen into the hands of certain officers called heralds, who had allowed for lucre such falsity and confusion to creep into their records that even their common seal could no longer be received as evidence in any court of justice. From this low estate they rose again when the new archaeology included heraldry in its interests, and several antiquaries of repute have of late years worn the herald's tabard.

In spite of the vast amount of material which the libraries catalogue under the head of "Heraldry," the subject has as yet received little attention from antiquaries working in the modern spirit. The old books are as remarkable for their detachment from the facts as for their folly. The work of Nicholas Upton, *De studio militari*, although written in the first half of the 15th century, shows, as has been already remarked, no attempt to reconcile the conceits of the author with the armorial practice which he must have seen about him on every side. Gerard Leigh, Bossewell, Ferne and Morgan carry on this bad tradition, each adding his own extravagances. The *Display of Heraldry*, first published in 1610 under the name of John Guillim, is more reasonable if not more learned, and in its various editions gives a valuable view of the decadent heraldry of the 17th century. In the 19th century many important essays on the subject are to be found in such magazines as the *Genealogist*, the *Herald and Genealogist* and the *Ancestor*, while Planché's *Pursuivant of Arms* contains some slight but suggestive work which attempts original enquiry. But Dr. Woodward's *Treatise on Heraldry, British and Foreign* (1896), in spite of many errors arising from the author's reliance upon unchecked material, must be counted the only scholarly book in English upon a matter which has engaged so many pens. Among foreign volumes may be cited those of Menestrier and Spener, and the vast compilation of the German Siebmacher. Notable ordinaries of arms are those of Papworth and Renesse, companions to the armorials of Burke and Rietstap. The student may be advised to turn his attention to all works dealing with the effigies, brasses and other monuments of the middle ages, to the ancient heraldic seals and to the heraldry of mediaeval architecture and ornament.

(O. B.)

HERAT, city and province, Afghanistan. The city lies in 34° 20′ 30″ N., and 62° 11′ 0″ E., 2,500 ft. above sea-level. Estimated pop. about 10,000. It has quite lost its ancient commercial importance. From it lines of communication radiate to Russian, British, Persian and Afghan territory. The city forms a quadrangle about 1,600 yd. by 1,500 yd.; on the west, south and east, only the gateways project from the line of defence but on the north there is a double outwork consisting of the *Ark* or citadel, and a lower work at its foot, called the *Ark-i-nao*, or "new citadel," which extends 100 yd. beyond the line of the city wall. That which distinguishes Herat from all other Oriental cities is the stupendous earthwork upon which the city wall is built. This earthwork averages 250 ft. in width at the base and about 50 ft. in height, and as it is crowned by a wall 25 ft. high and 14 ft. thick at the base, supported by about 150 semi-circular towers, and is further protected by a ditch 45 ft. in width and 16 in depth, it presents an appearance of imposing strength.

Defences.—When the royal engineers of the Russo-Afghan Boundary Commission entered Herat in 1885 they found its buildings in various stages of disrepair and lacking all effective defences. Outside, ancient ruins and mounds impeded all field of fire. To the north-west, beyond the Tal-i-Bangi, the magnificent outlines of the Mosalla filled a wide space with the glorious curves of dome and gateway and the stately grace of tapering minars. The needs of defence, however, called for its destruction, but four minars standing at the corners of the wide plinth still remain to attest to its glory and to exhibit samples of decorative tilework of intricate beauty of design and exquisite taste in the blending of colour. At the same time the ancient graveyards round the city were swept smooth and levelled; obstructions were demolished, outworks constructed, and the defences generally renovated. Whether or no the strength of this bulwark of north-western Afghanistan should ever be practically tested, the general result of the most recent investigations into the value of Herat as a strategic centre has been largely to modify the once widely-accepted view that the key to India lies within it. Abdur Rahman and his successor Habibullah steadfastly refused the offer of British engineers to strengthen its defences; and though the Afghans themselves have occasionally undertaken repairs, it is doubtful whether the old walls of Herat are maintained in a state of efficiency.

The City Gates.—The city possesses five gates, two on the northern face, the Kutab-chak near the north-east angle of the wall, and the Malik at the re-entering angle of the Ark-i-nao; and three others in the centres of the remaining faces, the Irak gate on the west, the Kandahar gate on the south and the Kushk gate on the east face. The main streets, the *Chahar-sûk* are well built, the principal one having a vaulted roof. Near the central quadrangle of the city is a vast domed reservoir of water. The only other

public building of any consequence in Herat is the Jamma Musjid or Great Mosque which comprises an area of 800 yd. square, and must have been a most magnificent structure. It was erected towards the close of the 15th century, during the reign of Shah Sultan Hussein of the family of Timur, and is said when perfect to have been 465 ft. long by 275 ft. wide, to have had 408 cupolas, 130 windows, 444 pillars and 6 entrances, and to have been adorned in the most magnificent manner with gilding, carving, precious mosaics and other elaborate and costly embellishments.

Ancient Ruins.—Along the slopes of the northern hills there is a space of some 4 m. in length by 3 m. in breadth, the surface of the plain, strewn over its whole extent with pieces of pottery and crumbling bricks, and also broken here and there by earthen mounds and ruined walls, the débris of palatial structures which at one time were the glory and wonder of the East. Of these structures indeed some have survived to the present day in a sufficiently perfect state to bear witness to the grandeur and beauty of the old architecture of Herat. Scarcely inferior to the mosque of the Mosalla though of more moderate dimensions, is the tomb of the saint Abdullah Ansari, in the same neighbourhood. This building, erected by Shah Rukh Mirza, grandson of Timur, over 500 years ago, contains exquisite Oriental sculpture. Adjoining the tomb also are marble sepulchres of princes of the house of Timur; and especially deserving of notice is a royal building tastefully decorated by an Italian artist named Geraldi, in the service of Shah Abbas the Great. It is held in high veneration by all classes, and the famous Dost Mohammed Khan is himself buried at the foot of the tomb of the saint. Two other royal palaces named respectively *Bagh-i-Shah* and *Takht-i-Sefer,* are on the same rising ground somewhat farther to the west.

Character of Inhabitants.—The original inhabitants of Ariana were no doubt of the Aryan family, cognate with the Persian race, but they probably intermixed at a very early period with the Sacae and Massagetae, who seem to have held the mountains from Kabul to Herat and to whom must be ascribed—rather than to an infusion of Turco-Tartaric blood introduced by the armies of Jenghiz and Timur—the peculiar broad features and flattish countenance of the inhabitants of Herat, Seistan and the eastern provinces of Persia. Under Herat, however, there are a very large number of tribes, ruled over by separate and semi-independent chiefs, and belonging probably to different nationalities. The principal group of tribes is called the *Chahar-Aimak,* or "four races," the constituent parts of which, however, are variously stated by different authorities both as to strength and nomenclature. The Heratis are agricultural and not nearly so warlike as the Pathans from the neighbourhood of Kabul or Kandahar.

Environs of Herat.—The long narrow valley of the Hari Rud, starting from the western slopes of the Koh-i-Baba, extends almost due west for 300 m. before it takes its great northern bend at Kuhsan, and passes northwards through the broken ridges of the Siah Bubuk (the western extremity of the range which we now call Paropamisus) towards Sarakhs. For the greater part of its length it drains the southern slopes only of the Paropamisus and the northern slopes of a parallel range called Koh-i-Safed. The Paropamisus forms the southern face of the Turkistan plateau, which contains the sources of the Murghab river; the northern face of the same plateau is defined by the Band-i-Turkistan. On the south of the plateau we find a similar succession of narrow valleys dividing parallel flexures, or anticlinals, formed under similar geological conditions to those which appear to be universally applicable to the Himalaya, the Hindu Kush, and the Indus frontier mountain systems. From one of these long lateral valleys the Hari Rud receives its principal tributary, which joins the main river below Obeh, 180 m. from its source; and it is this tributary (separated from the Hari Rud by the narrow ridges of the Koh-i-Safed and Band-i-Baian) that offers the high road from Herat to Kabul, and not the Hari Rud itself. From its source to Obeh the Hari Rud is a valley of sandy desolation. Masses of melting snow annually give rise to floods, frequently rendering the river impassable and cutting off the crazy brick bridges at Herat and Tirpul. It is impossible, whilst watching the rolling, seething volume of flood-water which swirls westwards in April, to imagine the waste stretches of dry river-bed which in a few months' time (when every available drop of water is carried off for irrigation) will represent the Hari Rud. The soft shales or clays of the hills bounding the valley render these hills especially subject to the action of denudation, and the result, in rounded slopes and easily accessible crests, determines the nature of the easy tracks and passes which intersect them. At the same time, any excessive local rainfall is productive of difficulty and danger from the floods of liquid mud and loose boulders which sweep like an avalanche down the hill sides. The intense cold which usually accompanies these sudden northern blizzards of Herat and Turkistan is a further source of danger.

Cultivated Area.—From Obeh, 50 m. east of Herat, the cultivated portion of the valley commences, and it extends, with a width which varies from 8 to 16 m., in Kuhsan, 60 m. west of the city, presenting a remarkable scene of luxurious fertility. The system of irrigation by which these agricultural results are attained is most elaborate. The Herati Tajik, adopts the karez (or, Persian, *kanat*) system of underground irrigation and brings every drop of water that he can find to the surface. The valley about Herat includes a flat alluvial plain. Three miles to the south of the city the river flows from east to west, spanned by the Pal-i-Malun. East and west stretches the long vista of the Hari Rud. Due north lie the hills called the Koh-i-Mulla Khwaja about 3 m. distant from the city. This northern line of barren, broken sandstone hills is geographically no part of the Paropamisus range, from which it is separated by a stretch of sandy upland about 20 m. in width, called the Dasht-i-Hamdamao, or Dasht-i-Ardewan, formed by the talus or drift of the higher mountains. Through this stretch of *dasht* the drainage from the main water-divide breaks downwards to the plains of Herat, where it is arrested and utilized for irrigation purposes.

The Korokh Valley.—To the north-east of the city a very considerable valley has been formed between the Paropamisus and the subsidiary Koh-i-Mulla Khwaja range, called Korokh. Here there are one or two important villages and a well-known shrine marked by a group of pine trees which is unique in this part of Afghanistan. The valley leads to a group of passes across the Paropamisus into Turkistan, of which the Zirmast is perhaps the best known. The main water-divide between Herat and the Turkistan Chol (the loess district) has been called Paropamisus for want of any well-recognized general name. To the north of the Korokh valley it exhibits something of the formation of the Hindu Kush (of which it is apparently a geological extension), but as it passes westwards it becomes broken into fragments by processes of denudation, until it is hardly recognizable as a distinct range at all. The direct passes across it from Herat (the Baba and the Ardewan) wind amongst masses of disintegrating sandstone for some miles on each side of the dividing watershed, but farther west the rounded knolls of the rain-washed downs may be crossed almost at any point without difficulty.

HISTORY

The name of Herat first appears in the list of primitive Zoroastrian settlements contained in the *Vendidād Sadē,* where it seems to apply to the river or river-basin, which was the special centre of population. Of the foundation of Herat (or Heri) nothing is known. We can only infer from the colossal character of the earthworks which surround the modern town that, like the similar remains at Bost on the Helmund and at Ulan Robat of Arachosia, they belong to that period of Central-Asian history which preceded the rise of Achaemenian power, and which in Grecian romance is illustrated by the names of Bacchus, of Hercules, and of Semiramis. To trace in any detail the fortunes of Herat would be to write the modern history of the East, for there has hardly been a revolution, or war, in Central Asia since the time of the prophet in which Herat has not played a conspicuous part. Under the Tahirids of Khorasan, the Saffarids of Seistan, and the Samanids of Bokhara it flourished for some centuries in peace and progressive prosperity; but during the succeeding rule of the Ghaznevid kings its metropolitan character was for a time obscured by the celebrity of the neighbouring capital of Ghazni

(*q.v.*) until finally in the reign of Sultan Sanjar of Merv, about 1157, the city was entirely destroyed by an irruption of the Ghuzz, the predecessors of the modern Turkomans. Herat gradually recovered under the enlightened Ghorid kings, so that at the time of Jenghiz Khan's invasion it equalled or even exceeded in populousness and wealth its sister capitals of Balkh, Merv, and Nishapur, the united strength of the four cities being estimated at three millions of inhabitants. But this Mongol visitation was most calamitous: only 40 persons are said to have survived the general massacre of 1232, and a similar catastrophe overtook the city in 1398 on the fall of the Kurt dynasty (*see* MONGOLS). It is, therefore, astonishing to find that early in the 15th century Herat was again flourishing and populous, and the favoured seat of the art and literature of the East. It was under the princes of the house of Timur that most of the noble buildings were erected, of which the remains still excite our admiration at Herat, while all the great historical works relative to Asia, such as the *Rozet-es-Sefā*, the *Habīb-es-Seir*, *Hafiz Abrū's Tarīkh*, the *Matlā a-es-Sa'adin*, etc., date from the same place and the same age. Four times was Herat sacked by Turkomans and Usbegs during the centuries which intervened between the Timuride princes and the rise of the Afghan power, and it has never in modern times attained to anything like its old importance. Afghan tribes, who had originally dwelt far to the east, were first settled at Herat by Nadir Shah, and from that time they have monopolized the government and formed the dominant element in the population. It is needless to trace the revolutions and counter-revolutions which have followed each other in quick succession at Herat since Ahmad Shah Durani founded the Afghan monarchy about the middle of the 18th century; it is enough to say that Herat has been throughout the seat of an Afghan Government, sometimes in subordination to Kabul and sometimes independent. Persia indeed for many years showed a strong disposition to reassert the supremacy over Herat which was exercised by the Safawid kings, but Britain steadily resisted the encroachment; and, indeed, after helping the Heratis to beat off the attack of the Persian army in 1838, the British at length compelled the shah in 1857, at the close of his war with them, to sign a treaty recognizing the further independence of the place, and pledging Persia against any further interference with the Afghans. In 1863 Herat, which for 50 years previously had been independent of Kabul, was incorporated by Dost Mohammed Khan in the Afghan monarchy.

See C. E. Yate, *Northern Afghanistan* (1888); Holdich, *Indian Borderland* (1901); Angus Hamilton, *Afghanistan* (1906).

HÉRAULT, a department in the south of France, formed from Lower Languedoc. Pop. (1926) 500,575. Area, 2,402 sq.m. It is bounded north-east by Gard, north-west by Aveyron and Tarn, and south by Aude and the Golfe du Lion. The southern prolongation of the Cévennes mts., composed of Archaean and Palaeozoic rocks, with Mesozoic rocks on the southern edge and in the plateau of Larzac, occupies the north-west of the department, the highest point being about 4,250 ft. above sea-level. South-east of this come hills and plateaus decreasing as they approach the rich coastal plains at the mouth of the Orb and the Hérault and, farther to the north-east the line of intercommunicating coastal salt lagoons (Etang de Thau, etc.). North-west the Garrigues, a district of dry Mesozoic limestone plateaus and hills, stretches into the neighbouring department of Gard. South-west of this is the plain of Pliocene rocks with recent eruptive rocks near Agde. The mountains of the north-west form the watershed between the Atlantic and Mediterranean basins. From them flow the Hérault, its tributary the Lergue, and more to the south-west the Livron and the Orb, the main rivers of the department.

The climate is colder and more rainy in the mountains than on the plain which has dry summers with occasional storms. Hérault ranks first among French departments for area of vineyards; the red wines of St. Georges, Cazouls-lès-Béziers, Picpoul and Maranssan, and the white wines of Frontignan and Lunel are famous. Mulberries, olives and chestnuts flourish. Silk-worms are reared. Considerable numbers of sheep are raised, their milk being utilized for the preparation of Roquefort cheeses. There are quarries of marble, limestone, gypsum, etc.; the marshes supply salt. The most important mineral springs are at Lamalou-les-Bains and Balaruc-les-Bains. Woollen and cotton cloth, especially for military use, silk (Ganges), casks, soap and fertilizing stuffs are made. There are also oil-works, distilleries (Béziers) and tanneries (Bédarieux). Fishing is important; Cette and Mèze are the chief ports. Hérault exports salt fish, wine, liqueurs, timber, salt, building-material, etc. It imports cattle, skins, wool, cereals, vegetables, coal and other commodities.

The railway lines belong chiefly to the Southern and P.L.M. companies. The Canal du Midi traverses the south of the department for 44 m. and terminates at Cette. The Canal des Étangs traverses the department for about 20 m., forming part of a line of communication between Cette and Aigues-Mortes. Montpellier, the capital, is the seat of a bishopric of the province of Avignon, and of a court of appeal and centre of an académie (educational division). The department belongs to the 16th military region, (Montpellier). It is divided into the arrondissements of Montpellier and Béziers, with 36 cantons and 342 communes.

Montpellier, Béziers, Lodève, Bédarieux, Cette, Agde, Pézenas, Lamalou-les-Bains and Clermont-l'Hérault are the more important towns. Among the other interesting places in the department are St. Pons, with a church of the 12th century, once a cathedral; Villemagne, which has two ruined churches, one of the 13th, the other of the 14th century; Pignan, a mediaeval town, near which is the 13th century abbey-church of Vignogoul in the early Gothic style; and St. Guilhem-le-Désert, which has a church of the 11th and 12th centuries. Maguelonne, which in the 6th century became the seat of a bishopric transferred to Montpellier in 1536, has a cathedral of the 12th century.

HÉRAULT DE SÉCHELLES, MARIE JEAN (1759–1794), French politician, was born at Paris on Sept. 20, 1759. He made his début as a lawyer at the Châtelet, and later was *avocat général* to the parlement of Paris. He devoted himself to literature, and his account of his visit to the comte de Buffon at Montbard has with some justice been called a masterpiece of interviewing, before the day of journalists Hérault took part in the taking of the Bastille, and on Dec. 8, 1789, was appointed a judge in Paris. On his return from a mission to Alsace (Jan.–April, 1791) he was appointed *commissaire du roi* in the court of cassation. He was elected as a deputy for Paris to the Legislative Assembly, where he gravitated towards the extreme left, and, as a member of the diplomatic committee, presented a famous report demanding that the nation should be declared to be in danger (June 11, 1793). After the revolution of Aug. 10, 1792 (*see* FRENCH REVOLUTION), he co-operated with Danton, and on Sept. 2, was appointed president of the Legislative Assembly. Hérault was several times president of the Convention, notably on June 2, 1793, the occasion of the attack on the Girondins, and on Aug. 10, 1793, when the passing of the new constitution was celebrated. On the rejection of the projected constitution drawn up by Condorcet, he was entrusted with the task of preparing a fresh one; his plan became the Constitution of 1793, which was passed, but never applied. As a member of the Committee of Public Safety Hérault was employed on a mission in Alsace (Oct.–Dec. 1793) which made him an object of suspicion to the other members of the Committee of Public Safety, and especially to Robespierre. He was accused of treason, condemned with Danton, and executed on the 16th Germinal in the year II. (April 5, 1794).

See the *Voyage à Montbard*, published by A. Aulard (1890); A Aulard, *Les Orateurs de la Législative et de la Convention* (2nd ed. 1906); J. Claretie, *Camille Desmoulins . . . étude sur les Dantonistes* (1875); Dr. Robinet, *Le Procès des Dantonistes* (1879); "Hérault de Séchelles, sa première mission en Alsace" in the review *La Révolution Française*, tome 22; E. Daudet, *Le Roman d'un conventionnel. Hérault de Séchelles et les dames de Bellegarde* (1904). His *Oeuvres littéraires* were edited (1907) by E. Dard.

HERB, in botany, the name given to those plants whose stem or stalk dies entirely or down to the root each year, and does not become, as in shrubs or trees, woody or permanent; such plants are also called "herbaceous." The term "herb" is also used of those herbaceous plants, which possess certain properties, and are used for medicinal purposes, for flavouring or garnishing in cook-

ing, and also for perfumes (*see* HORTICULTURE and PHARMACOLOGY).

HERBARIUM or **HORTUS SICCUS,** a collection of plants so dried and preserved as to illustrate as far as possible their characters. Since the same plant, owing to peculiarities of climate, soil and situation, degree of exposure to light and other influences may vary greatly according to the locality in which it occurs, it is only by gathering together for comparison and study a large series of examples of each species that the flora of different regions can be satisfactorily represented. Even in the best equipped botanical garden it is impossible to have, at one and the same time, more than a very small percentage of the representatives of the flora of any given region or of any large group of plants. Hence a good herbarium forms an indispensable part of a botanical museum or institution. There are large herbaria at the British Museum and at the Royal Gardens, Kew, and smaller collections at the botanical institutions of the principal British universities. The original herbarium of Linnaeus is in the possession of the Linnean Society of London. It was purchased from the widow of Linnaeus by Dr. (afterwards Sir) J. E. Smith, one of the founders of the Linnean Society, and after his death was purchased by the society. Herbaria are also associated with the more important botanic gardens and museums in other countries. The value of a herbarium is much enhanced by the possession of "types," that is, the original specimens on the study of which a species was founded. Thus the herbarium at the British Museum, which is especially rich in the earlier collections made in the 18th and early 19th centuries, contains the types of many species founded by the earlier workers in botany. It is also rich in the types of Australian plants in the collections of Sir Joseph Banks and Robert Brown, and contains in addition many valuable modern collections. The Kew herbarium, founded by Sir William Hooker and greatly increased by his son Sir Joseph Hooker, is also very rich in types, especially those of plants described in the *Flora of British India* and various colonial floras. The collection of Dillenius is deposited at Oxford, and that of Professor W. H. Harvey at Trinity College, Dublin. The collections of Antoine Laurent de Jussieu, his son Adrien, and of Auguste de St. Hilaire, are included in the large herbarium of the Jardin des Plantes at Paris, and in the same city is the extensive private collection of Dr. Ernest Cosson. At Geneva are three large collections—Augustin Pyrame de Candolle's, containing the typical specimens of the *Prodromus,* a large series of monographs of the families of flowering plants, Benjamin Delessert's fine series at the Botanic Garden, and the Boissier Herbarium, which is rich in Mediterranean and Oriental plants. The university of Göttingen had bequeathed to it the largest collection (exceeding 40,000 specimens) ever made by a single individual—that of Professor Grisebach. At the herbarium in Brussels are the specimens obtained by the traveller Karl Friedrich Philipp von Martius, the majority of which formed the groundwork of his *Flora Brasiliensis.* The Berlin herbarium is especially rich in more recent collections; and other national herbaria sufficiently extensive to subserve the requirements of the systematic botanist exist at Leningrad, Vienna, Leyden, Stockholm, Uppsala, Copenhagen and Florence. Of those in the United States of America, the chief, formed by Asa Gray, is the property of Harvard university; there is also a large one at the New York Botanical Garden. The herbarium at Melbourne, Australia, under Baron Müller, attained large proportions; and that of the Botanical Garden of Calcutta is noteworthy as the repository of numerous specimens described by writers on Indian botany.

Specimens of flowering plants and vascular cryptogams are generally mounted on sheets of stout smooth paper, of uniform quality; the size adopted at Kew is 17 in. long by 11 in. broad, that at the British Museum is slightly larger; the palms and their allies, however, and some ferns, require a larger size. The tough but flexible coarse grey paper, upon which on the Continent specimens are commonly fixed by gummed strips of the same, is less hygroscopic than ordinary cartridge paper, but has the disadvantage of affording harbourage in the inequalities of its surface to a minute insect, *Atropos pulsatoria,* which commits great havoc in damp specimens, and which, even if noticed, cannot be dislodged without difficulty. The majority of plant specimens are most suitably fastened on paper by a mixture of equal parts of gum tragacanth and gum arabic made into a thick paste with water. Rigid leathery leaves are fixed by means of glue, or, if they present too smooth a surface, by stitching at their edges. Where, as in private herbaria, the specimens are not liable to be handled with great frequency, a stitch here and there round the stem, tied at the back of the sheet, or slips of paper passed over the stem through two slits in the sheet and attached with gum to its back, or simply strips of gummed paper laid across the stem, may be resorted to.

To preserve them from insects, the plants, after mounting, are often brushed over with a liquid formed by the solution of ¼ lb. each of corrosive sublimate and carbolic acid in 1 gallon of methylated spirits. They are then laid out to dry on shelves made of a network of stout galvanized iron wire. The use of corrosive sublimate is not, however, recommended, as it forms on drying a fine powder which when the plants are handled will rub off and, being carried into the air, may prove injurious to workers. If the plants are subjected to some process, before mounting, by which injurious organisms are destroyed, such as exposure in a closed chamber to vapour of carbon bisulphide for some hours, the presence of pieces of camphor or naphthalene in the cabinet will be found a sufficient preservative. After mounting are written—usually in the right-hand corner of the sheet, or on a label there affixed—the designation of each species, the date and place of gathering, and the name of the collector. Particulars as to habit, local abundance, soil and claim to be indigenous may be written on the back of the sheet. A careful dissection of a flower greatly increases the value of the specimen. The species of each genus are then arranged either systematically or alphabetically in separate covers of stout, usually light brown paper, or, if the genus be large, in several covers with the name of the genus clearly indicated in the lower left-hand corner of each, and opposite it the names or reference numbers of the species. Undetermined species are relegated to the end of the genus. Thus prepared, the specimens are placed on shelves or movable trays, at intervals of about 6 in., in an air-tight cupboard, on the inner side of the door of which, as a special protection against insects, is suspended a muslin bag containing a piece of camphor.

The systematic arrangement varies in different herbaria. In the great British herbaria the orders and genera of flowering plants are usually arranged according to Bentham and Hooker's *Genera plantarum*; the species generally follow the arrangement of the most recent complete monograph of the family. In non-flowering plants the works usually followed are for ferns, Hooker and Baker's *Synopsis filicum;* for mosses, Müller's *Synopsis muscorum frondosorum,* Jaeger & Sauerbeck's *Genera et species muscorum,* and Engler & Prantl's *Pflanzenfamilien;* for algae, de Toni's *Sylloge algarum;* for hepaticae, Gottsche, Lindenberg and Nees ab Esenbeck's *Synopsis hepaticarum,* supplemented by Stephani's *Species hepaticarum;* for fungi, Saccardo's *Sylloge fungorum,* and for mycetozoa Lister's monograph of the group. For the members of large genera, *e.g., Piper* and *Ficus,* since the number of cosmopolitan or very widely distributed species is comparatively few, a geographical grouping is found specially convenient by those who are constantly receiving parcels of plants from known foreign sources. The ordinary systematic arrangement possesses the great advantage, in the case of large genera, of readily indicating the affinities of any particular specimen with the forms most nearly allied to it.

HERBART, JOHANN FRIEDRICH (1776–1841), German philosopher and educationist, was born at Oldenburg on May 4, 1776. After studying under Fichte at Jena he tutored in Switzerland where he met Pestalozzi. He lectured at Göttingen in 1805, whence he removed in 1809 to occupy the chair formerly held by Kant at Königsberg. Here he also conducted a seminary of pedagogy till 1833, when he returned as professor of philosophy to Göttingen, where he died on Aug. 14, 1841.

Philosophy, according to Herbart, means the reflection upon and

elaboration of our empirical conceptions. Logic, its first division, clarifies our conceptions and the judgments and reasonings arising from them. But the more distinct some conceptions are, the more contradictory their elements become; so to manipulate these as to make them thinkable is the problem of metaphysics.

Logic receives comparatively meagre notice from Herbart, though he insists on its purely formal character, and expresses himself in the main at one with Kantians such as Fries and Krug.

As a metaphysician he starts from the scepticism of Hume and Kant, and on account of the contradictions involved, questions the real validity of even the *forms* of experience which he admits are "given." Suppose we are given a conception A uniting among its constituent marks two contradictory ones, M and N. We can neither deny the unity nor reject one of the contradictory members. To do either is forbidden by experience; to do nothing is forbidden by logic. We must assume then that the conception is contradictory because incomplete, and what we have must point the way to what we want. Experience asserts that M is the same (*i.e.*, a mark of the same concept) as N, while logic denies it; and so—it being impossible for one and the same M to sustain these contradictory positions, we must posit *several* M's. But even now we cannot say one of these M's is the same as N, another is not; for every M must be both thinkable and valid. We must take the M's not singly but together, and assume that N results from a combination of M's. This is Herbart's method of relations, the counterpart in his system of the Hegelian dialectic.

In the *Ontology* this method is employed to determine what in reality corresponds to the empirical conceptions of substance and cause, or rather of inherence and change The conception of the real consists of the two conceptions of being and quality. That which we are compelled to "posit" is that which *is*, and in the recognition of this lies the simple conception of being. We know what being is because we are bound against our will to endure the persistence of a presentation. As to the quality of the real, it must exclude everything negative; for non-A sublates instead of positing, and is but relative to A. The real must be absolutely simple; for if it contain two determinations, then either these are reducible to one, which is the true quality, or they are not, when each is conditioned by the other and their position no longer absolute. The simplicity also excludes quantitative conceptions. But there may be a plurality of "reals," albeit the mere conception of being tells us nothing of this. This cardinal point of Herbart's system makes it a "pluralistic realism."

The contradictions in the common-sense conception of inherence is now obvious. For example, when A has attributes, *a, b, c* . . . , each presented in intuition, A, as a real, being simple, must $=a$; similarly it must $=b$; and so on. Now this would be possible if *a, b, c* . . . were but "contingent aspects" of A, as, *e.g.*, $2^3, \sqrt{64}, 4+3+1$ are contingent aspects of 8. Such is not the case, and so we have as many contradictions as attributes; for we must say A is *a*, is not *a*, is *b*, is not *b*, etc. There must then, according to the method of relations, be several A's. For *a* let us assume $A_1+A_2+A_3$ . . .; for *b*, $A_4+A_5+A_6$ . . .; and so on. But what relation can there be among these several A's, which will restore to us the unity of our original A or substance? There is but one; we must assume that the first A of every series is identical, just as the centre is the same point in every radius. In place of the one absolute position, which the common understanding substitutes for the absolute positions of the *n* attributes, we have really a series of two or more positions for each attribute, every series, however, beginning with the same central real (hence the unity of substance in a group of attributes), but each being continued by different reals (hence the plurality of attributes in unity of substance). Where there is the appearance of inherence, therefore, there is always a plurality of reals and no such correlative to substance as attribute or accident. Substantiality is impossible without causality, and to this as its true correlative we now turn.

The common-sense conception of change involves the same contradiction of opposing qualities in one real. The same A that was *a, b, c* . . . becomes *a, b, d* . . .; and this on reflection proves unthinkable. The metaphysical supplementing is also fundamentally as before. Since *c* depended on a series of reals $A_6+A_7+A_8$ . . . in connection with A, and *d* may be said similarly to depend on a series $A_4+A_5+A_6$ . . ., then the change from *c* to *d* means, not that the central real A or any real has changed, but that A is now in connection with A_4, etc., and no longer in connection with A_6, etc.

What happens when a number of reals are in connection? The answer is the second hinge-point of Herbart's theoretical philosophy. What actually happens as distinct from what seems to happen, when two reals A and B are together is that, assuming them to differ in quality, they tend to disturb each other to the extent of that difference, at the same time that each preserves itself intact by resisting the other's disturbance. And so by coming into connection with different reals the "self-preservations" of A will vary accordingly.

Having determined what really is and what actually happens, Herbart next explains synthetically the objective semblance that results from these. If this construction is to be objective, and valid for all intelligences, ontology must furnish us with a clue. This we have in the forms of Space, Time and Motion which are involved whenever we think the reals as being in, or coming into, connection and the opposite. These forms are "intelligible" because valid for all who comprehend the real and actual, although no such forms are predicable of the real and actual themselves. The elementary spatial relation is "the contiguity of two points," so that every "pure and independent line" is discrete. But an investigation of dependent lines which are often incommensurable forces us to adopt the contradictory fiction of partially overlapping, *i.e.* divisible points, or in other words, the conception of Continuity. But this contradiction is one we cannot eliminate by the method of relations, because it does not involve anything real; and in fact as a necessary outcome of an "intelligible" form, the fiction of continuity is valid for the "objective semblance." By its help we comprehend what actually happens among reals to produce the appearance of matter. When three or more reals are together, each disturbance and self-preservation will (in general) be imperfect, *i.e.*, of less intensity than when only two reals are together. But "objective semblance" corresponds with reality; the spatial or external relations of the reals in this case must, therefore, tally with their inner or actual states. Had the self-preservations been perfect, the coincidence in space would have been complete, and the group of reals inextended; or had the several reals been simply contiguous, *i.e.*, without connection, then, as nothing would actually have happened, nothing would appear. Motion, likewise, implicates the contradictory conception of continuity, and cannot, therefore, be a real predicate, though necessary to the comprehension of the objective semblance. For we have to think of the reals as absolutely independent and yet as entering into connections. This we can only do by conceiving them as originally moving through intelligible space in rectilinear paths and with uniform velocities. For such motion no cause need be supposed; motion, in fact, is no more a state of the moving real than rest is, both alike being but relations, with which, therefore, the real has no concern. The changes in this motion, however, for which we *should* require a cause, would be the objective semblance of the self-preservations that actually occur when reals meet. Further, by means of such motion these actual occurrences, which are in themselves timeless, fall for an observer in a definite time—a time which becomes continuous through the partial coincidence of events.

It remains to make good the assumption that we are spectators of the objective semblance and to show the possibility of knowledge. Here, again, a contradictory conception appears, viz., that of the Ego as the identity of knowing and being, and as such the stronghold of idealism. The contradiction is evident when the ego is defined to be a subject (and so a real) that is its own object. The solution the method of relations furnishes is summarily that there are several objects which modify each other, and so constitute that ego we take for the presented real. The subject like all reals is necessarily unknown, but we can know what actually happens when the soul is in connection with other's reals, for its self-

preservations then are what we call sensations. These sensations are the sole material of our knowledge and are given to us in definite groups and series, whence we come to know the relations of those reals, which, though themselves unknown, our sensations compel us to posit.

Herbart regards the doctrine of mental faculties as refuted by his metaphysics, and contends that all psychical phenomena result from the action and interaction of elementary ideas or presentations. The soul being one and simple, its separate acts of self-preservation or primary presentations must be simple too, and its several presentations must become united. If they are of opposite quality, the presentations mutually suppress or obscure each other. The act of presentation then becomes partly an effort, and its product, the idea, becomes in the same proportion less and less intense till equilibrium is reached, and the remainders coalesce. We have thus a mechanics and a statics of mind. In the statics two magnitudes have to be determined: (1) the amount of the suppression or inhibition and (2) the ratio in which this is shared among the opposing presentations. Equilibrium is never quite obtained for those presentations which continue above the threshold of consciousness, while the rest which cannot so continue are speedily driven beyond the threshold. The law according to which a presentation freed from inhibition and rising anew into consciousness tends to raise the other presentations with which it is combined is important. Suppose two presentations p and π united by the residua r and ρ; then the amount of p's "help" to π is r, the portion of which appropriated by π is given by the ratio $\rho : \pi$; and thus the initial help is $\frac{r\rho}{\pi}$.

But after a time t, when a portion of ρ represented by ω has been actually brought into consciousness, the help afforded in the next instant will be found by the equation

$$\frac{r\rho}{\pi} \cdot \frac{\rho - \omega}{\rho} dt = d\omega,$$

from which by integration we have the value of ω.

$$\omega = \rho\left(1 - \epsilon^{-\frac{rt}{\pi}}\right).$$

So that if there are several π's connected with p by smaller and smaller parts, there will be a definite "serial" order in which they will be revived by p; and on this fact Herbart rests all the phenomena of memory and the development of spatial and temporal forms. Emotions and volitions, he holds, are not directly self-preservations of the soul, as presentations are, but variable states of such presentations resulting from their interaction when above the threshold of consciousness. Thus when some presentations tend to force a presentation into consciousness, and others tend to drive it out, that presentation is the seat of painful feeling. Desires are presentations struggling into consciousness against hindrances, and when accompanied by the supposition of success become volitions. Transcendental freedom in Kant's sense is impossible. Self-consciousness is the result of an interaction essentially the same as that which takes place when a comparatively simple presentation finds the field of consciousness occupied by a long-formed and well-consolidated "mass" of presentations. What we call Self is such a central mass.

Aesthetics elaborates the "ideas" involved in the expression of taste called forth by those relations of object which acquire for them the attribution of beauty or the reverse. The beautiful is predicated absolutely and involuntarily by all who have attained the right standpoint. Ethics, the chief branch of aesthetics, deals with such relations among volitions as thus unconditionally please or displease. These relations Herbart reduces to five: (1) *Internal Freedom,* the underlying relation being that of the individual's will to his judgment of it; (2) *Perfection,* the relation being that of his several volitions to each other in respect of intensity, variety and concentration; (3) *Benevolence,* the relation being that between his own will and the thought of another's; (4) *Right,* in case of actual conflict with another; and (5) *Retribution* or *Equity,* for intended good or evil done. The ideas of a final society, a system of rewards and punishments, a system of administration, a system of culture and an "unanimated society," corresponding to the ideas of law, equity, benevolence, perfection and internal freedom respectively, result when we take account of a number of individuals. Virtue is the perfect conformity of the will with the moral ideas. The conception of duty arises from the existence of hindrances to the attainment of virtue. The application of ethics to things as they are with a view to the realization of the moral ideas is moral technology, which includes Politics and Paedagogy. The aim of education should be the cultivation of the good will and the formation of character. Since ideas build up the Ego, an intelligent interest involving the process of observation, expectation, demand and action, should be extended to a variety of subjects.

In *Theology* Herbart held the argument from design to be valid for divine activity and to justify belief in a supersensible real, concerning which, however, exact knowledge is neither attainable nor on practical grounds desirable.

Among the post-Kantians Herbart doubtless ranks next to Hegel in importance. His criticisms are worth more than his constructions; indeed for exactness and penetration of thought he is on a level with Hume and Kant. (J. WAR.; X)

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There is a life of Herbart in Hartenstein's introduction to his *Kleinere philosophische Schriften und Abhandlungen* (1842) and by F. H. T. Allihn in *Zeitschrift für exacte Philosophie* (Leipzig, 1861). *See* also: H. A. Fechner, *Zur Kritik der Grundlagen von Herbart's Metaphysik* (Leipzig, 1853); M. W. Drobisch, *Über die Fortbildung der Philosophie durch Herbart* (Leipzig, 1876); K. S. Just, *Die Fortbildung der Kant'schen Ethik durch Herbart* (Eisenach, 1876); C. Ufer, *Vorschule der Pädagogik Herbarts* (1883; Eng. tr., 1895); L. Strümpell, *Das System der Pädagogik Herbarts* (Leipzig, 1894); J. Christinger, *Herbarts Erziehungslehre und ihre Fortbildner* (Zurich, 1895); H. M. and E. Felkin, *Introduction to Herbart's Science and Practice of Education* (1895); C. de Garmo, *Herbart and the Herbartians* (New York, 1895); E. Wagner, *Vollständige Darstellung der Lehre Herbarts* (1899); J. Adams, *The Herbartian Psychology applied to Education* (1897); F. H. Hayward, *The Meaning of Education as interpreted by Herbart* (1907); W. Kinkel, *J. F. Herbart* (1903); A. Darroch, *Herbart and the Herbartian Theory of Education* (1903); C. J. Dodd, *Introduction to the Herbartian Principles of Teaching* (1904); J. Davidson, *A new Interpretation of Herbart's Psychology, etc.* (1906); R. D. Chalke, *A Synthesis of Froebel and Herbart* (1912). *See* also Überweg, *Grundriss der Gesch. der Phil.* Pt. 4 (1923) containing a full bibliography.

HERBELOT DE MOLAINVILLE, BARTHELEMY D' (1625–1695), French orientalist, was born on Dec. 14, 1625, in Paris. He was educated at the University of Paris, and devoted himself to the study of oriental languages, going to Italy to perfect himself in them by converse with the orientals who frequented its sea-ports. There he also made the acquaintance of Holstenius, the Dutch humanist (1596–1661), and Leo Allatius, the Greek scholar (1586–1669). On his return to France after a year and a half, he was received into the house of Fouquet, superintendent of finance, who gave him a pension of 1,500 livres. On Fouquet's disgrace in 1661, he was appointed secretary and interpreter of Eastern languages to the king. On a second visit to Italy the grand-duke Ferdinand II. of Tuscany presented him with a large number of valuable oriental mss., and tried to attach him to his court. Herbelot, however, was recalled to France by Colbert, and in 1692 he succeeded D'Auvergne in the chair of Syriac, in the Collège de France. He died in Paris on Dec. 8, 1695. His great work is the *Bibliothèque orientale, ou dictionnaire universel contenant tout ce qui regarde la connoissance des peuples de l'Orient,* based mainly on the Arabic dictionary of Hadji Khalfa, which occupied him nearly all his life, and was completed in 1697 by A. Galland.

The *Bibliothèque* was reprinted at Maestricht (1776), and at The Hague (4 vols., 1777–99). The latter edition is enriched with the contributions of the Dutch orientalist Schultens, Johann Jakob Reiske (1716–74), and by a supplement provided by Visdelow and Galland.

HERBERAY DES ESSARTS, NICOLAS DE (d. about 1557), French translator, was born in Picardy. He served in the artillery, and at the expressed desire of Francis I. he translated into French the first eight books of *Amadis de Gaul* (1540–48). His other translations from the Spanish include *L'Amant maltraité de sa mye* (1539); *Le Premier Livre de la chronique de dom Florès de Grèce* (1552); and *L'Horloge des princes* (1555) from Guevara. The *Amadis de Gaul* was translated into English by Anthony Munday in 1619.

HERBERT (Family). Earlier generations of a pedigree which carries the origin of the Herberts to Herbert the Chamberlain, a Domesday tenant, being disregarded, their patriarch may be taken to be one Jenkin ap Adam (temp. Edward III.), who had a small Monmouthshire estate at Llanvapley and the office of master sergeant of the lordship of Abergavenny, a place which gave him precedence after the steward of that lordship.

Sir William Herbert, called by the Welsh Gwilim Ddu or Black William, was a baron in 1461 and a Knight of the Garter in the following year. With many manors and castles on the Marches he had the castle, town and lordship of Pembroke, and after the attainder of Jasper Tudor in 1468 was created earl of Pembroke. When in July 1469 he was taken by Sir John Conyers and the northern Lancastrians on Hedgecote, he was beheaded with his brother Sir Richard Herbert of Coldbrook. The second earl while still a minor exchanged at the king's desire in 1479 his earldom of Pembroke for that of Huntingdon. In 1484 this son of one whom Hall not unjustly describes as born "a mean gentleman" contracted to marry Katharine the daughter of King Richard III., but her death annulled the contract and the earl married Mary, daughter of the Earl Rivers, by whom he had a daughter Elizabeth, whose descendants, the Somersets, lived in the Herbert's castle of Raglan until the cannon of the parliament broke it in ruins. With the second earl's death in 1491 the first Herbert earldom became extinct. The ancestor of the present earls of Pembroke and Carnarvon and of the Herbert who was created marquess of Powis was a natural son of the first earl, one Richard Herbert, whom the restored inscription on his tomb at Abergavenny incorrectly describes as a knight. He was constable and porter of Abergavenny Castle, and his son William, "a mad fighting fellow" in his youth, married a sister of Catherine Parr and thus in 1543 became nearly allied to the king, who made him one of the executors of his will. The earldom of Pembroke was revived for him in 1551.

The honours and titles of this clan of marchmen make a long list. They include the marquessate of Powis, two earldoms with the title of Pembroke, two with that of Powis, and the earldoms of Huntingdon and Montgomery, Torrington and Carnarvon, the viscountcies of Montgomery and Ludlow, fourteen baronies and seven baronetcies. Seven Herberts have worn the Garter. The knights and rich squires of the stock can hardly be reckoned, more especially as they must be sought among Raglans, Morgans, Parrys, Vaughans, Progers, Hugheses, Thomases, Philips, Powels, Gwyns, Evanses and Joneses, as well as among those who have borne the surname of Herbert, a surname which in the 19th century was adopted by the Joneses of Llanarth and Clytha, although they claim no descent from those sons of Sir William ap Thomas for whom it was devised.

HERBERT, EDMOND (1812–1890), French geologist, was born at Villefargau, Yonne, on June 12, 1812. He was educated at the Collège de Meaux, Auxerre, and at the École Normale in Paris. After holding various appointments he was appointed in 1857 professor of geology at the Sorbonne. To him we owe the first definite arrangement of the Chalk into palaeontological zones (*see* Table in *Geol. Mag.*, 1869, p. 200). During his later years he was regarded as the leading geologist in France. He was a member of the Institute, and was three times president of the Geological Society of France in the course of his life. He died in Paris on April 4, 1890.

HERBERT, GEORGE (1593–1633), English poet, was born at Montgomery castle, on April 3, 1593, the fifth son of Sir Richard Herbert and a brother of Lord Herbert of Cherbury. His mother, Lady Magdalen Herbert, a woman of great good sense and sweetness of character, and a friend of John Donne, exercised great influence over her son. Educated privately until 1605, he was then sent to Westminster and in 1609 he became a scholar of Trinity college, Cambridge, where he was made major fellow in 1616. In 1616 he became reader in rhetoric and in 1619 orator for the university. In this capacity he spent most of his time at court, and was not often at Cambridge except when the king was there. He hoped, indeed, that the post would lead for him, as it had for his predecessors, to political advancement; but the death of James I. in 1625 put an end to these hopes and he accepted an appointment as prebendary of Layton Ecclesia (Leighton Bromswold), Huntingdon, where he rebuilt the church. In his Cambridge days he had already written some Latin satiric verses in defence of the universities and the English Church in reply to Andrew Melville's *Anti-Jami-Cami-Categoria.* His friends at this period included Dr. Donne, Sir Henry Wotton, Izaak Walton, Bishop Andrewes and Francis Bacon, who dedicated to him his translation of the Psalms. At Leighton he was within two miles of Little Gidding, and came under the influence of Nicholas Ferrar. There is little doubt that the close friendship with Ferrar had a large share in Herbert's definite adoption of the religious life. We have Herbert's own authority for saying that this period and some space of time after was for him a time of intense religious conflict, out of which eventually came the serenity mirrored in his verse.

In 1630 Charles I., at the instance of the earl of Pembroke, whose kinsman Herbert was, presented him to the living of Fugglestone with Bemerton, near Salisbury, and he was ordained priest in September. A year before, after three days' acquaintance, he had married Jane Danvers, whose father had been set on the marriage for a long time. The story of the poet's life at Bemerton, as told by Walton, is one of the most exquisite pictures in literary biography. He devoted much time to explaining the meaning of various parts of the prayer-book, and held services twice every day, at which many of the parishioners attended, and some "let their plough rest when Mr. Herbert's saints-bell rung to prayers, that they might also offer their devotions to God with him."

Next to Christianity itself he loved the English Church. He was passionately fond of music, and his own hymns were written to the accompaniment of his lute or viol. He usually walked once or twice a week to attend the cathedral at Salisbury and before returning home, would "sing and play his part" at a meeting of music lovers. Walton illustrates his kindness to the poor by many touching anecdotes, but he had not been three years at Bemerton when he succumbed to consumption. He was buried beneath the altar of his own church on March 3, 1633.

None of Herbert's English poems was published during his lifetime. On his death-bed he gave to Nicholas Ferrar a manuscript with the title *The Temple; Sacred Poems and Private Ejaculations,* published at Cambridge, apparently for private circulation, almost immediately after Herbert's death. *The Temple* is a collection of religious poems connected by unity of sentiment and inspiration. There is apparent throughout great neatness of execution, particularly in the conclusion, which often comes as a surprise. Herbert was thoroughly imbued with the "metaphysical" tendencies of the age. He was a notable amateur of the "conceit," which, like Donne, he "transplanted" to religious uses. Nothing in his own church at Bemerton was too commonplace to serve as a starting-point for the epigrammatic expression of his piety. The church key reminds him that "it is my sin that locks his handes," and the stones of the floor are patience and humility, while the cement that binds them together is love and charity. The same use is made of illustrations from everyday life, and the curious store of medical and chemical information beloved of the time.

Bibliography.—Nicholas Ferrar's translation (1638) of the *Hundred and Ten Considerations . . .* of Juan de Valdes contained a letter and notes by Herbert. In 1652 appeared *Herbert's Remains; or, Sundry Pieces of that Sweet Singer of the Temple, Mr. George Herbert.* This included *A Priest to the Temple; or, The Country Parson, his Character, and Rule of Holy Life,* in prose; *Jacula prudentum,* a collection of

proverbs with a separate title-page dated 1651, which had appeared in a shorter form as *Outlandish Proverbs* in 1640; and some miscellaneous matter. The most complete edition of his works is that by Dr. A. B. Grosart in 1874, this edition of the poetical works being reproduced in the "Aldine edition" in 1876. *The English Works of George Herbert . . .* (3 vols., 1905) were edited in much detail by G. H. Palmer. A contemporary account of Herbert's life by Barnabas Oley was prefixed to the *Remains* of 1652, but the classic authority is Izaak Walton's *Life of Mr. George Herbert,* published in 1670, with some letters from Herbert to his mother. *See* also A. G. Hyde, *George Herbert and his Times* (1907), and the "Oxford" edition of his poems by A. Waugh (1908).

HERBERT, SIR THOMAS (1606–82), English traveller and author, born at York in 1606, became a commoner of Jesus college, Oxford, in 1621, but afterwards removed to Cambridge. In 1627 he joined the suite of Sir Dodmore Cotton, then starting as ambassador for Persia with Sir Robert Shirley. Sailing in March they visited the Cape, Madagascar, Goa and Surat; landing at Gambrun (Jan. 10, 1627–28), they travelled inland to Ashraf and thence to Kazvin, where both Cotton and Shirley died, and whence Herbert made extensive travels in the Persian Hinterland, visiting Kashan, Bagdad, etc. On his return voyage he touched at Ceylon, the Coromandel coast, Mauritius and St. Helena. He reached England in 1629, travelled in Europe in 1630–31, married in 1632 and retired from court in 1634. After this he resided on his Tintern estate and elsewhere till the Civil War, siding with the parliament till his appointment to attend on the king in 1646. He was rewarded with a baronetcy at the Restoration (1660). He died at Petergate house, York, on March 1, 1682.

Herbert's chief work is the *Description of the Persian Monarchy now beinge: the Orientall Indyes, Iles and other parts of the Greater Asia and Africk* (1634), reissued with additions, etc., in 1638 as *Some Yeares Travels into Africa and Asia the Great (also into divers parts of Asia and Afrique)*; a third edition followed in 1664, and a fourth in 1677. Among its illustrations are remarkable sketches of the dodo, cuneiform inscriptions and Persepolis.

See Robert Davies' account of Herbert in *The Yorkshire Archaeological and Topographical Journal* (1870), containing a facsimile of the inscription on Herbert's tomb; Wood's *Athenae,* iv.; and *Fasti,* ii.

HERBERT, VICTOR (1859–1924), American musical composer, was born in Dublin, Ireland, Feb. 1, 1859. His musical education was received in Germany, where he studied under the leading masters. He became principal violoncello player in the court orchestra, Stuttgart, also appearing as a soloist on the concert platform in European musical centres. In 1886 he accepted a position as solo violoncellist in the Metropolitan orchestra, New York city. He organized Victor Herbert's New York orchestra in 1904. Of a number of light operas he composed, his greatest successes were *Babes in Toyland* (1903), *Mlle. Modiste* (1905), and *The Red Mill* (1906). In 1911 he wrote a grand opera, *Natoma.* More successful, however, was the music which he composed for the photoplay *The Birth of a Nation.* In his later years he composed much for musical revues. He died in New York city May 26, 1924.

HERBERT OF CHERBURY, EDWARD HERBERT, BARON (1583–1648), English soldier, diplomatist, historian and religious philosopher, eldest son of Richard Herbert of Montgomery Castle (a member of a collateral branch of the family of the earls of Pembroke), was born at Eyton-on-Severn on March 3, 1583, and educated at University college, Oxford. On the accession of James I. he presented himself at court and was created a knight of the Bath in 1603. In 1608 he went to Paris where he was entertained by Henry IV. In 1610 he served as a volunteer in the Low Countries under the prince of Orange, whose intimate friend he became, and distinguished himself at the capture of Juliers from the emperor. He then travelled in Italy, and two years after his return to England in 1617, Buckingham made him ambassador at Paris, but a quarrel with de Luynes occasioned his recall in 1621. After the death of de Luynes, Herbert resumed his post in Feb. 1622, and tried to accomplish the union between Charles and Henrietta Maria and secure the assistance of Louis XIII. for the unfortunate elector palatine. On being dismissed in April 1624, he received the Irish peerage of Castle island in 1624 and the English barony of Cherbury, or Chirbury, in 1629. In 1632 he was appointed a member of the council of war. He attended the king at York in 1639, and in May 1642 was imprisoned by the parliament for urging the addition of the words "without cause" to the resolution that the king violated his oath by making war on parliament. He retired to Montgomery Castle, and declined the king's summons. On Sept. 5, 1644, he surrendered the castle to the parliamentary forces. He died in London on Aug. 20, 1648.

Lord Herbert's most important work is the *De veritate prout distinguitur a revelatione, a verisimile, a possibile et a falso* (1624) which combines a theory of knowledge with a partial psychology, a methodology for the investigation of truth, and a scheme of natural religion. His other writings include the *De religione gentilium* (1663), a natural history of religion; *Expeditio Buckinghami ducis* (1656); *Life and Raigne of Henry VIII.* (1649) based on authentic papers; a volume of poems (1665) and an autobiography, first published by Horace Walpole in 1764, and edited by Sidney Lee (1886, 2nd ed. 1907). His English and Latin poems have been recently edited by G. C. Moore Smith (Oxford, 1923).

See Lee's article in *Dict. National Biography;* C. de Rémusat, *Lord Herbert de Cherbury* (1874) and C. Güttler, *Eduard, Lord Herbert von Cherbury* (1897).

HERBERT OF LEA, SIDNEY HERBERT, 1ST BARON (1810–1861), English statesman, was the younger son of the 11th earl of Pembroke. Educated at Harrow and Oriel, Oxford, he made a reputation at the Oxford Union as a speaker, and entered the House of Commons as Conservative member for a division of Wiltshire in 1832. Under Peel he held minor offices, and in 1845 was included in the cabinet as secretary for war, and again held this office in 1852–1855, being responsible for the War Office during the Crimean difficulties, and in 1859. It was Sidney Herbert who sent Florence Nightingale out to the Crimea, and he led the movement for War Office reform after the war, the hard work entailed causing his breakdown in health, so that in July 1861, having been created a baron, he had to resign office, and died on Aug. 2, 1861.

See Lord Stanmore, *Life of Lord Herbert of Lea* (1906). *See* also references under NIGHTINGALE, FLORENCE.

HERBERTON, a small mining town of Cardwell county, Queensland, Australia, 55 m. S.W. of Cairns. Tin was discovered in the locality in 1879, and has been worked together with some copper, bismuth, silver and gold.

HERCEGOVINA: *see* BOSNIA, HERCEGOVINA.

HERCULANEUM, an ancient city of Italy, situated about two-thirds of a mile from the Portici station of the railway from Naples to Pompeii. The small part of the city, which was investigated at the spot called *Gli scavi nuovi* (the new excavations) was discovered in the 19th century. But the more important works were executed in the 18th century; and of the buildings then explored at a great depth, by means of tunnels, none is visible except the theatre, the orchestra of which lies 85 ft. below the surface.

Herculaneum was a small city of Campania between Neapolis and Pompeii, situated between two streams at the foot of Vesuvius on a hill overlooking the sea with a safe harbour. It fell under the power of Rome during the Samnite wars. It remained faithful to Rome for a long time, but it joined the Italian allies in the Social War. Having submitted anew in June of the year 665 (88 B.C.), it appears to have been less severely treated than Pompeii. It enjoyed great prosperity towards the close of the republic and in the earlier times of the empire, since many splendid villas were built here, one belonging to the imperial house, another to the family of Calpurnius Piso. By means of the Via Campana it had easy communication north-westward with Neapolis, Puteoli and Capua, and thence by the Via Appia with Rome; and southwards with Pompeii and Nuceria, and thence with Lucania and the Bruttii In the year A.D. 63 it suffered terribly from an earthquake; and hardly had it completed the restoration of some of its principal buildings when it fell beneath the great eruption of the year 79, described by Pliny the younger (*Ep.* vi. 16, 20), in which Pompeii also was destroyed, with other cities of

Campania. On August 23 Pliny the elder, who had command of the Roman fleet at Misenum, set out to render assistance to Rectina and others dwelling on that coast, but, as there was no escape by sea, the harbour having been filled up, he was obliged to abandon those who had managed to flee from their houses, overwhelmed in a moment by the material poured forth by Vesuvius. Thus, while many made their escape from Pompeii (which was overwhelmed by the fall of the small stones and afterwards by the rain of ashes), comparatively few could manage to escape from Herculaneum, and these found shelter in Neapolis, where they inhabited a quarter called after the buried city. The name of Herculaneum, which for some time remained attached to the site of the disaster, is mentioned in the later itineraries.

In 1719, while Prince Elbeuf was seeking crushed marble, he learned from the peasants that there were in the vicinity some pits from which they had extracted many statues. In 1738, excavations were begun on the spot. At first it was believed that a temple was being explored, but afterwards the inscriptions proved that the building was a theatre, and many scholars hastened to Naples to see the marvellous statues of the Balbi and the paintings on the walls. Bernardo Tanucci, secretary of state in 1755, founded the Accademia Ercolanese, which published the principal works on Herculaneum (*Le Pitture ed i bronzi d' Ercolano*, 8 vols., 1757–1792; *Dissertationis isagogicae ad Herculanensium voluminum explanationem pars prima*, 1797). The excavations, which continued for more than forty years (1738–1780), were executed at first under Alcubierre (1738–1741), and then with the assistance of the engineers Rorro and Bardet (1741–1745), Carl Weber (1750–1764), and Francesco La Vega. After the death of Alcubierre (1780) the last-named was appointed director-in-chief, but from that time the investigations at Herculaneum were intermitted, and the researches at Pompeii were vigorously carried on. Resumed in 1827, the excavations at Herculaneum were shortly afterwards suspended, nor were the new attempts made in 1866 attended with any success. The antiquities excavated at Herculaneum in the 18th century form a collection of the highest scientific and artistic value. They come partly from the buildings of the ancient city (theatre, basilica, houses and forum), and partly from the private villa of a great Roman family (*cf.* Comparetti and de Petra, *La Villa Ercolanese dei Pisoni*, Turin, 1883). From the city come, among many other marble statues, the two equestrian statues of the Balbi and the great imperial and municipal bronze statues. Mural paintings of extraordinary beauty were also discovered here, such as those that represent Theseus after the slaughter of the Minotaur, Chiron teaching Achilles the art of playing on the lyre and Hercules finding Telephus who is being suckled by the hind.

The monochromes of Herculaneum remain among the finest specimens of the exquisite taste and consummate skill displayed by the ancient artists. Among the best preserved is Leto and Niobe. The Villa Suburbana has given up a good number of marble busts, and the so-called statue of Aristides, but above all that splendid collection of bronze statues and busts (mostly reproductions of famous Greek works) now to be found in the Naples Museum, the reposing Hermes, the drunken Silenus, the sleeping Faunus, the dancing girls, the bust called Plato, that wrongly believed to be Seneca, the two quoit-throwers or discoboli, and other masterpieces. But a still further discovery made in the Villa Suburbana contributed to magnify the greatness of Herculaneum; within its walls was found the famous library, of which, counting both entire and fragmentary volumes, 1,803 papyri are preserved. Among the nations which took the greatest interest in the discovery of the Herculaneum library, the most honourable rank belongs to England, which sent Hayter and other scholars to Naples to hasten the publication of the volumes. Of the 341 papyri which have been unrolled, 195 have been published (*Herculanensium voluminum quae supersunt* [Naples, 1793–1809]; *Collectio altera*, 1862–1876). They contain works by Epicurus, Demetrius, Polystratus, Colotes, Chrysippus, Carniscus and Philodemus. The names of the authors are in themselves sufficient to show that the library belonged to a person whose principal study was the Epicurean philosophy. But of the great master of this school only a few works have been found. Of his treatise Περὶ φύσεως, divided into 37 books, it is known that there were three copies in the library. Even the other authors above mentioned are but poorly represented, with the exception of Philodemus, of whom 26 different treatises have been recognized. But all these philosophic discussions, belonging for the most part to an author less than secondary among the Epicureans, fall short of the high expectations excited by the first discovery of the library. Among the many volumes unrolled only a few are of historical importance—that which treats of the philosophers of the Academy and that which deals with the Stoics. There are in the library some volumes written in Latin, all so damaged that hardly any of them can be deciphered. One with verses relating to the battle of Actium is believed to belong to a poem of Rabirius. The plan of the villa is the only satisfactory document for the topography of Herculaneum.

The most important reference work is C. Waldstein and L. Shoobridge, *Herculaneum, Past, Present and Future* (1908); it contains full references to the history and the explorations, and to the buildings and objects found (with illustrations). Miss E. R. Barker's *Buried Herculaneum* (1908) is exceedingly useful. Excavations were resumed by the Italian Government in 1927, and interesting buildings found.

HERCULANO DE CARVALHO E ARAUJO, ALEXANDRE (1810–1877), Portuguese historian, was born in Lisbon of humble stock, his grandfather having been a foreman stonemason in the royal employ. In 1831 under the absolute rule of D. Miguel, Herculano had to take refuge in England and France. In 1832 he accompanied the Liberal expedition to Terceira as a volunteer, and was one of D. Pedro's famous army of 7,500 men who landed at Mindello and occupied Oporto. He published his first volume of verses, *A Voz do Propheta*, in 1836, and two years later another entitled *A Harpa do Crente*. In 1837 he founded the *Panorama* in imitation of the *English Penny Magazine*, and there and in *Illustração* he published the historical tales which were afterwards collected into *Lendas e Narrativas* (1851); in the same year he became royal librarian at the Ajuda Palace. On entering parliament in 1840 he resigned the editorship of *Panorama* to devote himself to history.

Herculano introduced the historical novel into Portugal in 1844 by a book written in imitation of Walter Scott. *Eurico* treats of the fall of the Visigothic monarchy and the beginnings of resistance in the Asturias, while the *Monge de Cister* (1848) describes the time of King John I. Herculano had greater book learning than Scott, but lacked descriptive talent and skill in dialogue. These and editions of two old chronicles, the *Chronica de D. Sebastião* (1839) and the *Annaes del rei D. João III.* (1844), prepared Herculano for his life's work, and the year 1846 saw the first volume of his *History of Portugal*, a book written on critical lines and based on documents. Serious students in Portugal and abroad welcomed the book as an historical work of the first rank, but the first volume gave rise to a celebrated controversy, because Herculano had reduced the famous battle of Ourique to a mere skirmish, and denied the apparition of Christ to King Alphonso. Herculano was denounced from the pulpit and the press; in a letter to the cardinal patriarch of Lisbon entitled *Eu e o Clero* (1850), he denounced the fanaticism and ignorance of the clergy in plain terms. The second volume of his history appeared in 1847, the third in 1849 and the fourth in 1853. His *History of the Origin and Establishment of the Inquisition* (1854–55) was compiled, as the preface showed, to stem the Ultramontane reaction. In 1856 he began editing a series of *Portugaliae monumenta historica*, but personal differences between him and the keeper of the Archive office, which he was forced to frequent, caused him to interrupt his historical studies, and on the death of his friend King Pedro V. he left the Ajuda and retired to a country house at Val de Lobos near Santarem. His protest against the Concordat of Feb. 21, 1857, between Portugal and the Holy See, his successful opposition to the entry of foreign religious orders, and his advocacy of civil marriage, were the chief landmarks in his battle with Ultramontanism, and his *Estudos sobre o Casamento Civil* were put on the Index. Finally in 1871 he attacked the dogmas

of the Immaculate Conception and Papal infallibility, and fell into line with the Old Catholics.

A rare capacity for tedious work, a dour Catonian rectitude, a passion for truth, pride, irritability at criticism and independence of character, are the marks of Herculano as a man. He could be broken but never bent, and his rude frankness accorded with his hard, sombre face, and alienated men's sympathies though it did not lose him their respect. His lyrism is vigorous, sensitive, austere and almost entirely subjective and personal, while his pamphlets are distinguished by energy of conviction, strength of affirmation, and contempt for weaker and more ignorant opponents. His *History of Portugal,* by its style a Portuguese classic, is a great but incomplete monument (it ends with the year 1279). A lack of imagination and of the philosophic spirit prevented him from penetrating or drawing characters, but his analytical gift, joined to persevering toil and honesty of purpose, enabled him to present a faithful account of ascertained facts and a satisfactory and lucid explanation of political and economic events. He is the greatest modern historian of Portugal and the Peninsula.

See A. Romero Ortiz, *La Literatura Portuguesa en el siglo xix.* (1869); Antonio de Serpa Pimentel, *Alexandre Herculano e o seu tempo* (1881); Moniz Barreto in *Revista de Portugal* (July 1889). A definitive edition of the *Historia de Portugal* was published by Prof. David Lopes in 8 illus. vols. (1914–16). (E. P.; A. B)

HERCULES, the latinized form of the Greek HERACLES, the most famous Greek hero. His name (Gr. Ἡρακλῆς, probably "glorious gift of Hera," *cf.* Diocles) shows that he cannot be originally a god, since no Greek god ever has a name compounded of that of another deity. Probably a real man, a chieftain of Tiryns in Mycenaean times and vassal to Argos, lies behind the very complicated mythology of Heracles. As told in later ages, the story in its main outline runs as follows:

Zeus loved Alcmene, wife of Amphitryon of Tiryns, who at the time was living in exile at Thebes. Taking the shape of Amphitryon, he begat a son who he intended should be lord of the Argolid; but by a trick of Hera that position was won for Eurystheus, who was born shortly before Heracles. Hera pursued Heracles with her hatred In his cradle she sent serpents to kill him, which, however, he despatched. In young manhood, after his first adventure (the killing of the lion of Mt. Cithaeron), Heracles won for his wife Megara, daughter of Creon, king of Thebes, but again Hera interfered, and in a fit of madness sent by her he murdered Megara and her children. For this or for some other reason he became the servant of Eurystheus, son of Sthenelus and king of Argos. The numerous tasks imposed by his master were arranged at some unknown but not early date in antiquity into a cycle of 12 (the 12 Labours or *Dodekathlos*), usually in the following order: 1, capture of the lion of Nemea; 2, the Hydra of Lerna; 3, capture of the hind (or stag) of Arcadia; 4, capture of the boar of Erymanthus; 5, cleansing of Augeias' stables in Elis; 6, shooting the birds of Stymphalus (so far we have Peloponnesian adventures only, and these are probably the oldest); 7, capture of the Cretan bull; 8, capture of the mares of Diomedes in Thrace; 9, taking the girdle of Hippolyte, queen of the Amazons; 10, seizing the cattle of Geryon; 11, bringing the apples of the Hesperides; 12, fetching up Cerberus from the lower world. It will be seen that the last two take place in the other world; there is little doubt that they represent a forcible seizure of immortality, and are parallel to the adventure mentioned by Homer (*Iliad,* v., 395) in which he fights and wounds Hades.

Subsidiary to the *Dodekathlos* is a series of minor adventures called *Parerga.* For example, during the 4th labour, he met and fought the Centaurs; during the 11th, he wrestled with the giant Antaeus. A further series of enterprises, undertaken after he was freed from the service of Eurystheus, are known as πράξεις. These include the campaigns against Troy, Elis and Pylos. Other notable incidents are his struggle with Apollo for the sacred tripod at Delphi, stopped by Zeus throwing a thunderbolt between the combatants, and his share in various famous exploits, such as the battle of the gods and giants, and the Argonautic expedition. His last series of adventures was as follows:

His second wife was Deianeira, daughter of Oeneus king of Calydon, for whom he wrestled with her other suitor, the river Achelous. As he was taking her home, the centaur Nessus tried to violate her, and was shot by Heracles with an arrow dipped in the venom of the Hydra. Dying, the centaur bade Deianeira take the blood from his wound and keep it safe, for anyone wearing a garment rubbed with it would love her for ever. Years after, when Hyllus and several other children had been born to them, Heracles fell madly in love with Iole, daughter of Eurytus king of Oechalia. He was repulsed by Eurytus when he demanded her, and the matter was further complicated by his killing Eurytus' son, for which he had to go into exile for a year, as slave to the Lydian queen Omphale, who set him to do women's work. According to some accounts, Heracles loved her and served her to gain her favours Returning, he captured Oechalia and took Iole prisoner. Deianeira realized that she was a dangerous rival, and sent Heracles a garment smeared with the blood of Nessus. This was a powerful poison, and Heracles was seized with terrible agonies At last he had himself brought up to the top of Mt. Oeta where a huge pyre was built. On this he was put and induced a shepherd, Poeas, with the gift of his bow and arrows, to light it. His mortal part was burned, but his divine part ascended to heaven, was reconciled to Hera, and wedded Hebe. The story of the burning is connected with a very ancient ceremony on Oeta at which victims and also puppets in human shape were burned; *see* Nilsson in *Journ. Hell. Studies,* xliii. (1923) p. 144. This is the latest form of the persistent theme of the winning of immortality.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

HERCULES RESTING. FROM A CAST MODELLED AFTER A ROMAN BRONZE STATUE IN THE NAPLES MUSEUM

Even this short sketch shows how complex the saga is. The Peloponnesian adventures may well be in origin an exaggerated account of the exploits of a real man, a great fighter and hunter; many of the others may have been originally accredited to some local hero, afterwards absorbed by Heracles. The incident of Omphale sounds like the tale of some Oriental mother-goddess and her male consort. There are several other traces of Heracles being identified with foreign gods; *e.g.,* he is equated with the Phoenician Melqart.

In cult, he is sometimes a hero, sometimes a god; Athens claimed to have been the first to give him divine honours. His titles are numerous, among the most characteristic being ἀλεξίκακος (averter of evil, also a title of Apollo) and καλλίνικος (nobly victorious). In art and literature, he is represented as an enormously strong man, of moderate height, a huge eater and drinker, very amorous, generally kindly but with occasional outbursts of brutal rage. He generally wears the skin of the Nemean lion; his characteristic weapon is the bow, frequently also the club (whether this is original or not, is doubtful). Numerous representations of him survive; of statues the most notorious is the hideous muscle-bound figure, now at Naples, known as the Farnese Hercules.

There is another Heracles, one of the Idaean Dactyli, who has only the name in common with the son of Alcmene.

In Italy, his name is corrupted in various ways, the most familiar being the Latin Hercules. He is worshipped as a god only, hero-cult not being Italian, and is principally a god of merchants and traders, although others also pray to him for his characteristic gifts of good luck or rescue from danger. Tithes of commercial profits, etc., were often presented to him, and feasts held in his honour. His best-known cult was at the Ara

Maxima, in the Forum Boarium at Rome. Though very early, this cult is probably not to be identified with that of any native deity. Late and artificial legends represented him as returning from the raid on Geryon's cattle by way of Italy, visiting the future site of Rome and there introducing more humane rites in place of human sacrifices and teaching Evander's people to worship himself, having earned their gratitude by killing the monster Cacus (really an ancient fire-god).

For Heracles *see* especially Preller-Robert, *Griechische Mythologie*, ii., p. 421 foll.; L. R. Farnell, *Hero-Cults*, p. 95 foll.; the arts. HERAKLES, HERCULES in the various classical dictionaries may also be consulted with profit. Add for some points B. Schweitzer, *Herakles* (Tübingen, 1922). For Hercules, *see* Preller-Jordan, *Römische Mythologie*, ii., p. 278 foll.; Wissowa, *Religion u. Kultus*, p. 271 ff. All these works contain references to the older literature, classical and modern. (H. J. R.)

Hercules was a favourite figure in French mediaeval literature. In the romance of Alexander the tent of the hero is decorated with incidents from his adventures. In the prose romance *Les Prouesses et vaillances du preux Hercule* (Paris, 1500), the hero's labours are represented as having been performed in honour of a Boeotian princess; Pluto is a king dwelling in a dismal castle; the Fates are duennas watching Proserpine; the entrance to Pluto's castle is watched by the giant Cerberus. Hercules conquers Spain and takes Merida from Geryon. The book is translated into English as *Hercules of Greece* (n.d.). Fragments of a French poem on the subject will be found in the *Bulletin de la soc. des anciens textes français* (1877). Don Enrique de Villena took from *Les Prouesses* his prose *Los Doze Trabajos de Hercules* (Zamora, 1483 and 1499), and Fernandez de Heredia wrote *Trabajos y afanes de Hercules* (Madrid, 1682), which belies its title, being a collection of adages and allegories. *Le Fatiche d'Ercole* (1475) is a romance in poetic prose by Pietro Bassi, and the *Dodeci Travagli di Ercole* (1544), a poem by J. Perillos.

HERCULES, in astronomy, a constellation of the northern hemisphere. Represented by a man kneeling, this constellation was first known as "the man on his knees," and was afterwards designated Cetheus, Theseus and Hercules by the ancient Greeks. Hercules contains a famous globular star-cluster (Messier 13) which is the finest example in the northern hemisphere. The sun's motion through space is directed towards a point in this constellation.

HERCZEG, FERENCZ (1863–), Hungarian novelist and dramatist, was born at Versecz (Viršet) on Sept. 22, 1863, of a family of German extraction. He became honorary president of the Petöfi Society and a member of the Hungarian Academy. He was several times elected a deputy and in his review, *Magyar Figyelö*, supported Count Tisza. He was a master of the psychological novel. Among the most notable of his historical novels are *Pogányok* (The Pagans) (1902) and *A hét svób* (The Seven Swabians), while his tragedy *Byzance* (1912) is considered a masterpiece. His novels and plays have been translated into nearly every European language.

HERD, a number of animals of one kind driven or fed together, usually applied to cattle but used also of whales, porpoises, etc., and of birds, as swans, cranes and curlews. A "herd-book" is a book containing the pedigree and other information of any breed of cattle or pigs.

HERDER, JOHANN GOTTFRIED VON (1744–1803), German poet and philosopher, was born at Mohrungen, East Prussia, on Aug. 25, 1744, of poor parents. The hardships of his early years drove him to introspection and to communion with nature, and thus favoured a more than proportionate development of the sentimental and poetic side of his mind. In 1762 he went to Königsberg to study medicine, but soon, with the help of friends, he abandoned it for theology and philosophy. At Königsberg he came under the influence of Kant and was stimulated to fresh critical enquiry by his revolutionary ideas in philosophy. To Kant's lectures and conversations he also owed something of his large interest in cosmological and anthropological problems. He was still more influenced by J. G. Hamann, "the northern Mage," a vague, incoherent, yet gifted writer from whom Herder acquired some of his strong feeling for the naïve element in poetry, and for the earliest developments of national literature. Even before he went to Königsberg he had begun to write verse; his first published writings were occasional poems and reviews for the *Königsbergische Zeitung*.

On leaving the university Herder became assistant master at the cathedral school of Riga, and a few years later, assistant pastor. In 1767 he published his first considerable work, *Fragmente über die neuere deutsche Literatur*, which secured the interest of Lessing. From this time he continued to pour forth a number of critical writings on literature, art, etc. His bold ideas, which were a great advance even on Lessing's doctrines, excited hostile criticism, which took the form of aspersions on his religious orthodoxy, and he resolved to leave Riga. He contemplated at this time a radical reform of social life in Livonia, which (after the example of Rousseau) he thought to effect by better educational methods, and he visited France, England, Holland, etc., to study their systems of education. During his voyage to France he first shaped his idea of the genesis of primitive poetry, and of the gradual evolution of humanity. But he was turned aside from these plans of practical social reform by an offer of a post as travelling tutor and chaplain to the young prince of Eutin-Holstein. His new duties led him to Strasbourg, where he met the young Goethe, on whose poetical development he exercised so potent an influence. (*See* GOETHE.) At Darmstadt he made the acquaintance of Caroline Flachsland, his future wife. He soon (1771) threw up his tutorship for an appointment as court preacher and member of the consistory at Bückeburg where he encountered opposition from the orthodox clergy and their followers. His health continued poor, and he suffered from a fistula in the eye. Pecuniary difficulties delayed his marriage and added to his depression.

He was attracted by the poetry of the north, more particularly Percy's *Reliques*, the poems of "Ossian" (the genuineness of which he did not doubt) and the works of Shakespeare. Under these influences he broke with classicism, and became the pioneer of the new *Sturm und Drang* movement. He inspired a band of young writers at Darmstadt and Frankfort, including Goethe, who in a journal of their own sought to diffuse the new ideas, and finally brought about the release of German literature from the imitation of French classicism.

Herder had married in 1773. Three years later he obtained through Goethe's influence the post of general superintendent and court preacher at Weimar, where he passed the rest of his life. There he enjoyed the society of Goethe, Wieland, Jean Paul (who came to Weimar in order to be near Herder), and the patronage of the court. Yet the social atmosphere of the place did not suit him; his personal relations with Goethe again and again became embittered. This, added to ill-health, intensified his natural irritability, and the history of his later Weimar days is a rather dreary chronicle. At Weimar he made his collection of popular poetry, *Stimmen der Völker in Liedern* (1778–79); his translation of the Spanish romances of the *Cid* (1805); and wrote his important but unfinished work on Hebrew poetry, *Vom Geist der hebräischen Poesie* (1782–83); and his *opus magnum*, the *Ideen zur Philosophie der Geschichte der Menschheit* (4 vols., 1784–91). Towards the close of his life he occupied himself, like Lessing, with philosophy and theology. The boldness of some of his ideas cost him some valuable friendships, as that of Jacobi, Lavater and even of his early teacher Hamann. He died on Dec. 18, 1803.

His Works.—Herder's writings were for a long time regarded principally as of great interest in the history of the Romantic movement, and their permanent value was perhaps underestimated. They may be arranged in an ascending series, corresponding to the way in which the genetic or historical idea, which he may be said to have originated, was developed. First come the works on poetic literature, art, language and religion as special regions of development. Secondly, we have in the *Ideen* a general account of the process of human evolution. Thirdly, there are writings which may be said to supply the philosophic basis of his leading ideas.

1. In the region of poetry Herder sought to persuade his countrymen, both by example and precept, to return to a natural and spontaneous form of utterance. His own poetry has but little value; Herder was a skilful verse-maker but hardly a creative poet. He was most successful in his translation of popular song, in which he shows a rare sympathetic insight into the feelings and ideas of peoples as unlike as Greenlanders and Spaniards, Indians and Scots. In the *Fragmente über die neuere deutsche Literatur* (1767)

he aims at nationalizing German poetry and freeing it from extraneous influence. He ridicules the ambition of German writers to be classic, as Lessing had ridiculed their eagerness to be French. He looked at poetry as a kind of "proteus among the people, which changes its form according to language, manners, habits, according to temperament and climate, nay, even according to the accent of different nations." This fact of the idiosyncrasy of national poetry he illustrated with great fulness in the case of Homer, the nature of whose works he was one of the first to elucidate, the Hebrew poets, and the poetry of the north as typified in "Ossian." This same idea of necessary relation to national character and circumstance is also applied to dramatic poetry, and more especially to Shakespeare, whose essentially modern and Teutonic character Herder brings out.

2. The views on art in Herder's *Kritische Wälder* (1769), *Plastik* (1778), etc., are valuable as a correction of the excesses into which reverence for Greek art had betrayed Winckelmann and Lessing, by help of his fundamental idea of national idiosyncrasy. He argued against the setting up of classic art as an unchanging type, universally valid, and emphasized the excellences of Gothic art. Beyond this, he pleaded the cause of painting as a distinct art, which Lessing in his desire to mark off the formative arts from poetry and music had confounded with sculpture. He regarded painting as less real than sculpture, because lacking the third dimension of space, and admitting of much greater freedom of treatment. Herder appreciated the early German painters, and helped to awaken the modern interest in Dürer.

3. By his *Über den Ursprung der Sprache* (1772), Herder laid the rude foundations of the science of comparative philology and of the ultimate nature and origin of language. Directed against the supposition of a divine communication of language to man, it argues that speech is a necessary outcome of that special arrangement of mental forces which distinguishes man, and more particularly of his habits of reflection. "If," Herder says, "it is incomprehensible to others how a human mind could invent language, it is as incomprehensible to me how a human mind could be what it is without discovering language for itself."

4. Herder also laid the foundations of a comparative science of religion and mythology. He rejected Hume's notion that religion sprang out of the fears of primitive men, in favour of the theory that it represents man's first attempts to explain phenomena. He thus associated religion with mythology and primitive poetry. Later forms of religion owed their vitality to their embodiment of the deep-seated moral feelings of our common humanity. His appreciation of Christianity rested on a belief in its essential humanity. In later life he found his way to a speculative basis for his religious beliefs.

5. Herder's masterpiece, the *Ideen zur Philosophie der Geschichte,* aims at explaining human development in connection with the nature of man's physical environment. Man is viewed as a part of nature, and his widely differing forms of development as strictly natural processes. Herder's philosophy thus stands in contrast to the anthropology of Kant, which regards human development as the gradual manifestation of a growing faculty of rational free will. The *Ideen* shows Herder as an evolutionist after the manner of Leibnitz, and not after that of more modern evolutionists. The lower forms of life prefigure man in unequal degrees of imperfection; they exist for his sake, but do not represent necessary antecedent conditions of human existence. The genetic method is applied to varieties of man, not to man as a whole. Herder in his provokingly tentative way of thinking comes near to ideas propounded by Spencer and Darwin. His account of the first dawnings of culture, and of the ruder oriental civilizations, is marked by genuine insight, but his account of the development of classic culture is less skilful.

6. Of Herder's properly metaphysical speculations little needs to be said. He had no accurate knowledge either of Spinoza, whose monism he advocated, or of Kant, whose critical philosophy he fiercely attacked. Herder's Spinozism, set forth in *Vom Erkennen und Empfinden der menschlichen Seele* (1778), is much less logically conceived than Lessing's. It is the religious aspect which attracts him, the presentation in God of an object which at once satisfies the feelings and the intellect. With respect to his attacks on the critical philosophy in the *Metakritik zur Kritik der reinen Vernunft* (1799), it is easy to understand how his concrete mind, ever alive to the unity of things, instinctively rebelled against that analytic separation of the mental processes which Kant attempted. However crude this critical investigation, it helped to direct philosophic reflection to the unity of mind, and so to develop post-Kantian speculation. Herder was much attracted by Schelling's early writings, but appears to have disliked Hegelianism because of the atheism it seemed to involve. In the *Kalligone* (1800), a work directed against Kant's *Kritik der Urteilskraft,* Herder argues for the close connection of the beautiful and the good. To his mind the content of art, which he conceived as human feeling and human life in its completeness, was much more valuable than the form, and so he naturally emphasized the moral element in art. Thus his theoretic opposition to the Kantian aesthetics is but the reflection of his practical opposition to the form-idolatry of the Weimar poets.

BIBLIOGRAPHY.—Herder's *Sämtliche Werke* in 45 vols. was published by his widow (1805–20); later editions were superseded by the critical edition by B. Suphan (32 vols., 1877 *sqq.*). Of the many "selected works," mention may be made of those by B. Suphan (4 vols., 1884–87); by H. Lambel, H. Meyer and E. Kühnemann in Kürschner's *Deutsche Nationalliteratur* (10 vols., 1885–94). For Herder's correspondence, see *Aus Herders Nachlass* (3 vols., 1856–57); *Herders Reise nach Italien* (1859); *Von und an Herder: Ungedruckte Briefe* (3 vols., 1861–62)—all edited by H. Düntzer and F. G. von Herder; Herder's *Briefwechsel mit Nicolai; Briefe an Hamann,* ed. by O. Hoffmann (1887 and 1889). *See* also *Erinnerungen aus dem Leben Herders,* by his wife, ed. J. G. Müller (2 vols., 1820); *J. G. von Herders Lebensbild,* by his son, E. G. von Herder (6 vols., 1846); C. Joret, *Herder et la renaissance littéraire en Allemagne au XVIIIe siècle* (1875); R. Haym, *Herder nach seinem Leben und seinen Werken* (2 vols., 1880–85); H. Nevinson, *A Sketch of Herder and his Times* (1884); M. Kronenberg, *Herders Philosophie* (1889); E. Kühnemann, *Herders Leben* (1895); R. Bürkner, *Herder, sein Leben und Wirken* (1904); S. Siegel, *Herder als Philosoph* (1907); G. Jacoby, *Herders und Kants Ästhetik* (1907) and *Herder als Faust* (1911); Hoffart, *Herders "Gott"* (1918); G. Weber, *Herder und das Drama* (1922); K. May, *Lessings und Herders Kunsttheoret* (1923).

HÉRÉDIA, JOSÉ MARIA DE (1842–1905), French poet, the modern master of the French sonnet, was born at Fortuna Cafeyere, near Santiago de Cuba, being in blood part Spanish Creole and part French. At the age of eight he came from the West Indies to France, and received his classical education with the priests of Saint Vincent at Senlis. After a visit to Havana he returned to study at the École des Chartes at Paris. In the later '60s, with François Coppée, Sully-Prudhomme, Paul Verlaine and others less distinguished, he made one of the band of poets who gathered round Leconte de Lisle, and received the name of Parnassiens. To this new school, form—the technical side of their art—was of supreme importance, and, in reaction against the influence of Musset, they rigorously repressed in their work the expression of personal feeling and emotion. "True poetry," said Hérédia in his discourse on entering the Academy—"true poetry dwells in nature and in humanity, which are eternal, and not in the heart of the creature of a day, however great." Hérédia's place in the movement was soon assured. He was the *élève bien-aimé* of the master. He wrote very little, and published even less, but his sonnets circulated in ms., and gave him a reputation before they appeared in 1893, together with a few longer poems, as a volume, under the title of *Les Trophées.* He was elected to the Academy on Feb. 22, 1894, in the place of Louis de Mazade-Percin the publicist. Few purely literary men can have entered the Academy with credentials so small in quantity:—a small volume of verse—a translation, with introduction, of Diaz del Castillo's *History of the Conquest of New Spain* (1878–81)—a translation of the life of the nun Alferez (1894), de Quincey's *Spanish Military Nun*—and one or two short pieces of occasional verse, and an introduction or so. But the sonnets are of their kind among the most superb in modern literature. "A *Légende des siècles* in sonnets," M. François Coppée called them. Each presents a picture, striking, brilliant, drawn with unfaltering hand—the picture of some characteristic scene in man's long history. Each line is flawless, polished like a gem. Hérédia was one of the most skilful craftsmen who ever practised the art of verse. In

1901 he became librarian of the Bibliothèque de l'Arsénal at Paris. He died at the Château de Bourdonné (Seine-et-Oise) on Oct. 3, 1905, having completed his critical edition of André Chénier's works.

HEREDIA Y CAMPUZANO, JOSÉ MARIA (1803–1839), Cuban poet, was born at Santiago de Cuba on Dec. 31, 1803, studied at the University of Havana, and was called to the bar in 1823. In 1823 he was arrested on a charge of conspiracy against the Spanish Government, and was sentenced to banishment for life. He took refuge in the United States, published a volume of verses at New York in 1825 and then went to Mexico. In 1832 a collection of his poems was issued at Toluca, and in 1836 he obtained permission to visit Cuba for two months. Disappointed in his political ambitions and broken in health, Heredia returned to Mexico, and died at Toluca on May 21, 1839.

Many of his earlier pieces are merely clever translations from French, English and Italian; but his originality is established by such poems as the *Himno del desterrado*, the epistle to Emilia, *Desengaños*, and the celebrated ode to Niagara. His patriotism and imagination have secured for Heredia a real supremacy among Spanish-American poets.

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HEREDITAMENT, in law, every kind of property that can be *inherited*. Hereditaments are divided into corporeal and incorporeal; corporeal hereditaments are "such as affect the senses, and may be seen and handled by the body; incorporeal are not the subject of sensation, can neither be seen nor handled, are creatures of the mind, and exist only in contemplation" (Blackstone, *Commentaries*). An example of a corporeal hereditament is land held in freehold, of incorporeal hereditaments, tithes, advowsons, pensions, annuities, rents, franchises, etc. (*See* FREEHOLDS.)

HEREDITARY PENSIONS: *see* PENSIONS: PERPETUAL OR HEREDITARY.

HEREDITY may be defined as "the resemblance between an organism and its ancestors, in so far as this resemblance is not due to similarity of environment." Thus rickets is not a hereditary disease, yet a rickety father is more likely to have rickety children than the average man; because rickets are due to bad food and lighting, and bad environments are to some extent inherited, though not in the biological sense. Similarly syphilis is only hereditary in the sense that a parent may infect his or her child. The causative organism here constitutes a similarity in their environments. In plants certain abnormal conditions, once believed to be hereditary, are only known to be infections because they can be transmitted by grafting. It is very much easier to study the inheritance of such characters as eye colour, which in man and most animals is unaffected by the environment, than body weight or psychological traits, which depend upon surroundings to a greater or less extent.

Pure Lines.—Just as by keeping the environment as nearly as possible constant for all the animals or plants in an experiment, we can study the effects of hereditary differences; so in certain cases, we can eliminate hereditary differences within a group of organisms, and thus determine the limits of the power of heredity in determining structure and function. When an organism can be produced asexually, as in the case of many Protozoa, most fruit-trees, the potato, the tulip and many other plants, a population so produced is very uniform, and the differences within it are not hereditary, except in rare cases. Such a race is called a *clone* (from Gr. κλόνος, a mob). A similar condition can be reached by very prolonged self-fertilization as in beans and wheats, or in-breeding, as in rats and guinea-pigs. Such a population is called a pure line. In a pure line of beans the heaviest may weigh three times the lightest; but its progeny weigh no more on the average than those of the lightest bean. The differences of weight are therefore wholly due to environment. It is thought by some biologists that such differences are inherited (*see* LAMARCKISM) but if such a phenomenon occurs it is both rare and slow. Moreover it has never been demonstrated with a pure line as initial material. Pure lines of men do not exist, but a pair of so-called "identical" human twins, derived from the same fertilized ovum, have the same hereditary make-up, and all differences between them are due to environment.

Segregation.—All the members of a family have the same ancestors, but the differences between them are not wholly, or usually even mainly, due to environment, but to a phenomenon called segregation. These differences are usually inheritable. Thus a pair of cream guinea-pigs will produce yellows, creams and whites, and the yellows and whites will breed true. Segregation is due to an unequal transmission of the material basis of heredity to the offspring by the parents. It is a universal phenomenon except in pure lines. In the case of human stature about half the variance (*see* BIOMETRY) is due to heredity, half to segregation and very little to environment.

The Physical Basis.—Before entering on a detailed account of heredity it is necessary to recall certain facts regarding reproduction (*see* REPRODUCTION; SEX and CYTOLOGY). A higher animal or plant is formed by the union of two gametes (Gr. γαμέτης, a spouse), a large egg-cell and a small spermatozoön or generative nucleus from a pollen-grain. The egg-cell contributes most of the cytoplasm, but the nucleus is equally or almost equally derived from both parents. In hermaphrodite plants and animals each parent contributes a similar set of chromosomes to the nucleus of the *zygote* (Gr. ζυγωτός, yoked), as the product of the two gametes is called. In bisexual organisms this is only true of one of the sexes. In most bisexual animals, and in all bisexual plants so far investigated in which the sex is determined by the chromosomes (*q.v.*), the eggs all contain the same complement of chromosomes, but there are two types of male gamete. One type contains a set of chromosomes like that of the egg, and produces female zygotes. The other has one chromosome less, or else one of its chromosomes differs from one of those in the egg's set. The chromosome characteristic of the female-producing gamete is called the *X* chromosome, that (if any) characteristic of the male-producing gamete the *Y* chromosome. Thus the females contain two *X* chromosomes, the males an *X* and usually a *Y*. (Figs. 1 and 2.) In birds, Lepidoptera (butterflies and moths) and some fish, the spermatozoa are all alike, but the female forms male-producing and female-producing eggs, the former generally containing a *Y* chromosome, the latter always an *X*.

The chromosomes of paternal and maternal origin preserve their identity throughout the life of the zygote, but shortly before the formation of the gametes they usually twist together and appear in many cases to exchange parts (fig. 1). The gametes each obtain a set of half the zygotic number of chromosomes, and hence are called haploid (Gr. ἁπλοῦς, single); the zygote with its double set is described as diploid (Gr. διπλοῦς, double). The special cell-division responsible for the halving of the chromosome number is called the reduction division. Except in rare cases the fact that two chromosomes have come from the same parent does not give them any tendency to pass into the same gamete. They are assorted according to the laws of chance. This is the principal material basis of segregation.

CYTOPLASMIC INHERITANCE

Since the mother contributes most of the cytoplasm to the newly-formed zygote, it is clear that, if this played an important part in heredity, she would be more important than the father in determining the characters of the offspring. This is not in general the case, but a few characters are known in plants which are inherited only from the mother, like the family name in a matriarchal society. Thus in *Mirabilis Jalapa* and other plants, the seed borne by the white parts of variegated individuals gives rise to nothing but white, no matter what plant supplies the pollen. In other variegated plants, such as *Pelargonium* and *Oenothera*, the pollen exerts a certain influence, but generally less than that of the egg-cell. Since variegation is due to the presence in the cells of colourless instead of green plastids (*see* PLANTS: *Cytology*), and the plastids lie outside the nucleus and are rarely transmitted by the pollen, this is quite intelligible.

Again in certain crosses between plant races a factor influencing

sex is transmitted through the cytoplasm only (*see* SEX).

MENDELIAN INHERITANCE

Heredity in Bryophyta (*q.v.*).—In the higher plants and animals the gametes are inconspicuous, and their hereditary make-up can only be inferred from the zygotes which they produce. In the Bryophyta (mosses and liverworts) the haploid generation or gametophyte is the familiar plant. It produces gametes which fuse to form a sporophyte with a double set of chromosomes. This produces spores with the haploid number, from each of which a gametophyte may be formed. The common moss *Funaria hygrometrica* possesses true-breeding broad- and narrow-leaved races. If they are crossed the sporophyte so formed produces equal numbers of broad- and narrow-leaved offspring. If we denote the haploid gametophytes by the letters *B* and *N* we may call the hybrid sporophyte *BN*. The characters segregate at the reduction division, as is shown by the fact that two of the spores in each tetrad formed from a single diploid cell of a *BN* sporophyte give rise to *B* gametophytes, two to *N*. The diploid generation also varies. *BB* sporophytes have larger capsules than *NN*, while *BN* are intermediate.

Inheritance Without Dominance.—Let us apply this point of view to the higher animals and plants, where it is only in the zygote that differences can be observed. If we mate a yellow guinea-pig with a pink-eyed white, the offspring are cream (the offspring of certain albinos will also have black or chocolate pigment, but the yellow areas of the coat or hairs will always be of a creamy colour). Both yellows and whites always breed true. Now the creams, if mated to a white, give equal numbers of creams and whites; if to a yellow, equal numbers of yellows and creams. Clearly the cream parents are responsible for this heterogeneity. Calling the yellows *YY* and the whites *WW* and their gametes *Y* and *W* respectively, the product of their fusion, *YW*, is a cream, producing *Y* and *W* gametes in equal numbers. Mated with *YY* it therefore gives *YY* (yellow) and *YW* (cream); with *WW*, *YW* (cream) and *WW* (white). When two creams are mated together the *Y* eggs are equally likely to be fertilized by *Y* or *W* spermatozoa, and therefore produce equal numbers of *YY* and *YW* zygotes. Similarly the *W* eggs give equal numbers of *YW* and *WW*. Zygotes are therefore produced in the ratio 1*YY* : 2*YW* : 1*WW*, or 1 yellow : 2 creams : 1 white. Of course these ratios are not generally obtained unless large numbers of animals are counted, any more than the numbers of red and black cards in a hand taken at random from a pack are in general equal. It is to be noted that the results of all these matings are the same whichever type of animal is used as father. The object (for it is known to be a material object) in the gamete which determines the colour is called a gene (*q.v.*) or factor. A zygote possessing two like genes (as the yellow or white guinea-pig) is called a *homozygote* (Gr. ὁμός, same, ζυγόν, yoke, pair); one possessing two unlike genes (as the cream) is called a *heterozygote* (Gr. ἕτερος, other). Two genes which can form a pair of this kind are called allelomorphs (Gr. ἀλλήλων, one another, μορφή, form).

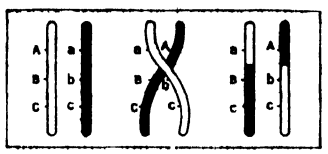
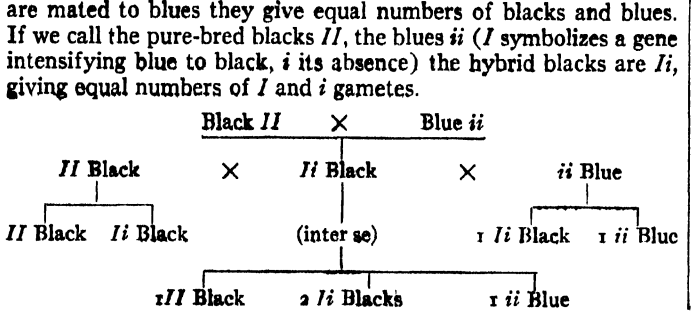


FIG. 1.—DIAGRAM ILLUSTRATING MORGAN'S THEORY OF LINKAGE

Dominance.—Usually the course of events is slightly obscured by the phenomenon of dominance. If we mate pure-breeding black and blue rabbits, the young are all black, but if these hybrid blacks are mated to blues they give equal numbers of blacks and blues. If we call the pure-bred blacks *II*, the blues *ii* (*I* symbolizes a gene intensifying blue to black, *i* its absence) the hybrid blacks are *Ii*, giving equal numbers of *I* and *i* gametes.



Mated with blues (*i* gametes) they therefore give *Ii* (black) and *ii* (blue) in equal numbers; mated with one another, 3 blacks to one blue; with homozygous blacks, blacks only. It is usual, following G. Mendel, to denote the generation produced by crossing two different individuals or races by F_1, their offspring when self-fertilized or mated *inter se* by F_2. It will be seen that all possible blacks fall into two classes, homozygotes (*II*) and heterozygotes (*Ii*), which can be distinguished by mating them with a blue. When a gene is as effective in one dose as in two, it is said to be dominant; its allelomorph is said to be recessive. Sometimes these two terms are applied to the characters produced by the genes. Thus black is said to be dominant over blue. In the case of chemical characters such as coat and flower colour, dominance is usually complete. Where form or size is affected the heterozygote is often more or less intermediate, though usually nearer to one parent. But here too dominance may be complete.

A class of organisms whose members cannot be distinguished from one another by observation is called a *phenotype* (Gr. φαίνομαι, I appear, τύπος, type); a class which can be distinguished from another by breeding tests is called a *genotype* (Gr. γένος, race). Thus in the above example, all the black rabbits form one phenotype, but include two genotypes, *II* and *Ii*.

Mendelian inheritance (*see* also MENDELISM) has so far been observed in men, other mammals, birds, amphibians, fish, insects, crustaceans, molluscs, algae, mosses, ferns, monocotyledons and dicotyledons. It is thus probably characteristic of all sexually reproducing organisms. For example, in the pea tallness is dominant over dwarfness, coloured flowers over white flowers, and so on. A recessive character breeds true, a dominant does not necessarily do so. This is important in breeding.

Inheritance of Several Genes.—When two different pairs of allelomorphs are involved in a cross, inheritance is usually independent. For example, shortness of hair is dominant over length in rabbits, and is due to a gene which we may call *S*. If we mate a homozygous short-haired black (*IISS*) rabbit with a long-haired (so-called "Angora") blue, which, being recessive, must be homozygous (*iiss*), the offspring are doubly heterozygous short-haired blacks (*IiSs*). Half their gametes carry *I* and half *i*, and the same is true regarding *S* and *s*. As the genes *I* and *S* show no tendency to stay together, the four possible classes of gametes *IS*, *Is*, *iS* and *is* are formed in equal numbers. So if the *IiSs*

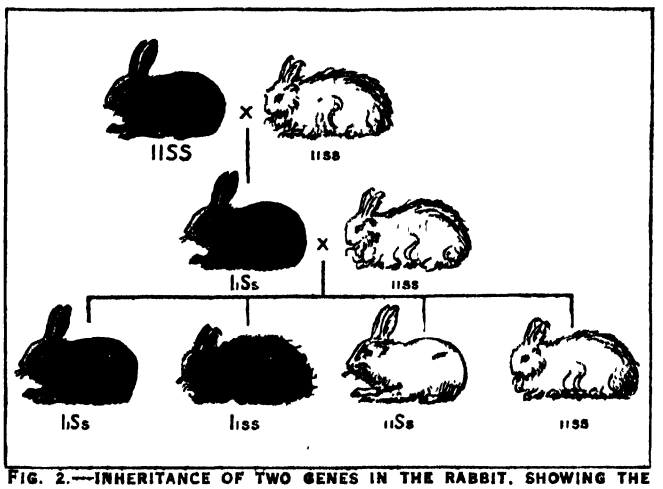


FIG. 2.—INHERITANCE OF TWO GENES IN THE RABBIT, SHOWING THE ORIGIN OF NEW TYPES BY CROSSING

rabbits are mated with double recessive (*iiss*) the offspring consist of equal numbers of *IiSs* (short-haired black) *Iiss* (long-haired black) *iiSs* (short-haired blue) and *iiss* (long-haired blue) (fig. 2). If *IiSs* are mated together the ratios obtained in F_2 are 3 black to 1 blue and 3 short to 1 long, or, combining the two, 9 short black : 3 short blue : 3 long black : 1 long blue. The genetical behaviour of double heterozygotes is precisely the same whether they are made from the mating *IISS*×*iiss* as above, from *IIss*×*iiSS* (long-haired black × short-haired blue) or in any other way, *e.g.*, from the mating *Iiss*×*iiSs*, which will give one *IiSs* in four. Just the same is true where three or more pairs of allelo-

morphs are concerned. Thus if a rose-combed black feathered fowl with four toes is mated with a normal-combed buff with five toes, the offspring are rose-combed black with five toes, these characters being dominant, and in the offspring all the eight possible recombinations will appear. The processes of inheritance and segregation appear relatively simple as soon as attention is focussed as far as possible on the gametes rather than on the zygotes, even though it is only in rare cases such as the Bryophyta that the gametes can be distinguished on inspection.

Sex-linked Inheritance.—With regard to the genes so far considered the results of reciprocal crosses are exactly the same both in appearance and genetical behaviour. It makes no difference whether the gene determining short hair is brought in from the father or the mother, whether that for flower colour is contributed by the pollen or the ovules, and so on. This is not always the case. An extreme example of the opposite condition is furnished by such Hymenoptera as bees and many wasps, in which fertilized eggs become females, and unfertilized males, which are generally haploid. Thus a dominant gene *N* in the wasp *Habrobracon* determines the presence of normal as opposed to defective wings. A normal male is of the composition *N*, and all his daughters by whatever female are *Nn* or *NN*, *i.e.*, normal. (He cannot of course beget sons.) An abnormal male (*n*) begets all normal daughters with a *NN* female, half and half with a *Nn*, and all abnormal with a *nn*. The sons depend on the composition of their mothers only. *NN* mothers produce only *N* males, *Nn* produce *N* and *n*, while *nn* produce *n* only. The same principle holds for the bee.

Now in an animal where the female is the homogametic sex, of composition *XX* (*see* SEX) it is clear that she transmits an *X* chromosome to all her children; whilst the *XY* or *Xo* male transmits it only to his daughters. Thus if any genes follow this chromosome in their distribution to the gametes, characters determined by them should be inherited like those of the Hymenoptera. This is the case with a number of characters. For example a black male cat may be represented as *B*, a yellow as *Y*, a black female as *BB*, a yellow as *YY*, whilst the heterozygous female *BY* is a black and yellow or tortoiseshell cat. Tortoiseshell males are rare and generally sterile. (The tabby pattern, or piebaldness, may be superimposed on the above colours, but this does not affect the inheritance.) We have 6 possible matings:—

Parents		Offspring	
Mother	Father	Daughters	Sons
Black ♀, *BB*	Black ♂, *B*	*BB* (black)	*B* (black)
Tortoise ♀, *BY*	„ ♂, *B*	*BB* „ *BY* (tortoise)	*B* „ *Y* (yellow)
Yellow ♀, *YY*	„ ♂, *B*	*BY* (tortoise)	*Y* (yellow)
Black ♀, *BB*	Yellow ♂, *Y*	*BY* „	*B* (black)
Tortoise ♀, *BY*	„ ♂, *Y*	*BY* „ *YY* (yellow)	*B* (black), *Y* (yellow)
Yellow ♀, *BB*	„ ♂, *Y*	*YY* (yellow)	*Y* (yellow)

These expectations are fulfilled. The difference between the reciprocal crosses of black and yellow is striking. The same holds when dominance is complete, as in human colourblindness, which is completely recessive.

Similarly where the male is homogametic, as in birds, reciprocal crosses give different results. Thus in the fowl, the Light Sussex breed carry a dominant gene *S* inhibiting yellow pigment, which is absent in the Rhode Island Red. If we cross a Light Sussex cock (*SS*) with a Rhode Island hen (*s*) all the F_1 chickens are produced from *S* spermatozoa and are therefore nearly white. The cockerels are *Ss*, and if crossed with red hens give equal numbers of white and red chickens of both sexes; the pullets (*S*) behave genetically like Light Sussex hens. If however a Rhode Island cock (*ss*) is crossed with a Light Sussex hen (*S*) the pullets, which have not received an *X* chromosome with an *S* factor from their mother, are *s*, *i.e.*, red, the cockerels, *Ss*, *i.e.*, white (fig. 3). The sexes can thus be distinguished at hatching, a fact of economic importance.

Genes inherited in this way are said to be sex-linked. Sex-linkage has been found in men, cats, fowls, pigeons, fish, flies, moths, grasshoppers and in a few dioecious plants. Except perhaps in fish, genes are very rarely found in the *Y* chromosome. Nevertheless such genes are known in man and in *Drosophila*.

Multiple Allelomorphism.—While genes are generally only found to be allelomorphic in pairs (*e.g.*, those causing dense and

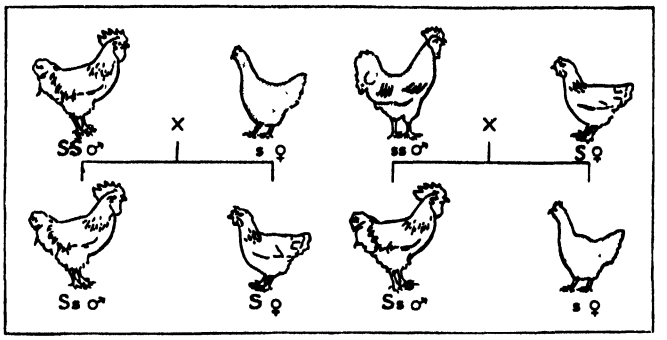


FIG. 3.—SEX-LINKED INHERITANCE IN POULTRY, SHOWING THE METHOD BY WHICH THE SEX OF DAY-OLD CHICKS CAN BE DISTINGUISHED

dilute colour, or short and long hair in rabbits) this is not always the case. Thus in the rabbit four genes *C*, C^{ch}, C^{h} and *c* are known, which in the homozygous condition, and in the presence of the other genes found in the wild-coloured grey rabbit, determine the following colours:— *CC* wild colour, $C^{ch}C^{ch}$ "Chinchilla" (black hairs with white tips), $C^{h}C^{h}$ "Himalayan" (white with black nose, ears and feet), *cc* white. Only one of these genes can get into a gamete, only two into a zygote. They are dominant over one another in the order given. Thus any rabbit containing *C* is fully coloured, $C^{ch}C^{h}$ and $C^{ch}c$ are chinchilla (rather lighter than the homozygote), $C^{h}c$ is "Himalayan." Hence if we mate *CC* (wild colour) and *cc* (white) the offspring are wild coloured, and mated *inter se* give only wild coloured and white. No Himalayans or chinchillas can appear unless the genes C^{ch} or C^{h} have been introduced.

Similarly in *Primula sinensis* the size of the "eye" in the flower is mainly determined by three allelomorphic genes, E^{s}, *E* and *e*. $E^{s}E^{s}$, $E^{s}E$, and $E^{s}e$ give the small "Queen Alexandra" eye, *EE* and *Ee* the normal eye, and *ee* the large "Primrose Queen" eye. So a plant bearing the small eye when self-fertilized may give either normal or large eyes in one quarter of its offspring, but cannot give both. As many as eleven multiple allelomorphs belonging to the same series (determining eye colour in *Drosophila melanogaster*) have been found.

Linkage.—In some cases two genes which are not allelomorphic do not separate independently. Thus in *Primula sinensis* a gene *G* renders the stigma green, whilst in *gg* plants it is red; *SS* and *Ss* plants have a short "thrum" style and long stamens, *ss* a long pin style and short stamens. On crossing *GGSS* (green thrum) with *ggss* (red pin) the offspring are *GgSs* (green thrum). If now the pollen of such plant is used on a *ggss*, the four classes of offspring do not appear in equal numbers, but in the ratios

60 *GSgs* : 40 *Gsgs* : 40 *gSgs* : 60 *gsgs*

There is thus an excess of *Gs* and *Gs* pollen grains, *i.e.*, genes which have entered the zygote in the same gamete tend to leave it in the same gamete. This phenomenon is called coupling. If the doubly heterozygous plants are made up from the cross green pin (*GGss*) × red thrum (*ggSS*) the pollen of the offspring used on a double recessive gives

40 *GSgs* : 60 *Gsgs* : 60 *gSgs* : 40 *gsgs*

This is called repulsion, and the two phenomena together are called linkage. The two types of *GgSs* plant may be denominated $\frac{GS}{gs}$ and $\frac{Gs}{gS}$. If we fertilize them with *gs* pollen from a double recessive (red pin) the numbers obtained are:—

67 *GSgs* : 33 *Gsgs* : 33 *gSgs* : 67 *gsgs*

and

33 *GSgs* : 67 *Gsgs* : 67 *gSgs* : 33 *gsgs*

Linkage is thus (in this case) slightly stronger in the formation of ovules than of pollen. In a general way if two genes *A* and *B* are linked, then when a double heterozygote $\frac{AB}{ab}$ is formed from gametes *AB* and *ab* then the gametic series formed are

(1—p) *AB* : p*AB* : p*aB* : (1—p)*ab* eggs or ovules, and

(1—q) *AB*: q*Ab*: q*aB*: (1—q)*ab* spermatozoa or pollen grains, where p and q are numbers less than ½, which when expressed as percentages are called cross-over values, for reasons which will appear later. If the double heterozygote $\frac{Ab}{aB}$ is formed from gametes *Ab* and *aB* the corresponding gametic series are:—

p*AB* : (1—p)*Ab* : (1—p)*aB* : p*ab* eggs or ovules

q*AB* : (1—q)*Ab* : (1—q)*aB* : q*ab* spermatozoids or pollen grains.

Now if a zygote $\frac{Ab}{aB}$ is self-fertilized or mated with a similar zygote, the offspring are produced in the following proportions:—

2+pq *AABB, AaBB, AABb* and *AaBb* (*i.e.*, double dominants)
1—pq *AAbb* and *Aabb*
1—pq *aaBB* and *aaBb*
pq *aabb*

Or classing them simply by their appearance:—

(2+pq)*AB* : (1—pq)*Ab* : (1—pq)*aB* : pq*ab*

This is the zygotic series characteristic of repulsion in F_2. An $\frac{AB}{ab}$ zygote producing a gametic series of the coupling type, gives

$$[2+(1-p)(1-q)].1B : [1-(1-p)(1-q)]Ab : [1-(1-p)(1-q)]aB : (1-p)(1-q)ab.$$

For example, whereas in the absence of linkage the phenotypes *AB, aB, Ab, ab* would be in the ratios 9:3:3:1; with linkage values of ·25 the numbers would be 33:15:15:1 for repulsion in F_2, 41:7:7:9 for coupling. With strong linkage, p=q=·01 would give 20,001 *AB* : 9,999 *Ab* : 9,999 *aB* : 1 *ab* in the case of repulsion, 29,801 *AB* : 199 *Ab* : 199 *aB* : 9801 *ab*. It is clear that in the case of strong repulsion it is exceedingly difficult to obtain a double recessive, and in that of strong coupling fairly difficult to separate the two genes.

In the fly *Drosophila melanogaster*, and other insect species, in certain fish, and in the fowl and pigeon, the only organisms so far investigated in this respect, all the sex-linked genes are themselves linked. Thus in the fowl, besides the yellow inhibiting gene *S* (causing silver as opposed to gold plumage) the gene *B* causing barring of the feathers with white, as in the Plymouth Rock, is sex-linked. If a hen carrying both these genes is mated with a gold unbarred cock of composition $\frac{bs}{bs}$, all the pullets, which receive an *X* chromosome from the father only, are of course *bs* (gold unbarred), all the cockerels $\frac{BS}{bs}$ (heterozygous silver barred), so linkage is complete. If these cockerels are mated with *bs* hens, the chickens begotten in their first year of breeding are roughly in the proportions:—

$\frac{3BS}{bs}$ (barred silver) : $\frac{1Bs}{bs}$ (barred gold) : $\frac{1bS}{bs}$ (unbarred silver): $\frac{3bs}{bs}$ (unbarred gold) *i.e.*, p=.25. In the later years the linkage is less. In the female of *Drosophila melanogaster* more than a hundred sex-linked genes show mutual linkage.

THE CHROMOSOME THEORY

Since the sex-linked genes were associated with the *X* chromosome, it is natural to suggest that the other genes should be similarly associated with the other chromosomes. If so there should be as many groups of mutually linked genes as there are chromosomes in the gametes. This is the case in *Drosophila melanogaster* and the sweet pea, the organisms most thoroughly investigated. In the former the number of chromosomes in the gamete, and of linkage groups, is four (fig. 4, 1, 2), in the latter seven. In no organism has it been shown that there are more linkage groups than chromosomes, but in some there appear to be fewer.

The evidence that, in *Drosophila melanogaster* at least, a linked group of genes is carried on or by an individual chromosome, is overwhelming. Thus occasional females are found which have a *Y* chromosome as well as 2 *X*'s. (fig. 1, 3). These form four types

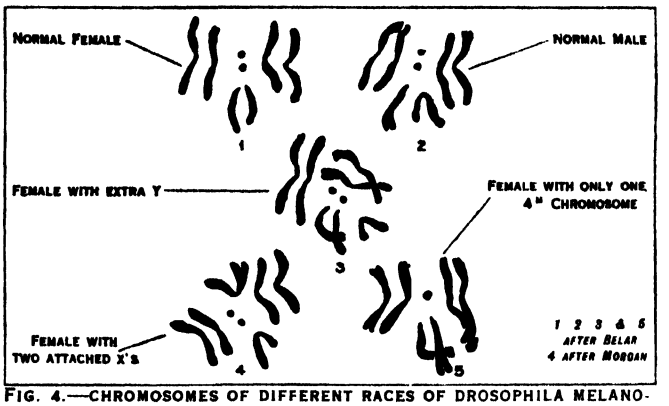


FIG. 4.—CHROMOSOMES OF DIFFERENT RACES OF DROSOPHILA MELANOGASTER, THE MATERIAL BASIS OF HEREDITY

of egg, many containing *X* and *XY* and fewer containing *XX* and *Y*. If such a female be mated with a male carrying a dominant sex-linked gene (*e.g.*, that for "Bar" or oblong eye) which with a normal female would give bar-eyed daughters and normal sons, the following types of offspring may be expected, representing the bar-carrying *X* chromosome by *X'*, so that the spermatozoa carry *X'* or *Y*:—

From *X'* spermatozoa: *X'X* (bar ♀) *X'XY* (bar ♀), *X'XX* (dies), *X'Y* (bar ♂)
From *Y* spermatozoa: *XY* (normal ♂), *XYY* (normal ♂), *XXY* (normal ♀), *YY* (dies).

There are thus exceptional bar-eyed males and normal females, of which the latter behave genetically like their mothers. Similarly the *X'XY* and *XYY* individuals behave according to theoretical expectation.

Again the two *X* chromosomes in a female may be attached to form a *V* (fig. 1, 4). Such females, as will be seen, also inevitably contain a *Y*. They therefore form eggs containing *XX* and *Y*. With a normal male they produce zygotes:—

$\widehat{XX}X$ (dies), $\widehat{XX}Y$ (♀) *XY* (♂) *YY* (dies).

Hence the female offspring get two united *X* chromosomes from their mother, the males get the *X* from their father. Thus sex-linked genes involved in such a cross are handed down from father to son and from mother to daughter, and not passed from one to the other as in the normal case.

Again *Drosophila melanogaster* may lose one of its small fourth chromosomes, such flies being viable but small (fig. 1, 5). Now of over 400 genes known in this fly one linkage group contains only three, and is therefore thought to be associated with the small chromosome. A recessive character determined by one of these genes is eyelessness. If *E* is the gene for normal eyes, *e* for eyelessness, the small unhealthy round-eyed fly with only one small chromosome may be denoted by *Eo*, the cytologically normal fly heterozygous for eyelessness by *Ee*. When these are mated the four types of zygote formed are *EE* (normal), *Ee* (heterozygote) *Eo* (small normal) and *eo* (small eyeless). In a similar way the chromosome containing the recessive gene determining the waltzing habit has been identified in the mouse, though here only a part of it was missing in the cytologically abnormal individuals. Many other cases are known which enable given genes to be allotted to visibly distinguishable chromosomes. For example in *Drosophila melanogaster* individuals with three instead of two of the small fourth chromosome behave as expected on the above theory.

Except in the case of sex-linked genes, linkage is generally of about the same intensity in the formation of masculine and feminine gametes. In the same plant it may be stronger for one pair of genes in the formation of pollen, for another in that of ovules. In animals however it is always slightly more intense in the hetero-

gametic sex, *i.e.*, the male except in birds and Lepidoptera (linkage has not been thoroughly investigated in these groups, except for sex-linked genes). In mammals the intensity is only slightly greater in the male, but in insects sexual dimorphism is very marked in this respect, linkage being almost complete in the males of Orthoptera, and quite complete in the males of *Drosophila* and the females of *Bombyx*, a fact which makes the determination of linkage groups far easier than in plants or mammals. In the fish so far studied sex-linked genes may either be transmitted in the ordinary way, or only by males to males. Occasionally such a gene crosses over, and thus alters its type of inheritance. This is probably due to linkage of other chromosomes with the sex chromosomes, but may be due to sex being determined by a single gene, not a whole chromosome. The intensity of linkage varies with age in *Drosophila* and in fowls, but not appreciably in rats or mice, and with temperature in *Drosophila*. It is also affected by hereditary factors.

Arrangement of the Genes.—If each linkage group corresponds to a chromosome, the two most plausible hypotheses to account for linkage are as follows: (a) The probability that two genes *A* and *B* which have entered in or with the same chromosome should be separated in gametogenesis is the probability that one should cross from a maternal to a paternal chromosome while the other does not, or conversely. (This hypothesis is negatived by the facts shortly to be discussed.) (b) Whole blocks of the chromosomes, with their associated genes, may be exchanged (This hypothesis agrees with the facts.) The farther apart two genes are situated in or on the chromosome the more likely they are to be separated in gametogenesis. Now consider a zygote in which three dominant genes, *A*, *B*, *C* are borne by one chromosome, their recessive allelomorphs *a*, *b*, *c* by the corresponding chromosome derived from the other parent. The formation of an *Abc* or an *aBC* gamete means that the chromosomes have crossed over and exchanged genes at a point between the loci of *A* and *B*. Similarly the formation of an *ABc* or an *abC* gamete means that crossing over has occurred between the loci of *B* and *C*. And *AbC* or *aBc* gametes are only formed if both these events occur. Now if the probability of crossing over between *A* and *B* is p_1, and between those of *B* and *C* is p_2, that of a double cross-over is p_1p_2, if the fact that crossing over has occurred between *A* and *B* does not influence the probability of a cross-over between *B* and *C*. Actually the probability of a double cross-over is always somewhat less than this, presumably on account of a stiffness of the chromosomes, which makes it unlikely that they should bend so much as to cross over at two nearly adjacent points. It follows that if the probability of crossing over between *A* and *B* is 10%, between *B* and *C* is 5%, the probability of a double cross-over is something less than ½%, whereas if the two genes were not arranged in a line it might have any value up to 35%.

By determining cross-over values for a number of linked genes it is possible to construct a map of any chromosome. The unit of distance on the map is the separation giving a possibility of crossing-over of 1% between genes at this distance. This distance does not correspond to a definite distance in millionths of a centimetre, for there is evidence that crossing over occurs more easily in some parts of a chromosome than others. Such a map for 26 of the most important of the 150 sex-linked genes of *Drosophila melanogaster* is given in fig. 5. If x be the distance on the map between two genes, the probability of crossing over between them is given by

$$y = f(100x)$$

where $y = 100x$ when both are small, but can never exceed ½, however large the value of x. Approximately

$$x = \cdot 7y - \cdot 15\log_e(1-2y)$$

but the relation between map distance and cross-over value is slightly different in different parts of the same chromosome, so the function is not perfectly definite. In other words, the cross-over value, expressed as a percentage, is equal to the map distance when both are small, very nearly so up to distances of about 20 units, but at 50 units distance (as determined by adding up the distances between the several loci) the cross-over value is only about 40%, and even at a distance of over 100 units it does not exceed 50%, though it is very near to this value. Extensive chromosome maps have been made for several species of *Drosophila*, and in the maize plant and sweet pea, less detailed ones in other species. There is no tendency for genes with like effects to aggregate in the same chromosomes or in the same parts of them. However multiple allelomorphic genes always occur in the same locus. Occasionally a race of *Drosophila* is found which, when crossed with the normal type, gives little or no crossing over in one chromosome or section of a chromosome. This has been found to be due to a reversal in the order of the genes, which prevents the normal pairing. It is generally supposed that crossing over occurs during diakinesis (*see* CYTOLOGY) when the chromosomes may be seen twisting round one another.

LETHAL AND SEMILETHAL GENES DEFICIENCIES

The various phenotypes of a given organism generally differ slightly in viability, for a gene, although its main effect may be local, always affects the organism as a whole. Of course the viability depends on the environment. Thus hairless (recessive) mice are clearly more likely to die of cold than the normal type. Usually the expectation of life of the normal, or wild type, exceeds that of others significantly, but occasionally a mutant may be longer lived or more fertile than the wild type. A combination of several abnormal genes may yield a better expectation of life than any of the genes alone. The table below gives the expectations of life for *Drosophila melanogaster* produced by several genes in the second chromosome.

Type	♂ expectation of life (days)	♀ expectation of life (days)
Normal	38·1	40·6
Purple eye	27·4	21·8
Arc wing	25·2	28·2
Speck (on wing)	46·6	38·9
Purple arc	36·0	32·0
Arc speck	38·4	34·7
Speck purple	23·7	23·0
Purple arc speck	38·4	40·7

(after Gonsalez)

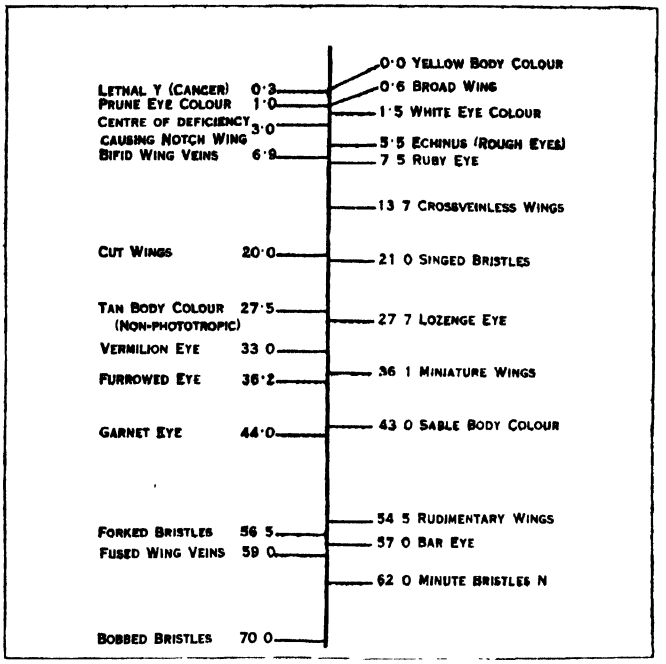
The expectations given are of course under laboratory and not natural conditions. But many phenotypes have an extremely low viability. When only a few per cent of the unsuccessful phenotypes survive to maturity the gene is called a semi-lethal. When none survive it is called a lethal. The deaths may be due to various causes. Thus a recessive sex-linked gene in *Drosophila melanogaster* causes the deaths of half the females heterozygous for it, as the result of a malignant tumour. In plants a very common type of lethal gene produces plants lacking chlorophyll, which therefore soon die.

Linkage of Lethals.—Lethal genes are often discovered because they lead to abnormal ratios in the progeny. Thus in *Drosophila* a female heterozygous for a recessive sex-linked lethal will produce twice as many daughters as sons, for half her sons will receive the lethal gene and die, while half the daughters are heterozygous for it, and resemble the mother in their genetical behaviour. If such a female be mated with a male which carries a sex-linked dominant gene, all her daughters will bear this gene in one of their *X* chromosomes, and half will bear the lethal in the other. Hence all surviving sons of the latter class of females will receive the dominant gene from their grandfather, except where this has crossed over into the same chromosome as the lethal. In this way the cross-over values between lethal and other genes can be found, and the lethal genes can be assigned to their proper places in the chromosome.

Where the normal or wild type of organism is known, more genes are generally found recessive than dominant to it. And of the few dominants a fair proportion are generally lethal when homozygous. Thus when a yellow mouse is mated to a non-yellow, half the offspring are yellow, *i.e.*, the yellows behave as heterozygous dominants. When two yellows are mated, the ratio of yellows to non-yellows is two, not three, to one, and the yellow children are heterozygous. The homozygous yellows per-

ish at an early embryonic stage. Similarly the Dexter Kerry cows (a short-legged form) when mated with normal cattle give equal numbers of normal and short-legged. Mated together they give 1 normal : 2 dexters : 1 aborted or still-born. These homozygotes are dwarfs with bulldog-like faces and only rudiments of a thyroid gland, whose practical absence presumably accounts for their abnormality. In the fowl the homozygotes of the frizzled and Scotch Dumpy breeds die in the shell.

Deficiencies.—Some, but not all, lethals are due to the absence of a section of chromosome including several genes. If a zygote



AFTER BELAR

FIG. 5.—SCALE OF THE X CHROMOSOME OF DROSOPHILA MELANOGASTER (SEE FIG. 4) SHOWING LOCATION OF A FEW OF THE GENES IN IT

heterozygous for such a lethal (which is called a deficiency) is mated to another recessive for the genes left out in the deficiency, all the offspring which carry the lethal show the recessive characters, since the dominant allelomorphs carried by a normal chromosome are absent from the deficient section. The probability of crossing-over is diminished in the neighbourhood of a deficiency. The lethal effect when homozygous is clearly due to the complete absence of one or more genes necessary for life.

Gametic Lethals.—In the higher plants the haploid generation, especially the pollen grains, have an independent life of their own. Genes carried by them may affect their behaviour to a greater or less extent. In some cases pollen carrying a given gene may be quite sterile. In others it is handicapped to a greater or less extent in comparison with the normal. Plants heterozygous for such genes therefore give normal ratios when used as mothers, abnormal when used as pollen parents. It is doubtful if gametic lethals occur on the female side of plants. They do not in animals. Spermatozoa may be capable of swimming and fusing with an ovum, even if they contain too few or too many chromosomes.

Balanced Lethals.—One of the dominant genes modifying wing shape in *Drosophila*, beaded, (*B*) is lethal when homozygous. Nevertheless it has been possible to obtain a stock with beaded wings breeding nearly true. When mated with normals only half the offspring are beaded. But the other half also carry a lethal, located, like *B*, in the third chromosome.

Representing this lethal by *l*, the true-breeding beaded are $\frac{BL}{bl}$. When mated together they give $\frac{1BL}{BL}$ (dies): $\frac{2BL}{bl}$: $\frac{1bl}{bl}$ (dies) with a few $\frac{Bl}{bl}$, $\frac{BL}{Bl}$, etc., which die, and $\frac{bL}{bl}$ and $\frac{bl}{bL}$, which are normals, due to crossing over. If a recessive gene is present in either chromosome in the neighbourhood of the lethals, very much less than one in four of such recessives appear when the stock is inbred. Such cases of balanced lethals occur in nature.

The Case of Oenothera.—Most species of the genus *Oenothera* breed nearly true, but give a few "mutants." When crossed with another species the offspring are generally of two, rarely of four, different types, whereas in normal species-crosses all are alike. This behaviour has been shown to be due to balanced lethals. A pollen lethal (causing sterility of half the pollen) may lie in the corresponding chromosome (or chromosome group, for the chromosomes are often attached to one another) with a zygotic lethal (causing sterility of half the seeds) or with a gene acting as a pseudo-lethal to the ovules. Such a gene is not lethal in itself, but when present in the heterozygous condition with a certain allelomorph, a megaspore containing the latter proliferates taking the place of the cell normally giving rise to the embryo. The few "mutants," which are not in general mutants in the ordinary sense, are mostly due to crossing over, which allows the reappearance of recessive genes. Other "mutants" are due to chromosomal aberrations. Any two, or all three, of these lethals may be present in a single plant.

THE CO-OPERATION AND NATURE OF GENES

Epistasy.—In a normal organism very many genes must co-operate to produce the normal structures, chemical substances and functions. Thus in the rabbit at least 10 genes must be present to produce the normal coat colour. The most important of these is *C*. A rabbit of the ultimate recessive genotype *cc* of the series of allelomorphs to which it belongs is a pink-eyed white, and all such rabbits are indistinguishable, no matter what other genes determining colour they may carry. Thus if a white rabbit carries two of the genes *I* for density of pigment, it will give dense-coloured young when mated with a pure-bred blue (*CCii*); if it is recessive it will give blue on some other dilute colour, if heterozygous, half dense and half dilute. But *II* and *ii* whites can only be distinguished by their ancestry or descendants. A gene such as *I* which can only manifest itself in presence of another such as *C* is said to be epistatic to it. All other colour genes are epistatic to *C*.

Inhibitors.—A rabbit of the composition *eegg*, but bearing the other colour genes of the wild rabbit, is born yellow but develops some black pigment, becoming a "tortoiseshell." *EEgg* or *Eegg* is black, *E* causing extension of the dark eye-pigment into the coat; *eeGG* or *eeGg* is a pure yellow, *G* inhibiting the black pigment in the coat; *EEGG*, *EeGG*, *EEGg* or *EeGg* is the wild coloured grey. Here *G* inhibits all pigmentation on the belly, and also black pigmentation on portions of the hairs, which have therefore yellow tips. Such colour inhibitors are very common. Thus several types of dominant white fowl are known, in which pigmentation has been inhibited by different genes. Similarly there is a dominant white form of *Primula sinensis*, and *Primula elatior* contains a gene which, on crossing the species, inhibits the anthocyanin colour of *Primula Juliae*, although *P. elatior* itself does not contain any genes causing the formation of anthocyanin against which the inhibitory gene could act. Again *Drosophila melanogaster* (and doubtless other Diptera) contains two independent genes inhibiting the growth of the balancers or rudimentary wings. In the absence of either, these develop into wing-like structures.

Several genes may co-operate to produce a given effect. Thus in the sweet pea there are two types of recessive whites, due to genes in different chromosomes. Each breeds true but when crossed they give coloured flowers. Calling the colour genes *C* and *R* the heterozygous coloured form is *CcRr*. When selfed it gives an F_2 of 9 *CR* : 3*Crr* : 3*ccR* : 1*ccrr*, *i.e.*, 9 coloured to 7 white. Again any of a number of genes may be sufficient to produce a given effect. Thus in hexaploid wheats any of three genes will produce red colour. If a plant containing all three be crossed with a triple recessive, only 1 in 64 of the F_2 will be white. Still more complicated cases are known, and they constitute one of the greatest practical difficulties in the study of heredity. The case in which the effects of the several genes are not clear-cut will be considered later.

Sex-limited Inheritance.—Many genes, though of course inherited through both sexes, can only find expression in one. Thus milk-production and butter-percentage in cows, and egg-laying in hens, are both determined by genes inherited from the father as well as from the mother. The same is true of characters not obviously connected with sex. For example in *Drosophila* a particular recessive gene, "bobbed," causes a shortening of bristles in the female only. This is because the Y-chromosome normally contains the dominant allelomorph of "bobbed." When this is lost the character appears in both sexes. A gene which only acts upon one sex is described as sex-limited in its expression. Such genes are also sometimes, though not generally, sex-linked. The action of a gene may be delayed for a generation. Thus a particular gene in the sweet pea causes all the pollen grains produced by plants carrying it to be long, as opposed to round. As this gene is dominant, the pollen grains of a heterozygous individual are all long, even though half of them carry the recessive gene for round pollen. Similarly a gene in the silk-worm causes females bearing it to produce pink eggs and larvae, so that here also the appearance of the larvae is no guide to their genetic composition. Such inheritance is called maternal, and is a special (and in practice rather confusing) type of sex-limited inheritance.

Influence of Environment.—Just as genes are influenced by one another in their expression, they are influenced by variations in the environment. For example the size or flowering time of an organism are naturally determined by its nutrition and other environmental factors, as well as by genes. But very often the effect of environment is much greater on one phenotype than on another. Thus cold increases the amount of black pigment in the skin and hair of the "Himalayan" rabbit, where the blackness of the extremities is only due to their low temperature; but it has little or no effect either on the white or the fully coloured rabbit. Again whereas damp food has very little effect on normal *Drosophila*, it causes the production of grossly abnormal abdomens in a particular genotype. Where it is desired to eliminate a hereditary character, the environment should be so adjusted that it can find its fullest expression. Thus the seed of many beets and mangolds, when sown in the open, produces about 1% of bolters, *i.e.*, plants flowering in their first year. Bolting depends both on heredity and environment. If the seed is sown under glass in December and planted out in the spring, half or more of the plants may bolt, and by eliminating them for several generations the hereditary tendency to bolt may be got rid of, which is almost impossible under ordinary conditions of planting.

Presence and Absence Theory.—The simplest explanation of the phenomenon of dominance is the "presence and absence" theory. According to this view a recessive gene is simply the absence of the corresponding dominant gene. One need not of course imagine a mere void in its place, but some structure which does not have its function. Where dominance is complete it is assumed that one of the dominant genes can effectively do the work of two. In a series of multiple allelomorphs it is supposed that the various intermediate members of the series function to a lesser degree than the ultimate dominant. In this case we should expect that the intermediate genes would not be completely dominant. This is generally the case. Thus in *Drosophila melanogaster* there are 10 genes in the same locus giving eye colours intermediate between white and the normal red. None of these show the complete dominance which red shows over them all. If an activity of the gene or genes arbitrarily denoted by 100 or over is needed for complete colour, it is clear that no gene producing by itself an effect of less than 100 could be fully dominant. The presence and absence theory is borne out by the facts of sex linkage and deficiency, where an absent gene behaves like a recessive gene. But it meets with difficulties in explaining the origin of genes dominant over the normal type, and occasionally breaks down where, in a triploid, two recessive genes are dominant over one which is dominant in the diploid. Nevertheless, in a modified form, it is very widely applicable.

In some cases we may say that a dominant gene causes the formation of a certain substance, *e.g.*, a particular anthocyanin pigment or a particular colloid concerned in immunity. Thus in the guinea-pig the presence of complement (*see* IMMUNITY) in the serum is dominant to its absence. The recessives are so liable to disease that the character has died out. More rarely a gene inhibits such a formation. On the presence and absence theory it should do so by producing a definite substance. This is at least sometimes the case. Thus the skins of black rabbits contain a catalyst which causes the formation of melanin (black pigment) from tyrosin and hydrogen peroxide. This is absent in recessive white and yellow rabbits. The gene *G* which inhibits pigment formation produces a substance in the skin of the white bellies of rabbits carrying it which can be shown in the test-tube to inhibit pigment formation by the extract of black skin. A dominant gene causing the "English" piebald pattern acts by forming the same or a similar inhibitory substance. The co-operation of genes is therefore largely to be explained on biochemical lines.

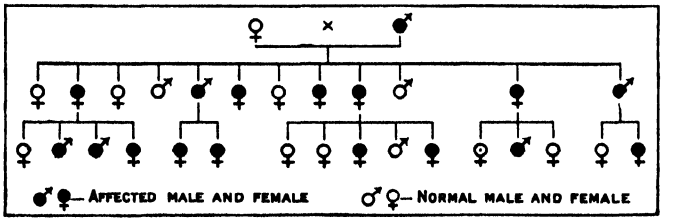
Growth Rate.—In some cases the genotype determines the rate of a reaction, such as the growth of a given organ, or the rate of formation of a pigment. Thus a series of genotypes in certain insects and crustaceans are characterized by different rates of darkening during larval life. Those which arrive at a certain stage before the end of metamorphosis are indistinguishable in the adult form. But those characterized by very slow rates cannot complete pigment formation before development is over, and yield light-coloured adults.

Nature of the Gene.—The gene then is a unit, situated (during nuclear division) at a definite point in a definite chromosome, and dividing once at each cell division. Its diameter, to judge from data as to linkage, is probably not much more than ten times that of an average protein molecule, and may be less. A gene may be responsible for any of the differences which exist between different varieties of a species, including types so aberrant as to be incapable of life. There is reason to suppose that genes act by promoting or retarding specific chemical reactions. The heads of spermatozoa consist largely of compounds of nucleic acid with rather simple proteins.

POLYPLOIDY AND ANEUPLOIDY

While the above principles apply to inheritance in most plants and animals, they break down to a greater or less extent in many of the most important cultivated plants, because these possess a more complicated mechanism for the reduction division, and therefore a more complex type of segregation.

Tetraploidy.—An organism with double the normal somatic and four times the gametic or haploid number is called a tetraploid (Gr. τετραπλοῦς, fourfold), and in general one with any multiple of this number is called a polyploid (Gr. πολυπλοῦς, manifold). Tetraploids may arise in a species in several ways. The commonest is by a doubling of the chromosome number during vegetative multiplication of a plant. Thus if tomatoes are cut down and allowed to regenerate, about 2% will regenerate a tetraploid branch. Tetraploids can also arise by the union of two gametes in neither of which the reduction division has taken place. They are generally larger than the parent species, and fertile *inter se*, but may be nearly sterile when crossed with the parent. They therefore satisfy many of the criteria of a new species. In such a plant there are four chromosomes of each type, and two of each go into a gamete. The laws of heredity in it can be illustrated by the case of style length in the giant tetraploid form of *Primula sinensis*. The gene *S* for shortness is almost completely dominant. There are five genotypes whose gametes may be tested by mating with long-styled (*ssss*) plants.



AFTER FARABEE

FIG. 6.—PART OF A PEDIGREE OF BRACHYDACTYLY (SHORT FINGERS)

Genotype	Gametes
SSSS	*SS*
SSSs	1 *SS* : 1 *Ss*
SSss	1 *SS* : 4 *Ss* : 1 *ss*
Ssss	1 *Ss* : 1 *ss*
ssss	*ss*

The first four are all short-styled. The *SSSS* and *SSSs* types can only be distinguished by a genetical analysis of their progeny, but *SSss* and *Ssss* differ in that the former give one recessive in six when mated with a recessive, and one in thirty-six when mated *inter se* or self-fertilized, while the latter give the ordinary Mendelian ratios of one in two and one in four.

Allopolyploidy.—A different type of tetraploidy arises from species crossing. If *Primula floribunda* and *Primula verticillata* (which have the same chromosome number of 18) are crossed, the offspring generally have 18 chromosomes, but are sterile, like mules. Such plants occasionally produce a tetraploid branch with the chromosome number 36. Such a branch is self-fertile, and the seeds from it yield the new species *Primula kewensis*. In this the nine pairs of chromosomes derived from each species pair with one another before the reduction division, so the gametes receive one haploid set from each parent species and the new plant breeds true. Such a condition is called allopolyploidy, that of polyploids arising with a species, autopolyploidy. Occasionally a chromosome from *floribunda* will pair with one from *verticillata*, and a new type of gamete will thus arise. Hence *Primula kewensis* does not breed quite true. It will also be clear that when two allopolyploid plants are crossed, the inheritance is not necessarily Mendelian. Recessive characters may disappear on crossing if the conditions before the reduction division are such as to prevent two chromosomes bearing the recessive gene from entering the same gamete.

The following cultivated plants are wholly or mainly polyploid:—Wheat, oats, plum, sour cherry, strawberry, apple, pear, rose, dahlia; and polyploid races of raspberries and other *Rubi*, chrysanthemum and many other plants exist in cultivation. In nature polyploidy is fairly common in certain genera, but inheritance in natural polyploids has been little studied. Polyploidy is rare in animals, but may arise from certain species-crosses.

Aneuploidy.—Besides the polyploids so far described, which have regular reduction divisions, haploid, triploid and other forms exist in which the chromosomes cannot all find mates, and the reduction division is therefore irregular. Such plants cannot therefore be propagated sexually, for the pollen and ovules are often infertile, and their combination practically never reproduces the parent. But they can be and are propagated asexually, and several domestic tulips, hyacinths and ornamental (though not fruit-bearing) cherries are triploids. By irregularities in the reduction division plants may be formed with too many or too few chromosomes. The former are often quite vigorous, and may be economically valuable. Thus all cultivated sweet cherries have one, two or three chromosomes more than the wild form. Their gametogenesis is irregular, and they never breed true sexually, but can be propagated by grafting. The various types of ovule produced by such plants are sometimes equally viable, but the pollen grains with an abnormal chromosome number are always less so than those with the normal number; hence such plants when bred sexually gradually revert to the normal type. Forms with a chromosome number which does not permit of a normal reduction division and normal heredity are called aneuploid.

Triploidy is the normal condition in the endosperm of seeds. The second generative nucleus of the pollen-grain fuses with the double secondary nucleus of the embryo-sac, producing a triploid endosperm nucleus. When this receives a dominant gene from the pollen grain the character of the endosperm may be altered, a phenomenon known as xenia.

MULTIPLE FACTORS AND QUASI-CONTINUOUS VARIATION

When a variable species is adequately analysed on Mendelian lines a very large number of genes are found to affect any character considered. Thus in *Primula sinensis* twelve genes affect the flower colour, apart from those determining the size and shape of the eye; in *Drosophila melanogaster* 103 genes are known which have marked effects on the wings. When almost all the variations in a population are due to one or two genes and the environment, analysis is generally easy. When a large number are present it becomes quite impossible except as the result of prolonged experiment.

Multiple Factors.—While in plants single genes often determine the difference in size between races (as in the case of the tall and short sweet peas) this is rarely so in domestic animals. Thus the difference in size between the Hamburgh and Sebright bantam fowls appears to be due to four genes, of which the Hamburgh possesses three, *A*, *B* and *C*, and the bantam one, *D*, all in the homozygous form. They are all incompletely dominant. The F_1 is intermediate between the parents, and uniform. The F_2 is very variable and includes the genotypes *AABBCCDD* and *aabbccdd*, which are larger and smaller respectively than either parent race. When two pure-breeding races are crossed, something of this kind usually occurs.

Correlation.—In a species such as man where inbreeding is rare, variation in stature is apparently continuous, though the atomic constitution of matter makes it fairly clear that the number of possible phenotypes is finite. Provided that mating in such a population is at random, or alternatively that the intensity of assortative mating is known, a great deal may be found out regarding heredity in human populations by statistical methods. The resemblance between parents and children, brothers and sisters, and other relatives, can thus be estimated. Great care must be taken to exclude the effect of similar environments in increasing such correlations. But for example among the richer classes in England, where rickets and underfeeding are rare, the environment is relatively unimportant in determining stature. In the case of a number of human characters, such as stature, span, forearm length, the coefficient of correlation between parent and child ranges from ·51 to ·42, between sibs from ·54 to ·46. If we consider the variance (*see* VARIATION AND SELECTION) of a population if the parents (and hence all ancestors) are given, the variance is diminished to about 46%, which is mainly due to segregation, and not to differences in the environment. In other words differences in ancestry and segregation within families have about equal effects in producing variance. While the pre-Mendelian genetics do not account for segregation, Mendel's principles do so. It has been shown that the coefficients of correlation found for human stature are quantitatively predictable on the hypothesis that it is the resultant of very numerous genes. On the other hand until these genes can be determined, statistical methods are the only ones available for the analysis of this kind of inheritance.

INBREEDING AND OUTBREEDING

In numerous animal and plant species prolonged inbreeding may lead to the production of defective and sterile individuals. When members of two inbred lines are mated, there is usually a considerable gain in vigour. But more careful work has shown that inbreeding is not always harmful. Many plants, such as the pea, are normally self-fertilized, and rats have been successfully bred from brother to sister matings for more than 20 generations. If a plant heterozygous for a number of genes is self-fertilized, only half its offspring will be heterozygous for each of them, and the average plant will be heterozygous for only half the original number. The same process occurs, only more slowly, with inbreeding. In either case nearly complete homozygosis is reached in about six generations. Experience shows that most of the harmful effects of inbreeding, if any, appear within the first five to ten generations. If rigid selection is exercised during that period, a vigorous inbreeding race may often be built up, which does not vary appreciably in a constant environment, and cannot, of course, be further altered by selection.

Two distinct views are held as to the advantages of outcrossing. On the one hand it is thought that the bad effects of inbreeding are merely due to the appearance of recessive characters, and that it should be theoretically possible to eliminate these. Of course if the desirable dominant genes were very strongly repelled the practical difficulties would be immense.

Other workers believe that heterozygosis is beneficial as such. It is certainly of interest that the more successful types of asexually propagated plants often give evidence of extreme heterozygosis when self-fertilized. For example, the raspberry "Superlative" gives white plants which die at an early stage, plants sterile on the male side, others sterile on the female side, besides several recessive colour varieties; seedlings from it, which are homozygous for the dominant characters allelomorphic to these, are less satisfactory as fruit plants than their parent. It is possible therefore that it may be advantageous to be heterozygous for one or more lethal genes.

The condition of heterosis or hybrid vigour is of considerable interest as a character which is genetically determined, but yet not inherited. In particular the first generation of a cross between species is often larger and healthier than either parent, though they may be sterile or yield very unsatisfactory offspring. When, however, a cross is made between tetraploid species, or the chromosome number of a hybrid is doubled, an allotetraploid is produced in which there is no segregation, and it is suggested that the good effects of heterosis are not annulled by sexual reproduction in such case though the matter has not as yet been definitely decided.

FERTILITY AND HETEROSTYLISM

Many plants and some hermaphrodite animals are self-sterile. In some species this is a purely individual matter, but in others the species falls into two or more groups, members of each of which are sterile when mated *inter se*, but fertile when crossed with another group. The sterility may be absolute, but is not always so. Plants may sometimes be obtained by unions within an apparently self-sterile group if the end of the style is cut off before fertilization so that the pollen tubes have an abnormally short distance to grow. The mutually infertile groups are anatomically distinguishable in the case of heterostylous plants. Here one type has a short style and long stamens, the other a long style and short stamens. Not only is there a barrier to self-fertilization, but unions between plants of the same class are generally relatively, sometimes completely, infertile. Where this infertility is not complete it is found that the short-styled (or thrum) type is dominant, most of such plants in nature being heterozygous. In some cases intermediate types of plant exist, also genetically determined.

An analysis is often possible where no visible characters distinguish the classes. Thus in self-sterile plants of *Nicotiana* three allelomorphic (or strongly repelled) genes S_1, S_2, S_3 are found, no plant being homozygous for all three. A plant of composition S_1S_2 is self-sterile, but if its pollen is used on one of composition S_2S_3, the S_1 grains are functional. Thus the products of the various possible matings are:—

$S_1S_2 \times S_2S_3$, 1 S_1S_2 : 1 S_2S_3; $S_2S_3 \times S_1S_3$, 1 S_1S_3 : 1 S_1S_2, and so on (the pollen parent is shown on the right). A colour-determining gene exhibits partial linkage with these genes. In the same species other genes allelomorphic to S_1, S_2 and S_3 exist, and also a gene which renders plants possessing it self-fertile. Self and mutual sterility is of considerable economic importance in the case of apples, plums and cherries, in all of which fertilization is necessary before fruit can be formed, though the fruit persists even if the embryos do not survive beyond a certain stage. Hence the conditions are highly complicated. In the plum it seems probable that fertility is determined by a system of genes like those of *Nicotiana*, their action being further complicated by the condition of polyploidy.

While allopolyploid plants are generally fully fertile *inter se*, autotetraploids are often less so than the corresponding diploids, though of course they are far more fertile *inter se* than in a cross with a diploid. But tetraploid forms of self-sterile species are commonly self-fertile. Very little is known concerning the inheritance of fertility in animals, except that genes involving physiological changes often depress it, and that it is usually increased by a moderate degree of heterosis, and diminished in species-crosses. Of course intersexuality is commonly accompanied by lessened fertility (*see* SEX).

SOMATIC SEGREGATION

When an organism produces several types of offspring the normal moment of segregation is at the reduction division, in which case segregation usually obeys Mendel's laws. But other types of segregation may occur. Much less is known about them than about the normal type, but a distinction may be made between three types of event, mutation, break-up of a chimaera, and plastid inheritance. Somatic segregation is more important in plants than in animals, because in the latter the germ cells are usually early differentiated from the soma, and whereas in a plant with white and green branches the gametes will often be different on the two branches, an insect whose right and left wings differ will commonly produce only one type of gamete.

Chimaeras.—It will be convenient to begin with a discussion of chimaeras. A chimerical plant may be sectorial, as when one half of a stem, with its leaves, is green, the other white, shoots from the border of the two sectors being of mixed colour. Or it may be periclinal, as when a green core is contained in a white skin, or conversely, a common arrangement in *Pelargonium* (usually called "geranium"). The outer layer may consist of one, two or more cells. Occasionally as the result of grafting, a periclinal chimaera may be composed of layers of two different species; as for example *Cytisus Adami*, which consists of a layer of *C. purpureus* over a core of *C. Laburnum*, and bears flowers of both the species together with those of the chimerical type. Though one type of chimaera may occasionally give rise to another, the periclinal type can generally be propagated vegetatively. Thus many commercial types of potato are periclinal chimaeras. When, however, the vegetative propagation is only from one layer, that layer is alone represented in the offspring. Thus a white-cored geranium can be propagated by an ordinary cutting, but a root-cutting gives only white plants, and when a potato such as Noroton Beauty (a mottled form) has its "eyes" removed the tubers give rise to red potatoes identical with the variety Triumph. It clearly consists of a core of Triumph surrounded by a nearly colourless layer. While periclinal chimaeras are common in such asexually propagated plants as the potato and the geranium, they are rare in the raspberry, because the "suckers" or asexually propagated plants grow from the roots in this case. Occasionally chimaeras are still more complicated, owing to the occurrence of more than two tissue types.

Stable chimaeras cannot be reproduced sexually. Their gametes generally reproduce the characters of the sub-epidermal layer, and are usually of one genotype only. Very often, however, chimaeras are sterile, or only one gender of gamete is produced. Chimaeras may arise from grafting, or more frequently from bud variation, which appears to be simply due to mutation (*q.v.*) in a somatic cell. If so it is usually found that the mutant portion differs by one gene only from the original plant though it may differ in chromosome number. When the chimaera is sectorial the mutant branches can often be propagated by grafting or by cuttings. In this way, for example, the red Magnum Bonum plum arose as a bud sport from yellow Magnum Bonum. In practice it is often impossible to be sure, without further experiment, whether a given case of somatic segregation is due to the break up of a chimaera, or to mutation in a somatic cell.

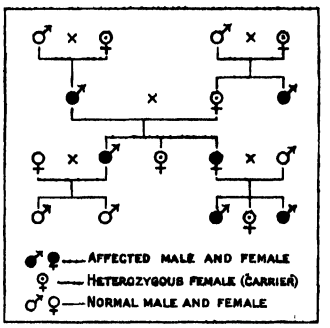
Plastid Inheritance and Multimutation.—Plants may exhibit variegation either of the chlorophyll in the leaves, or the pigments of the flowers. In some cases the variegated condition is a simple recessive to the normal. Sometimes, however, as in *Mirabilis jalapa*, a recessive plant of the var. *variegata* (here variegated green and yellow), will produce a pure green branch, or, on self-fertilization, a pure green seedling. Such seedlings behave as heterozygotes for the recessive character of variegation. Here it is clear that the recessive gene occasionally mutates back to the dominant. Probably the genetical mutability and the variegation are different aspects of the same phenomenon. While some geneticists regard these "multimutating genes" as an explanation of all abnormally inherited variegation, many cases seem to call for some other explanation. In *Pelargonium zonale*, green or green-skinned branches give only green seedlings when selfed, and white or white-skinned only white. The cross yields a mixture of green,

white and mosaic plants. This kind of inheritance is most readily explained as due to plastids which are not passed on from one cell to another according to any definite law. In such cases inheritance may be through both sexes, as in *Pelargonium* and *Oenothera*, or through the female only, as in *Mirabilis* and *Primula*. Thus in *Mirabilis Jalapa* var. *albomaculata* the leaves are mottled green and white, with occasional green shoots. The condition is not transmitted through the pollen, and the seeds, no matter with what pollen, produce a mixture of green, albomaculata, and white plants. Non-Mendelian variegation occurs even in the prothallia of certain variegated ferns, and is common as a result of species crossing. Non-Mendelian inheritance occurs very rarely.

HEREDITY IN MAN

There is now no doubt that the laws of heredity are the same in man and in other animals, but their application is very different. In the case of domestic animals a new type is often bred from extensively. There is thus a fair probability that two piebald cats will owe their origin to a single common ancestor, and that their condition will therefore be due to the same gene or genes. With two piebald men not known to be related the opposite is probably true. Again in-breeding and in consequence homozygosity are far commoner in most other organisms than in man. It is convenient to divide human heritable characters into well-marked characters exhibiting Mendelian inheritance, other physical characters, and other psychological characters.

Dominant Abnormalities.—Many well-marked hereditary abnormalities run in families. A dominant character is handed down regardless of sex, only by an affected individual, and to about half of his or her children. Among anomalies of the eyes alone, such characters include myopia, two or more types of presenile cataract, retinitis pigmentosa (in certain families), acute glaucoma, and night-blindness (in some families). A pedigree of the latter includes 2,116 individuals, of whom 135 were night-blind, all descended from Jean Nougaret, who was born near Montpelier in 1635. Other dominant characters include several ear and skin diseases, diabetes insipidus and other metabolic diseases. In some cases the inheritance is apparently somewhat irregular. Thus acholuric jaundice is strongly hereditary, but occasionally transmitted through unaffected individuals. The latter however are found to have abnormally fragile red blood corpuscles, and it is this character which is actually inherited, though a person displaying it may actually escape the usual consequence of jaundice. In addition a number of malformations are inherited as dominants, including brachydactyly (absence of one bone in each finger) and lobster-claw (absence of all digits except sometimes the thumb and little finger). Minor anomalies inherited in this way may prove very serious in the homozygous form. Thus a marriage between cousins with a hereditary shortening of one finger produced a child without hands or feet. The social importance of dominant abnormalities, which are inherited only from affected persons may be gauged by the fact that over 10% of blindness in Germany is due to hereditary cataract alone. On the other hand many of the above complaints can also be produced by environmental influences.



AFTER TORT.

FIG. 7.—PART OF A PEDIGREE OF HUMAN COLOUR-BLINDNESS, TRANSMITTED BY APPARENTLY NORMAL WOMEN TO HALF THEIR SONS

Sex-linked Recessive Abnormalities.—Another great group of abnormalities are sex-linked recessives. They are very much commoner in males than in females, and are not passed on by affected males to their children, though their daughters, who receive an abnormal X-chomosome from them, hand the character on to half their sons. The most serious condition inherited in this way is haemophilia, a failure of the blood to clot which generally leads to death by haemorrhage. A very common group of characters inherited in this way are the four types of colour-blindness, namely protanopia (red-blindness) and its milder form protanomalia, deuteranopia (green-blindness) and its milder form deuteranomalia. The two types of red-blindness, with normal sight, give a series of multiple allelomorphs, as do the two types of green-blindness, but it is not certain whether all five characters are allelomorphic. Among other sex-linked recessives are retinitis pigmentosa (in certain families) and atrophy of the optic nerve.

Autosomal Recessive Anomalies.—Autosomal recessive characters are harder to detect. They do not at first sight appear to be hereditary at all, and are best studied in cases such as deaf-mutism where two affected persons commonly marry, in which case all the children are commonly deaf and dumb. However recessive anomalies are vastly more likely to appear in the children of marriages between cousins, or of incestuous unions, than in the general public, since two relations are likely to carry the same recessive gene. Among such anomalies are albinism, some types of retinitis pigmentosa, "day-blindness" or total colour-blindness, deaf-mutism in many families, a number of skin diseases and several diseases of metabolism, including alcaptonuria. Many other anomalies are very probably inherited in a Mendelian manner, for example an inability to become immune to measles or scarlet fever, which leads to suffering from these diseases more than once. Since however this character can only be demonstrated when infection has occurred, it is impossible to be certain of its heredity. Similarly cancer is a recessive character in certain strains of mice, and is at least in some degree hereditary in man, though undoubtedly due in part to external causes.

Other Mendelian Characters.—Among non-pathological physical characters which are inherited in a Mendelian manner should be named the iso-agglutinins. Every human being falls into one of four groups, *AB*, *A*, *B* and *o*. The corpuscles of group *o* are not agglutinated by any sera, and can therefore safely be injected into members of any group. Those of group *A* are agglutinated by groups *B* and *o*, of group *B* by groups *A* and *o*, of group *AB* by the other groups. Inheritance is Mendelian, the presence of *A* or *B* being due to a distinct dominant gene, the two perhaps being a pair of multiple allelomorphs. The groups are found in different proportions in different races, and are also present in the anthropoid apes. In western Europe brown- or green-eyed persons mostly differ from the blue and grey eyed by a single dominant gene, but other genes are also concerned. The sharp segregation which often occurs among the second and later generations of inter-racial crosses makes it clear that Mendelian genes are concerned, but their analysis has not yet gone very far.

Quantitative Characters.—Most of the human characters whose inheritance can be studied in large populations are quantitative and apparently continuously varying characters such as stature, length of forearm or cranial index are probably due to a number of genes. In these cases Mendelian methods are as yet inapplicable, but much may be learned by statistical means. Such characters show the following correlations between relatives:—

Brother with brother or sister with sister	about ·52
One parent with son or daughter	about ·46
Grandparent and grandchild	about ·27
Uncle or aunt and nephew or niece	about ·25
First cousins *inter se*	about ·15

The law of ancestral heredity, applied to eye and coat colour, states that the coefficient of correlation between the character in an individual and any ancestor distant by $n+1$ generations is ar^n, where a = about $\frac{1}{2}$ and r = about $\frac{1}{3}$. Earlier work suggested higher correlations with remote ancestors.

In other words, if allowing for the slight tendency of like to mate with like, we may say that of the total variance ancestry accounts for about 54%, *i.e.*, less than half is due to segregation within a family with the same parents, and very little indeed to differences in environment. Putting the matter in another way, if the measured character of the average of the parents deviates from the average of the population by a certain amount, their children will on the average deviate by about 75% of that amount. Thus if a father is 4in. above the average height, and the mother 1in. below, the "mid-parent" is 1½in. higher. The average height of children of such parents is just over one inch above the average for their sex. Substantially similar results are obtained for the

inheritance of health and longevity, eye- and hair-colour, and other characters. It is important that the correlations are the same for characters such as eye-colour, which are not substantially influenced by the environment, and height, which may be, as in the case of rickets. It follows that, in the populations so far investigated, heredity accounted for much more variation than environment.

Psychological Characters.—Psychological characters are harder to measure, and it is very hard to compare children with their parents, but when brothers and sisters are compared with one another, success at school, intelligence quotients, quick temper, and so on, are correlated to the same extent as physical characters. The question arises how far this resemblance is due to similarity of environment among brothers. Among other tests the following have been applied. If fraternal resemblance depends appreciably on environment, brothers in an orphanage should vary more, in comparison with their companions, than brothers at an ordinary school. They do not do so. Foster-children should resemble their foster-parents in intelligence rating to nearly the extent found among blood-relations. They are found to show a resemblance with their foster-mothers which is slight in comparison with that between blood relations, and practically no resemblance with their foster-fathers. Again attempts to correlate intelligence within elementary schools with economic and other environmental conditions yield very small correlation-coefficients.

Monozygotic Twins.—An important line of evidence is derived from the study of "identical" or monozygotic twins formed from the same fertilized ovum, and therefore genetically identical. They resemble one another far more than ordinary brothers and sisters, or dizygotic twins. Preliminary studies seem to show that when separated at birth their adult intelligence quotients resemble one another to a very great extent, but their emotional reactions and moral character may differ markedly.

Mental defect is very strongly inherited, but only sometimes does it follow a definitely Mendelian course. In some pedigrees feeble-mindedness appears to be recessive, but there is no such sharp line between feeble-minded and dull individuals as would be the case were this always so. Probably many genes are concerned.

HEREDITY IN SOME ANIMALS

Mammals.—The character which has been most extensively studied is colour. This is inherited on very similar lines in the dog, cat, rabbit, guinea-pig, rat and mouse. The horse somewhat resembles these, but the cow, pig and sheep diverge considerably. Albinism is always recessive, though dominant genes producing black-eyed whites are often found. Where the wild colour is grey with a light-coloured belly, blackness is usually recessive, but again dominant genes converting grey into black are known in some species. Yellow is usually recessive to darker colours, and the brindled condition is often due to a multiple allelomorph intermediate in its action between the genes determining yellow and full colour. Chocolate pigmentation, as in the liver spaniel, is always recessive to black. Piebaldness may be recessive or dominant, and different genes may affect the pattern differently. Thus the white face of Hereford cattle is due to a dominant gene, while the ordinary type of piebaldness is neither dominant nor recessive, heterozygotes being intermediate.

Some structural characters are inherited on Mendelian lines. Thus long hair is recessive in rabbits, guinea-pigs, dogs and cats; and the polled character is dominant in cattle. A number of malformations and lethal genes are recessive. But the most economically important characters, such as butter- and milk-yield in cattle, are generally due to several genes. These are inherited through both sexes, even when only one manifests the character. Thus the Danish dairy industry owes much to two "butter bulls" who transmitted a gene or genes determining high butter yield to all their cow calves. In the large domestic animals selection is mainly practiced on the males, and these can often be genetically analysed by testing with a recessive. Thus a black polled bull who gives only black polled calves with red-horned cows must be homozygous for both the polled and black genes, and will yield only polled black calves even with heterozygous cows.

Poultry.—In poultry and pigeons the characters distinguishing the different breeds are mostly determined by quite a few genes. Thus the comb shape is determined by four or five principal genes. One of these determines the presence of a comb. Another converts this into a rose comb, yet a third into a pea comb, the two together giving a "walnut" comb. A fourth gene, not completely dominant, determines a double comb. At least 12 genes are known modifying the structure or arrangement of the feathers, and about the same number determining pigmentation, besides several genes which affect the colour of the skin and internal organs. Egg colour is determined by a number of genes as is broodiness, though here the main gene appears to be a dominant causing broodiness. Fecundity is strongly inherited, and appears to be determined by two dominant genes. At least four genes are sex-linked. Inheritance in pigeons and canaries has been less thoroughly investigated, but in both a number of genes are known.

Drosophila.—A large amount of work has been done on *Drosophila melanogaster* and related species, and on members of the Tettigidae (locusts), and a smaller amount on other invertebrates. In *Drosophila melanogaster* over 400 genes are known, modifying almost every part of the body, and also such psychological characters as phototropism. Many, but by no means all, produce types less viable than the wild form.

HEREDITY IN PLANTS

Flower Colour.—Flower colour has been more extensively studied than any other character. Thus in *Primula sinensis,* in which more genes are known than in any other flower (28 in all), 11 affect flower colour, while 3 others determine the size of the "eye" or central coloured patch, the remainder affecting structural characters, such as leaf shape and habit of the plant. Many of the genes affect several parts. Thus the same gene causes crimping of the leaves and petals, and the light-coloured flowers due to several recessive genes are associated with light stems and leaves.

Flower colour may be due to red or blue anthocyanin in the sap, to yellow pigment in the plastids, or to both. The combination is generally purple or orange. Some plants, *e.g.,* the primrose, have no anthocyanin, others, such as *Primula sinensis,* no yellow pigment, while many, *e.g.,* the rose, tulip and stock, have both. Usually each pigment is governed by a separate set of genes. Loss of the principal gene or genes determining anthocyanin formation gives a yellow plant if plastid pigments are present, otherwise a white. Similarly loss of the principal gene for yellow may convert a bronze into a red. In addition either the anthocyanin or the plastids may be whitened by a dominant gene. A gene may alter the colour of the anthocyanin either by altering the reaction of the cell-sap (for blue anthocyanin is generally reddened by acid) or by altering its molecular structure. The genes which cause large changes in flower colour (*e.g.,* turn a white into a coloured plant) often affect leaf and stem colour too. They may also affect structural characters. Thus whiteness in stocks may be due to the loss of either of two genes. A white stock cannot have hairy leaves. The hairiness or otherwise of the coloured plants is determined by two further dominant genes.

Cereals.—Maize has been very thoroughly analysed, and the inheritance of many economically important characters is understood. Thus the sugary endosperm of the sweet corn is due to a recessive gene, and another recessive gene determines waxy endosperm. But most cultivated wheats and oats are hexaploids, though a few are tetraploids. They are moreover allohexaploids. Hence while certain characters behave in a Mendelian manner, the same character may be due to a gene in either of the three sets of chromosomes, and will therefore exhibit different linkages in different races. Moreover, as usual in allopolyploids, characters which behave as recessives in F_1 do not always reappear in F_2. The characters known to be Mendelian are not in general those of the greatest economic importance. Resistance to disease varies in its inheritance with the species of rust or mildew concerned. Thus resistance to yellow rust, *Puccinia glumarum,* is recessive,

but that to brown rust, *Puccinia triticina,* and mildew, *Erisyphe graminis,* are dominant. But the matter is greatly complicated by the fact that a wheat which is immune in one environment may be attacked in another, owing to the existence of different races of the same parasite species.

Anisogeny.—Among the structural and physiological characters which have been found to obey Mendel's laws are size, habit, leaf shape, flower shape, time of flowering, heterostylism, sterility of either male or female organs, hairiness, and a variety of abnormalities. An occasional complication of plant genetics is anisogeny, *i.e.,* the ovules and pollen grains are of different genetical composition. This may be due to differences in the cytoplasm or plastids which are maternally inherited, to only half the pollen grains being functional or, in dioecious plants to sex-linkage. Thus in the stock, *Matthiola incana,* a race exists which, though single, gives slightly more than 50% of double flowered plants when self-fertilized. When used as a female with a normal single, half the F_1 produce doubles; when used as a male all the F_1 do so. But doubleness now behaves as an ordinary recessive. This is generally explained on the view that the dominant gene *S* for singleness is closely linked with a gene *p* which prevents the proper functioning of pollen grains bearing it. The ever-sporting type is $\frac{sp}{SP}$ All its functional pollen is *sP*, so that when selfed, about half the seeds are $\frac{Sp}{sp}$ and give doubles, the other half perpetuating the parental type. The gene inhibiting plastid colour is carried in the same chromosome.

Unicellular Organisms.—In Protista, including Bacteria and certain algae, any cell can reproduce, and there is no clear distinction between growth and reproduction. Where reproduction is asexual we have a condition parallel to that of a clone in the higher plants, and variations are rather feebly inherited. Nevertheless selection has sometimes been at least temporarily effective within such a clone. When sexual reproduction occurs, there is often a marked outbreak of variation. Acquired characters, such as those produced by certain poisons in trypanosomes, are inherited at least for a considerable period but are generally lost on sexual reproduction, and sometimes without it. Adaptive characters acquired by a strain of micro-organisms, *e.g.*, a capacity for fermenting sugars not usually attacked, may be genuine adaptations inherited, but are sometimes believed to be due to the selection of mutants.

Species Crosses.—When two species with different chromosome numbers are successfully crossed the reduction divisions of the hybrid are generally irregular, and it is nearly or quite sterile. Occasionally in such cases unreduced gametes may be formed, in which case there is no segregation of characters, and allopolyploidy may result in later generations. When however the chromosome numbers are equal, the normal segregation mechanism may be able to function, though it does not always do so. In this case the F_2 generation, and the results of back-crossing F_1 to either parent, are usually polymorphic, and may include monstrous or more or less inviable forms. In certain cases, owing to the inviability of most gametic and zygotic combinations, the F_2 consists entirely of types resembling one or other parent fairly closely. Sometimes however a partial Mendelian analysis is possible. For example from the cross between the primrose, *Primula acaulis,* and the blue Asiatic primrose, *Primula Juliae,* it appears that the former possesses a gene for yellow pigment, the latter for anthocyanin, so that whites appear in F_2. If the oxlip, *P. elatior,* is crossed with *Juliae* it is found to carry a gene inhibiting anthocyanin formation and one for the umbellate habit as well as those of *acaulis.* At least two genes are concerned in determining hairiness in these crosses, one being linked with a colour gene. Besides genes, species may differ in cytoplasmic factors, as do *Geranium striatum* and *G. Endressii,* and the commonness of variegation as the result of species crosses suggests that the plastids may also differ. Mendelian analysis has been carried some way in specific crosses of the moths of the sub-family Bistoninae, and some other animals, but it is complicated not only by sterility and upsets of sex (*q.v.*), but by the effects of heterosis, which cause increase in size and vigour.

Where species cannot be crossed their genetics and chromosomal architecture can be compared; thus the Norway rat, *Rattus norvegicus,* has three linked autosomal genes, *C, R* and *P* whose loss causes albinism, red-eyed yellowness and pink-eyed yellowness respectively. *C* and *P* have also been lost in different mouse races, and are linked with somewhat greater intensity, *R* has been lost in the black rat *Rattus rattus, C* and *R* in the Californian deer-mouse, *Peromyscus maniculatus,* where they are also linked. Clearly the architecture of the germ-plasm is similar in these species. On the other hand the arrangement of the genes in the chromosomes differs appreciably in different species of *Drosophila,* and sectors of a chromosome have been reversed in certain geographical races of *D. melanogaster.* In the rodents certain species and varieties differ by colour genes which are multiple allelomorphs of those producing well marked changes such as yellowness; that is to say that these particular genes differ less between species than domestic varieties.

HISTORY

19th Century.—Early thought on this subject was mainly speculative, and has left very little mark on modern theories. On the other hand a considerable empirical knowledge of the subject has long been current among practical breeders of animals, and to a less extent of plants. Among the principles clearly recognized, and formulated among others by C Darwin in *Variation of Animals and Plants under Domestication,* were the facts that when two widely divergent varieties were crossed the F_1, tended to resemble the wild form of the species (atavism, *q.v.*) and that in such a case, or a species cross, the F_2 were very variable. Atavism is a consequence of the fact that most variants are recessive to the wild type. Various theories were put forward in the 19th century, mostly based on the assumption that acquired characters were inherited. Thus Darwin supposed that particles were carried by the blood from adult organs to the gonads, and affected the hereditary characters transmitted.

In the late 19th century, apart from Mendel's work, two main lines of enquiry were pursued. A. Weissman (*q.v.*) and others showed that characters acquired by the adult are not in general transmitted to the offspring (*see* LAMARCKISM). It is of course possible that this occurs in exceptional cases, or so slowly that the process is only effective on a geological time-scale. He stressed the continuity of the germ-plasm from one generation to another, and developed a theory of heredity by the chromosomes which has since been abandoned, but which contained the essential idea that inheritance was not of characters, but of determinants which caused them to appear under the right conditions. F. Galton began an enquiry into heredity by statistical methods which enabled him to formulate a law of ancestral heredity which, in a modified form, holds good for large mixed populations. His work on human heredity was particularly important, and he was able to demonstrate the relative importance of heredity and environment by a study of identical twins. The statistical method was later developed by K. Pearson and his colleagues into an instrument of research which is indispensable in the investigation of quantitative characters. H. de Vries began an investigation of heredity on *Oenothera* and its mutant derivatives and stressed the importance of unit characters, *i.e.,* the somatic expressions of single genes or groups of linked genes.

1900–10.—In 1900 G. Mendel's paper on inheritance in peas, published in 1865, was rediscovered by de Vries, Correns and Tschermak, who were able to illustrate the principles there enunciated from other plants. The core of Mendel's discovery was that the factors determining hereditary characters segregate into the gametes of a hybrid according to definite and quantitative laws. In the next few years W. M. Bateson and his pupils (Saunders, Punnett, Hurst, Doncaster, Durham, Gregory, Marryat, Wheldale and Sollas) published a mass of work extending Mendelism to other plants, and to man, other mammals, birds and insects. In the course of this work Doncaster, Durham and Marryat discovered sex-linkage in the moth, *Abraxas grossulariata,* and the canary, while Bateson, Saunders and Punnett discovered linkage between genes. About the same time Cuénot discovered

multiple allelomorphism in the mouse. A large amount of detailed Mendelian work on a variety of organisms was carried out by Correns, Lang, Tschermak and others in Germany, and Castle and Davenport in America. Biffen began the Mendelian analysis of cereals, later carried on by Engledow, Watkins and others, and Nettleship demonstrated the Mendelian inheritance of a number of human defects. This work met with determined opposition from the statistical or biometrical school of Pearson, who laid stress on deviations from Mendel's laws, now known to be due partly to differential viability of zygotes and gametes which distort the theoretical ratios, partly to the fact that varieties generally differ by a number of minor genes as well as those which are readily observed. The Mendelians retorted that the statistical method ignored genetical differences which exist between individuals of the same phenotypical characters and could not account for segregation. Pearson and his school, however, continued to investigate the inheritance of human physical and psychical characters with great success by statistical methods Meanwhile Johanssen, working with beans, developed the concept of a pure line, which has been fundamental in all subsequent genetics. McClung, E. B. Wilson, T. H. Morgan and others discovered X and Y chromosomes, and R. R. Gates discovered the first case of a hereditary character associated with an abnormal chromosome number. Such was the position about 1910.

Since 1910.—In that year Morgan put forward the view that sex-linked genes were carried by the X chromosome, and in 1913 his pupil Sturtevant enunciated the theory of the linear arrangement of the genes in the chromosome. These theories, which had been foreshadowed by Correns and Sutton, have since been tested on a vast scale on *Drosophila* by Morgan and his school, especially Bridges, H. J. Muller and Sturtevant. Bridges in particular investigated the genetics of cytologically abnormal individuals, and Muller balanced lethals and the frequency of mutation. Thanks to this fundamental work the chromosome theory is now pretty generally accepted, although for some time Bateson and R. C. Punnett regarded linkage as due to differential multiplication of different types of cell. Among the more notable investigations of inheritance on orthodox Mendelian lines carried out in plants of late years are those of Nilsson-Ehle and Kajanus on inheritance in the polyploid cereals, of East, Emerson and Hayes on maize, Goodspeed and Clausen on tobacco, Baur on *Antirrhinum*, Gregory, de Winton and Bateson on *Primula sinensis*, of Punnett on the sweet pea, Andersson on ferns and Wettstein on mosses, where individual gametophytes can be studied. In animals special mention should be made of the work on various rodents by Castle and his colleagues, the rabbit and fowl by Punnett and his colleagues, the fowl by Dunn, *Paratettix* and *Apotettix* by Nabours, and on other Drosophilae by Metz and Lutz.

The special problems arising in autopolyploids were attacked by Gregory, Blakeslee and Winkler, while Winge, Heribert-Nilsson, Newton and Pellew, Crane and Darlington dealt mainly with allopolyploids, and Lotsy with the effects of hybridization in general. Little, Crew and Mohr studied lethal genes in animals, and Heribert-Nilsson discovered certation between pollen grains. Bateson, Chittenden, Pellew and Correns studied non-Mendelian inheritance in plants, while Renner brought the genetics of *Oenothera* into line with those of other organisms. Lehmann analysed sterility in *Veronica*, and East and his colleagues in *Nicotiana*.

On the physiological side Onslow studied the chemistry of pigmentation, R. Goldschmidt and J. S. Huxley the detailed effects of genes on growth-rates, and Goldschmidt and F. A. E. Crew the genetics of sexual abnormality (*see* SEX) while Brink began a study of the effect of genes on the physiology of the pollen grain, and Pearl of the genetics of longevity. Muller, W. H. Harrison and others showed that mutation could be produced by appropriate chemical (metallic salts in the food) or physical (X-rays) stimuli to the germ cells.

On the theoretical side R. A. Fisher showed that the results of Pearson and his colleagues followed from the assumption that such characters as stature were due to multiple genes acted on by natural selection, and thus healed the breach between the Mendelian and biometric schools.

In the last part of the 19th century genetics was studied mainly with a view to elucidating the method of evolution. In the 20th century, it has mainly been studied for its own sake and that of its practical applications. This independence has been of great advantage, but in the last few years the problem of evolution has been taken up again by geneticists. Among the outstanding work is that of Sumner on geographical races of deer-mice, and that of the Russian school. Vaviloff has studied the geographical distribution of the cereals, Serebrovsky that of the poultry genes, and Tschetwerikoff the genetical nature of the wild populations of *Drosophila*.

The facts so far arrived at have had a considerable practical importance in the breeding of cereals, and some in horticulture. They are beginning to influence the breeders of live-stock, especially poultry, and attempts are being made to apply them to the human race (*see* EUGENICS).

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HEREFORD, city, municipal borough, and county town of Herefordshire, England, on the river Wye, 144 m. W.N.W. of London by rail. Pop. (1921) 23,322. Hereford (*Herefortuna*) was founded after the crossing of the Severn by the West Saxons early in the 7th century, as a settlement near the Welsh March. Probably founded by Earl Harold, afterwards Harold II., the castle was taken by Stephen, and was the prison of Prince Edward during the Barons' Wars. The pacification of Wales deprived Hereford of military significance until it became a Royalist stronghold during the Civil Wars. It surrendered easily to Waller in 1643; but was reoccupied by the king's troops and received Rupert on his march to Wales after Naseby. It was besieged by the Scots in 1645, relieved by the king, but fell again to the Parliamentarians. In 1086 the town included fees of the bishop, the dean and chapter, and the Knights Hospitallers, but was otherwise royal demesne. Richard I. in 1189 sold the town to the citizens at a fee farm rent, which grant was confirmed several times. Incorporation was granted in 1597, and confirmed in 1620 and 1697–98. Hereford returned two members to parliament from 1295 until 1885. Hereford was the site of a provincial mint in 1086 and later. A grant of an exclusive merchant gild, in 1215–16, was several times confirmed. The trade in wool was important in 1202, and eventually responsible for many gilds. It brought into the market Welsh friezes and white cloth; but declined in the 16th century.

The cathedral of St. Ethelbert exemplifies all styles from Norman to Perpendicular. The see was detached from Lichfield in 676, Putta being its first bishop. The removal of murdered Aethelbert's body from Marden to Hereford led to the foundation of a superior church, reconstructed by Bishop Athelstane, and burnt by the Welsh in 1055. Begun again in 1079 by Bishop Robert Losinga, it was carried on by Bishop Reynelm and completed in 1148 by Bishop R. de Betun. In 1786 the western tower fell and carried with it the west front and the first bay of the nave. The present west front was completed in 1905. The total length of the cathedral outside is 342 ft., inside 327 ft. 5 in., the nave being 158 ft. 6 in., the choir from screen to reredos 75 ft. 6 in. and the lady

chapel 93 ft. 5 in. The principal features are the central tower, of Decorated work, and the north porch, rich Perpendicular with parvis. The bishop's cloisters, of which only two walks remain, are Perpendicular, of curious design, with heavy tracery in the bays. Of the former decagonal Decorated chapter-house, only the doorway and slight traces remain. Within, the nave has Norman arcades, and there is a late Norman font. The south transept is also Norman, but largely altered by the introduction of Perpendicular work. The north transept was rebuilt in 1287. The dark choir is Norman in the arcades and the stage above, with Early English clerestory and vaulting. At the east end is a Norman arch, blocked until 1841 by a Grecian screen erected in 1717. The choir stalls are largely Decorated. The organ contains original work by Renatus Harris, and was presented by Charles II. The small north-east and south-east transepts are Decorated but retain traces of the Norman apsidal terminations eastward. The eastern lady chapel, dated about 1220, shows elaborate Early English work. On the south side opens the little Perpendicular chantry of Bishop Audley (1492–1502). In the north choir aisle is the fan-vaulted chantry of Bishop Stanbury (1470). The crypt is Early English. The ancient monastic library still retains several rare manuscripts and relics. In the south choir aisle is the Map of the World, dating from about 1314, the work of a Lincolnshire monk, Richard of Haldingham.

From the south-east transept of the cathedral a cloister leads to the quadrangular college of the Vicars-Choral, a Perpendicular building. On this side of the cathedral, too, the bishop's palace, originally a Norman hall, lies near the castle green, the site of the historic castle, now utterly effaced. The church of All Saints is Early English and Decorated. One only of the six gates and a few fragments of the old walls are still to be seen, but there are ruins of the Black Friars' monastery in Widemarsh, and a mile out of Hereford on the Brecon Road, the White Cross, erected in 1347, commemorates the departure of the Black Plague. The "Old House" is a good example of the half-timbered style, dating from 1621, and the Coningsby hospital (almshouses) dates from 1614. St. Ethelbert's hospital is an Early English foundation. Old-established schools are the Cathedral school (1384) and the Blue Coat school (1710). A musical festival of the choirs of Hereford, Gloucester and Worcester cathedrals is held annually in rotation at these cities

HEREFORDSHIRE, an inland county of England on the south Welsh border, bounded north by Shropshire, east by Worcestershire, south by Monmouthshire and Gloucestershire, west by Radnorshire and Brecknockshire. The area is 839·6 sq.m. The county is almost wholly drained by the Wye and its tributaries, but on the north and east includes a small portion of the Severn basin. The Wye enters Herefordshire from Wales at Hay, and with a sinuous and beautiful course crosses the south-western part of the county, leaving it above the town of Monmouth. Of its tributaries, the Lugg enters near Presteign, and flows east to Leominster, where it turns south, receives the Arrow from the west, and joins the Wye 6 m. below Hereford, the Frome flowing in from the east immediately above the junction. The Monnow rising in the mountains of Brecknockshire forms the boundary between Herefordshire and Monmouthshire over one-half of its course (about 20 m.), but it joins the main river at Monmouth. Its principal tributary in Herefordshire is the Dore. The Wye is celebrated for its salmon fishing, which is carefully preserved, while the Lugg, Arrow and Frome abound in trout and grayling, as does the Teme, a tributary of the Severn, which forms parts of the northern and eastern boundary. The Laddon, also flowing to the Severn, rises in the county and leaves it in the south-east, passing the town of Ledbury. The greater part of the county is underlain by Old Red Sandstone, the harder bands in which form high ground (from 500 to 800 ft.) between the various valleys, while on the eastern boundary rise the Malvern hills, with Worcestershire Beacon (1,395 ft.) and Herefordshire Beacon (1,194 ft.). The Malvern hills form an inlier of Pre-Cambrian gneisses and volcanic rocks along the western edge of which occur Cambrian and Silurian rocks, the limestone bands of the latter forming wooded scarp faces. There is also a similar topography in the Woolhope region where there is an oval shaped inlier of Silurian rocks. Smaller patches crop out at Westhide east of Hereford and May Hill, but the most important form the hills between Presteign and Ludlow in the north of the county. The Brecknockshire boundary is formed by the Black Mts., which, formed of Old Red Sandstone, exceed 2,000 feet. On its south-eastern margin the county just reaches the Carboniferous Limestone cliffs of the Wye valley near Ross, the scenery of which is famous. Glacial deposits, chiefly sand and gravel, are found in the lower ground along the river-courses, while caves in the Carboniferous Limestone have yielded remains of the hyena, cave-lion, rhinoceros, mammoth and reindeer.

Agriculture and Industries.—The soil is generally marl and clay, but in various parts contains calcareous earth in mixed proportions. Westward the soil is tenacious and retentive of water; on the east it is a stiff and often reddish clay. In the south is found a light sandy loam. More than four-fifths of the total area of the county is under cultivation and about two-thirds of this is in permanent pasture. Ash and oak coppices and larch plantations clothe its hillsides and crests. The rich red soil is famous for its pear and apple orchards, the county ranking in this respect next to Devonshire. The apple crop, generally large, is enormous one year out of four. Twenty hogsheads of cider have been made from an acre of orchard, 12 being the ordinary yield. Cider is the staple beverage of the county, and the trade in cider and perry is large. Hops are another staple of the county, the vines of which are planted in rows on ploughed land.

Herefordshire breeds bright red cattle with mottled or white faces and sleek silky coats, which though not good milkers, put on more meat and fat and produce finer beef at an early age, in proportion to food consumed, than almost any other variety. Its small, white-faced, hornless, symmetrical breed of sheep known as "the Ryelands," from Ross, made the county long famous. In its original form the breed is extinct, crossing with the Leicester having improved size and stamina at the cost of the fleece, and the chief breeds of sheep on Herefordshire farms at present are Shropshire Downs, Cotswolds and Radnors, with their crosses. Agricultural horses of good quality are still bred in the north, and saddle and coach horses may be met with at the fairs.

Manufacturing enterprise is insignificant. There are some iron foundries and factories for agricultural implements, and some paper is made. There are considerable limestone quarries, as, for example, near Ledbury.

Communications.—Hereford is an important railway centre. The Worcester and Cardiff line (G.W. railway) entering on the east, runs to Hereford by Ledbury and then southward. The joint line of the G.W. and L.M.S. companies runs north from Hereford by Leominster, proceeding to Shrewsbury, Crewe and Chester. At Leominster a G.W. branch crosses, connecting Worcester, Bromyard and New Radnor. From Hereford a G.W. branch follows the Wye south to Ross, and thence to the Forest of Dean and to Gloucester; another follows the Wye westward; a branch connects Ledbury with Gloucester, and the Golden Valley is traversed by a branch from Pontrilas on the Worcester-Cardiff line. None of the rivers is commercially navigable and the canals are out of use.

Population and Administration.—The area of the ancient county is 537,363 ac., with a population (1921) of 113,189. The area of the administrative county is 538,924 ac. The county contains 12 hundreds. It is divided into two parliamentary divisions, Leominster and Hereford, each returning one member. There are two municipal boroughs—Hereford (pop. 23,322) and Leominster (5,538). The other urban districts are Bromyard (1,573), Kington (1,688), Ledbury (3,154) and Ross (4,665). The county is in the Oxford circuit, and assizes are held at Hereford. It has one court of quarter sessions and is divided into 11 petty sessional divisions. The boroughs of Hereford and Leominster have separate commissions of the peace, and the borough of Hereford has in addition a separate court of quarter sessions. The ancient county is almost entirely in the diocese of Hereford, with small parts in those of Gloucester, Worcester and Llandaff.

History.—The prehistoric period in Herefordshire does not seem to have been very important and the county was probably

then very heavily forested. The early Iron Age camp on the Herefordshire Beacon (Malvern hills) is an important earthwork. During the 7th century the West Saxons pushed across the Severn and established themselves between Wales and Mercia, with which kingdom they soon became incorporated. The district, now Herefordshire, was occupied by a tribe, the Hecanas, who congregated chiefly about Hereford and in the mining districts round Ross. In the 8th century Offa extended the Mercian frontier to the Wye, securing it by the earthwork known as Offa's dyke, portions of which are visible at Knighton and Moorhampton in this county. In 915 the Danes made their way up the Severn to the district of Archenfield and in 921 they besieged Wigmore, which had been rebuilt in that year by Edward. The district was the scene of constant border warfare with the Welsh, and Harold, whose earldom included this county, ordered that any Welshman caught trespassing over the border should lose his right hand In the period preceding the Conquest much disturbance was caused by the outrages of the Norman colony planted in this county by Edward the Confessor. Richard's castle in the north of the county was the first Norman fortress erected on English soil, and Wigmore, Ewyas, Harold, Clifford, Weobley, Hereford, Donnington and Caldecot were all the sites of Norman strongholds.

Hereford and Weobley castles were held against Stephen but were captured in 1138. Edward, afterwards Edward I, was imprisoned in Hereford castle, and made his famous escape thence in 1265. In 1326 the parliament assembled at Hereford which deposed Edward II. In the 14th and 15th centuries the forest of Deerfold gave refuge to some of the most noted followers of Wycliffe. During the Wars of the Roses the county supported the Yorkist cause, and Edward, afterwards Edward IV., raised 23,000 men in this neighbourhood. The battle of Mortimer's Cross was fought in 1461 near Wigmore. During the civil war of the 17th century, the county was royalist and Hereford, Goodrich and Ledbury all endured sieges.

The earldom of Hereford was granted by William I. to William FitzOsbern, about 1067, but the title lapsed until conferred on Henry de Bohun about 1199. It remained in the possession of the Bohuns until the death of Humphrey de Bohun in 1373; in 1397 Henry, afterwards King Henry IV., who had married Mary Bohun, was created duke of Hereford Edward VI. created Walter Devereux, a descendant of the Bohun family, Viscount Hereford, in 1550, and his grandson, the famous earl of Essex, was born in this county. Since this date the viscounty has been held by the Devereux family, and the holder ranks as the premier viscount of England. Sir John Oldcastle, the leader of the Lollards, was sheriff of Herefordshire in 1406.

Herefordshire probably originated as a shire in the time of Aethelstan, and is mentioned in the Saxon Chronicle in 1051. In the Domesday Survey parts of Monmouthshire and Radnorshire are assessed under Herefordshire, and the western and southern borders remained debatable ground until with the incorporation of the Welsh marches in 1535 considerable territory was restored to Herefordshire. At the time of the Domesday Survey the divisions of the county were very unsettled. As many as 19 hundreds are mentioned, but these were of varying extent, some containing only one manor, some from 20 to 30. Of the 12 modern hundreds, only Greytree, Radlow, Stretford, Wolphy and Wormelow retain Domesday names. Herefordshire has been included in the diocese of Hereford since its foundation in 676.

Herefordshire was governed by a sheriff as early as the reign of Edward the Confessor, the shire-court meeting at Hereford where later the assizes and quarter sessions were also held. In 1606 an act was passed declaring Hereford free from the jurisdiction of the council of Wales, but the county was not finally relieved from the interference of the Lords Marchers until the reign of William and Mary.

Herefordshire has always been a rich agricultural area, manufactures being unimportant, with the sole exception of the woollen and the cloth trade which flourished soon after the Conquest. Iron was worked in Wormelow hundred in Roman times, and the Domesday Survey mentions iron workers in Marcle. At the time of Henry VIII. the towns had become much impoverished. Hops were grown in the county soon after their introduction into England in 1524. In 1580 and again in 1637 the county was severely visited by the plague, but in the 17th century it had a flourishing timber trade and was noted for its orchards and cider.

Herefordshire was first represented in parliament in 1295, when it returned two members, the boroughs of Ledbury, Hereford, Leominster and Weobley being also represented. Hereford was again represented in 1299, and Bromyard and Ross in 1304, but the boroughs made very irregular returns, and from 1306 until Weobley regained representation in 1627, only Hereford and Leominster were represented. Under the act of 1832 the county returned three members and Weobley was disfranchised. The act of 1868 deprived Leominster of one member, and in 1885 Leominster was disfranchised, and Hereford lost one member. By the act of 1918, Hereford ceased to be a parliamentary borough. The entire county (inclusive of the boroughs) is now represented by two members.

Antiquities.—There are remains of several of the strongholds which Herefordshire possessed as a march county, some of which were maintained and enlarged, after the settlement of the border, to serve in later wars. To the south of Ross are those of Wilton and Goodrich, commanding the Wye. Of the several castles in the valleys of the boundary-river Monnow and its tributaries, those in this county include Pembridge, Kilpeck and Longtown. In the north the finest example is Wigmore.

Beside the cathedral of Hereford, and the fine churches of Ledbury, Leominster and Ross, described under separate headings, the county contains some churches of almost unique interest. In that of Kilpeck Norman work is seen. It consists of the three divisions of nave, choir and chancel, divided by ornate arches, the chancel ending in an apse, with a beautiful and elaborate west end and south doorway. A similar plan is seen in Peterchurch and in Moccas church, above Hereford The church at Bromyard exhibits Norman details. At Abbey Dore, the Cistercian abbey church, still in use, is a large and beautiful specimen of Early English work. At Madley, south of the Wye, 5 m. W. of Hereford, is a fine Decorated church (with earlier portions), with the rare feature of a Decorated apsidal chancel over an octagonal crypt. Of the churches in mixed styles those in the larger towns are the most noteworthy, together with that of Weobley.

The half-timbered style of domestic architecture beautifies many of the towns and villages Among country houses, that of Treago, 9 m. W. of Ross, is a remarkable example of a fortified mansion of the 13th century. Rudhall and Sufton Court, between Ross and Hereford, are good specimens of 15th century work, and portions of Hampton Court, 8 m. N. of Hereford, are of the same period. Holme Lacy, 5 m. S.E. of Hereford, is a fine mansion of the latter part of the 17th century. Downton castle possesses historical interest in having been designed in 1774, in a strange mixture of Gothic and Greek styles, by Richard Payne Knight (1750–1824), a famous scholar, numismatist and member of parliament for Leominster and Ludlow; while Eaton hall, now a farm, was the seat of the family of the famous geographer Richard Hakluyt.

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HERERO, a Bantu-speaking people inhabiting the central parts of South West Africa. Predominantly a pastoral people, they practise a little agriculture. They live in small household groups which are scattered irregularly over the tribal territory. They have a double clan system, one set (*oruzo*) with patrilineal descent, the other (*canda*) with matrilineal. The former is associated with religious observances, the latter with economic life. Both are totemic and exogamous. The kinship system is classificatory, and cross-cousin marriage is preferred. Ancestor worship is the main religious cult, and each household keeps permanently alight a sacred fire upon which the welfare of its members is supposed to depend.

See I. Irle, *Die Herero,* 1906.

HERESY, in its primary meaning signifies an *act* of *choice,* whether good or bad (*cf.* LXX. in Gen. xlix. 5; Lev. xxii. 18, 21;

Neh. xii. 40; 1 Macc. viii. 30); it is the English equivalent of the Greek *αἵρεσις*. From this arose its later meaning of personal choice of an opinion or belief, or personal adhesion to a group or party advocating certain principles of belief; from this again it was used of the group or party as such, as a school or "sect." In Eusebius (*Hist.* x. 5) the Christian Church itself is described as the "most sacred heresy." But in the N.T. we see the word, acquiring the implication of disparagement or condemnation. It is applied to the Pharisees and Sadducees (Acts v. 17, xv. 5, xxvi. 5) and to Christianity itself by opponents (Acts xxiv. 14, xxviii. 22), with implied censure of a factious spirit. Specially noteworthy is its application to "divisions" due, not to matters of opinion, but to breaches of the law of love (Rom. xvi. 17; Gal. v. 20; 1 Cor. i. 10; iii. 3, 4; xi. 19). In one of the latest books of the N.T. the word is used of doctrinal errors and their advocates (2 Peter ii. 1, and Jude, 4, "false teachers," "sects of perdition"). In general, the apostolic writings show a vehement antagonism towards all teaching opposed to the gospel, whether the word "heresy" is used or not. This is explained by the character of the teachings or movements so attacked. They involved such a blending of the gospel with Jewish and Pagan elements as would have destroyed everything distinctive of it. Before illustrating the theological and ecclesiastical use of the word heresy in the history of Christianity, we must briefly examine its more general significance.

Heresy in Science.—It is evident that the normal conduct of human relations implies a general similarity in the constitution of the human mind, and demands some common ground of belief or (in this sense) an "orthodoxy." Within certain wide limits, all education presupposes the necessity of furnishing to mankind some common measure for the interpretation of the facts of life. Each generation hands on to its successor a common body of knowledge and belief about the facts of the past and the present. The acceptance of a large body of "orthodoxy"—that is, of beliefs commonly held as a basis of thought and conduct—is essential to the effective and coherent action of any organized society. Heresy as to the multiplication table is not allowed. In the life of the average man, the mental forces which are his own in the sense of originality or dissent or deviation from the norm are extremely small in their extent as compared with those due to education, sympathy, imitation and similar social influences. Even in science, the discovering mind has and must have a background or basis of knowledge and belief accepted without analysis or criticism Science has its orthodoxy as well as religion. There are things which a scientific man may not believe, and other things which he may not disbelieve without treason to the brotherhood of his craft.

From this point of view a "heresy" may be compared to a "paradox," in the sense of a proposition contrary to the body of belief on a given subject held in a particular country or a particular age, or even by most men, always and everywhere. And this fact serves to call attention to the other side of the case which we have stated. Such a proposition is not necessarily false because of its paradoxical or heretical character. Many times in the history of human thought a belief once heretical has become a universally accepted truth, "sometimes a paradox, but now the time gives it proof" (*Hamlet*, iii., i. 115): so Hobbes described a paradox as "an opinion not yet generally received" (*English Works*, edit. Molesworth, v. 304). In every age of the world there have been established systems opposed from time to time by isolated and dissentient reformers (*cf.* De Morgan, *Budget of Paradoxes*, 1872, p. 4, *sqq.*). Such an established system has sometimes fallen slowly and gradually, upset by the rising influence of some one man or undermined by gradual change of opinion in the many. It must be admitted that an opinion being "generally received" implies a preoccupation of the ground which must hold good until sufficient reason is adduced against it. To this extent there is a presumption against anything "heretical"; the burden of proof lies with him who maintains it. Nevertheless, the history of science is partly the history of paradoxes becoming commonplaces and heresies becoming orthodoxies, *e.g.*, the motion of the earth, the possibility of the antipodes, the pressure of the atmosphere (as against the dogma "Nature abhors a vacuum"), the circulation of the blood, the facts of hypnotism, the electrical phenomena produced by Galvani's experiments—to mention only a few of the cases now utterly beyond the reach of controversy. Contemporary science is enlarging indefinitely its conception of natural possibility; and hitherto unknown and unsuspected facts have emerged in regions of enquiry which might have been supposed exhaustively explored, *e.g.*, the constituent gases of the atmosphere. "Such experiences indicate the need of a spirit of caution in those who may be tempted to condemn avenues of scientific enquiry as bound in advance to be unfruitful. Yet it does not follow that the march of science is impeded by such premature judgments. Rather they may be regarded as sheep-dogs, which keep the scientific flock together in its progress to those fields of thought which for the moment offer the richest pasture" (H. A. L. Fisher, *Orthodoxy*, p. 37, 1922).

Heresy in Religion.—In the history of religion, and above all in the history of Christianity, "heresy" implies "orthodoxy." It is beyond dispute that the system of dogma, the essentials of which are formulated in the Apostles', Nicene, and Athanasian creeds, emerged gradually in a development which can be historically traced (*see* the standard Histories of Dogma, especially Seeberg, Harnack and Loofs). This developing orthodoxy forms the *main stream* in the history of Christian thought; and the various heresies which emerged during the first four centuries were dealt with as "heresies" because in every case they endeavoured to open up a more or less dangerous divergence from the main stream. The significance of heresy reached its height when the Church was regarded as the divinely ordained depository of saving truth (*cf.* Cyprian, *De Unitate Ecclesiae*, sec. 3; Augustine, *Epistle* 185, and many other passages). The simple primitive creed which can be traced in the N.T.—"Jesus Christ is Lord (*κύριος*)"—was found insufficient as the movement spread; and even before systematic theology (with the aid of contemporary philosophic speculation) began to take shape, a "Rule of Faith" established itself, bringing together those elements (*στοιχεῖα*) of Christian faith which were accounted essential. The Rule of Faith (*κήρυγμα ἀποστολικόν*, or *παράδοσις ἀποστολική*) was not directly derived from the Scriptures, but was from the apostolic tradition current in the congregations which looked to apostles as their founders. Growing at first by oral tradition, it afterwards appeared in written forms, varying in statement rather than substance, and can be traced in the early fathers (*cf.* A. E. Burn, *Introduction to the Creeds*, 1899, and *The Apostles' Creed*, 1912). The final form of this early Rule of Faith is found in what is now known as the Apostles' Creed. The acceptance of the Rule of Faith explains the ancient conception of heresy. Every serious departure from this Rule was attacked as heresy, with much argument and often with much abuse (*cf.* Bethune-Baker, *Introduction to the Early History of Christian Doctrine*, 1903, pp. 2, *seq.*). The heretical movements emerging in the 1st and 2nd centuries constituted a serious danger to the Christian movement. If the main stream had been diverted into any one of these channels, it would have lost itself and historical Christianity (so far as we can see) would have disappeared. In the 1st century the Jewish-Christian tendency formed such a channel. The primitive Christian communities in Palestine were Jewish Christians because they had not realized the universal character of the gospel. The historic Jewish Christian tendency was left behind and survived for a period in the form of heretical sects (*see* EBIONITES). In the 2nd century another channel, deeper and more dangerous, was opened up by the Gnostic schools (*see* GNOSTICISM; MARCION AND THE MARCION CHURCHES; DOCETISM). The controversy with the Gnostics largely created the Rule of Faith. The appeal to Scripture was not sufficient (apart from the fact that the N.T. Canon was only in process of formation); because the heretics had their own methods of interpreting Scripture. Hence the fathers stepped back from the written word to tradition. Another group of important heretical movements arose within the Church itself in the same century. Some theologians (especially in Rome) found insuperable difficulties in the current trinitarian terminology and

were led to surrender either one or the other of the two factors which the leaders of the Church were determined to hold together —the *human* and the *divine* in Christ (*see* ADOPTIANISM; MONARCHIANISM). And at the end of the century we find an enthusiastic reaction against the Church as an organized institution, with authoritative doctrine, ritual and officials appearing to enter into alliance with the world (*see* MONTANISM). A kindred movement afterwards appeared in the time of Augustine in a different form (*see* DONATISM).

The influence of these controversies continued in the 3rd century, when new divergent tendencies emerged. A revised Adoptianism, embodied in a more elaborate theology, was taught by Paul of Samosata and by Lucian at Antioch (*see* PAULICIANS). It spread widely and Arius was influenced by it. During the latter part of the 3rd and part of the 4th century, the movement said to have been founded by Mani, the Mesopotamian (*see* MANICHAEISM), at first sight looking like a revived Gnosticism, invaded the Church; Augustine adopted it for a time, and its influence is probably found in some of the enthusiastic movements characteristic of the early mediaeval period (*see* below). Manichaeism, however, was not a serious danger to the Church; and the controversies characteristic of the 4th century were those arising from the Adoptianist Christology as it spread in the East through Paul of Samosata and through Origen's doctrine of the subordination of Christ to the Father (*see* ORIGEN). The doctrinal struggle came to a head in the contest between the followers of Arius and their opponents, afterwards led by Athanasius, at the Council of Nicaea in 325 (*see* ARIUS; ATHANASIUS). Arianism became a heresy, but it found defenders down to modern times. The Nicene Council is a turning-point in the history of heresy. The earlier heresies (as indicated above) threatened to mingle with the gospel Jewish or pagan elements fatal to its essence; while many of the later heresies were differences in the interpretation of Christian truth which did not in the same way threaten the essence of Christianity. No vital interest of Christian truth justified the extravagant denunciations in which theological partisanship so recklessly and ruthlessly indulged. Again, in the ante-Nicene period only ecclesiastical penalties, such as reproof, deposition or excommunication, could be imposed; but in the post-Nicene the union of Church and State transformed theological error into legal offence. This greatly embittered the Christological controversies which sprang from the Council of Nicaea (*see* NESTORIANS; MONOPHYSITES; MONOTHELITES). From the end of the 4th century the emperors accepted the view that they were bound to use their secular power against heretics for the maintenance of orthodox doctrine.

The heresies of the middle ages were not matters of doctrine merely (however important), but were symptoms of spiritual movements, common to people of many lands, and in one way or another threatening the foundations of the Roman Catholic system (*see* ALBIGENSES; BOGOMILS; CATHARS; WALDENSES). Such movements led to active ecclesiastical legislation against heresy; and several councils in the 12th and 13th centuries declared that the secular arm was bound to punish heretics. But it was maintained that heretics must in the first instance be brought before ecclesiastical courts, and this led to the erection of special Church courts with a procedure of their own (*see* INQUISITION). In evangelical Protestantism the older attitude survived in some of the earlier Protestant constitutions, where heresy is regarded as a crime punishable by the State. Logically, evangelical Protestantism, which declines to force the consciences of its members and appeals only to Scripture for the confirmation of its doctrines, can only denounce erroneous doctrine as erroneous, and deal with them by persuasion and argument; although this consideration does not prevent or invalidate disciplinary action in reference to ministers or lay members who defy the official standards of the organized Church to which they claim to belong.

BIBLIOGRAPHY.—For a general account *see* G. Cross, art. "Heresy" in Hastings, *Encyclopaedia of Religion and Ethics*, with references there given, and (from the Roman Catholic point of view) J. Wilhelm, art. "Heresy" in the *Catholic Encyclopaedia;* also A. Gordon, *Heresy: its Ancient Wrongs and Modern Rights*, 1913 (with special reference to Gt. Britain). On legal procedure, *see* Havet, *L'hérésie et le bras seculier au moyen age* (1881); Richter-Wahl, *Lehrbuch des Kirchenrechts* (1886); Phillimore, *Ecclesiastical Law.* On the history, *see* Hilgenfeld, *Ketzergeschichte des Urchristenthums* (1884, specially valuable for sources); J. J. von Dollinger, *Beiträge zur Sektengeschichte des Mittelalters;* and the standard histories of Dogma and of the Church. (S. H. M.)

HEREWARD, styled "THE WAKE" (an addition of later days), an Englishman famous for his resistance to William the Conqueror. An account of his possessions given in the Domesday book proves that he was a tenant of Peterborough abbey, from which he held lands at Witham-on-the-Hill and Barholme-with-Stow in the south-west of Lincolnshire, and of Crowland abbey at Rippingale in the neighbouring fenland. In 1070 he joined the Danes, with whom William had signed a treaty allowing them to pass the winter in England, in an attack on Peterborough abbey (June 2) which they sacked. Driven back by Turold, they retired to Ely, which Hereward and his company of outlaws appear to have held, in spite of the desertion of the Danes, until the next year. He was joined there by Morkere and Siward Barn, and Ely became so notorious as a refuge for rebels that the king was forced to organise an attack on it from Cambridge. The outlaws were overcome by the superior strength of the king's force, and most of them, including Morkere, surrendered. Hereward escaped through the marshes with a few of his men. The references to Hereward in the chronicles, where the only authentic information about his life appears, end with this incident, but according to popular legend he lived to carry out further attacks on the Normans, but finally obtained a pardon from William.

See E. A. Freeman, "The Legend of Hereward" in *History of the Norman Conquest*, vol. iv.; J. H Round, *Feudal England;* H. W. C. Davies, *England under the Normans and Angevins;* and C. Kingsley's romance *Hereward the Wake.*

HERFORD, a town in the Prussian province of Westphalia, situated at the confluence of the Werre and Aa, on the Minden and Cologne railway, 9 m. N.E. of Bielefeld, and at the junction of the railway to Detmold. Pop. (1925) 36,106. It owes its origin to a Benedictine nunnery, said to have been founded in 832, and confirmed by the emperor Louis the Pious in 839. From the emperor Frederick I. the abbess obtained princely rank and a seat in the imperial diet. The foundation was secularized in 1803. Herford was a member of the Hanseatic League, and in 1631 it became a free imperial town, but in 1647 it was subjugated by the elector of Brandenburg. It came into the possession of Westphalia in 1807, and in 1813 into that of Prussia.

Herford possesses a gymnasium founded in 1540, while its churches include the Münsterkirche, a Romanesque building with a Gothic apse of the 15th century and the Marienkirche, in the Gothic style. The industries include cotton and flax-spinning, and the manufacture of linen cloth, carpets, furniture, machinery, sugar, chocolate, tobacco and margarine.

HERGENRÖTHER, JOSEPH VON (1824–1890), German Catholic theologian, was born at Würzburg, Bavaria, on Sept. 15, 1824. He studied at Würzburg, at Rome, and at Munich where he became instructor in theology. In 1852 he was recalled to Würzburg as professor of ecclesiastical law and history. He was one of the most learned theologians on the Ultramontane side of the Infallibility question, and in 1868 was sent to Rome to arrange the proceedings of the Vatican Council. In 1870 he wrote *Anti-Janus,* an answer to *The Pope and the Council,* by "Janus" (Döllinger and J. Friedrich), which made a great sensation at the time. In 1877 he was made prelate of the papal household, in 1879 cardinal deacon, and afterwards curator of the Vatican archives. He died in Rome on Oct. 3, 1890. His works include *Photius, Patriarch von Constantinopel. Sein Leben, seine Schriften und das griechische Schisma* (3 vols., Regensburg, 1867–69) and an additional volume (1869) *Monumenta Graeca ad Photium . . . pertinentia.*

HERGESHEIMER, JOSEPH (1880–), American author, was born at Philadelphia, Pennsylvania, U.S.A., Feb. 15, 1880, and was educated at a Quaker school there and at the Pennsylvania Academy of Fine Arts. As a writer of fiction he is distinguished by the warmth and colour of his descriptive passages and by his psychological insight.

His publications include: *The Lay Anthony* (1914); *Mountain Blood* (1915); *The Three Black Pennys* (1917); *Gold and Iron* (1918); *Java Head* (1919); *Linda Condon* (1919); *San Cristóbal de la Habana* (1920); *Cytherea* (1922); *The Bright Shawl* (1922); *Balisand* (1924); *Tampico* (1926); and *Quiet Cities* (1928).

HERING, EWALD (1834–1918), German physiologist and psychologist, was born at Alt-Gersdorf, Saxony, on Aug. 5, 1834. He practised medicine in Leipzig, where in 1862 he became lecturer in physiology at the university. He was professor of physiology at the medico-surgical Josephs-Akademie in Vienna (1865–70); at Prague (1870–95) and then again at Leipzig. Hering's chief work was in physiological optics and more especially the perception of colour. He gave the four-colour theory authoritative form by making it a theory of antagonistic colour-pairs (black and white, blue and yellow, red and green); and formulated the logical conclusion of the principle of the nativistic theory of the visual perception of space against the "empiristic" doctrine of Helmholtz.

His chief works are: *Beiträge zur Physiologie* (1861); *Über das Gedachtnis als eine allgemeine Funktion der organisierten Materie* (1870, 4th ed., 1913; Eng. trans. 1897); *Grundzüge einer Theorie des Temperatursinnes* (1877); *Zur Lehre vom Lichtsinne* (1878); *Temperatursinn* (1880); *Zur Theorie der Nerventhätigkeit* (1899); *Grundzüge der Lehre vom Lichtsinn* (1905–11). *See* O. Klemm, *A History of Psychology* (1914); F. Hillebrand, *E. Hering* (1918); G. S. Brett, *A History of Psychology* (vol. 3, 1921).

HERINGSDORF, a popular seaside resort in the Prussian province of Pomerania, on the north coast of the island of Usedom, 5 m. by rail N.W. of Swinemünde. It is surrounded by beech woods. Pop. (1925) 2,022.

HERINGTON, a city of Dickinson county, Kan., U.S.A., 75m. S.W. of Topeka, on Federal highways 50N and 77, and served by the Missouri Pacific and the Rock Island railways. The population in 1927 (local census) was 5,100. The city was settled about 1885 and incorporated in 1887.

HERIOT, GEORGE (1563–1624), the founder of Heriot's hospital, Edinburgh, was descended from an old Haddington family; his father, a goldsmith in Edinburgh, represented the city in the Scottish parliament. In 1597 George Heriot became goldsmith (and money-lender) to Anne of Denmark, consort of James VI. In 1601 he became jeweller to the king, and followed him to London, occupying a shop opposite the Exchange. He died in London on Feb. 10, 1624. The surplus of his estate was bequeathed to found a hospital for the education of freemen's sons of the town of Edinburgh; the increment of this bequest supplied funds for the erection of several Heriot foundation schools in different parts of the city.

HERIOT, originally the arms and equipment (*O. E. geatwa*) of a soldier or army (*here*). The lord of a fee provided his tenant with arms and a horse, either as a gift or loan, which he was to use in the military service paid by him. On the death of the tenant the lord claimed the return of the equipment. When by the 10th century land was being given instead of arms, the heriot was still paid, but more in the nature of a "relief" (*q.v.*). By the 13th century the payment was made either in money or in kind by the handing over of the best beast or of the best other chattel of the tenant (*see* Pollock and Maitland, *History of English Law*). For the manorial law relating to heriots, *see* COPYHOLD.

HERISAU, the largest town in the Swiss canton of Appenzell, built on the Glatt torrent, and by rail 7 m. S.W. of St. Gall or 13½ m. N.W. of Appenzell. Pop. (1920) 15,015. The lower portion of the tower of the parish church dates from the 11th century or even earlier. About 5 m. to the south-east is Hundwil, where the *Landsgemeinde* of Ausser Rhoden meets in the odd years (in other years at Trogen) on the last Sunday in April. Some of the finest embroideries are manufactured in Herisau.

HERITABLE JURISDICTIONS, in the law of Scotland, grants of jurisdiction made to a man and his heirs. They included civil and criminal jurisdictions, and were a usual accompaniment of feudal tenures. The power which they conferred on great families was recognized as a source of danger to the State, and led to frequent attempts being made by statute to restrict them, both before and after the Union. They were abolished in 1746, in consequence of the rising of '45.

HERKIMER, NICHOLAS (*c.* 1728–1777), American Revolutionary soldier, was born near Fort Herkimer, N. Y., probably about 1728. He was the son of Johan Host Herkimer who came to America from the Palatinate about 1725. Nicholas was commissioned lieutenant of militia under provincial authority in 1758, and was made brigadier general of the Tryon county militia, N.Y., in 1776. In 1777 he marched to relieve Col. Peter Gansevoort at Ft. Stanwix who was besieged by Gen. St. Leger of the British forces. Herkimer was ambushed at Oriskany, but fought so well that the British were forced to fall back into Canada. Herkimer was mortally wounded and died Aug. 17, 1777.

See *Dedication of the Oriskany Monument* by the Oneida Historical Society (1884); Eugene W. Lyttle, "Nicholas Herkimer," *Proc. of N.Y. State Hist. Assoc.* (1904).

HERKIMER, a village of New York, on the Mohawk river, 15 m. S.E. of Utica; the county seat of Herkimer county. It is served by the New York Central railroad. The population was 10,450 in 1920 (22.8% foreign-born white) and was estimated locally at 12,000 in 1928. It is the trade centre of a rich dairying region, and has important manufactures, especially of office furniture and equipment, with an output in 1925 valued at $5,726,713. The village was named after Gen. Nicholas Herkimer, who was mortally wounded at the battle of Oriskany (Aug. 6, 1777). It was founded about 1725 by Palatine Germans, who bought a large tract from the Mohawk Indians and established several settlements, known as the German Flats. In 1756 a stone house built in 1740 by John Jost Herkimer (father of the general and one of the original colonists), a stone church and other buildings, were fortified by Sir William Johnson

HERKOMER, SIR HUBERT VON (1849–1914), British painter, was born at Waal, in Bavaria on May 26, 1849, and eight years later was brought to England by his father, a woodcarver of great ability. He lived for some time at Southampton and in the school of art there began his art training; in 1866 he entered upon a course of study at the South Kensington Schools, and in 1869 exhibited for the first time at the Royal Academy. By his picture, "The Last Muster," at the Academy in 1875, he established his position as an artist of high distinction. He was elected A.R.A. in 1879, and R.A. in 1890; an associate of the Royal Society of Painters in Water Colours in 1893, and a full member in 1894; and in 1885 he was appointed Slade professor at Oxford. He achieved marked success as a worker in enamel, as an etcher, mezzotint engraver and illustrative draughtsman; and he exercised wide influence upon art education by means of the Herkomer School (Incorporated), at Bushey, which he founded in 1883 and directed gratuitously until 1904, when he retired. Three of his pictures, "Found" (1885), "The Chapel of the Charterhouse" (1889) and "The Council of the Royal Academy, 1907" are in the National Gallery of British Art. In the year 1907 he received the honorary degree of D.C.L. at Oxford, and a knighthood was conferred upon him by the king in addition to the commandership of the Royal Victorian Order. He died at Budleigh Salterton on March 31, 1914.

See A. L. Baldry, *Hubert von Herkomer, R.A.* (1901); W. L. Courtney, *Professor Hubert Herkomer, Royal Academician, His Life and Work* (1892); J. Saxon Mills, *Life and Letters of Sir H. Herkomer* (1923); and his autobiographical writings: *My School and My Gospel* (1908), and *The Herkomers* (1910).

HERLIN (or HERLEN), FRIEDRICH, of Nördlingen, German artist, the most distinguished member of a family of painters of the Swabian school, in the 15th century. His name occurs in the archives of Nördlingen from 1461 until his death in 1491. In 1467 he was made citizen and town painter at Nördlingen, "because of his acquaintance with Flemish methods of painting." One of the first of his acknowledged productions is a shrine on one of the altars of the church of Rothenburg on the Tauber, the wings of which were finished in 1466, with seven scenes from the lives of Christ and the Virgin Mary. In the townhall of Rothenburg is a Madonna and St. Catherine of 1467. In the church of Bopfingen portions of an altarpiece of 1472 representing the "Nativity" and the "Adoration of the Magi" and "Scenes from the life of St. Blasius"; and in the town hall of Nördlingen a triptych of 1488, representing the "Nativity" and

"Christ amidst the Doctors," at the side of a votive Madonna attended by St. Luke and St. Margaret as patrons of the painter's family. In each of these works the painter's name certifies the picture, and the manner is that of a pupil of van der Weyden. Herlin's epitaph, preserved by Rathgeber, states that he died on Oct. 12, 1491, and was buried at Nördlingen.

See F. Haack, *Friedrich Herlin* (1900); G. Burckhardt, *Herlin Forschungen* (1911).

HERMAE, properly the plural of the name Hermes (*q.v.*). The adoration of *baetyli* (*q.v.*) was and continued to be a fairly common feature of Greek cult, particularly in the more backward districts, such as Laconia, where, for instance, a meteoric stone received worship as *Zeus Kappotas* (Zeus the Descender, *i.e.*, Thunderbolt; *see Pausanias,* III., 22, 1.). Not dissimilar objects were the posts, pillars or heaps of rough stones set up along roads or to mark boundaries. These, like the Latin Terminus (*q.v.*), were sacred things, and connected with the cult of Hermes; indeed, some go so far as to derive his name from ερμα (stone, rock, piece of ballast; so Preller, and, more recently, Nilsson and Miss J. E. Harrison). With the development of artistic taste and the conception of the gods as having human form (anthropomorphism), these somewhat unsightly objects tended to be replaced, often by statues, frequently also by pillars, generally square and tapering towards the bottom, so as to suggest the human figure. These were surmounted by a head, usually that of Hermes (hence the name), and had a phallus in front, half-way up. They were used, not only as cult-objects, but for all manner of purposes, as mile-stones (*see* pseudo-Plato, *Hipparchus*, 228 D *et seq*), boundary-marks, and so forth. But that most if not all of them were regarded with respect, if not actually worshipped, is clear from the famous mutilation of the Hermae. Just before the ill-fated expedition to Sicily sailed from Athens (415 B.C.), "all the stone Hermae in the city of Athens . . . or most of them, had their faces smashed" (περιεκόπησαν τὰ πρόσωπα, Thucydides vi., 27, 1). The whole city was in an uproar of superstitious panic at this impiety, and numerous trials for sacrilege resulted.

Herms are not infrequent in Roman sculpture, for example with heads of Silvanus or Iuppiter Terminus. In later times, all manner of fanciful herms were made and used as ornaments; these are commonly known by compound names, as Hermathena (Cicero, *ad Att.* I. 1, 5), Hermanubis, and the like; but it is not clear whether this means a herm with the head of Athena, Anubis, etc., instead of that of Hermes, or a double herm having the heads of both deities, Janus-fashion. Certainly both types existed, and the heads were by no means always those of gods

See the classical dictionaries, and especially P. Paris in Daremberg-Saglio (*s.v.*). For the mutilation of the Hermae, *see* the histories of Greece; for stone-heaps, J. G. Frazer, *Golden Bough,* (3rd ed.), ix. chap. 1.

HERMAGORAS, of Temnos, Greek rhetorician of the Rhodian school and teacher of oratory in Rome, flourished during the first half of the 1st century B.C. He founded a special school, the members of which called themselves Hermagorei. His chief opponent was Poseidonius of Rhodes (Plutarch, *Pompey* 42). According to Suidas and Strabo, he was the author of rhetorical manuals and of other works, which should perhaps be attributed to his younger namesake, surnamed Carion, the pupil of Theodorus of Gadara.

See Strabo xiii. p. 621; Cicero, *De inventione,* i. 6, 8; Brutus, 76, 263; 78, 271; Quintilian, *Instit.* iii. 1. 16, 3, 9, 11, 22; C. W. Piderit, *De Hermagora rhetore* (1839); G. Thiele, *Hermagoras: Ein Beitrag zur Geschichte der Rhetorik* (1893).

HERMANDAD, a Castilian word meaning, strictly speaking, a brotherhood. In the Romance language spoken on the east coast of Spain in Catalonia it is written *germandat* or *germania* (Lat. *germanus,* full brother). In the form *germania* it has acquired the significance of "thieves' Latin" or "thieves' cant," and is applied to any jargon supposed to be understood only by the initiated. But the typical "germania" is a mixture of slang and of the gipsy language. The hermandades have played a conspicuous part in the history of Spain. The first recorded case of the formation of an hermandad occurred in the 12th century when the towns and the peasantry of the north united to police the pilgrim road to Santiago in Galicia, and protect the pilgrims against robber knights. Throughout the middle ages such alliances were frequently formed by combinations of towns to protect the roads connecting them, and were occasionally extended to political purposes. They acted to some extent like the Fehmic courts of Germany. The Catholic sovereigns, Ferdinand and Isabella, adapted an existing hermandad to the purpose of a general police acting under officials appointed by themselves, and endowed with large powers of summary jurisdiction even in capital cases. In Catalonia and Valencia the "germanias" were combinations of the peasantry to resist the exactions of the feudal lords.

HERMAN DE VALENCIENNES, 12th-century French poet, was born at Valenciennes, of good parentage. He became a priest and wrote the *Histoire de la Bible,* which includes a separate poem on the Assumption of the Virgin. The work is generally known as *Le Roman de sapience,* the name arising from a copyist's error in the first line of the poem:

"Comens de sapiense, ce est la cremors de Deu"

the first word being miswritten in one ms. *Romens,* and in another *Romanz.* Indeed, the work has the form of an ordinary romance, and cannot be regarded as a translation. He selects Biblical stories to suit his purpose, and adds freely from legendary sources, displaying considerable art in the use of his materials. This scriptural poem, very popular in its day, mentions Henry II. of England as already dead, and must therefore be posterior to 1189.

See *Notices et extraits des manuscrits* (vol. 34), and J. Bonnard, *Les Traductions de la Bible en vers français au moyen âge* (1884).

HERMANN I. (d. 1217), landgrave of Thuringia and count palatine of Saxony, was the second son of Louis II. the Hard, landgrave of Thuringia, and Judith of Hohenstaufen, sister of the emperor Frederick I. About 1180 he received from his brother Louis the Saxon palatinate, and married Sophia, sister of a former count palatine. In 1190 Louis died and Hermann frustrated the attempt of the emperor Henry VI. to seize Thuringia as a vacant fief of the Empire, and established himself as landgrave. In 1197 he went on crusade. When Henry VI. died in 1198 Hermann's support was purchased by the late emperor's brother Philip, duke of Swabia, but as soon as Philip's cause appeared to be weakening he transferred his allegiance to Otto of Brunswick, afterwards the emperor Otto IV. Philip accordingly invaded Thuringia in 1204 and compelled Hermann to come to terms by which he surrendered the lands he had obtained in 1198 After the death of Philip and the recognition of Otto he was among the princes who invited Frederick of Hohenstaufen, afterwards the emperor Frederick II., to come to Germany and assume the crown. The Saxons consequently attacked Thuringia, but the landgrave was saved by Frederick's arrival in Germany in 1212. After the death of his first wife in 1195 Hermann married Sophia, daughter of Otto I., duke of Bavaria. By her he had four sons, two of whom, Louis and Henry Raspe, succeeded their father in turn as landgrave. Hermann died at Gotha on April 25, 1217. Walther von der Vogelweide and other Minnesingers were welcomed to his castle, and Hermann figures in story and in opera as the promoter of the famous singing contest at the Wartburg.

See E. Winkelmann, *Philipp von Schwaben und Otto IV. von Braunschweig* (Leipzig, 1873–78); T. Knochenhauer, *Geschichte Thüringens* (Gotha, 1871); and F. Wachter, *Thüringische und obersächsische Geschichte* (Leipzig, 1826).

HERMANN, JOHANN GOTTFRIED JAKOB (1772–1848), German classical scholar and philologist, was born at Leipzig on Nov. 28, 1772. He studied at Leipzig university, and spent his life there as lecturer and professor, dying on Dec. 31, 1848. As leader of the school that held linguistic studies to be the sole aim of philology, he was opposed by A. Böckh and Otfried Müller, the representatives of the historico-antiquarian school, which regarded Hermann's view of philology as inadequate and one-sided.

His early work was done in grammar and metre, his most important books being *Elementa doctrinae metricae* (1816) and

De emendanda ratione Graecae grammaticae (1801).

See monographs by O. Jahn (1849) and H. Köchly (1874); C. Bursian, *Geschichte der klassischen Philologie in Deutschland* (1883); art. in *Allgem. deutsche Biog.*; Sandys, *Hist. Class. Schol.* (1908) iii.

HERMANN, KARL FRIEDRICH (1804–1855), German classical scholar and antiquary, was born on Aug. 4, 1804, at Frankfort-on-Main, and died at Göttingen on Dec. 31, 1855, having been professor at Marburg and Göttingen, where he succeeded Müller. He was chiefly distinguished for his works on Greek antiquities and ancient philosophy. Among these may be mentioned the *Lehrbuch der griechischen Antiquitäten* (new ed., 1889); and *Culturgeschichte der Griechen und Römer* (1857–58), published after his death by C. G. Schmidt.

See M. Lechner, *Zur Erinnerung an K. F. Hermann* (1864), and article by C. Halm in *Allgemeine deutsche Biographie*, xii. (1880).

HERMANN OF REICHENAU (HERIMANNUS AUGIENSIS), commonly distinguished as Hermannus Contractus, *i.e.*, the Lame (1013–1054), German scholar and chronicler, was the son of Count Wolferad of Alshausen, Swabia. Hermann became a monk of the famous abbey of Reichenau and exercised a great personal and intellectual influence on the scholars that gathered round him. He died on Sept. 24, 1054, at the family castle. Besides the ordinary monastic studies, he devoted himself to mathematics, astronomy and music, and constructed watches and various instruments.

His chief work is a *Chronicon ad annum 1054* (continued down to 1066 by his pupil Bertold) which furnishes important original material for the history of the emperor Henry III. The first edition, from a MS. no longer extant, was printed by J. Sichard at Basel in 1529. A critical edition is given in Pertz's *Monumenta Germaniae historica* (vol. v.), and a German translation by K. F. A. Nobbe in *Die Geschichtsschreiber der deutschen Vorzeit* (2nd ed., Leipzig, 1893). The separate lives of Conrad II and Henry III., often ascribed to Hermann, appear to have perished. His *De mensura astrolabii* and *De utilitatibus astrolabii* (to be found, on the authority of Salzburg MSS., in Pez, *Thesaurus anecdotorum novissimus*, iii.) being the first important European contributions to this subject, Hermann was for a time considered the inventor of the astrolabe. A didactic poem by him, *De octo vitiis principalibus*, is printed in Haupt's *Zeitschrift für deutsches Alterthum* (vol. xiii); and he is sometimes credited with the composition of the Latin hymns *Veni Sancte Spiritus*, *Salve Regina*, and *Alma Redemptoris*. A *martyrologium* by Hermann, discovered by E. Dümmler in a MS. at Stuttgart, was published by him in "Das Martyrologium Notkers und seine Verwandten" in *Forschungen zur deutschen Geschichte*, xxv. (Göttingen, 1885).

See H. Hansjakob, *Herimann der Lahme* (Mainz, 1875); Potthast, *Bibliotheca med. aev.*; and J. R. Dieterich, *Die Geschichtsschreibung der Abtei Reichenau* (1926).

HERMANN OF WIED (1477–1552), elector and archbishop of Cologne, was the fourth son of Frederick, count of Wied (d. 1487), and was born on Jan. 14, 1477. He became elector and archbishop of Cologne in 1515. With the aid of his friend John Gropper (1503–1559), he began, about 1536, to institute certain reforms in his own diocese. One step led to another, and as all efforts at union failed the elector invited Martin Bucer to Cologne in 1542. Supported by the estates of the electorate, and relying upon the recess of the diet of Regensburg in 1541, he encouraged Bucer to press on with the work of reform, and in 1543 invited Melanchthon to his assistance. Summoned both before the emperor and the pope, the elector was deposed and excommunicated by Paul III. in 1546. He resigned his office in 1547, and retired to Wied. Hermann, who was also a bishop of Paderborn from 1532 to 1547, died on Aug. 15, 1552.

See C. Varrentrapp, *Hermann von Wied* (Leipzig, 1878).

HERMANT, ABEL (1862–), French author and dramatist, was born in Paris on Feb. 3, 1862. A brilliant wit and an exquisite stylist, he consistently devoted his abundant talents to describing the lighter side of life. His most characteristic works are those grouped under the general title, *Mémoires pour servir à l'histoire de la société* (1905), in which with unfaltering gaiety and a humour saved only by the delicacy of its expression from appearing scabrous, he mocks the aristocracy and wealthy bourgeoisie of France. He excels, too, in long series of amusing dialogues. *Le Caravansérail* (1917), a study of rich foreigners plunged into the cosmopolitan circles of Paris, is perhaps his best-known work, but the series of *Scènes de la vie des cours et des ambassades*, which includes *La carrière* (1894) and *Le sceptre* (1900), no less pungently portrays the complications of diplomacy in a dignified central European court. Among his plays may be noted *La meute* (1896), a comedy of parasites, and *Sylvie, ou la curieuse d'amour* (1900), which with infinite grace displays the reactions of a light-headed woman to the successive phases of revolutionary and imperial France. A more ambitious work is the long novel, *Le cycle de lord Chelsea*, 4 vols. (1923).

See Peltier, *Abel Hermant* (1924).

HERMAPHRODITE is the term used to describe an individual which elaborates both male and female germ-cells, synchronously or at different times. Non-functional hermaphroditism (the condition in which, though both male and female germ-cells are elaborated transiently or permanently, only one kind is functional), exists in three forms. In accessory hermaphroditism there is in addition to the testis a rudimentary ovary which, however, does not produce ova, *e.g.*, Bidder's organ in the male toad, and the ovary in the male of the stone-fly *Perla marginata*. In accidental hermaphroditism ova occur sporadically in the testis and spermatic tissues in the ovary. The condition is not uncommon among the Crustacea, it is of importance in that it shows that a primordial germ-cell can, under different circumstances, develop into a spermatozoon or into an ovum. In teratological hermaphroditism, commonly encountered in birds and mammals, the reproductive system consists of an intimate mixture of male and female structures. Its nature is as yet not understood.

Functional hermaphroditism, the condition in which both male and female gametes are produced by one and the same individual, both kinds being functional, also exists in three forms. In unisexual monoecism a genetic female (or male) develops at certain times spermatozoa in the ovary (or ova in the testis), and the individual previously functioning as a female (male) now functions as a male (female), *e.g.*, *Angiostomum nigrovenosum* and other nematodes and probably the hermaphrodite molluscs. In other words, one sex has become hermaphroditic. Gynomonoecism, in which the female temporarily produces sperm, is more common than andromonoecism. In consecutive monoecism every individual is first a male and then a female (or less commonly, first a female and then a male). Genetically the organisms are either males or neutrals. The condition is associated with parasitism and sedentary modes of life, *e.g.*, *Danalia*, one of the Liriopsidae, which is parasitic on a parasitic Rhizocephalan Crustacean. In spatial monoecism both male and female reproductive organs are present and the condition is a real functional hermaphroditism, *e.g.* certain Oligochaetes, Cestoda, Trematoda. The genetic basis of the condition is unknown. (*See* SEX; also MONSTER.)

BIBLIOGRAPHY.—T. H. Morgan, *Heredity and Sex* (1914); R. Goldschmidt, *The Physiology and Mechanism of Sex-determination* (1923); and F. A. E. Crew, *The Genetics of Sexuality in Animals* (1927).

(F. A. E. C.)

HERMAPHRODITUS, in Greek mythology a being, partly male, partly female, of little importance in cult (first named in Theophrastus, *Charact.* 28 [16]); the Superstitious Man garlands the *Hermaphroditi* (*see* Jebb-Sandys *l.c.*). The conception undoubtedly had its origin in the East, where deities of a similar dual nature frequently occur. Within the Greek area, it is found in Cyprus. Here, according to Macrobius (*Saturnalia*, iii. 8.2) there was a bearded statue of a male Aphrodite, called *Aphroditos* by Aristophanes. The legend is a product of the Hellenistic period. In accordance with this, Hermaphroditus is the son of Hermes and Aphrodite, of whom the nymph of the fountain of Salmacis in Caria became enamoured. When he bathed in her fountain, she entreated the gods that she might be forever united with him. The result was the formation of a being half man, half woman. This story is told by Ovid (*Metam.* iv. 285 *et seq.*) to explain the peculiarly enervating qualities of the water of the fountain. Hermaphroditus was a favourite subject in later Greek art.

See articles in Daremberg and Saglio, *Dictionnaire des antiquités*, and Roscher's *Lexikon der Mythologie*; and for art, A. Baumeister, *Denkmäler des klassischen Altertums* (1884–88).

HERMAS, SHEPHERD OF, one of the works representing the Apostolic Fathers (*q.v.*), a hortatory writing which "holds the mirror up" to the Church in Rome during the 3rd Christian generation. This is the period indicated by the evidence of the Muratorian Canon, which assigns it to the brother of Pius, Roman bishop *c.* 139–154. Probably it was not the fruit of a single effort of its author. Rather its contents came to him piecemeal and at various stages in his ministry as a Christian "prophet," extending over a period of years.

In its present form it falls under three heads: *Visions, Mandates, Similitudes.* These titles are somewhat misleading. In the four "Visions" the author appears to be transforming his personal religious history into a type (as Bunyan did in the *Pilgrim's Progress*). He is deeply impressed by the sad state of religion among professing Christians in Rome, and the "Visions" set forth his personal call to a mission of repentance and the awakened conscience. But before Hermas announces his message to the Roman Church, and thence to the churches abroad, there are added two *Visions* (iii. iv.) tending to heighten its impressiveness. He is shown the "holy church" under the similitude of a tower in building, and the great and final tribulation under that of a devouring beast, which yet is innocuous to undoubting faith.

The personal revelation given in the "Visions" is then elaborated in a fresh series of revelations through an angel in the guise of a Shepherd, who in a preliminary interview announces himself as the Angel of Repentance, sent to administer the special "repentance" which it was Hermas's mission to declare. "I was sent, quoth he, to show thee *again* all that thou sawest before, to wit the sum of the things profitable for thee. First of all write thou my mandates and similitudes; and *the rest*, as I will show thee, so shalt thou write." This programme is fulfilled in the xii *Mandates* and *Similitudes* i.–viii., while *Simil.* ix. is "the rest" and constitutes a distinct "book"; while *Sim.* x. is really an epilogue in which Hermas is "delivered" afresh to the Shepherd, for the rest of his days. He is "to continue in this ministry" of proclaiming the Shepherd's teaching, "so that they who have repented or are about to repent may have the same mind with thee," and so receive a good report before God (*Sim.* x. 2 2–4). Only they must "make haste to do aright," lest while they delay the tower be finished (4. 4), and the new aeon dawn (after the final tribulation: cf. *Vis.* iv. 3. 5). Hermas sees that mere repentance is not enough to meet the backsliding condition in which so many Christians then were, owing to the recoil of inveterate habits of worldliness entrenched in society around and within. It is, after all, too negative a thing to stand by itself or to satisfy God." "Cease, Hermas," says the Church, "to pray all about thy sins. Ask for righteousness also" (*Vis.* iii. 1. 6).

Value of the Work.—Here lies a great merit of Hermas's book, his insight into experimental religion and the secret of failure in Christians about him, to many of whom Christianity had come by birth rather than personal conviction. Thus they were divided in soul between spiritual goods and worldly pleasures, and were apt to doubt whether the rewards promised by God to the life of "simplicity" (all Christ meant by the childlike spirit, including generosity in giving and forgiving) and self-restraint, were real or not. For while the expected "end of the age" delayed, persecutions abounded. Such "doubled-souled" persons, like Mr. Facing-both-ways, inclined to say, "The Christian ideal may be glorious, but is it practicable?" It is this most fatal doubt which evokes the Shepherd's sternest rebuke; and, he meets it with the ultimate religious appeal, viz., to "the glory of God." He who made man "to rule over all things under heaven," could He have given behests beyond man's ability? If only a man "hath the Lord in his heart," he "shall know that there is nothing easier nor sweeter nor gentler than these mandates" (*Mand.* xii. 3–4). So in the forefront of the *Mandates* stands the secret of all: "First of all believe that there is one God. . . . Believe therefore in Him, and fear Him, and fearing Him have self-mastery. For the fear of the Lord dwelleth in the good desire," and to "put on" this master-desire is to possess power to curb "evil desire" in all its shapes (*Mand.* xii. 1–2). Elsewhere "good desire" is analysed into the "spirits" of the several virtues, which yet are organically related, Faith being mother, and Self-mastery her daughter, and so on (*Vis.* iii. 8. 3, *seq.*; cf. *Sim* ix. 15). These are the specific forms of the Holy Spirit power, without whose indwelling the mandates cannot be kept (*Sim.* x. 3; *cf.* ix. 13 2, 24, 2).

The absence of the historic names, "Jesus" and "Christ," may be due to the form of the book as purporting to quote angelic communications. This would also explain the absence of explicit scriptural citations generally, though knowledge both of the Old Testament and of several New Testament books—including the congenially symbolic Gospel of John—is clear.

Hermas faithfully reflects the Roman Church of the early 2nd century (*cf.* E. von Dobschütz, *"Christian Life in the Primitive Church,"* 1904). Indeed the prime value of the *Shepherd* is the light it casts on Christianity at Rome in the otherwise obscure period *c.* 110–140, when it had as yet hardly felt the influences converging on it from other centres of tradition and thought. Thus Hermas's comparatively mild censures on Gnostic teachers in *Sim.* ix. suggest that the greater systems, like the Valentinian and Marcionite, had not yet made an impression there, as Harnack argues that they must have done by *c.* 145. This date, then, is a likely lower limit for Hermas's revision of his earlier prophetic memoranda, and their publication in a single homogeneous work, such as the *Shepherd* appears to be.

BIBLIOGRAPHY.—The chief modern edition is by O. von Gebhardt and A. Harnack, in Fasc. iii. of their *Patr. apost. opera* (Leipzig, 1877); it is edited less fully by F. X. Funk, *Patr. apost.* (Tübingen, 1901). A convenient edition, with text and translation, is contained in *The Apostolic Fathers*, vol. ii., by Kirsopp Lake (Loeb Classical Library). For the wide literature of the subject *see* the two former editions, also Harnack's *Chronologie der altchr. Lit.* i. 257 *seq.*, and O. Bardenhewer, *Gesch. der altkirchl. Lit.* i. 557, *seq.*

HERMENEUTICS, the science or art of interpretation or explanation, especially of the Holy Scriptures. (Gr. ἑρμηνευτική *sc.* τέχνη, Lat. *ars hermeneutica*, from ἑρμηνεύειν to interpret, from Hermes, the messenger of the gods.)

HERMES, a Greek god, son of Zeus and Maia, daughter of Atlas, and often identified with Mercury (*q.v.*) and with Casmilus or Cadmilus, one of the Cabeiri (*q.v.*). The derivation of his name and his primitive character are very uncertain. The earliest centre of his cult was probably Arcadia, where Mt. Cyllene was reputed to be his birthplace. Here he was specially worshipped as the god of fertility, and his images were ithyphallic, as also were the "Hermae" (*q.v.*) at Athens. At Cyllene in Elis a mere phallus served as his emblem, and was highly venerated in the time of Pausanias (vi. 26, 3).

Both in literature and cult Hermes was constantly associated with the protection of cattle and sheep; at Tanagra and elsewhere his title was κριοφόρος, the ram-bearer. As a pastoral god he was often closely connected with deities of vegetation, especially Pan and the nymphs. His pastoral character is recognized in the *Iliad* (xiv. 490) and the later epic hymn to Hermes; and his Homeric titles ἀκάκητα, ἐριούνιος, δώτωρ ἐάων ("gracious," "the ready helper," "giver of good things") probably refer to him as the giver of fertility. In the *Odyssey*, however, he appears mainly as the messenger of the gods, and the conductor of the dead to Hades. Hence, in later times he is often represented in art and mythology as a herald. The conductor of souls was naturally a chthonian god; at Athens there was a festival in honour of Hermes and the souls of the dead, and Aeschylus (*Persae*, 628) invokes Hermes, with Earth and Hades, in summoning a spirit from the underworld. With this go his functions as a dream-god; he is called the "conductor of dreams" and the Greeks offered to him the last libation before sleep. As a messenger he may also have become the god of roads and doorways; he was the protector of travellers and his images were used for boundary-marks (*see* HERMAE). Treasure casually found was the gift of Hermes (ἕρμαιον), and any stroke of good luck was attributed to him; this and his function as a deity of gain, honest or dishonest (κερδῶος) are natural derivatives of his character as god of fertility. The trickery and cunning of Hermes is a prominent theme in literature from Homer downwards, al-

though it is very rarely recognized in official cult. In the hymn to Hermes the god figures as a precocious child (a type familiar in folk-lore), who, when a new-born babe, steals the cows of Apollo. In many respects he was a counterpart of Apollo, less dignified and powerful, but more human than his greater brother. Hermes was a patron of music, like Apollo, and invented the cithara; he presided over the games with Apollo and Heracles, and his statues were common in the stadia and gymnasia. He is god of eloquence also; like Apollo he is something of a prophet, though a much inferior one, presiding over some kinds of popular divination. For his oracle at Pharae, *see* ORACLES.

The sacred number of Hermes was 4, and the 4th of the month his birthday. Apart from the Hermae, in archaic art he was portrayed as a full-grown and bearded man, clothed in a long chiton, and often wearing a cap (*κυνῆ*) or a broad-brimmed hat (*πέτασος*), and winged boots. Sometimes he was represented in his pastoral character, as when he bears a sheep on his shoulders; at other times he appears as the messenger or herald of the gods with the *κηρυκεῖον*, or herald's staff, which is his most frequent attribute. From the latter part of the 5th century his art-type was changed in conformity with the general development of Greek sculpture. He now became a nude and beardless youth, the type of the young athlete. In the 4th century this type was probably fixed by Praxiteles in his statue of Hermes at Olympia.

BIBLIOGRAPHY.—L. Preller, ed. C. Robert, *Griech. Mythologie*, ii. 385 *seq.* (1894); W. H. Roscher, *Lex. der griech. u. rom. Mythologie*, s.v. (1884–86); C. Daremberg and E. Saglio, *Dict. des ant. grecques et rom.*; Farnell, *Cults of the Greek States* v. (1909); O. Gruppe, *Griech. Mythologie u. Religionsgesch.* p. 1318 *et seq.* (1906). M. P. Nilsson, *Griechische Feste* (1906), p. 388.

HERMES, GEORG (1775–1831), German Roman Catholic theologian, was born on April 22, 1775, at Dreyerwalde, in Westphalia, and was educated at the gymnasium and university of Münster. He was ordained in 1799 and two years after the publication of his *Untersuchungen über die innere Wahrheit des Christenthums* (Münster, 1805), became professor of theology at Münster. There his rationalistic mode of teaching and his disagreements with the Vicar-General von Droste-Vischering did little to smooth the way for his *Einleitung in die christkatholische Theologie* (1819–29), a work which shows the influence of Kant and Fichte, though in the first part the author severely criticizes these thinkers, especially for their views on the existence of God and on revelation. In 1820 Hermes was appointed professor of theology at Bonn where he died on May 26, 1831. His *Christkatholische Dogmatik* was published posthumously (3 vols., 1831–34). After his death, the contests between his followers and their opponents grew so bitter that the dispute was referred to Rome. The judgment was adverse, and in 1835 a papal bull condemned the *Einleitung* and the *Dogmatik*. In 1847 the condemnation of 1835 was confirmed by Pius IX.

See K. Werner, *Geschichte der katholischen Theologie* (1866), and *Dict. de Théol. catholique*.

HERMESIANAX, of Colophon, elegiac poet of the Alexandrian school, flourished about 330 B.C. Of his chief work, a poem in three books, dedicated to his mistress Leontion, Athenaeus (xiii. 597) has preserved about 100 lines, containing instances of the power of love. Hermesianax, whose style is characterized by alternate force and tenderness, was popular in his own times, and was esteemed even in the Augustan period.

Many separate editions have been published of the fragment, the text of which is in a very unsatisfactory condition: by F. W. Schneidewin (1838), J. Bailey (1839, with notes, glossary, and Latin and English versions), and others; R. Schulze's *Quaestiones Hermesianacteae* (1858), contains an account of the life and writings of the poet and a section on the identity of Leontion.

HERMES TRISMEGISTUS [Lat. "the thrice greatest Hermes], an honorific designation of the Egyptian Hermes; *i.e.*, Thoth (q.v.), the god of wisdom. In late hieroglyphic the name of Thoth often has the epithet "the twice very great," sometimes "the thrice very great"; in the popular language (demotic) the corresponding epithet is "the five times very great," found as early as the 3rd century B.C. Greek translations give *ὁ μέγας καὶ μέγας* and *μέγιστος*: *τρισμεγας* occurs in a late magical text: *ὁ τρισμέγιστος* has not yet been found earlier than the 2nd century A.D., but there can now be no doubt of its origin in the Egyptian epithets.

Thoth was "the scribe of the gods," "Lord of divine words," and to Hermes was attributed the authorship of all the strictly sacred books generally called by Greek authors *Hermetic*. These, according to Clemens Alexandrinus, our sole ancient authority (*Strom.* vi. p. 268 et seq.) were 42 in number, and dealt with a variety of subjects, mostly ritual. Works are extant in papyri and on temple walls, treating of geography, astronomy, ritual, myths, medicine, etc. It is probable that the native priests would have been ready to ascribe the authorship or inspiration, as well as the care and protection of all their books of sacred lore to Thoth, although there were a goddess of writing (Seshit), and the ancient deified scribes Imuthes and Amenophis, and later inspired doctors Petosiris, Nechepso, etc., to be reckoned with; there are indeed some definite traces of such an attribution extant in individual cases.

Whether a canon of such books was ever established, even in the latest times, may be seriously doubted. Forty-two was the number of divine assessors at the judgment of the dead before Osiris, and was the standard number of the nomes or counties in Egypt. The name of Hermes was at various dates, but especially in the 3rd century A.D. placed at the head of numerous syncretistic writings. These are partly of an Oriental tendency, partly an offshoot of popular Greek philosophy, particularly Stoic. They are all more or less mystical and gnostic in tone, but represent no single dogmatic system. At an unknown, but probably post-classical date, a number of these pieces were put together into what is called the *Corpus Hermeticum*, which still survives. The first of this collection the *Poimandres*, is the best known. Many other works, now lost, are represented by quotations in Stobaius and other authors, and a few survive in translations, Latin or Arabic. There is no satisfactory edition or translation; the most elaborate is Scott's (*see* below).

Besides Thoth, Anubis (*q.v.*) was constantly identified with Hermes; *see* also HORUS.

BIBLIOGRAPHY.—*See* R. Reitzenstein, *Poimandres, Studien zur griechisch-ägyptischen und frühchristlichen Literatur* (Leipzig, 1904); G. R. S. Mead, *Thrice Greatest Hermes* (1907), introduction and translation; W. Scott, *Hermetica* (text, translation and notes) (Oxford, 1924); F. Brauninger, *Untersuchungen zu den Schriften des Hermes Trismegistos*, Gräfenhainichen, 1926.

HERMIAS. (1) A Greek philosopher of the Alexandrian school and a disciple of Proclus. His chief works were a study of the *Isagoge* of Porphyry and a commentary on Plato's *Phaedrus* (ed. P. Couvreur, Paris, 1901). Unlike the majority of logicians of the time, he admitted the absolute validity of the second and third figures of the syllogism.

(2) A Christian apologist and philosopher who flourished about the end of the 4th century. Nothing is known about his life, but a small thesis *Διασυρμὸς τῶν ἔξω φιλοσόφων* has been preserved. In it he attacked pagan philosophy for its lack of logic in dealing with the root problems of life, the soul, the cosmos and the first cause. There is an edition by von Otto in the *Corpus apologetarum* (Jena, 1872).

HERMIPPUS, "the one-eyed," Athenian writer of the Old Comedy, flourished during the Peloponnesian War. He is said to have written 40 plays, of which the titles and fragments of nine are preserved. He was a bitter opponent of Pericles, whom he accused (probably in the *Μοῖραι*) of being a bully and a coward, and of carousing with his boon companions while the Lacedaemonians were invading Attica. He is said to have prosecuted Aspasia for impiety and offences against morality (Plutarch, *Pericles*, 32). In the *Ἀρτοπωλίδες* ("Bakeresses") he attacked the demagogue Hyperbolus.

Fragments in T. Kock, *Comicorum Atticorum fragmenta*, i. (1880), and A. Meineke, *Poëtarum Graecorum comicorum fragmenta* (1855).

HERMIT (Gr. *ἐρεμίτης*, from *ἔρημος*, a desert) one who withdraws from intercourse with human beings to live a life of religious contemplation, and so distinguished from a "coenobite" (Gr. *κοινός*, common, and *βίος*, life), one who shares a life of

withdrawal with others in a community (*see* ASCETICISM and MONASTICISM). Strictly speaking, the hermit or eremite was a solitary who, like the hermits of the Thebaid, chose desert and remote places for his habitation, and was thus distinct from the anchorite (Gr. *ἀναχωρητής* from *ἀναχωρεῖν*, to withdraw), whose cell or enclosed dwelling was often attached to a church or in the neighbourhood of some place of public resort.

HERMIT CRAB, a genus of crusteans (*Paguridea*) commonly found on the coasts of Europe, America and the West Indies. In the adult stage it occupies the shells of gastropod molluscs, thrusting its abdomen inside the shell, the curve of which it follows; this part of the body is not encased as in other species of the same order. It lives under commensal conditions by association with sponges, sea anemones and other animals. *See* CRUSTACEA, SYMBIOSIS and MALACOSTRACA.

HERMOGENES, of Tarsus, Greek rhetorician, surnamed *Ξυστήρ* (the polisher), flourished in the reign of Marcus Aurelius (A.D. 161–180). His precocity secured him a public appointment as teacher of his art while he was still a boy, but at the age of 25 his faculties gave way. He had, however, composed a series of rhetorical treatises, which became popular text-books, and the subject of commentaries. Of his *Art of Speaking* we still possess the sections *Περὶ τῶν στάσεων* (on legal issues), *Περὶ εὑρέσεως* (on the invention of arguments), *Περὶ ἰδεῶν* (on the various kinds of style), *Περὶ μεθόδου δεινότητος* (on the method of speaking effectively), and *Προγυμνάσματα* (rhetorical exercises).

Editions by C. Walz (1832), and by L. Spengel (1854), in their *Rhetores Graeci;* H. Rabe (Leipzig, 1913); bibliographical note on the commentaries in W. Christ, *Geschichte der griechischen Literatur* (1898).

HERMON, the most imposing, if not the highest, mountain in Syria, and visible far and wide. It is attached to the southern end of Anti-Lebanon. Its snowy top and the beauty of its outline inspired many images of Hebrew poetry. The Sidonians named it Sirion and it was Senīr to the Amorites (Deut. iii. 9). According to one view it was the Mount of Transfiguration. To the modern Arab it is *Jebel esh-Sheikh* ("old man mountain") or *Jebel eth-Thelj* ("snow mountain"). Conder explained the former name as given because the "sheikh" of the Druses sought retirement there in the tenth century, but the hoary appearance of the mountain itself may have determined the name.

The ridge of Hermon which rises to a sharp peak is 20 m. long. "The formation of the lower part is Nubian sandstone, that of the upper part is a hard dark-grey crystalline limestone belonging to the Neocomian period, and full of fossils." The view from the summit is very extensive and a summer sunrise over Damascus viewed from that point of vantage is an awe-inspiring sight. Hermon is covered in the spring with snow which never entirely disappears and in autumn there is always some snow left piled up in great drifts to 20 or 30 ft. in the gullies and ravines on the mountain top. The ravines and gorges which pierce its lower slopes to the west and south-west are fertile and the vegetation is luxuriant. To a height of 500 ft. oaks, poplars, and brush are met. Foxes, wolves, and Syrian bears still haunt its fastnesses, if in decreasing numbers. The summit splits into three peaks the highest of which is 9,700 ft. above sea-level. On the southern are the ruins of a temple dedicated probably to Baal. This peak, too, is enclosed with a wall. On the plateau separating the peaks is a cave about 8 yd. square. Twelve other small temples, oriented east, are found on the slopes of the mountain. They are dated by archaeologists at *c.* A.D. 200 and from them several Greek inscriptions have been recovered. (E. Ro.)

HERMSDORF, a village in the Prussian province of Silesia near Waldenburg. Pop. (1925) 11,713. There are coal mines in the vicinity, and matches are manufactured. Hermsdorf is known as Niederhermsdorf to distinguish it from other places of the same name. Perhaps the most noteworthy of these is a village (Pop. [1925] 3,099) in Silesia at the foot of the Riesengebirge, chiefly famous for the ruins of the castle of Kynast. This castle, formerly the seat of the Schaffgotsch family, was destroyed by lightning in 1675. A third Hermsdorf is a village in Thuringia, where porcelain is made. Pop. (1925) 3,452.

HERNANDES or **FERNANDES, GREGORIO** (*c.* 1576–1636), Spanish sculptor, was born in Galicia about 1576. He was a pupil of Francisco del Rincon at Valladolid and became a famous sculptor of altarpieces and religious subjects. The figures on the high altar of San Miguel are his work and he also executed the altar of the Nuestra Señora de la Concepcion monastery at Vittoria (1618–21). An early figure of Christ (1605) is in the monastery of the Sacrament in Madrid, and the museum at Valladolid contains among other pieces a *Pieta* and a relief, "The Baptism of Christ." One of his finest works is the "Virgin of Sorrows" at Santa Cruz. He died at Valladolid on Jan. 22, 1636.

See Marti and Monso, *Estudios historicos artisticos relativos a Valladolid* (1898); Merlet, *L'Art et les artistes,* vol. xvii. (1913).

HERNÁNDEZ, JOSÉ (1834–1886), Argentine poet, was born near Buenos Aires, on Nov. 10, 1834, of distinguished lineage. His youth was spent on the pampas, but after the overthrow of Rosas in 1852, he took an active interest in the national rehabilitation and held numerous posts in the provincial Governments. In the struggle between Buenos Aires and the other provinces, he sided with Urquiza against Mitre, and with López Jordán against Sarmiento, and upon the complete collapse of the provincial cause in 1872, was forced to seek refuge out of the country. Returning to Buenos Aires soon afterwards, he resumed his position of influence, founded the *Revista de la Plata,* and was conspicuous in establishing the new provincial capital at La Plata. He died at Belgrano on Oct. 21, 1886. He is remembered chiefly for his poem *Martín Fierro,* the first epic in Spanish-American literature since Ercilla's *Araucana,* and the finest example we have of the so-called *gauchesca* literature. It appeared in two parts, the first, *La Ida,* in 1872, and in 1878, the second, *La Vuelta de Martín Fierro.* This poem is not Hernández's only literary effort, but it is the only one to win the confirmation of time.

See Henry A. Holmes, *Martín Fierro, an Epic of the Argentine* (New York, 1923); Carlos O. Bunge, *Martín Fierro* (Buenos Aires, 1915); Ricardo Rojas, *La literatura argentina* (vol. i., Buenos Aires, 1917); José M. Salaverría, *El Poema de la Pampa* (Madrid, 1918); for a complete bibliography *see* S. E. Leavitt, *Argentine Literature, a bibliography* (1924). (W. B. P.)

HERNE, JAMES A. (originally AHERNE) (1840–1901), American actor and playwright, was born in Troy (N.Y.), and after theatrical experiences in various companies produced his own first play, *Hearts of Oak,* in 1878, and his great success, *Shore Acres,* in 1882. His humour and pathos found their proper setting in rural drama, and *Shore Acres* was seen throughout the United States almost continuously for six seasons, being followed by the less successful *Sag Harbor,* 1900.

HERNE, a town in the Prussian province of Westphalia, 15 m. by rail N.N.W. of Dortmund. Pop. (1925) 66,542. It has coal mines, boiler-works, ammonia works, etc. Herne was made a town in 1897.

HERNE BAY, a seaside resort of Kent, England, 8 m. N. by E. of Canterbury, on the S.R. Pop. of urban district (1921) 11,872. It has grown up since 1830, above a sandy and pebbly shore. The church of St. Martin in the village of Herne, 1½ m. inland, is Early English and later; the living was held by Nicholas Ridley (1538), afterwards Bishop of London. At Reculver, 3 m. E. of Herne Bay, is the site of the Roman station of *Regulbium.* The fortress occupied about 8 ac., but only traces of the south and east walls remain. In Saxon times it was converted into a palace by King Ethelbert, and in 669 a monastery was founded here by Egbert. Parts of the Early English church, taken down early in the 19th century owing to the encroachment of the sea, are preserved in the modern church of St. Mary, but its twin towers, known as the Sisters, from the tradition that they were built by a Benedictine abbess of Faversham in memory of her sister, were preserved by Trinity House as a conspicuous landmark.

HERNE THE HUNTER, a legendary huntsman believed to haunt Windsor Great Park at night, especially near an aged tree, "Herne's oak." This was blown down in 1863, and a young oak was planted by Queen Victoria on the spot. Herne's French counterpart is the *Grand Veneur* of Fontainebleau. Herne is

mentioned in *The Merry Wives of Windsor* and in Harrison Ainsworth's *Windsor Castle*. The Herne legend is probably a variant of the "Wild Huntsman" myth, descended (E. B. Tylor, *Primitive Culture*, 4th ed. pp. 361–362) from a prehistoric storm-myth.

HERNIA, in surgery, the protrusion of a part from its normal cavity; thus, *hernia cerebri* is a protrusion of brain-substance, *hernia pulmonum*, a protrusion of a portion of lung, and *hernia iridis*, a protrusion of some of the iris through an aperture in the cornea. As a result of X-ray examinations herniae of abdominal viscera into the thorax through a defect in the diaphragm have been recognized with some frequency. But, used by itself, hernia implies, in common language, a "rupture." A rupture may occur at any weak point in the abdominal wall. The common situations are the groin (*inguinal*), the upper part of the thigh (*femoral*), and the navel (*umbilical*). The hernia may contain intestine alone, omentum alone, or both. The predisposing cause of rupture is abnormal length of the mesentery or of the omentum, together with some weak spot in the abdominal wall, as in an inguinal hernia, which descends along the canal in which the spermatic cord lies in the male and the round ligament of the womb in the female. A femoral hernia comes through a weak spot in the abdomen to the inner side of the great femoral vessels; a ventral hernia takes place by the yielding of the scar tissue left after an abdominal operation. The exciting cause of hernia is generally over-exertion, as in lifting a heavy weight, jumping off a high wall, straining, constipation, or excessive coughing. The pressure of the diaphragm above and the abdominal wall in front acting on the abdominal viscera causes a protrusion at the weakest point.

Rupture is either congenital or acquired. A child may be born with a hernia in the inguinal or umbilical region, owing to defective development in those parts; or the rupture may first appear, perhaps, in adult life as the result of a strain or hurt. Men suffer more often than women, because of their physical labours and greater liability to accidents, and because the canal for the spermatic cord out of the abdomen is wider than that for the round ligament of the womb.

At first a rupture is small but it gradually increases in bulk. It varies in size from a marble to a child's head. The swelling consists of three parts—the coverings, sac, and contents. The "coverings" are the structures which form the abdominal wall at the part where the rupture occurs, thinned and matted together as the result of pressure or thickened from repeated attacks of inflammation. The "sac" is composed of the peritoneum or membrane lining the abdominal cavity; in some rare cases the sac is wanting. The neck of the sac is the narrowed portion where the peritoneum forming the sac becomes continuous with the general peritoneal cavity. The neck of the sac is often thickened, indurated, and adherent to surrounding parts, the result of chronic inflammation. The "contents" are bowel, omental fat, or, in children, an ovary.

The hernia may be reducible, irreducible, or strangulated. A "reducible" hernia is one in which the contents can be pushed back into the abdomen. In some cases reduction is easy, in others, a matter of great difficulty. At any moment a reducible hernia may become "irreducible," perhaps from inflammatory adhesions in and around the fatty contents, or from extra fullness of the bowel in the sac. A "strangulated" hernia is one in which the circulation of blood through the hernial contents is impeded by the pinching at the narrowest part of the passage. The interference is at first slight, but quickly becomes pronounced; the pinched bowel in the hernial sac swells as a finger does when a string is tightly wound round its base. Congestion is followed by inflammation, infection by micro-organisms and mortification. The rapidity with which these changes take place depends on the tightness of the constriction. As a rule, the more rapidly a hernia forms the greater the rapidity of serious change in the conditions of the bowel or omentum, and the more urgent are the symptoms. The constricting band may be one of the structures which form the boundaries of the openings through which the hernia has travelled, or it may be the neck of the sac, which has become thickened in consequence of inflammation—especially is this the case in an inguinal hernia.

Reducible Hernia.—With a reducible hernia there is a soft compressible tumour (elastic when it contains intestine, doughy when it contains omentum), its size increasing in the erect, and diminishing in the horizontal posture. As a rule, it causes no trouble during the night. It gives an impulse on coughing, and when the intestinal contents are pushed back into the abdomen a gurgling sensation is perceptible by the fingers. Such a tumour may be met with in any part of the abdominal wall, but the chief situations are as already given. Inguinal hernia is commoner in men, femoral, in women. As an inguinal hernia increases in size it passes into the scrotum in the male, into the labium in the female; while a femoral hernia gradually pushes upwards to the abdomen.

The palliative treatment of a reducible hernia consists in pushing back the contents of the tumour into the abdomen and applying a truss or elastic bandage to prevent their again escaping. The younger the patient the more chance there is of the truss acting as a curative agent. The truss may generally be left off at night, but it should be put on in the morning before the patient leaves his bed. If, after the hernia has been once returned, it is not allowed again to come down, there is a probability of an actual cure taking place; but if it is allowed to come down occasionally, as it may do, even during the night, in consequence of a cough, or from the patient turning suddenly in bed, the weak spot is again opened out, and the improvement which might have been going on for weeks is undone. It is sometimes found impossible to keep up a hernia by means of a truss, and an operation becomes necessary. The operation is spoken of as "the radical treatment of hernia," in contradistinction to the so-called "palliative treatment" by means of a truss. The principles involved in the operation are the emptying of the sac and its entire removal, and the closure of the opening into the abdomen by strong sutures: and, in this way, great advance has been made by modern surgery. Experience has shown that very few ruptures are unsuited for radical treatment by operation.

Irreducible Hernia.—The main symptom is a swelling in one of the situations already referred to, of long standing and perhaps of large size, in which the contents of the tumour, in whole or in part, cannot be pushed back into the abdomen. The irreducibility is due either to its large size or to changes which have taken place by indurations or adhesions. Such a hernia is a constant source of danger; its contents are liable to injury from external violence; it may at any time become strangulated, or the contents may inflame, and strangulation may occur secondarily to the inflammation. It gives rise to dragging sensations (referred to the abdomen), colic, dyspepsia, and constipation, which may lead to stoppage of the passage of the contents through that portion of the intestinal canal which lies in the hernia. When an irreducible hernia becomes painful and tender a local peritonitis has occurred, which resembles in many of its symptoms a case of strangulation, and must be regarded with suspicion and anxiety. Indeed, the only safe treatment is by operation.

The treatment of irreducible hernia may be palliative; a "bag truss" may be worn in the hope of preventing the hernia getting larger; the bowels must be kept open, and all irregularities of diet avoided. But it must be repeated that a person with such a hernia is in constant danger, and if possible a radical operation should be done.

In *Strangulated Hernia* the bowel or omentum is being nipped at the neck of the sac, and the flow of blood into and from the delicate tissues is stopped. The symptoms are nausea, vomiting of bilious matter, and, after a time, of faecal-smelling matter; a twisting, burning pain generally referred to the region of the navel, intestinal obstruction; a quick, wiry pulse and pain on pressure over the tumour; the expression grows anxious, the abdomen becomes tense and drum-like, and there is no impulse in the tumour on coughing, because its contents are practically pinched off from the general abdominal cavity. Sometimes there is complete absence of pain and tenderness in the hernia itself, and in an aged person all the symptoms may be very slight. Sooner or later, from eight hours to eight days, if the strangulation is unrelieved, the tumour becomes livid, crackling with gas, mortification of the bowel at the neck of the sac takes place, followed by

extravasation of the intestinal contents into the abdominal cavity; the patient has hiccough; he becomes collapsed, and dies comatose from blood-poisoning.

The treatment of a strangulated hernia admits of no delay; it must be operated on at once. There should be no attempt at treatment by hot-bath or ice-bag: operation is urgently needed. An anaesthetic should be administered, and perhaps one gentle attempt to return the contents by pressure may be made, but no prolonged attempts are justifiable, because the condition of the hernial contents may be such that they cannot bear the pressure of the fingers.

Attempts at replacement to be successful should be made in a direction opposite to the one in which the hernia has come down. The inguinal hernia should be pressed upwards, outwards, and backwards, the femoral hernia downwards, backwards, and upwards. The larger the hernia the greater is the chance of success, and the smaller the hernia the greater the risk of its being injured by manipulation and delay. In every case the handling must be absolutely gentle. If it does not succeed the surgeon must at once cut down on the swelling, carefully dividing the different coverings until he reaches the sac. The sac is then opened, the constriction divided, care being taken not to injure the bowel. The bowel must be examined before it is returned into the abdomen, and if its lustreless appearance, its dusky colour, or its smell, suggests that it is mortified, or is on the point of mortifying, it must not be put back or perforation would give rise to septic peritonitis, which probably would have a fatal ending. In such a case the damaged piece of bowel must be resected and the healthy ends of the bowel joined together by fine suturing. Matted or diseased omentum must be tied off and removed.

HERNICI, an ancient people of Italy, whose territory was in Latium between the Fucine lake and the Trerus, bounded by the Volsci on the south, and by the Aequi and the Marsi on the north. In 486 B.C. they were still strong enough to conclude an equal treaty with the Latins (Dion. Hal. viii. 64 and 68). They broke away from Rome in 362 (Livy. vii. 6 ff.) and in 306 (Livy iv. 42), when their chief town Anagnia (*q.v.*) was taken and reduced to a praefecture, but Ferentinum, Aletrium and Verulae were allowed to remain free *municipia*. By 225 B.C. their territory was not distinguished from Latium generally, and it seems probable that they had then received the full Roman citizenship. The oldest Latin inscriptions of the district (from Ferentinum, C.I.L. x. 5837–40) are earlier than the Social War, and present no local characteristic.

For further details of their history *see* C.I.L. x. 572.

See also R. S. Conway, *Italic Dialects* (1897), p. 306 ff., where the glosses and the local and personal names of the district will be found.

HERNÖSAND, a seaport of Sweden, chief town of the district (*län*) of Vesternorrland on the Gulf of Bothnia. Pop. (1928) 11,692. Hernösand was founded in 1584, and received its first town-privileges from John III. in 1587. It stands on the island of Hernö (which is connected with the mainland by bridges) near the mouth of the Ångerman river, 423 m. N. of Stockholm by rail. It is the seat of a bishop and possesses a cathedral. There are engine-works, timber-yards and saw-mills. The harbour is good, but generally icebound from mid-January to May. Timber, cellulose and wood-pulp are exported.

HERO, a Greek word (ἥρως) of varying meaning whose etymology is unknown.

(1) **In Homer:** a complimentary term (roughly="gentleman," "noble"), applied to the chief characters of the poems, or even to persons of lower rank, or the free warriors generally. Hence in Hellenistic Greek, a great or noble man, a hero; sometimes also a great classical writer.

(2) **Hero-Cult.** After Homer we hear of what had probably existed before him, the cult of the distinguished dead (*see* ANCESTOR-WORSHIP). The heroes, as the objects of this cult are called, are not disembodied spirits, nor demi-gods; their position is not intermediate between gods and men, but by the side of these they exist as a separate class, though minor divine figures are often confused with them. Even in Homer, traces of an earlier ancestor-worship appear; *e.g.*, in funeral games in honour of Patroclus and other heroes, while the Hesiodic account of the five ages of man is a reminiscence of the belief in the continued existence of souls in a higher life. This agrees with the clear traces in Mycenaean graves of a cult of the dead. This pre-historic worship and belief, for a time obscured, were subsequently revived. According to Porphyry (*De abstinentia,* iv. 22), Draco ordered the inhabitants of Attica to honour the gods and heroes of their country "in accordance with the usage of their fathers" with offerings of first fruits and sacrificial cakes every year, thereby clearly pointing to a custom of high antiquity. Heroic honours were bestowed upon the founders of a colony or city, and the ancestors of families; if their name was not known, one was adopted from legend, or invented, as the supposed ancestors of the noble and priestly families of Attica and elsewhere. Again, side by side with gods of superior rank, certain heroes were worshipped as protecting spirits of the country or state; such were the Aeacidae amongst the Aeginetans, Ajax son of Oileus amongst the Epizephyrian Locrians and Hector at Thebes.

Neglect of the worship of these heroes was held to be responsible for pestilence, bad crops, and other misfortunes, while, on the other hand, if duly honoured, their influence was equally beneficent. This belief was supported by the Delphic oracle, which was largely instrumental in promoting hero-worship and keeping alive its due observance. Special importance was attached to the grave of the hero and to his bodily remains. The grave was regarded as his place of abode, from which he could be absent only for a brief period; hence his bones were fetched from abroad (*e.g.*, Cimon brought those of Theseus from Scyros), or if they could not be procured, at least a cenotaph was erected in his honour. Their relics, the house of Cadmus at Thebes, the hut of Orestes at Tegea, the stone on which Telamon had sat at Salamis (in Cyprus) also were carefully preserved. Special shrines (ἡρῷα) were also erected in their honour, usually over their graves. Like the gods, the cult heroes were supposed to exercise an influence on human affairs, though not to the same extent, their sphere of action being confined to their own localities. Among the earliest known historical examples of the elevation of the dead to the ranks of heroes are Timesius, the founder of Abdera, Miltiades, son of Cypselus, Harmodius and Aristogeiton and Brasidas, the victor of Amphipolis, who ousted the local Athenian hero Hagnon. In course of time admission to the rank of a hero became far more common, and was even accorded to the living, such as Lysimachus in Samothrace and the tyrant Nicias of Cos. This is one of the sources of the Hellenistic and Roman cult of kings and emperors. In addition to persons of high rank, poets, legendary and others, legislators and physicians, the patrons of various trades or handicrafts, the heads of philosophical schools received the honours of a cult. Finally, hero sank into a mere complimentary term for any dead man.

The cult of the heroes exhibits points of resemblance with that of the chthonian divinities, but differs from that of the ordinary gods. Normally, sacrifice was offered at night, on a hearth (ἐσχάρα), not an altar: the blood of the victim, which was black and sacrificed with its head turned earthwards, was allowed to trickle on the ground or into a trench or tube leading to the grave to appease the departed; the technical expression for the sacrifice was not *thuein*, but *enagizein* (less commonly *entemnein*) and generally the flesh was not eaten but burned. The chthonian aspect of the hero is further shown by his attribute the snake, and in many cases he appears under that form himself. On special occasions a sacrificial meal of cooked food was set out for the heroes, of which they were solemnly invited to partake. The fullest description of such a festival is the account given by Plutarch (*Aristides,* 21) of the festival celebrated by the Plataeans in honour of their countrymen who had fallen at the battle of Plataea. Later theologians (*see* Plutarch, *de defectu oraculorum,* 10, 415B) arranged an ascending scale of heroes (beatified human souls), daimones and gods, and held that promotion from one grade to another was possible.

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Antiquités; L. R. Farnell, *Greek Hero-Cults* (1921). (2) On particular points: Pfister, *Reliquien Kult im Altertum;* Bruck, *Totenteil und Seelgerät* (Munich, 1926); Oeconomus, *De profusionum receptaculis sepulcralibus* (Athens, 1921). (X.)

Teutonic Legend.—Many of the chief characteristics of the ancient Greek heroes are reproduced in those of the Teutonic North. Superhuman qualities and powers are commonly ascribed to both, an important difference being that whatever worship may have been paid to the Teutonic heroes never crystallized into a cult. This applies equally to those who have a recognized historical origin and to those who are regarded as purely mythical.

During the 19th century the "degraded gods" theory was applied not only to such conspicuous heroes as Siegfried, Dietrich and Beowulf, but to a host of minor characters. (*See* also Henri de Tourville, *Histoire de la formation particulariste,* 1903.) It is now, however, admitted that, whatever influence the one may have from time to time exercised on the other, Teutonic myth and Teutonic heroic legend were developed independently. The Teutonic heroes are, in the main, historical personages; though, like the Greek heroes, they are sometimes endowed with semi-divine attributes or interpreted as symbolical representations of natural forces.

The origin of Teutonic heroic saga, which includes that of the Germans, Goths, Anglo-Saxons and Scandinavians, is to be looked for in the traditions connected with the period of the so-called migration of nations (A.D. 350–650), the earliest traces of which are found in the works of historical writers such as Ammianus Marcellinus and Cassiodorus. It consequently rests upon a distinct basis of fact, the saga being the oldest form of historical tradition. (*See* also Tacitus, *Annals,* ii. 88) The next step in the development of epic narrative was the single lay of an episodic character, sung by a single individual, who was frequently a member of a distinguished family, not merely a professional minstrel. Then, as different stories grew up round the person of a particular hero, they formed a connected cycle of legend, the centre of which was the person of the hero (*e.g.,* Dietrich of Bern). The most important figures of these cycles are the following.

(1) Beowulf, king of the Geatas (Jutland), whose story is an amalgamation of the myth of Beowa, the slayer of the water-demon and the dragon, with the historical legend of Beowulf, nephew and successor of Hygelac (Cochilaicus), king of the Geatas, who was defeated and slain (*c.* 520) while ravaging the Frisian coast. Beowulf is the hero of spring and light who, after overcoming the spirit of the raging waters, finally succumbs to the dragon of approaching winter. Others regard him as a wind-hero, who disperses the pestilential vapours of the fens. Beowulf is also a culture-hero, indicating the blessings of a fixed habitation, secured against the attacks of the sea. (2) Hildebrand, the hero of the oldest German epic. He follows his master Theodoric to the court of Attila. After 30 years' absence, he returns to his home in Italy; his son Hadubrand, believing his father to be dead, suspects treachery, and a fight takes place, in which the son is slain by the father. (3) Ermanaric, the king of the East Goths, who according to Ammianus Marcellinus slew himself (*c.* 375) in terror at the invasion of the Huns. With him is connected the old German Dioscuri myth of the Hartungen. (4) Dietrich of Bern (Verona), the legendary name of Theodoric the Great. Attempts have been made to identify him as a kind of Donar or god of thunder. (5) Siegfried (M.H. Ger. Sîvrit), the hero of the *Nibelungenlied,* the Sigurd of the related northern sagas, is usually regarded as a purely mythical figure, a hero of light who is ultimately overcome by the powers of darkness, the mist-people (Nibelungen). He is, however, closely associated with historical characters and events, *e.g.,* with the Burgundian king Gundahari (Gunther, Gunnar) and the overthrow of his house and nation by the Huns. Theodor Abeling (*Das Nibelungenlied,* Leipzig, 1907) traces the Nibelung sagas to three groups of Burgundian legends, each based on fact. (*See* also the articles KRIEMHILD, NIBELUNGENLIED.) (6) Hugdietrich, Wolfdietrich and Ortnit, whose legend, like that of Siegfried, is of Frankish origin. It is preserved in four versions, the best of which is the oldest, and has an historical foundation. Hugdietrich is the "Frankish Dietrich" (=Hugo Theodoric) king of Austrasia (d. 534), who was illegitimate, and had to fight for his inheritance with his relatives. As the myth of the Hartungen is connected with Ermanaric, so another Dioscuri myth (of the Hartungen) is combined with the Ortnit-Wolfdietrich legend. The Hartungen are probably identical with the divine youths (mentioned in Tacitus as worshipped by the Vandal Naharvali or Nahanarvali), from whom the Vandal royal family, the Asdingi, claimed descent. Asdingi would be represented in Gothic by Hazdiggos "men with women's hair" (*cf. muliebri ornatu* in Tacitus), and in Middle High German by Hartungen. (7) Rother, king of Lombardy. Desiring to wed the daughter of Constantine, king of Constantinople, he sends envoys to ask her in marriage. They are thrown into prison by the king. Rother, who appears under the name of Dietrich, sets out with an army, liberates the envoys and carries off the princess. The slaying of a tame lion by one of the followers of Rother is founded in an incident which actually took place at the court of Alexius during the crusade of 1101 under Duke Welf of Bavaria, while *King Rother* was composed about 1160 by a Rhenish minstrel. Rother may be the Lombard king, Rothari (636–650), transferred to the period of the Crusades. (8) Walther of Aquitaine, chiefly known from the Latin poem *Waltharius,* written by Ekkehard of St. Gall at the beginning of the 10th century, and fragments of an 8th century Anglo-Saxon epic *Waldere.* Walther is not an historical figure. (9) Wieland (Volundr), Wayland the Smith, the only Teutonic hero (his original home was Lower Saxony) who firmly established himself in England. There is no historical background for his legend. He typifies the advance from the stone age to a higher stage of civilization (working in metals). (10) Högni (Hagen) and Hedin (Hetel), whose personalities are overshadowed by the heroines Hilde and Gudrun (Kudrun, Kutrun). In one version occurs the incident of the never-ending battle between the forces of Hagen and Hedin. The battle represents the eternal conflict between light and darkness, the alternation of day and night. The historical background is the raids of the Teutonic maritime tribes on the coasts of England and Ireland.

Famous heroes who are specially connected with England are Alfred the Great, Richard Coeur-de-Lion, King Horn, Havelok the Dane, Guy of Warwick, Sir Bevis of Hampton (or Southampton), Robin Hood and his companions.

Celtic Heroes.—The Celtic heroic saga in the British islands may be divided into the two principal groups of Gaelic (Irish) and Brython (Welsh), the first, excluding the purely mythological, into the Ultonian (connected with Ulster) and the Ossianic. The Ultonian is grouped round the names of King Conchobar and the hero Cuchulainn, the defender of Ulster against all Ireland, regarded by some as a solar hero. The second cycle contains the epics of Finn (Fionn, Fingal) mac Cumhail and his son Oisin (Ossian), the bard and warrior. (*See* CELT; CELTIC LITERATURE.)

Of Brython origin is the cycle of King Arthur (Artus), the adopted national hero of the mixed nationalities of whom the "English" people was composed. The original Welsh legend was spread by British refugees in Brittany, and was thus celebrated by both English and French Celts. From a literary point of view, however, it is chiefly French and forms "the matter of Brittany." Arthur, the leader (*comes Britanniae dux bellorum*) of the Siluri or Dumnonii against the Saxons, flourished at the beginning of the 6th century. He is first spoken of in Nenniu's *History of the Britons* (9th century), and at greater length in Geoffrey of Monmouth's *History of the Kings of Britain* (12th century), at the end of which the French Breton cycle attained its fullest development in the poems of Chrétien de Troyes and others.

Speaking generally, the Celtic heroes are differentiated from the Teutonic by the extreme exaggeration of their superhuman, or rather extra-human, qualities. Take, for instance, the description of some of Arthur's knights in the Welsh tale of *Kilhwch and Olwen* (in the *Mabinogion*); Sgilti Yscandroed, whose tread was so light that no blade of grass bent beneath his weight; Sol who could stand all day upon one leg; Sugyn who was so "broad-chested" that he could suck up the sea on which were 300

ships and leave nothing but dry land. Such figures as these make no human impression, and criticism has busied itself in tracing them to one or other of the shadowy divinities of the Celtic pantheon. Remnants of their primitive superhuman qualities cling to the Celtic heroes long after they have been transfigured, under the influence of Christianity and chivalry, into the heroes of the mediaeval Arthurian romance; while memories of early myths live on, strangely disguised, in certain of the episodes repeated uncritically by the mediaeval poets. So Merlin preserves his diabolic origin; Arthur his mystic coming and his mystic passing.

The chief heroes of the mediaeval Arthurian romances are Arthur himself, who tends however to become completely overshadowed by his knights; Merlin (Myrddin) the famous wizard, bard and warrior, first introduced by Geoffrey of Monmouth, originally called Ambrose from the British leader, Ambrosius Aurelianus, under whom he is said to have first served; Perceval (Parzival, Parsifal), the Welsh Peredur, the most intimately connected with the quest of the Grail (*q.v.*); Tristan (Tristram), the ideal lover of the middle ages, whose name is inseparably associated with that of Iseult; Lancelot, son of Ban, king of Brittany, known chiefly from his amour with Guinevere; Gawain (Welwain, Welsh Gwalchmai), Arthur's nephew, the type of knightly courage and chivalry. Among less important figures may be mentioned Kay (Kai of the *Mabinogion*), Arthur's foster-brother and seneschal, the type of the bluff and boastful warrior, and Bedivere (Bedwyr), the type of brave knight and faithful retainer, who alone is with Arthur at his passing, and afterwards becomes "a hermit and a holy man." (*See* ARTHUR, MERLIN, PERCEVAL, TRISTAN, LANCELOT, GAWAIN.)

Heroes of Romance.—Another series of heroes, forming the central figures of stories variously derived but developed in Europe by the Latin-speaking peoples, may be conveniently grouped under the heading of "romance." Of these the most important are Alexander of Macedon and Charlemagne. Alexander's name, in the form of Iskander, is familiar in legend and story all over the East to this day; to the West he was introduced through a Latin translation of the original Greek romance (by the pseudo-Callisthenes) to which the innumerable oriental versions are likewise traceable. (*See* ALEXANDER III., KING OF MACEDON: *The Romance of Alexander.*) More important in the West, however, was the cycle of legends gathering round the figure of Charlemagne, forming what was known as "the matter of France." The romances of this cycle, of Germanic (Frankish) origin and developed probably in the north of France by the French, contain reminiscences of the heroes of the Merovingian period, and were influenced later by the Arthurian cycle. Charlemagne is chiefly venerated as the champion of Christianity against the heathen and the Saracens. (*See* CHARLEMAGNE, *ad fin.* "The Charlemagne Legends.")

The most famous heroes who are associated with him are Roland, praefect of the marches of Brittany, the Orlando of Ariosto, slain at Roncevaux (Roncevalles) in the Pyrenees and his friend and rival, Oliver (Olivier); Ogier the Dane, the Holger Danske of Hans Andersen, and Huon of Bordeaux, probably both introduced from the Arthurian cycle; Renaud (Rinaldo) of Montauban, one of the four sons of Aymon; the traitor, Doon of Mayence; Gamelon, responsible for the treachery that led to the death of Roland; Archbishop Turpin, a typical specimen of muscular Christianity; William Fierabras, William au court nez, William of Toulouse and William of Orange (all probably identical), and Vivien, the nephew of the latter and the hero of Aliscans. The late Charlemagne romances originated the legends in English form, of *Sowdone of Babylone, Sir Otnel, Sir Firumbras* and *Huon of Bordeaux.* (*See* OBERON.)

The chief remains of the Spanish heroic epic are some poems on the Cid, on the seven Infantes of Lara and on Fernán Gonzales, count of Castile. The legend of Charlemagne, as told in the *Crónica general* of Alfonso X., created the desire for a national hero distinguished for his exploits against the Moors, and Roland was thus supplanted by Bernardo del Carpio. Another hero of a 14th century cycle of romance was Amadis of Gaul; its earliest form is Spanish, although the Portuguese have claimed it as a translation from their own language. There is no trace of a French original.

Slavonic Heroes.—The Slavonic heroic saga of Russia centres round Vladimir of Kiev (980–1015), the first Christian ruler of that country, whose personality is eclipsed by that of Ilya (Elias) of Mourom, the son of a peasant, who was said to have saved the empire from the Tatars. It is not known whether he was an historical personage. A much-discussed work is the *Tale of Igor*, the oldest of the Russian mediaeval epics. Mention may here be made of Wainamoinen, the great magician and hero of the Finnish epic *Kalevala.* The popular hero of the Serbians and Bulgarians is Marko Kralyevich, son of Vukashin, characterized by Goethe as a counterpart of the Greek Heracles. For the Persian, Indian, etc., heroes *see* the articles on the literature and religions of the various countries.

BIBLIOGRAPHY.—On the subject generally, *see* J. G. T. Grässe, *Die grossen Sagenkreise des Mittelalters* (Dresden, 1842), forming part of his *Lehrbuch einer Literargeschichte der beruhmtesten Volker des Mittelalters;* W. P. Ker, *Epic and Romance* (2nd ed., 1908). Teutonic: B. Symons, "Germanische Heldensage" in H. Paul's *Grundriss der germanischen Philologie*, iii. (Strasbourg, 1900), 2nd rev. ed., separately printed (*ib.*, 1905); W. Grimm, *Die deutsche Heldensage* (1829, 3rd ed., 1899), still one of the most important works; W. Müller, *Mythologie der deutschen Heldensage* (Heilbronn, 1886) and supplement, *Zur Mythologie der griechischen und deutschen Heldensage* (*ib.*, 1889) O. L. Zaiczek, *Deutsche Heldensagen, i.* (Strasbourg, 1898), and *Die deutsche Heldensage* (3rd rev. ed., Leipzig, 1906); Chantepie de la Saussaye, *The Religion of the Teutons* (Eng. trans., Boston, U.S.A., 1902); J. G. Robertson, *History of German Literature* (1902). (*See* also HILDEBRUCH.) Celtic: M. H. d'Arbois de Jubainville, *Cours de littérature celtique* (12 vols., 1883–1902); one vol trans. into English by R. I. Best, *The Irish Mythological Cycle and Celtic Mythology* (1903); Le Petit de Julleville, *Hist. de la langue et de la litt. français*, i. *Moyen âge* (1896); C. Squire, *The Mythology of the British Isles:* an *Introduction to Celtic Myth and Romance* (1905); J. Rhys, *Celtic Britain* (3rd ed., 1904). Slavonic: A. N. Rambaud, *La Russie épique* (1876); W. Wollner, *Untersuchungen uber die Volksepik der Grossrussen* (1879); W. R. Morfill, *Slavonic Literature* (1883).

HERO in Greek Ἡρώ, and **LEANDER** in Greek Λέανδρος, the characters in a pretty Hellenistic love-story, preserved in Ovid (*Heroides* 18 and 19; authorship of both disputed) and Musaeus (5th century A.D.), besides references elsewhere, none earlier than Virgil; much handled in modern times, *e.g.*, by Marlowe, Chapman and Byron. Hero, virgin priestess of Aphrodite at Sestos, was seen at a festival by Leander of Abydos; they fell in love with each other, and he used to swim the Hellespont at night to visit her; guided by a light from her tower. One stormy night this was extinguished, and Leander was drowned; Hero, seeing his body, drowned herself likewise.

See the editions of the *Heroides* by Palmer-Purser (Oxford, 1898); of Mousaios, by A. Ludwich (Bonn, 1912); bibl. in both.

HEROD, the name borne by the princes of a dynasty which reigned in Judaea from 40 B.C.

HEROD THE GREAT (*c.* 73 B.C.–4 B.C.), the son of Antipater and king of Judaea (40–4 B.C.), was descended from a family of Idumaean origin. When he was 25, his father, who had served in Caesar's campaign against Egypt, appointed him ruler of Galilee. He at once arrested Hezekiah the arch-brigand, who had overrun the Syrian border, and put him to death. For this he was cited in the name of Hyrcanus to appear before the Sanhedrin, whose prerogative he had usurped in executing Hezekiah. He appeared with a bodyguard, and the Sanhedrin was overawed. Only Sameas, a Pharisee, dared to insist upon the legal verdict of condemnation. But the governor of Syria had sent a demand for Herod's acquittal, and so Hyrcanus adjourned the trial and persuaded the accused to abscond. Herod returned with an army, but his father dissuaded him from wreaking vengeance upon his enemies.

About this time (47–46 B.C.) he was created *strategus* of Coelesyria by the provincial governor. In 43 B.C. Antipater was poisoned at the instigation of one Malichus, who was perhaps a Jewish patriot. Herod, with the connivance of Cassius, who was in Syria to collect war-tax, had Malichus assassinated. The country was now in a state of anarchy, owing to the extortions of Cassius and the encroachments of neighbouring powers. Antony, who became master of the East after Philippi, was ready to support the

sons of his friend Antipater; but he was absent in Egypt when the Parthians invaded Palestine to restore Antigonus to the throne of his father Aristobolus (40 B.C.). Herod escaped to Rome, where Antony, who had made him tetrarch, now persuaded the Senate to declare him king of Judaea.

In 39 B.C. Herod returned to Palestine and, when the presence of Antony put the reluctant Roman troops entirely at his disposal, he was able to lay siege to Jerusalem two years later. Secure of the support of Rome he endeavoured to legitimize his position in the eyes of the Jews by taking the Hasmonaean princess Mariamne to be his second wife. Jerusalem was taken by storm; the Roman troops withdrew to behead Antigonus the usurper at Antioch. In 37 B.C. Herod was king of Judaea, being the client of Antony and the husband of Mariamne.

The Pharisees, who dominated the bulk of the Jews, were content to accept Herod's rule as a judgment of God. Hyrcanus returned from his prison, and though his mutilation prevented him from holding office as high priest, he was able to exercise an influence favourable to the new dynasty. On the other hand, Herod's marriage with Mariamne brought some of his enemies into his own household He had scotched the faction of Hasmonaean sympathizers by killing 45 members of the Sanhedrin and confiscating their possessions But so long as there were representatives of the family alive, there was always a possible pretender to the throne which he occupied Mariamne's mother used her position to further the overthrow of her son-in-law; and she found an ally in Cleopatra of Egypt, who was unwilling to be spurned by him

The events of Herod's reign indicate the temporary triumphs of his different adversaries. His high-priest, a Babylonian, was deposed in order that Aristobulus III., Mariamne's brother, might hold the place to which he had some ancestral right. But the enthusiasm with which the people received him at the Feast of Tabernacles convinced Herod of the danger, and the youth was drowned by his order at Jericho. Cleopatra had obtained from Antony a grant of territory adjacent to Herod's domain and even part of it. She required Herod to collect arrears of tribute. So it fell out that, when Octavian and the Senate declared war against Antony and Cleopatra, Herod, preoccupied in obedience to her commands, was prevented from fighting against the future emperor of Rome.

After the battle of Actium (31 B.C.) Herod executed Hyrcanus. He took in hand to deal with the Hasmonaeans, and in 25 B.C. the old intriguers, their victims like Mariamne, and all pretenders were dead From this time onwards Herod was free to govern Palestine as a client-prince of the Roman empire should govern his kingdom. To put down the brigands and to check the raids of the Arabs on the frontier, he built or rebuilt fortresses, which were of assistance to the Jews in the great revolt against Rome. He restored the temple at Jerusalem, erected magnificent buildings, founded cities, and established games in honour of the emperor, who recognized his successful government by putting the districts of Ulatha and Panias under him in 20 B.C.

But Herod found new enemies in his household. His brother Pheroras and sister Salome plotted for their own advantage and against the two sons of Mariamne. The people still cherished a loyalty to the Hasmonaean lineage, although the young princes were also the sons of Herod. The enthusiasm with which they were received aroused suspicion in their father's mind, and they were strangled at Sebaste. On his deathbed Herod discovered that his eldest son, Antipater, had been plotting against him. He accused him before the governor of Syria and obtained leave from Augustus to put him to death. The father died five days after his son in 4 B.C. He had done much for the Jews, thanks to the favour he had won from the successive heads of the Roman State; and he had observed the Law publicly.

See Josephus, *Ant.* xv., xvi., xvii. 1–8, *B.J.* i. 18–33; Schürer, *Gesch. d. jüd. Völk.* (4th ed., 1901–09) i., and bibliography in Herzog's *Realencyklopädie.*

HEROD ANTIPAS, son of Herod the Great by the Samaritan Malthace, and full brother of Archelaus, received as his share of his father's dominions the provinces of Galilee and Peraea, with the title of tetrarch. He fortified Sepphoris in Galilee and Betharamptha in Peraea, and founded the important town of Tiberias on the west shore of the Sea of Galilee. He reigned 4 B.C.–A.D. 39. In the gospels he is mentioned as Herod, and he it was who was called a "fox" by Christ (Luke xiii. 32). He is erroneously spoken of as a king in Mark vi. 14. It was to him that Jesus was sent by Pilate to be tried. But it is in connection with his wife Herodias that he is best known He was married first to a daughter of Aretas, the Arabian king; but, making the acquaintance of Herodias, the wife of his brother Philip (not the tetrarch), during a visit to Rome, he arranged to marry her. Meantime his Arabian wife discovered the plan and escaped to her father, who completely defeated Herod's army. John the Baptist condemned his marriage with Herodias, and in consequence was put to death. Encouraged by his wife, Herod journeyed to Rome to crave a crown from the emperor Agrippa, his brother-in-law, managed to influence Caligula against him, and he was deprived of his dominions and banished to Lyons, Herodias voluntarily sharing his exile.

HEROD PHILIP, son of Herod the Great by Cleopatra of Jerusalem, received the tetrarchate of Ituraea and other districts east and north-east of the Lake of Galilee. His subjects were mainly Greeks or Syrians. He is described as an excellent ruler, who loved peace and was careful to maintain justice, and spent his time in his own territories. The cities he built include Caesarea Philippi and Bethsaida, which he called Julias. He died after a reign of 37 years (4 B.C.–A.D. 34).

HERODAS or **HERONDAS** (Gr Ἡρῶδας or Ἡρώνδας) (the name is spelt differently in the few places where he is mentioned), Greek poet, the author of short humorous dramatic scenes in verse, written under the Alexandrian empire in the 3rd century B.C. Apart from the intrinsic merit of these pieces, they are interesting in the history of Greek literature as being a new species illustrating Alexandrian methods. They are called Μιμίαμβοι "Mime-iambics." Mimes were the Dorian product of southern Italy and Sicily—scenes in popular life written in the language of the people. Two of the best known and the most vital among the *Idylls* of Theocritus, the 2nd and the 15th, we know to have been derived from mimes of Sophron What Theocritus is doing there Herodas, his younger contemporary, is doing in another manner—casting old material into novel form, upon a small scale, under strict conditions of technique. The method is entirely Alexandrian: Sophron had written in a peculiar kind of rhythmical prose; Theocritus uses the hexameter and Doric, Herodas the *scazon* or "lame" iambic (with a dragging spondee at the end) and the old Ionic dialect with which that curious metre was associated That, however, hardly goes beyond the choice and form of words; the structure of the sentences is close-knit Attic. But the grumbling metre and quaint language suit the tone of common life which Herodas aims at realizing; for Herodas is a realist. His persons talk in vehement exclamations and emphatic turns of speech, with proverbs and fixed phrases; and occasionally, where it is designed as proper to the part, with the most naked coarseness of expression.

The scene of the second and the fourth is laid at Cos, and the speaking characters in each are never more than three. In Mime I. the old nurse calls on Metriche, whose husband has been long away in Egypt, and endeavours to excite her interest in a young man, fallen deeply in love with her at first sight. Metriche declines with dignity, but consoles the old woman with an ample glass of wine. II. is a monologue by the Πορνοβοσκός ("Whoremonger") prosecuting a merchant-trader for breaking into his establishment at night and attempting to carry off one of the inmates, who is produced in court. The whole oration is also a burlesque in every detail of an Attic speech at law. In III. a desperate mother brings to the schoolmaster a truant urchin. In a voluble stream of interminable sentences she narrates his misdeeds and implores the schoolmaster to flog him. The boy accordingly is hoisted on another's back and flogged; but his spirit does not appear to be subdued. IV. is a visit of two poor women with an offering to the temple of Asclepius at Cos. While the humble cock is being sacrificed they admire

the works of art; among them a small boy strangling a vulpanser —doubtless the work of Boëthus that we know—and a procession by Apelles, "the Ephesian," of whom we have an interesting piece of contemporary eulogy. The oily sacristan is admirably painted in a few slight strokes. In V. a jealous woman accuses one of her slaves, whom she has made her favourite, of infidelity; has him bound and sent to receive 2,000 lashes. The only pleasing person in the piece is the little maid-servant—whose tact suggests to her mistress an excuse for postponing execution of a threat made in ungovernable fury. VI. is a friendly chat or a private conversation. The subject is an ugly one, but the dialogue is clever with some delicious touches. Our interest is engaged here in a certain Cerdon, the artistic shoemaker, to whom we are introduced in VII. (the name had already become generic for the shoemaker as the typical representative of retail trade), a little bald man with a fluent tongue, complaining of hard times, who bluffs and wheedles by turns. VII. opens with a mistress waking up her maids to listen to her dream; but we have only the beginning, and the other fragments are very short.

Within the limits of 100 lines or less Herodas presents us with an entertaining scene and with characters definitely drawn. Some of these had been perfected no doubt upon the Attic stage, where the tendency in the 4th century had been gradually to evolve accepted types. The execution has the qualities of first-rate Alexandrian work in miniature, the finish and firm outlines; and these little pictures bear the test of all artistic work—they do not lose their freshness with familiarity but gain in interest as one learns to appreciate their subtle points.

The papyrus ms., obtained from the Fayum, is in the possession of the British Museum, and was first printed by F. G. Kenyon in 1891. Editions by O. Crusius (1905, text only, in Teubner series) and J. A. Nairn (1904), with introduction, notes and bibliography; W. Headlam and A. D. Knox, with introduction, notes, and Eng. translation (Camb. 1922); Text (I. VI.), with French commentary by P. Gnoemeboom (Gnominque, 1922); other translations by H. Sharpley, *A Realist of the Aegean* (1906) (verse); R. T. Clark (1909), prose.

HERODIANS (Ἡρῳδιανοί) mentioned in the Gospels as taking up a hostile attitude to Jesus (once in Galilee and again in Jerusalem); *cf.* Mark iii. 6, xii. 13; Matt. xxii. 16; *cf.* also Mark viii. 15. In every case they are coupled with the Pharisees. The formation of the word (*cf.* "Caesariani" and "Pompeiani") favours the view that what is meant is a party among the Jews who favoured the Herodian dynasty, and were its political partisans. Another view is that they represented a religious party known in Rabbinical Literature as "Boethusians" *i.e.*, adherents of the family of Boethus, whose daughter Mariamne was one of the wives of Herod the Great, and whose sons were raised by him to the High Priesthood.

HERODIANUS, Greek historian, flourished during the third century A.D. He is supposed to have been a Syrian Greek. In 203 he was in Rome, where he held some minor posts; the statement that he was imperial procurator and legate of the Sicilian provinces rests upon conjecture only. His historical work (Ἡρωδιάνου τῆς μετὰ Μάρκον βασιλείας ἱστοριῶν βίβλια ὀκτω) deals with the years between the death of Marcus Aurelius and the proclamation of Gordianus III. (180–238). His work supplements Dion Cassius and has the value that attaches to a contemporary record written with candour and independence of view. But while he gives a lively account of external events—such as the death of Commodus and the assassination of Pertinax —the barbarian invasions, the spread of Christianity, the extension of the franchise by Caracalla are unnoticed. The dates are often wrong, and little attention is paid to geographical details, which makes the narrative of military expeditions beyond the borders of the empire difficult to understand.

Extensive use has been made of Herodianus by later chroniclers, especially the "Scriptores historiae Augustae" and John of Antioch. His history was first translated into Latin at the end of the 15th century by Politian. The most complete edition is by G. W. Irmisch (1789–1805), with elaborate indices, but the notes are very diffuse; critical editions by I. Bekker (1855), L. Mendelssohn (1883) and K. Stavenhagen (Teubner, 1922).

HERODIANUS, AELIUS, called ὁ τεχνικός, Alexandrian grammarian. He settled at Rome, under the patronage of Marcus Aurelius (161–180), to whom he dedicated his treatise on prosody (Καθολικὴ προσῳδία) in 21 books. Several epitomes of this work have been preserved. His Ἐπιμερισμοί dealt with difficult words and peculiar forms in Homer. Of his many grammatical treatises, only one has come down to us in a complete form (Περὶ μονήρους λέξεως), *on exceptional or anomalous words.*

The best edition is by A. Lentz, *Herodiani Technici reliquiae* (1867–70); a supplementary volume is included in Uhling's *Corpus grammaticorum Graecorum;* for further bibliographical information *see* W. Christ, *Geschichte der griechischen Literatur* (1898).

HERODOTUS (*c.* 484–425 B.C.), Greek historian, called the "Father of History," was born at Halicarnassus in Asia Minor, then dependent upon the Persians, in or about the year 484 B.C. Herodotus was thus born a Persian subject, and such he continued until he was 30 or 35 years of age. At the time of his birth Halicarnassus was under the rule of a Queen Artemisia (*q.v.*). The family of Herodotus belonged to the upper rank of the citizens. His father was named Lyxes, and his mother Rhaeo, or Dryo. He had a brother, Theodore, and an uncle or cousin, Panyasis (*q.v.*), the epic poet—a personage of so much importance that Artemisia's grandson, Lygdamis, suspecting him of treasonable projects, put him to death. It is probable that Herodotus shared his relative's political opinions, and either was exiled from Halicarnassus or quitted it voluntarily at the time of his execution. At any rate it is clear from the extant work of Herodotus that he must have devoted himself early to the literary life, and commenced that extensive course of reading which renders him one of the most instructive as well as one of the most charming of ancient writers. The poetical literature of Greece was already large; the prose literature was more extensive than is generally supposed; yet Herodotus shows an intimate acquaintance with the whole of it. The *Iliad* and the *Odyssey* are as familiar to him as Shakespeare to the educated Englishman He is acquainted with the poems of the epic cycle, the *Cypria,* the *Epigoni,* etc. He quotes or otherwise shows familiarity with the writings of Hesiod, Olen, Musaeus, Bacis, Lysistratus, Archilochus of Paros, Alcaeus, Sappho, Solon, Aesop, Aristeas of Proconnesus, Simonides of Ceos, Phrynichus, Aeschylus and Pindar. He quotes and criticizes Hecataeus, the best of the prose writers who had preceded him, and makes numerous allusions to other authors of the same class.

It must not, however, be supposed that he was at any time a mere student. It is probable that from an early age his inquiring disposition led him to engage in travels, both in Greece and in foreign countries. He traversed Asia Minor and European Greece probably more than once; he visited all the most important islands of the Archipelago—Rhodes, Cyprus, Delos, Paros, Thasos, Samothrace, Crete, Samos, Cythera and Aegina. He undertook the long and perilous journey from Sardis to the Persian capital, Susa, visited Babylon, Colchis, and the western shores of the Black sea as far as the estuary of the Dnieper; he travelled in Scythia and in Thrace, visited Zante and Magna Graecia, explored the antiquities of Tyre, coasted along the shores of Palestine, saw Gaza and made a long stay in Egypt. At the most moderate estimate, his travels covered a space of 31 degrees of longitude, or 1,700 miles, and 24 of latitude, or nearly the same distance. At all the more interesting sites he took up his abode for a time; he examined, he enquired, he made measurements, he accumulated materials. Having in his mind the scheme of his great work, he gave ample time to the elaboration of all its parts, and took care to obtain by personal observation a full knowledge of the various countries. The travels of Herodotus seem to have been chiefly accomplished between his 20th and his 37th years (464–447 B.C.) but the dates are difficult to determine.

After Herodotus had resided for some seven or eight years in Samos, events occurred in his native city which induced him to return thither. The tyranny of Lygdamis had gone from bad to worse, and at last he was expelled. According to Suidas, Herodotus was himself an actor, and indeed the chief actor, in the rebellion against him; but no other author confirms this statement. Halicarnassus became henceforward a voluntary member of the

Athenian confederacy. Herodotus would now naturally return to his native city, and enter upon the enjoyment of those rights of free citizenship on which every Greek set a high value. But soon, owing either to political causes or, according to ancient anecdote, to lack of literary appreciation he withdrew (about 447 B.C.) to Athens, where his work won such approval that in the year 445 B.C., on the proposition of a certain Anytus, he was voted a sum of ten talents (£2,400) by decree of the people. But he did not possess the status of a citizen, and at Athens the franchise, jealously guarded at this period, was not to be attained without great expense and difficulty. Accordingly, in the spring of the following year he sailed from Athens with the colonists who went out to found the colony of Thurii (*see* PERICLES), and became a citizen of the new town.

From this point of his career, when he had reached the age of 40, we lose sight of him almost wholly. He seems to have made but few journeys—one to Crotona, one to Metapontum, and possibly one to Athens (about 430 B.C.) being all that his work indicates. No doubt he was employed mainly, as Pliny testifies, in retouching and elaborating his general history. He may also have composed at Thurii that special work on the history of Assyria to which he twice refers in his first book, and which is quoted by Aristotle. It is not probable that he much outlived 424 B.C. The predominant voice of antiquity tells us that he died at Thurii, where his tomb was shown in later ages.

The History.—In estimating the great work of Herodotus, and his genius as its author, it is above all things necessary to conceive aright what that work was intended to be. It has been called "a universal history," "a history of the wars between the Greeks and the barbarians," and "a history of the struggle between Greece and Persia" But these titles are, all of them, too comprehensive. Herodotus, who omits wholly the histories of Phoenicia, Carthage and Etruria—three of the most important among the States existing in his day—cannot have intended to compose a "universal history," the very idea of which belongs to a later age. He speaks in places as if his object was to record the wars between the Greeks and the barbarians; but as he omits the Trojan War, in which he fully believes, the expedition of the Teucrians and Mysians against Thrace and Thessaly, the wars connected with the Ionian colonization of Asia Minor and others, it is evident that he does not really aim at embracing in his narrative all the wars between Greeks and barbarians with which he was acquainted. Nor does it ever seem to have been his object to give an account of the entire struggle between Greece and Persia. That struggle was not terminated by the battle of Mycale and the capture of Sestos in 479 B.C. His intention was not to give an account of the entire long contest between the two countries but to write the history of a particular war—the great Persian war of invasion. His aim was as definite as that of Thucydides or Schiller or Napier or any other writer who has made his subject a particular war; only he determined to treat it in a certain way. Every partial history requires an "introduction"; Herodotus, untrammelled by examples, resolved to give his history a magnificent introduction. Thucydides is content with a single introductory book, forming little more than one-eighth of his work; Herodotus has six such books, forming two-thirds of the entire composition.

By this arrangement he is enabled to treat his subject in the *grand* way, which is so characteristic of him. Making it his main object in his "introduction" to set before his readers the previous history of the two nations who were the actors in the great war, he is able in tracing their history to bring into his narrative some account of almost all the nations of the known world, and has room to expatiate freely upon their geography, antiquities, manners and customs, and the like, thus giving his work a "universal" character, and securing for it, without trenching upon unity, that variety, richness and fullness which are a principal charm of the best histories, and of none more than his. In tracing the growth of Persia from a petty subject kingdom to a vast dominant empire, he has occasion to set out the histories of Lydia, Media, Assyria, Babylon, Egypt, Scythia, Thrace; and to describe the countries and the peoples inhabiting them, their natural productions, climate, geographical position, monuments, etc.; while, in noting the contemporaneous changes in Greece, he is led to tell of the various migrations of the Greek race, their colonies, commerce, progress in the arts, revolutions, internal struggles, wars with one another, legislation, religious tenets and the like. The greatest variety of episodical matter is thus introduced; but the propriety of the occasion and the mode of introduction are such that no complaint can be made; the episodes never entangle, encumber or even unpleasantly interrupt the main narrative. Of his trustworthiness as a historian varying opinions have been entertained, which are dealt with under GREECE (*History* "Authorities"). But of his merits as a writer there can be no dispute. "O that I were in a condition," says Lucian, "to resemble Herodotus, if only in some measure! I by no means say in all his gifts, but only in some single point; as, for instance, the beauty of his language, or its harmony, or the natural and peculiar grace of the Ionic dialect, or his fullness of thought, or by whatever name those thousand beauties are called which to the despair of his imitator are united in him." Cicero calls his style "copious and polished," Quintilian, "sweet, pure and flowing"; Longinus says he was "the most Homeric of historians"; Dionysius, his countryman, prefers him to Thucydides, and regards him as combining in an extraordinary degree the excellences of sublimity, beauty and the true historical method of composition.

BIBLIOGRAPHY.—About 1450 a Latin version of the history of Herodotus was made and published by Laurentius Valla. This was revised in 1536 by Heusbach, and accompanies the Greek text in many editions. The first complete translation into a modern language was the English one of Littlebury (1737), followed (1786) by the French translation of Larcher, a valuable work with copious notes. A good German translation, without note or comment, was brought out by F. Lange (1811). A. Mustoxidi published an Italian version (1820); A. Schöll, German translation with notes (1828–32, new ed. 1855); Isaac Taylor, English version (1829); G. Rawlinson, English version (1858–60); G. C. Macauley (1890). Translations have been made into many languages.

The best of the older editions of the Greek text are: *Herodoti historiae* (edit. Schweighäuser, Strasbourg, 1816); *Herodoti Halicarnassei historiarum libri* IX. (edit. Gaisford, 1840); *Herodotus, with a Commentary* (J. W. Balkesley, 1854); *Herodoti musae* (edit. Bähr, Leipzig, 1856–61), and *Herodoti historiae* (edit. Abicht, Leipzig, 1869). The most recent editions are the following: H. Stein, *Herodoti Historiae* (edit. Major, 1869–71, with *apparatus criticus*); H. Kellenberg, *Historiarum libri* IX. (Leipzig, 1887); Van Herwerden, Ἱστορία (Leyden, 1885), H. Stein, *Herodotus erklärt* (1883); A. H. Sayce, *The Ancient Empires of the East, Herodotus I.–III., with introductions and appendices* (1883); R. W. Macan, *Herodotus IV.–VI.* (1895) and *Herodotus VII.–IX.* (1908); E. Abbott, *Herodotus V. and VI.* (1893); A. Wiedemann, *Herodots zweites Buch mit sachlichen Bemerkungen* (Leipzig, 1890), W. W. How and J. Wells, *Commentary upon Herodotus* (1912).

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HÉROET, ANTOINE, surnamed LA MAISON-NEUVE (d. 1568), French poet, bishop of Digne, was born in Paris of a family connected with the chancellor Olivier. His poetry belongs to his early years, for after he had taken orders he ceased to write profane poetry. His chief work is *La Parfaicte Amye* (Lyons, 1542) in which he developed the idea of a purely spiritual love, based chiefly on the reading of the Italian Neo-Platonists. The book aroused great controversy. La Borderie replied in *L'Amye de cour* with a description of a very much more human woman, and Charles Fontaine contributed a *Contr' amye de cour* to the

dispute. Héroet, in addition to some translations from the classics, wrote the *Complainte d'une dame nouvellement surprise d'amour*, an *Epistre a François Ier*, and some pieces included in the now very rare *Opuscules d'amour par Héroet, La Borderie et autres divins poëtes* (Lyons, 1547). Héroet belongs to the Lyonnese school of which Maurice Scève may be regarded as the leader.

See H. F. Cary, *The Early French Poets* (1846).

HEROIC ROMANCES, the name of a class of imaginative literature which flourished in the 17th century, principally in France. The beginnings of fiction in that country took a pseudo-bucolic form with the celebrated *Astrée* (1610) of Honoré d'Urfé (1568–1625); but this ingenious and diffuse production was the source of a vast literature, which took many and diverse forms. Although its action was, in the main, languid and sentimental, there was a side of the *Astrée* which encouraged that extravagant love of glory, that spirit of "panache," which was now rising to its height in France. That spirit it was which animated Marin le Roy, sieur de Gomberville (1600–74), the inventor of the Heroic Romances. In these there was experienced a violent recrudescence of the mediaeval elements of romance, the impossible valour devoted to a pursuit of the impossible beauty, but the whole clothed in the language and feeling and atmosphere of a later age. In the *Carithée* of Gomberville (1621) we have a pastoral which is already beginning to be a heroic romance, and a book in which, under a travesty of Roman history, an appeal is made to an extravagantly chivalrous enthusiasm. A further development was seen in the *Polyxène* (1623) of François de Molière, and the *Endymion* (1624) of Gombauld; in the latter the elderly queen, Marie de' Medici, was celebrated under the disguise of Diana, for whom a beautiful shepherd of Caria nourishes a hopeless passion. The earliest of the Heroic Romances, pure and simple, is, however, the celebrated *Polexandre* (1629) of Gomberville. The author began by intending his hero to represent Louis XIII., but he changed his mind, and drew a portrait of Cardinal Richelieu. The story deals with the adventures of a hero who visits all the seacoasts of the world, the most remote as well as the most fabulous, in search of an ineffable princess, Alcidiane. This absurd, yet very original piece of invention enjoyed an immense success. There was an equal amount of geography and more of ancient history in the *Ariane* (1632) of Desmarets de Saint-Sorlin (1595–1676), which has been greeted by Paul Morillot as the most readable of all the Heroic Romances.

Calprenède and Scudéry.—The type of that class of literature, however, has always been found in the highly elaborate writings of Gauthier de Coste de la Calprenède (1609–63), which enjoyed for a time a prodigious celebrity. His *Cassandre*, which appeared in ten volumes between 1642 and 1645, is perhaps the most characteristic of all the Heroic Romances It deals with the decline of the empire of Alexander the Great. It must not be supposed, however, that la Calprenède makes the smallest effort to deal with the subject accurately or realistically. The figures are seigneurs and great ladies of the court of Louis XIII., masquerading in Macedonian raiment. The passion of love is dominant, and it is treated in the most exalted and hyperbolical spirit. La Calprenède followed up the success of his *Cassandre* with a *Cléopâtre* (1647) in 12 volumes, and a *Faramond* (1661) which he did not live to finish. It should be said that la Calprenède objected to his books being styled romances, and insisted that they were specimens of "history embellished with certain inventions." He may, in opposition to his wishes, claim the doubtful praise of being, in reality, the creator of the modern historical novel.

The vogue of the historical romance was carried to its height by a brother and a sister, Georges de Scudéry (1601–67) and Madeleine de Scudéry (1608–1701), whose elephantine romances remain as portents in the history of literature. These novels—there are five of them—were signed by Georges de Scudéry, but it is believed that all were in the main written by Madeleine. The earliest was *Ibrahim, ou l'Illustre Bassa* (1641); it was followed by *Le Grand Cyrus* (1648–53) and the final, and most preposterous member of the series was *Clélie* (1649–54). The romances of Mlle. de Scudéry (for to her we may safely attribute them) are much inferior in style to those of la Calprenède. They are pretentious, affected and sickly. The author abuses the element of analysis, and pushes a psychology, which was beyond the age in penetration, to a wearisome and excessive extent.

Vogue in England.—In England the Heroic Romance had a period of flourishing popularity. All the principal French examples were translated, and "he was not to be admitted into the academy of wit who had not read *Astrea* and *The Grand Cyrus*." The vogue of these books in England lasted from about 1645 to 1660, and led to the composition of original works in imitation of the French. The most remarkable of these was *Parthenissa*, published in 1654 by Roger Boyle, Lord Broghill and afterwards earl of Orrery (1621–79). Addison speaks in the *Spectator* of the popularity of all these huge books, "the *Grand Cyrus*, with a pin stuck in one of the middle leaves, *Clélie*, which opened of itself in the place that describes two lovers in a bower." M. Jusserand has analysed what may be considered the very latest of the race, *Pandion and Amphigenia*, published in 1665 by the dramatist, John Crowne.

See G. de Percel, *De l'usage des romans* (1734); J. J. Jusserand, *Le Roman anglais au XVIIe siecle* (1888); André Le Breton, *Le Roman au XVIIe siècle* (1890); P. Morillot, *Le Roman en France depuis 1610* (1894). (E. G.; X.)

HEROIC VERSE, a term exclusively used in English to indicate the rhymed iambic line or HEROIC COUPLET. In ancient literature the heroic verse was the hexameter. It was in this measure that the *Iliad* and *Odyssey* and the *Aeneid* were written. In English, however, it is not enough to designate a single iambic line of five beats as heroic verse because it is necessary to distinguish blank verse from the distich, consisting of two rhymed lines, each of ten syllables. In French the Alexandrine has always been regarded as the heroic measure of that language. The current form of English heroic verse appears to be the invention of Chaucer, who used it in his *Legend of Good Women*, and afterwards, with still greater freedom, in the *Canterbury Tales*. He was followed nearly a century later by the Scottish poet, called Blind Harry (*c.* 1475), whose *Wallace* holds an important place in the history of versification as having passed on the tradition of the heroic couplet. Another Scottish poet, Gavin Douglas, selected heroic verse for his translation of the *Aeneid* (1513) and displayed, in such examples as the following, a skill which left little room for improvement at the hands of later poets:—

> "One sang, 'The ship sails over the salt foam,
> Will bring the merchants and my leman home';
> Some other sings, 'I will be blithe and light,
> Mine heart is leant upon so goodly wight.'"

The verse so successfully mastered was, however, not very generally used for heroic purposes in Tudor literature. The early poets of the revival, and Spenser and Shakespeare after them, greatly preferred stanzaic forms. For dramatic purposes blank verse was almost exclusively used, although the French had adopted the rhymed Alexandrine for their plays. In Elizabethan England heroic verse was often put to somewhat unheroic purposes, mainly in prologues and epilogues, or other short poems of occasion; but it was nobly redeemed by Marlowe in his *Hero and Leander* and respectably by Browne in his *Britannia's Pastorals*. It is to be noted, however, that those Elizabethans who, like Chapman and Drayton, aimed at producing a warlike and Homeric effect, did so in shambling 14-syllable couplets. The one heroic poem of that age written at considerable length in the appropriate national metre is the *Bosworth Field* of Sir John Beaumont (1582–1628). Since the middle of the 17th century, when heroic verse became the typical and for a while almost the solitary form in which serious English poetry was written, its history has known many vicissitudes. After having been the principal instrument of Dryden and Pope it was almost entirely rejected by Wordsworth and Coleridge, but revised, with various modifications, by Byron, Shelley (in *Julian and Maddalo*), and Keats (in *Lamia*). In the second half of the 19th century its prestige was restored by the brilliant work of Swinburne in *Tristram* and elsewhere. Alfred Noyes, in *Drake*, has given a contribution in this vein in recent times.

HEROIN. The trade name for a derivative of morphine (diacetylmorphine hydrochloride) which resembles morphine in its action but according to Ott is depressant to the spinal cord and about twice as depressant to the respiratory centre. For these reasons it is inferior to morphine as an analgesic. Its manufacture or importation is forbidden in the United States. Heroin is a white crystalline powder of bitter taste soluble in 3 parts of water and in 11 parts of 90% alcohol. Its most important medical use is as a respiratory sedative to allay cough in doses of one-sixteenth to one-sixth of a grain. At first it was used in place of morphine to avoid the danger of addiction characteristic of morphine but later experience showed that it is fully as dangerous in this respect. It makes addicts quickly; its victims are often mere children in years and experience; through insufflation, ingestion or subcutaneous injection its effect is practically instantaneous. According to the prison and police statistics "heroin is the drug used by addicts of over 95% of New York's underworld (criminal classes)" (Hubbard, New York State In. Med., 1924, 24, 62).

HÉROLD, LOUIS JOSEPH FERDINAND (1791–1833), French composer, the son of François Joseph Hérold, an accomplished pianist, was born in Paris, on Jan 28, 1791. In 1806 Hérold entered the Paris Conservatoire, where he studied under Catal and Méhul. In 1812 he gained the Grand Prix de Rome with the cantata *La Duchesse de la Vallière*, and started for Italy, where he remained till 1815 and composed a symphony, a cantata and several pieces of chamber music. His first opera *La Gioventù di Enrico V.*, was performed at Naples in 1815 After his return to Paris Hérold produced numerous works for the stage in rapid succession including the opera *La Clochette* (1817), *L'Auteur mort et vivant* (1820), *Marie* (1826), and the ballets *La Fille mal gardée* (1828) and *La Belle au bois dormant* (1829). In 1831 he produced the romantic opera *Zampa* and in the following year *Le Pré aux clercs*, both of which contain many fine pages and had great success. These two operas secured immortality for the name of the composer, who died on Jan. 18, 1833 of the lung disease from which he had suffered for many years His unfinished opera *Ludovic* was afterwards printed by J. F. F. Halévy.

See monographs by Jouvin (1868), Berthelot (1882) and Pougin.

HERON, a long-necked, long-legged bird, the type of the group *Ardeidae*. This group may be divided into herons, bitterns, (*q.v.*), egrets (*q.v.*) night-herons, and boatbills.



BY COURTESY OF THE NATIONAL ASSOCIATION OF AUDUBON SOCIETIES

THE GREEN HERON (BUTORIDES VIRESCENS), COMMON THROUGHOUT THE UNITED STATES

The common heron of Europe, *Ardea cinerea*, is one of the few large birds now inhabiting England. In olden times it afforded great sport to the hawker. Its flight is lofty and leisurely, but swift. Its food consists of fish, amphibia, and other small animals, which it strikes, while wading or standing in water, with its dagger-shaped beak. Herons, where sufficiently numerous, breed in colonies called heronries; the nest consists of a huge mass of sticks, lined with twigs, and is usually, though not invariably, placed on a tree. The light blue eggs number four to six and the young are at first clothed in flax-coloured "powder-down." The adult is recognized by its long neck, beak, and legs, its broad, slate-coloured wings, and the black plumes on its head. It measures 3ft. from bill to tail and may have a wing-spread of 6ft., but it rarely exceeds 4 lb. in weight. The sexes are not very dissimilar. Many herons have adornments in the shape of long plumes springing from the shoulder. These correspond to the aigrettes of the egrets, but retain their barbules.

In America the European heron is replaced by the great blue heron (*A. herodias*) which is larger. *A. goliath* of Africa and Asia is, however, the largest of the group. The Old World purple heron (*A. purpurea*) must also be mentioned. The Louisiana heron (*Hydranassa tricolor*) is an abundant form from North Carolina southwards; it is recognized on the wing by the conspicuous white abdomen. The little blue heron (*Florida coerulea*) breeds locally, but in large numbers, from the Gulf State to South Carolina It is white when immature.

Of the night herons (*Nycticorax*), *N. nycticorax* is widely spread over the Old World, and is replaced by a subspecies in America. Other species are found in America, Asia, West Africa, Australia, and the Galapagos, and a species inhabited Rodriguez at the time of its colonization, but is now extinct.

The boatbill (*Cancroma cochlearia*) is remarkable for its huge bill It is a native of tropical America.

Herons have been found in a fossil state in the Miocene and London clay of Europe.

HERON OF ALEXANDRIA, Greek geometer and writer on mechanical and physical subjects Heron's date is still a matter of controversy. The possible limits are 150 B.C. (for he was later than Apollonius of Perga and Hipparchus) and 250 A.D. (since he preceded Pappus). The latest discussions by scholars have tended to place him as late as the 3rd century A.D. (after Ptolemy), but there are those who still adhere to 150–100 B.C. as the probable date of his activity.

Of Heron's mechanical works, the *Pneumatica, Automatopoietice, Belopoeica* and *Cheiroballistra* survive in Greek The *Pneumatica*, in two books, describes many interesting contrivances such as siphons, "Heron's fountain," "penny-in-the-slot" machines, a fire-engine, a water-organ and arrangements employing the force of steam The *Belopoeica* (on engines of war) purports by its title (Ἥρωνος Κτησιβίου βελοποιϊκά) to be based on a work by Ctesibius, who was most probably the Ctesibius who lived under Ptolemy II Philadelphus (285–247 B.C.) Heron's *Mechanics*, in three books, is extant in Arabic, though not in its original form. This work is cited by Pappus, as is also the *Barulcus*, "weight-lifter," probably the same treatise under a different name. Book II. of the *Mechanics* deals with the five mechanical powers and mechanical problems of daily life, and Book III. with the construction of engines of all sorts. Both the *Belopoeica* and the *Mechanics* contain Heron's solution of the problem of the two mean proportionals.

The geometrical works attributed to Heron which survive in Greek bear the titles *Metrica, Definitiones, Geometria, Geodaesia, Stereometrica* (i., ii.), *Mensurae* and *Liber Geëponicus*. The *Metrica* was discovered as recently as 1896 by R. Schöne in a ms. at Constantinople. It is by far the most important, as it is the most genuine, of the geometrical works of Heron, and proves him to have been an accomplished mathematician. The other works containing, like the *Metrica*, problems of mensuration are not Heron's in their present form. A remarkable feature is the statement of a variety of close approximations to the square roots of numbers which are not complete squares; the *Metrica* describes a general method of finding successive approximations to the values of such surds, as well as a method of approximating to the cube root of a non-cube number; the former throws light on similar approximations to surds stated in Archimedes and elsewhere. Book I. of the *Metrica* includes the mensuration of triangles, quadrilaterals, regular polygons from the equilateral triangle to the regular dodecagon, circles and segments thereof, an ellipse, a parabolic segment, and of the surfaces of cylinders, right cones, spheres and segments thereof. Book II. shows how to measure the content of solid figures, including cones, pyramids, frusta of such solids, a sphere and a segment thereof, the five regular solids, besides the two remarkable solid figures measured by Archimedes in his *Method* (a solid like a hoof cut off by a plane from the end of a cylinder, and a solid made up of eight such "hoofs"). Book III. gives some problems of the same type as those in Euclid's treatise *On Divisions* (of figures). Akin to the geometrical works is that *On the Dioptra*, a remarkable book on land-surveying, so called from the instrument described in it, which was used for the same purposes as the modern theodolite; this treatise contains (as does the *Metrica*) a remarkable geometrical proof of the

expression for the area of a triangle in terms of its sides,

$$\Delta = \sqrt{\{s(s-a)(s-b)(s-c)\}}$$

Heron also wrote *Catoptrica* (on reflecting surfaces); and it seems certain that we possess this in a Latin translation by William of Moerbeke of a work which was formerly thought to be a fragment of Ptolemy's *Optics*. Of other treatises by Heron only fragments remain. One on *Water-Clocks* in four books is referred to by Pappus and Proclus. Another was a commentary on Euclid's *Elements*, quotations from which are found in the extant Arabian commentary by an-Nairīzī.

BIBLIOGRAPHY.—The *Pneumatica*, *Automatopoietice*, *Belopoeica* and *Cheiroballistra* of Heron were edited in Greek and Latin by Thévenot, (*Veterum mathematicorum opera*, Paris, 1693). The "geometrical" works (other than the *Metrica*), in Greek only, were edited by F. Hultsch (*Heronis Alexandrini geometricorum et stereometricorum reliquiae*, 1864). Except for the treatises on *Engines of War* (also edited by C. Wescher, *Polyorcétique des Grecs*, Paris, 1867), the authoritative edition is now *Heronis Alexandrini opera quae supersunt omnia*, included in Teubner's series; vol. i. and Supplement (by W. Schmidt) contains the *Pneumatica* and *Automata*, the fragment on *Water-Clocks*, etc.; vol. ii. pt. i. (L. Nix and W. Schmidt), the *Mechanics*, *Catoptrica*, etc.; vol. iii. (H. Schöne), the *Metrica* and *Dioptra*; vols. iv. and v. (J. L. Heiberg), the geometrical works.

For fuller accounts of Heron's works *see* G. Loria, *Le scienze esatte nell' antica Grecia*, 1014; Sir T. L. Heath, *History of Greek Mathematics*, vol. ii., pp. 298–354; Paulv-Wissowa's *Real-Encyklopädie s.v.*

(T. L. H.)

HEROPHILUS (*fl.* 300 B.C.), Alexandrian anatomist, was born at Chaludon, and was one of the founders of a school of anatomy at Alexandria. Being one of the first to perform post-mortem examinations, he studied the eye and cataract, traced the sinuses of the dura mater to their meeting point, still called the torcular herophili, and described the ventricles of the brain, an organ which he regarded as the centre of the nervous system. The nerve trunks he distinguished into sensory and motor branches. He also gave careful accounts of the liver, salivary glands, pancreas and the genital tracts of both sexes, and emphasized the curative powers of drugs, dietetics and gymnastics. Herophilus wrote commentaries on the works of Hippocrates, a book for midwives, and a treatise on the causes of sudden death.

HERPES, an inflammation of the true skin, attended with the formation of isolated or grouped vesicles of various sizes upon a reddened base. They contain a clear fluid, and either rupture or dry up. Two well-marked varieties of herpes are frequently met with. (*a*) In *herpes labialis et nasalis* the eruption occurs about the lips and nose. It is seen in cases of certain acute febrile ailments, such as fevers, inflammation of the lungs or even in a severe cold. It soon passes off. (*b*) In *herpes zoster, zona* or "shingles" the eruption occurs in the course of one or more cutaneous nerves, often on one side of the trunk, but it may be on the face, limbs or other parts. It may occur at any age, but is more frequent in elderly people. The appearance of the eruption is usually preceded by severe, stinging, neuralgic pains, and, not only during the continuance of the herpetic spots, but long after they have disappeared, these pains may continue. The disease seldom recurs. The most that can be done for its relief is to protect the parts with cotton wool or some dusting powder, while the pain may be allayed by aspirin or bromide of potassium. Quinine internally is often of service. Though the lesions are identical in appearance the two types differ in causation. Herpes labialis is due to a filter-passing virus which is inoculable into the rabbit's cornea; herpes zoster is associated with, and probably dependent upon, changes in the large cells of the posterior root ganglia (*see* SPINAL CORD) supplying the part affected.

HERPETOLOGY, the study of reptiles (*q.v.*).

HERRERA, FERNANDO DE (*c.* 1534–1597), Spanish lyrical poet, was born at Seville. His *Anotaciones á las obras de Garcilaso de la Vega* (1580) involved him in a series of literary polemics, and his verbal innovations laid him open to attack. But the workmanship of his sonnets to the countess of Gelves is admirable, while his odes on the battle of Lepanto, on Don John of Austria, and the elegy on King Sebastian of Portugal entitle him to rank as the greatest of Andalusian poets and as the most important of the followers of Garcilaso de la Vega (*see* VEGA).

See A. Coster, *Fernando de Herrera (El Divino)*, 1534–97 (Paris, 1908).

HERRERA, FRANCISCO (1576–1656) surnamed EL VIEJO (the old), Spanish painter, was born at Seville, is said to have studied under Luis Fernandez or under Francisco Pacheco. He was a skilful engraver, an accomplishment that led to his being charged with coining base money. He had to seek sanctuary in the Jesuit college of San Hermenegildo, which he adorned with a fine picture of its patron saint, now in the museum at Seville. Philip IV. on his visit to Seville in 1624 having seen this picture and learned the position of the artist pardoned him. In 1629 Herrera painted in conjunction with Turbaran for the church of St. Bonaventura at Seville a series of pictures illustrating the life of the saint; of the four paintings which were executed by Herrera three have survived; one is now in Prado museum at Madrid. Other notable works are the "Last Judgment" in the church of San Bernerdo at Seville; the "Pentecost" (1617) in the Greco Museum at Toledo; the "Vision of St. Basil" in the Louvre; the "St. Jerome" in the museum of Rouen. His last extant work dated 1648 is the "St Joseph with the Child," in the possession of Don T. Lazaro, Madrid. Herrera often chose humble subjects as fairs, carnivals, ale houses and the like, and these genre paintings called *bodegones* were much sought after. Three of these are still extant; one is in the Czernin collection at Vienna, one in the museum of Nantes and another in that of Avignon. There are some bold pen and ink drawings by the master representing apostles at the British Museum and at the National Library in Madrid. In 1650 Herrera moved from Seville to Madrid where he died in 1656. He was of violent temper; was amongst the strongest and most rebellious of Spanish artists; and it is said of him that he was wont to paint with heavy brushes and even with reeds. Under the influence of the painting of Juan de Ruelas, Herrera relinquished the timid Italian manner of the old Spanish school of painting and helped to initiate the free vigorous touch and style which reached such perfection in Velasquez. His pictures are marked by realism, energy of design and freedom of execution; he was a master of chiaroscuro, making his figures stand out in strong relief; his colour is vibrating. Among his pupils were Ignacio Iriarte, a landscape painter; and Velasquez, who as a boy of 13 worked in his studio for six months.

His son, FRANCISCO HERRERA (1622–1685), surnamed el Mozo (the young), was a painter and architect. Unable to endure his father's temper, the younger Herrera fled from Seville to Rome, where he became renowned for his pictures of still-life, flowers and fruit, and from his skill in painting fish was called by the Italians *lo Spagnuolo degli pesci*. In later life he painted portraits with great success. He returned to Seville at his father's death, and in 1660 was employed on two pictures in the cathedral; in 1660 he was appointed sub-director of the new academy there, under Murillo. Soon after he went to Madrid, where he was employed to paint a San Hermenegildo (now in the Prado Museum), for the barefooted Carmelites, and to decorate in fresco the roof of the choir of San Felipe el Real. The success of this last work procured for him a commission from Philip IV. to paint in fresco the roof of the Atocha church. He chose as his subject the Assumption of the Virgin. He was rewarded with the title of painter to the king, and was appointed superintendent of the royal buildings. Other notable works painted in Madrid are the "Ecce Homo," and "Christ bearing the Cross," in the Cervaldo collection in Madrid. His pictures are inferior to the older Herrera's both in design and in execution. As architect he is said to have designed the plans for the Pilas cathedral at Saragossa, the first important Baroque church in Spain. His youngest brother, known as Herrera el Rubio (the ruddy), who died very young, gave great promise as a painter.

HERRERA Y TORDESILLAS, ANTONIO DE (1559–1625), Spanish historian, secretary to Vespasian Gonzago and first historiographer of the Indies. His *Historia general de los hechos de los Castellanos en las islas y tierra firme del Mar Oceano* (1601) is borrowed largely from other mss., especially from those of Bartolomé de Las Casas and of Cervantes de Salazar. The work is, on the whole, accurate and unprejudiced, though confused. It was translated into English in 1740.

HERRICK, MYRON T. (1854–1929), American diplomat, was born at Huntington, O., Oct. 9, 1854. He studied law in Cleveland and was admitted to the bar in 1878. He practised in Cleveland from 1878 to 1886 and then turned his attention to banking and manufacturing. He also became interested in politics and held many local and State offices in the Republican organizations, serving six times as delegate to the Republican national convention and once (1892) as presidential elector from Ohio. From 1903–06 he was governor of Ohio, having been elected by the largest majority that had been given to an Ohio governor up to that time. He was forced by his business interests to decline appointments as secretary of the Treasury under McKinley and again under Taft, but in 1912 accepted the latter's appointment as ambassador to France. He continued to serve under Wilson, and at the outbreak of the World War also assumed charge of the German and Austrian embassies and later those of Turkey and minor nations. During the Marne offensive of 1914 when the French Government moved to Bordeaux, Herrick maintained headquarters in Paris. He formed the American Committee, which gave help to Americans and others travelling in Europe at the outbreak of the war. With Mrs Herrick he established the American Ambulance hospital at Neuilly, staffed and managed by Americans. After his return to America in Dec. 1914, he continued to devote much of his time to war relief activities and in recognition of his services France conferred upon him the cross of the Legion of Honour. Herrick was one of the initiators of the rural credit movement in the United States; he published the results of his study of the rural credit systems of Europe in *Rural Credits* (1914). In April 1921 he was again appointed ambassador to France and served in this post until his death in Paris on March 31, 1929.

HERRICK, ROBERT (1591–1674), English poet, was born at Cheapside, London, and baptized on Aug. 24, 1591. He belonged to an old Leicestershire family which had settled in London. He was the seventh child of Nicholas Herrick, goldsmith, of the City of London, who died in 1592, under suspicion of suicide. The children were brought up by their uncle, Sir William Herrick, one of the richest goldsmiths of the day, to whom in 1607 Robert was bound apprentice. He had probably been educated at Westminster school, and in 1614 he proceeded to Cambridge; and it was no doubt during his apprenticeship that the young poet was introduced to that circle of wits which he was afterwards to adorn. He seems to have been present at the first performance of *The Alchemist* in 1610, and it was probably about this time that Ben Jonson adopted him as his poetical "son." He entered the university as fellow-commoner of St. John's college, and he remained there until, in 1616, upon taking his degree, he removed to Trinity Hall. A lively series of 14 letters to his uncle, mainly begging for money, exists at Beau-manoir, and shows that Herrick suffered much from poverty at the university. He took his B.A. in 1617, and in 1620 he became master of arts. From this date until 1627 we entirely lose sight of him; it has been variously conjectured that he spent these years preparing for the ministry at Cambridge, or in much looser pursuits in London. In 1629 (Sept. 30) he was presented by the king to the vicarage of Dean Prior, not far from Totnes in Devonshire. At Dean Prior he resided quietly until 1648, when he was ejected by the Puritans. The solitude there oppressed him at first; the village was dull and remote, and he felt very bitterly that he was cut off from all literary and social associations; but soon he was pleased with the rural and semi-pagan customs that survived in the village, and in some of his most charming verses he has immortalized the morris-dances, wakes and quintains, the Christmas mummers and the Twelfth Night revellings, that diversified the quiet of Dean Prior. Herrick never married, but lived at the vicarage surrounded by a happy family of pets, and tended by an excellent old servant named Prudence Baldwin. His first appearance in print was in some verses he contributed to *A Description of the King and Queen of Fairies* (1635). In 1650 a volume of *Wit's Recreations* contained 62 small poems afterwards acknowledged by Herrick in the *Hesperides*, and one not reprinted until our own day. These partial appearances make it probable that he visited London from time to time. We have few hints of his life as a clergyman. Anthony Wood says that Herrick's sermons were florid and witty, and that he was "beloved by the neighbouring gentry." A very aged woman, one Dorothy King, stated that the poet once threw his sermon at his congregation, cursing them for their inattention. The same old woman recollected his favourite pig, which he taught to drink out of a tankard. He was a devotedly loyal supporter of the king during the Civil War, and immediately upon his ejection in 1648 he published his celebrated collection of lyrical poems, entitled *Hesperides; or the Works both Human and Divine of Robert Herrick*. The "divine works" bore the title of *Noble Numbers* and the date 1647. That he was reduced to great poverty in London has been stated, but there is no evidence to that effect. In Aug. 1662 Herrick returned to Dean Prior, supplanting his own supplanter, Dr. John Syms. He died in his 84th year, and was buried at Dean Prior, Oct. 15, 1674. A monument was erected to his memory in the parish church in 1857, by Mr. Perry Herrick, a descendant of a collateral branch of the family. The *Hesperides* (and *Noble Numbers*) is the only volume which Herrick published, but he contributed poems to *Lachrymae Musarum* (1649) and to *Wit's Recreations*.

As a pastoral lyrist Herrick stands first among English poets. His genius is limited in scope, and comparatively unambitious, but in its own field it is unrivalled. His tiny poems—and of the 1,300 that he has left behind him not one is long—are like jewels of various value, heaped together in a casket. Herrick has himself summed up, very correctly, the themes of his sylvan muse when he says:—

> "I sing of brooks, of blossoms, birds and bowers,
> Of April, May, of June and July flowers,
> I sing of May-poles, hock-carts, wassails, wakes,
> Of bridegrooms, brides and of their bridal-cakes."

He saw the picturesqueness of English homely life as no one before him had seen it, and he described it in his verse with a certain purple glow of Arcadian romance over it, in tones of immortal vigour and freshness. His love poems are still more beautiful; the best of them have an ardour and tender sweetness which give them a place in the forefront of modern lyrical poetry, and remind us of what was best in Horace and in the poets of the Greek anthology. (E. G.)

After suffering complete extinction for more than a century, the fame of Herrick was revived by John Nichols, who introduced his poems to the readers of the *Gentleman's Magazine* of 1796 and 1797. Dr. Drake followed in 1798 with considerable enthusiasm. By 1810 interest had so far revived in the forgotten poet that Dr. Nott ventured to print a selection from his poems, which attracted the favourable notice of the *Quarterly Review*. In 1823 the *Hesperides* and the *Noble Numbers* were for the first time edited by Mr. T. Maitland, afterwards Lord Dundrennan. Since then the reprints of Herrick have been numerous. They were edited by A. W. Pollard, with preface by Swinburne, for the Muses' Library (2 vols., 1891); by G. Saintsbury for the Aldine Poets (2 vols., 1893); by E. Rhys for "Everyman" (1908); and by F. W. Moorman (1921). *See* F. W. Moorman, *Robert Herrick* (1910); and F. Delattre, *Contribution à l'étude de la poesie anglaise au XVIIe siècle* (1910).

HERRICK, ROBERT (1868–), American author, was born at Cambridge (Mass.), April 26, 1868. He was educated at the Cambridge Latin school and at Harvard university, where he graduated in 1890. He became instructor in rhetoric at the Massachusetts Institute of Technology in 1890; in 1893 he accepted a similar position at the University of Chicago, where he was made professor of English (1905–23). His novels and short stories, as a rule, deal with problems of modern life; his style is realistic. He has published *The Web of Life* (1900); *The Real World* (1901); *The Common Lot* (1904); *The Memoirs of an American Citizen* (1905); *The Master of the Inn* (1908); *The Healer* (1911); *One Woman's Life* (1913); *Clark's Field* (1914); *The Conscript Mother* (1916); *Homely Lilla* (1923); *Waste* (1924); *Wanderings* (1925); and *Chimes* (1926).

See "Robert Herrick and Edgar Lee Masters, Interpreters of Our Modern World," in Harry Hansen's *Mid-West Portraits* (1923).

HERRIES, JOHN MAXWELL, 4TH LORD (*c.* 1512–1583), Scottish politician, was the second son of Robert Maxwell, 4th Lord Maxwell (d. 1546). In 1547 he married Agnes (d. 1594), daughter of William Herries, 3rd Lord Herries (d. 1543), and in

1567 he obtained the title of Lord Herries. Maxwell had become prominent among the men who rallied round Mary queen of Scots, although during the earlier part of his public life he had been associated with the religious reformers and had been imprisoned by the regent, Mary of Lorraine. From March 1566, when Maxwell joined Mary at Dunbar after the murder of David Rizzio and her escape from Holyrood, he remained one of her staunchest friends, although he disliked her marriage with Bothwell. He led her cavalry at Langside, and after this battle she committed herself to his care. Herries rode with the queen into England in May 1568, and he and John Lesley, bishop of Ross, were her chief commissioners at the conferences at York. After returning to Scotland, Herries was imprisoned by the regent Murray. He was among the supporters of the regent Lennox until his death on Jan 20, 1583. His son William, 5th Lord Herries (d. 1604), was warden of the west marches.

HERRIN, a coal-mining city of Williamson county, Ill., U.S.A., 90m. S.E. of Saint Louis, served by the Burlington, the Illinois Central and the Missouri Pacific railways The population in 1920 was 10,986 (87·5% native white). There are 36 coal mines in the immediate vicinity, and the county mined over 8,000,000 tons in 1926. Such manufactures as the city has are subsidiary to the mining industry. Herrin has had its part in the feuds and disturbances which have given the county the sobriquet "Bloody Williamson." In June, 1922, local hostility to a new mining company, attempting to operate on a non-union basis, was accompanied by violence on both sides, and culminated in "the Herrin Massacre," when some 25 of the outsiders were killed.

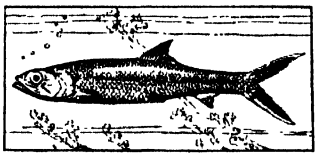
HERRING, a fish belonging to the genus *Clupea*, which is the most widely distributed of all fish genera. The commonest members of the genus are, besides the herring (*C. harengus*), the sprat (*C. sprattus*), the pilchard (*C. pilchardus*), the Allis shad (*C. alosa*) and the Thwaite shad (*C. finta*). Herrings are caught in great numbers in the North sea, off the west coast of Norway, in all the waters off the British Isles and in the Baltic sea. In the Atlantic ocean they are found from north of Cape Cod to Greenland, around Iceland, the Faeroes, and also in the White sea, and varieties of the species occur in the Caspian sea and the Black sea. The herring of the North Pacific ocean is *C. pallasi*, but is hardly distinguishable from *C. harengus*

To countries bordering the North sea, the herring fishery is of paramount importance, as is shown in the following table of landings for 1925.—

Norway.	Denmark.	Germany.	Holland	England.	Scotland.	France.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
187·764	4·597	48·202	53·070	170·589	99·239	17·036

The approximate value in sterling of these herrings was £5,109,350 or 33% of the total yield of the North sea fisheries.

In western European seas, herrings spawn at all seasons The Norwegian herrings spawn along the west coast in spring, and during this time also, spawning herrings occur near the Firth of Forth, off Cape Wrath, the Hebrides, and in the Skagerrak. From August to October spawning takes place off the north and east of Scotland, and at various places from Northumberland to the Wash on the English east coast. Winter spawning grounds are found near the Sandettie Light Vessel and the Gabbards shoal in December; off Cap d'Antifer in the eastern part of the English channel, and along the Devon and Cornish coasts in January and February. In the Baltic sea there is both a spring and an autumn spawning.



BY COURTESY OF THE N Y. ZOOLOGICAL SOCIETY

BIG-EYED HERRING OR TENPOUNDER (ELOPS SAURUS)

Herrings deposit their eggs in masses on the sea bottom, on stones, weeds, rocks, and gravel, where they are fertilised. On hatching the larvae are carried from the spawning grounds by winds and currents to various coasts, where they appear as "Whitebait herring"—8–12cms. ($3\frac{1}{8}$"–$4\frac{3}{4}$")—at the end of their first year. The second year is spent in the open sea, feeding mainly on copepods, and during this time they grow rapidly to 16–19 cms. It is not until they are becoming adult that they appear in shoals off the coast. The onset of maturity, accompanied by a decrease in growth-rate, takes place at different times in the various seas where herrings are caught.

In the North sea they mature mainly in the third or fourth year, while in Norway they do so at from five to eight years of age. Size also varies in different localities, fish of oceanic waters having a larger yearly growth than those of more enclosed areas. A herring of 28cms. (11") would be large for the southern North sea, while fish of 34cms. ($13\frac{1}{2}$") or more are common in Norwegian shoals.

In the Baltic sea, with its low salinity, mature herrings of 10cms. are found

The old conception of herring migrations was that all the fish of the North Atlantic and neighbouring waters wintered within the Arctic Circle, and in spring came south in large columns to spawn. It is now known that the movements are more limited, and that Norwegian herrings and those from the North sea, the Baltic, and the western English channel all differ structurally, the differences of these "races" being shown by the numerical variations of such characters as vertebrae, fin rays, and the scales along the "keel" of the fish. The cycle of migration is in three main parts—the feeding movement, when the genital organs are developed; the movement to the spawning grounds, and the dispersal after spawning.

On the scales of the herring there are concentric annual rings (like those in trees) from which age can be determined, and investigation has shown that mature herrings visit the same grounds each year until each year-class in turn becomes extinct. Commercially, herrings are salted or pickled for export. Herrings are also cured as kippers, bloaters, or "red-herring," and the iridescent substance, guanin, from their scales, is used in the manufacture of artificial pearls. (W. C. H.)

TRADE IN HERRINGS

The United Kingdom does a very large export trade in herrings. In the years 1913 and 1925–27, the following quantities of the fish were exported (values are given f.o.b British ports):

Year	*Quantities* cwt.	*Value* £
1913	8,795,000	5,331,000
1925	4,726,000	4,561,000
1926	5,144,000	4,636,000
1927	5,489,000	4,508,000

It will be observed that the exports have fallen greatly since the World War. That is because the Russian trade has almost ceased. In 1913 Russia took 3,566,000cwt. and in 1927 only 155,000cwt. The principal importers in 1927 were Poland, 1,492,000cwt. and Germany 1,995,000cwt. British herrings, exported in brine, are made into various delicacies on the continent of Europe; "Bismarck herring," for example, is re-exported to the British market. During the World War the problem of disposing of the surplus British herrings became a matter of great difficulty, and special efforts were made to induce the consumer to eat more of them. (*See* FISH-CURING.)

HERRING-BONE, in masonry construction, the use of courses or rows in which the individual bricks or stones are set at an angle of approximately 45° to the horizontal and with alternate courses at right angles to each other. Herring-bone work is occasionally found in late Roman brick construction, and was common throughout the Romanesque period (*see* BYZANTINE AND ROMANESQUE ARCHITECTURE) sometimes decoratively, as in much of the brick work of north Italy, sometimes structurally, with the apparent idea that long, thin stones could be more efficiently used in this manner than if laid horizontally. In modern construction, the herring-bone is almost entirely restricted to decorative brick work and paving. A similar pattern is often used in hard wood floors.

HERRINGS, BATTLE OF THE, the name applied to the action of Rouvray, fought in 1429 between the French (and Scots) and the English, who, under Sir John Falstolfe (or Falstaff), were

convoying Lenten provisions, chiefly herrings, to the besiegers of Orleans. (*See* ORLEANS and HUNDRED YEARS' WAR.) Its historical interest lies not merely in the name of the commander, but in the fact that, faced by four times his own number, he used his wagons to form a "laager," with the archers firing from them and spearmen between. The French horse beat in vain against this "laager"—which may well have been an improvisation based on accounts of the recent successes of the Hussite *Wagenburg* in Bohemia. (*See* HUSSITES, TACTICS, ZIZKA.)

HERRIOT, EDOUARD (1872–), French politician, was born at Troyes, in Champagne, on July 5, 1872, the son of an officer. He was sent first to the Lycée of La Roche-sur-Yon, and afterwards to that of Louis-le-Grand, which bore the reputation of being the best school in France. He then entered the École Normale Supérieure, which included many eminent teachers such as Brunetière and Gaston Boissier, both of whom were men of authority and unquestioned reputation. Here he remained working assiduously for several years, and while delighting in the pursuit of learning thoroughly enjoyed the interchange of ideas with his fellow-students, on whom he left an unforgettable impression. In 1894 he graduated with high honours. Whilst undergoing his military service at Nancy, his favourite relaxation was the study of Greek literature. His book *Philon le Juif* (1897) was crowned by the Académie Française.

Having been appointed a professor at the Lycée of Nantes, he was entrusted the following year first with the Chair of rhetoric, and then of higher rhetoric at the Lycée of Lyons. He imparted to his pupils not merely the principles of knowledge but also the love of it for its own sake; a scholar of great refinement, he possessed the gift of stimulating others, and his lucid and attractive lectures captivated all hearers. On relinquishing his chair he became a popular lecturer, as well as journalist and propagandist, and his book, *Madame Récamier et ses Amis* (1905), achieved widespread popularity. His *Précis de l'histoire des lettres françaises* (1905) shows that his literary criticism was based on a minute study of the text.

In May 1904 Herriot was made a municipal councillor and deputy mayor of Lyons and the following year became mayor. Thenceforward, with the exception of three months, he guided the destinies of Lyons; for at each successive election of the municipal council he resumed office. In 1910 he became a member of the conseil général and in 1912 senator for the department of the Rhône. From Dec. 1916 to March 1917 he occupied the post of minister of public works, transport and supplies in the Briand cabinet. During this time he inaugurated a policy of restriction which enabled France to economise her resources. Having to a large extent solved the problem of supplies, he brought order into the transport service; stations, railway lines and ports were cleared, and an efficient service was maintained.

Herriot now felt that by entering the Chamber, he would be better able to carry out his cherished ideas. He therefore renounced his office as senator, and was elected in Nov. 1919 deputy for the Rhône department. He was then appointed a member of the finance Commission and reporter-general of the budget of public instruction. The Radical party now chose him as their leader, and as a defender of the principles of democracy he soon reached the front rank of French statesmen. As an orator he showed subtlety, versatility and imagination. Both in speaking as well as writing Herriot approached his subject from the loftiest standpoint—the result of his wide knowledge, culture and absolute integrity. His chief qualities might be summed up in three words: logic, wisdom and conviction; and it was the combination of these which enabled him to draw up a formula for an experimental policy.

Even before hostilities had ceased, Herriot turned his attention to post-war problems. He insisted on the necessity for the reconstruction and economic development of France. In 1916, at the moment when the victory of January seemed imminent, he organized the Lyons Fair. In 1917 he published *Agir*, a book which at a time when the fate of France was so uncertain, bore the character of an unflinching act of faith; for in it Herriot maintained that the culture and civilisation of France were too deep-rooted and too strong to be overcome. This gospel of action soon inspired the faint-hearted with fresh hope.

After the victory, Herriot brought out a work in two volumes, *Créer* (1919), dedicated to the youth of France. It contained his programme of reconstruction, and gave his compatriots a fine example of resolution, fearlessness and patriotism. A similar example emerged from his visits to Russia, the United States of America and Canada. He was confronted with an even harder task than before, for as head of the Radical party the eyes of all French democrats were turned towards him. He inspired the opposition and acted as its mouthpiece. After the elections of May 1924 he became premier and minister of foreign affairs. During the London conferences, in the application of the Dawes plan and finally over the Geneva protocol, he displayed a rare combination of idealism and common sense, and outlined those great aims, in pursuit of which the nations of the world should unite to avoid war. By these efforts he gained the confidence of all men of good will, not only in Europe but over the whole world. Germany in consequence offered to draw up a security pact destined to be signed eight months later at Locarno. (*See* SECURITY.)

This achievement, however, by no means disarmed Herriot's adversaries. The financial problems which he had to face were the occasion of innumerable attacks upon him and finally a hostile vote of the Senate obliged him to resign in April 1925. (*See* FRANCE.) A few days later, he was elected president of the Chamber of Deputies by the deputies who desired to testify to the courage, zeal for work and talents of the leader of the Left. In June 1926 Briand invited Herriot to join him in a ministry of National Union. Herriot personally was willing, but his Radical followers objected. President Doumergue then asked Herriot to form a Government; he tried, and failed, because the moderates, whose support was necessary, feared his radical ideas on finance. Briand then formed a cabinet which was defeated on July 17 on a bill asking for full financial powers for the Government. The defeat was partly due to the unexpected action of Herriot as president of the Chamber; he left the presidential chair to speak from his place as a deputy against the action of the Government which, he thought, threatened the rights of the Chamber.

Herriot formed a ministry, but it was defeated two days later. He then joined (July 23) the ministry of National Union formed by Poincaré, as minister of public instruction. He resigned his presidency of the Radical Socialist Federation in the autumn, but of course retained his membership. In Nov. 1928 the party congress withdrew its support in terms which made it necessary for Herriot and the other Radical Socialist ministers to resign from the cabinet. (L. RI.)

HERRNHUT, a town of Germany, in the republic of Saxony, 18 m. S.E. of Bautzen, and situated on the Löbau-Zittau railway. Pop. 1,664. It is the principal seat of the Moravian or Bohemian brotherhood, the members of which are called *Herrnhuter*. A colony of these people, fleeing from persecution in Moravia, settled at Herrnhut in 1722 on a site presented by Count Zinzendorf. The buildings of the society include a church, a school and houses for the brethren, the sisters and the widowed of both sexes. The town is remarkable for its ordered, regular life and its scrupulous cleanliness. Linen and various minor articles are manufactured. Berthelsdorf, a village about a mile distant, has been the seat of the directorate of the community since about 1789.

HERSCHEL, CAROLINE LUCRETIA (1750–1848), English astronomer, sister of Sir William Herschel, was born at Hanover on Mar. 16, 1750. She assisted her mother in the management of the household until 1772, when her brother fetched her to Bath, where he had established himself as a teacher of music. At once she became a valuable co-operator with him both in his professional duties and in his astronomical researches. When her brother accepted the office of astronomer to George III., she became his constant assistant in his observations, and also executed the laborious calculations which were connected with them. During her leisure hours she swept the heavens with a small Newtonian telescope and by this means she detected in 1783 three nebulae, and during the eleven years 1786–97 eight comets. In 1797 she presented to the Royal Society an Index

to Flamsteed's observations, together with a catalogue of 561 stars accidentally omitted from the *British Catalogue*, and a list of the errata in that publication. She returned to Hanover in 1822, and in 1828 completed the reduction to January 1800, of 2,500 nebulae discovered by her brother. Caroline Herschel died on Jan. 9, 1848. She had received the gold medal of the Astronomical Society in 1828, and one from the king of Prussia in 1846.

See Mrs. John Herschel, *Memoir and Correspondence of Caroline Herschel* (1876).

HERSCHEL, SIR FREDERICK WILLIAM (1738–1822), generally known as Sir William Herschel, English astronomer, was born at Hanover on Nov. 15, 1738. His father was a musician in the Hanoverian guard, and in 1757 Herschel was sent to England to earn his living as a musician.

Beginnings.—In 1766 he worked as organist in Bath. During the next five or six years he became the leading musical authority. In 1772 he revisited Hanover to bring back with him his sister Caroline, whose services he much needed, as he was already studying astronomy in the time he could spare from his musical engagements. She thus describes her brother's life soon after her arrival: "He used to retire to bed with a bason of milk or a glass of water, with Smith's *Harmonics* and Ferguson's *Astronomy*, etc., and so went to sleep buried under his favourite authors; and his first thoughts on waking were how to obtain instruments for viewing those objects himself of which he had been reading." It was in this way that he was introduced to the writings of Ferguson and Keill, and subsequently to those of Lalande, whereby he educated himself to become an astronomer of undying fame.

In those days telescopes were rare, very expensive and not very efficient, and Herschel used a small Gregorian reflector of about 2 in. aperture. Finding it impossible to obtain a reflector of larger dimensions, he decided to construct his own and, in 1774 had the satisfaction of viewing the heavens with a Newtonian telescope of 6 ft. focal length made by his own hands. He had from the very first conceived the gigantic project of surveying the entire heavens, and, if possible, of ascertaining the plan of their general structure. For this he required adequate instruments, and he, his brother and his sister toiled at the grinding and polishing of hundreds of specula. After 1774 every available hour of the night was devoted to the long-hoped-for scrutiny of the skies.

In May 1780 his first two papers on the variable star "Mira" and the mountains of the moon were communicated to the Royal Society.

The phenomena of variable stars were examined by Herschel as a guide to what might be occurring in our own sun, and the results of his investigations were communicated to the Royal Society in six memoirs (see *Phil. Trans.*, 1780–1801). It was in 1801 that these remarkable papers culminated in the enquiry whether any relation could be traced in the recurrence of sun-spots, regarded as evidences of solar activity, and the varying seasons of our planet, as exhibited by the varying price of corn.

The Rotation of Planets.—In 1781 he communicated to the Royal Society the first of a series of papers on the rotation of the planets and of their several satellites. These enquiries occupy the greater part of seven memoirs extending from 1781–97. While engaged on them he noticed the curious appearance of a white spot near to each of the poles of the planet Mars. On investigating the inclination of its axis to the plane of its orbit, and finding that it differed little from that of the earth, he concluded that its changes of climate also would resemble our own, and that these white patches were probably polar snow. He also discovered that the times of the rotations of the various satellites round their axes conform to the analogy of our moon by equalling the times of their revolution round their primaries.

In the same year (1781) Herschel made a discovery which completely altered the character of his professional life. In the course of a methodical review of the heavens he lighted on an object which averred itself to be a new planet, moving outside the orbit of Saturn. He assigned to it the name Georgium Sidus, but this has been laid aside in favour of Uranus. The object was detected with a 7-ft. reflector having an aperture of 6½ in. Seven memoirs on the subject were communicated by him to the Royal Society, extending from the date of the discovery, in 1781–1815.

For the discovery of the planet he was awarded the Copley medal of the Royal Society, elected a fellow, and in the following year, 1782, he accepted George III.'s offer to give up music and become his private astronomer. So Herschel and his sister moved first to Datchet and in 1786 to Slough. Here he resumed his astronomical pursuits with extraordinary vigour, although for a time he had to supplement his income by making and selling telescopes. The necessity for this interruption in his observations was overcome in 1788 when he married the wealthy widow of a London merchant.

Double Stars.—A material part of the task that Herschel had set himself embraced the determination of the relative distances of the stars from our sun and from each other. This resulted in a most important series of observations. He had observed many stars in apparently very close contiguity, but often differing greatly in relative brightness He concluded that, on the average, the brighter star would be the nearer to us, the fainter enormously more distant.

In the hope, therefore, of detecting an annual parallactic displacement of one star with respect to another, he mapped down the places and aspects of all the double stars that he met with, and communicated in 1782 and 1785 very extensive catalogues of the results. His last scientific memoir, sent to the Royal Astronomical Society in 1822, when he was its first president and already in his 84th year, related to these investigations. In the memoir of 1782 he threw out the hint that these apparently contiguous stars might be genuine pairs in mutual revolution. Eleven years afterwards (1793), he remeasured the relative positions of many such couples and his prediction was verified, for he ascertained that some of these stars circulated round each other, after the manner required by the laws of gravitation. This discovery, announced in 1802, would of itself suffice to immortalize his memory.

In 1783 he wrote his first memorable paper on the "Motion of the Solar System in Space"—a sublime speculation, yet through his genius realized by considerations of the utmost simplicity He returned to the same subject with fuller details in 1805. In a series of papers, extending from the year 1784–1818, he used his method of star-gauging and concluded that our sun was a star situated not far from the bifurcation of the Milky Way, and that all the stars visible to us lie more or less in clusters scattered throughout a comparatively thin, but immensely extended stratum. On either side of this assemblage of stars, Herschel discovered a canopy of discrete nebulous masses, such as those from the condensation of which he supposed the whole stellar universe to have been formed.

Hitherto we have said nothing about his construction of the great reflecting telescope, of 40 ft. focal length and 4 ft. aperture. The full description of this celebrated instrument will be found in the 85th volume of the *Transactions* of the Royal Society. On the day that it was finished (Aug. 28, 1789) Herschel saw at the first view, in a grandeur not witnessed before, the Saturnian system with six satellites, five of which had been discovered long before, while the sixth he had glimpsed two years before, in his exquisite little telescope of 6½ in. aperture, but now saw in unmistakable brightness. On Sept. 17 he discovered a seventh, which proved to be the nearest to the globe of Saturn.

Herschel died at Slough on Aug. 25, 1822, a description of him given a few years before by Campbell being—"A great, simple, good old man. His simplicity, his kindness, his anecdotes, his readiness to explain his own sublime conceptions of the universe, are indescribably charming."

See Mrs. John Herschel, *Memoir of Caroline Herschel* (1876); E. S. Holden, *Herschel, his Life and Works* (1881); A. M. Clerke, *The Herschels and Modern Astronomy* (1895); E. S. Holden and C. S. Hastings, *Synopsis of the Scientific Writings of Sir William Herschel* (Washington, 1881); Baron Laurier, *Éloge historique*, Paris Memoirs (1823), p. lxi.; F. Arago, *Analyse historique, Annuaire du Bureau des Longitudes* (1842), p. 249; Arago, *Biographies of Scientific Men*, p. 167; Madame d'Arblay's *Diary, passim; Public Characters* (1798–99), p. 384 (with portrait); J. Sime, *William Herschel and his Work* (1900). Herschel's photometric Star Catalogues were discussed and reduced by E. C. Pickering in *Harvard Annals*, vols. xiv. p. 145, xxiii., and xxiv.

HERSCHEL, SIR JOHN FREDERICK WILLIAM, BART. (1792–1871), English astronomer, the only son of Sir William Herschel, was born at Slough, Bucks, on March 7, 1792. He was educated for a short while at Eton, then by a private tutor and then at St. John's, Cambridge, where he graduated as senior wrangler in 1813. During his undergraduateship he and two of his fellow-students who subsequently attained to very high eminence, Dean Peacock and Charles Babbage, entered into a compact that they would "do their best to leave the world wiser than they found it"—a compact loyally and successfully carried out by all three to the end. As a commencement of this laudable attempt we find Herschel associated with these two friends in the production of a work on the differential calculus, and on cognate branches of mathematical science, which changed the style and aspect of mathematical learning in England, and brought it up to the level of the Continental methods. Two or three memoirs communicated to the Royal Society on new applications of mathematical analysis at once placed him in the front rank of the cultivators of this branch of knowledge. Of these his father had the gratification of introducing the first, but the others were presented in his own right as a fellow.

With the intention of being called to the bar, he entered his name at Lincoln's Inn on January 24, 1814 and placed himself under the guidance of an eminent special pleader. Probably this temporary choice of a profession was inspired by the extraordinary success in legal pursuits which had attended the efforts of some noted Cambridge mathematicians. Be that as it may, an early acquaintance with D Wollaston in London soon changed the direction of his studies.

He took up astronomy in 1816; and in 1820, assisted by his father, he completed for a reflecting telescope a mirror of 18 in diameter and 20 ft. focal length. This, subsequently improved by his own hands, became the instrument which enabled him to effect the astronomical observations forming the chief basis of his fame. In 1821–23 we find him associated with Sir James South in the re-examination of his father's double stars For this work he was presented in 1826 with the Astronomical Society's gold medal; and with the Lalande medal of the French Institute in 1825; while the Royal Society had in 1821 bestowed upon him the Copley medal for his mathematical contributions to their *Transactions*. From 1824 to 1827 he was secretary to that society; and was in 1827 elected to the chair of the Astronomical Society, which office he also filled on two subsequent occasions In the discharge of his duties to the last named society he delivered presidential addresses and wrote obituary notices of deceased fellows, memorable for their combination of eloquence and wisdom. In 1831 the honour of knighthood was conferred on him by William IV., and two years later he again received the recognition of the Royal Society by the award of one of their medals for his memoir "On the Investigation of the Orbits of Revolving Double Stars."

Before the end of the year 1833, Sir John Herschel had re-examined all his father's double stars and nebulae, and had added many similar bodies to his own lists; thus accomplishing, under the conditions then prevailing, the full work of a lifetime. For it should be remembered that astronomers were not as yet provided with those valuable automatic contrivances which at present materially abridge the labour and increase the accuracy of their determinations. John Herschel then determined to explore the southern, besides re-exploring northern skies. "I resolved," he said, "to attempt the completion of a survey of the whole surface of the heavens; and for this purpose to transport into the other hemisphere the same instrument which had been employed in this, so as to give a unity to the results of both portions of the survey, and to render them comparable with each other." So, he and his family embarked for the Cape on Nov. 13, 1833; they arrived in Table bay on Jan. 15, 1834; and he began regular observations on March 4.

To give an adequate description of the vast mass of labour completed during the next four busy years of his life at Feldhausen would require the transcription of a considerable portion of the *Cape Observations*, published in 1847, nine years after the author's return to England, for the cogent reason, that as he said, "The whole of the observations, as well as the entire work of reducing, arranging and preparing them for the press, have been executed by myself." It contains catalogues and charts of southern nebulae and star-clusters, a catalogue of the relative positions and magnitudes of southern double stars and his observations on the varying and relative brightness of the stars. Herschel returned to his English home in 1838, and was welcomed with an enthusiastic greeting.

He was created a baronet by Queen Victoria at her coronation and, what to him was better than such reward, other men caught this contagion of his example and laboured in fields similar to his own, with an adequate portion of his success. He also paved the way for Sir George Stokes's discovery of fluorescence by his addition of the lavender rays to the spectrum and, by his announcement in 1845 of 'epipolic dispersion' as exhibited by sulphate of quinine.

Herschel was a highly accomplished chemist. His discovery in 1819 of the solvent power of hyposulphite of soda on the otherwise insoluble salts of silver was the prelude to its use as a fixing agent in photography; and he invented in 1839, independently of Fox Talbot, the process of photography on sensitized paper. He was the first person to apply the now well-known terms *positive* and *negative* to photographic images, and to imprint them upon glass prepared by the deposit of a sensitive film. Perhaps no man can become a truly great mathematician or philosopher if devoid of imaginative power. John Herschel possessed this endowment to a large extent; and he solaced his declining years with the translation of the *Iliad* into verse. But the main work of his later life was the collection of all his father's catalogues of nebulae and double stars combined with his own observations and those of other astronomers into a single volume. A complete list of his contributions to learned societies will be found in the Royal Society's great catalogue, and from them may be gathered most of the records of his busy scientific life. Sir John Herschel met with an amount of public recognition which was unusual in the time of his illustrious father. He was a member of almost every important learned society in both hemispheres. For five years he held the same office of master of the mint, which a century before had belonged to Sir Isaac Newton.

In private life Sir John Herschel was a firm and most active friend; he had no jealousies; he avoided all scientific feuds; he gladly lent a helping hand to those who consulted him in scientific difficulties; he was pleased by appreciation of his work without being solicitous for applause. It was truthfully said of him that his life was 'full of the serenity of a sage and the docile innocence of the child.'

He died on May 11, 1871, and his remains are interred in Westminster abbey close to the grave of Sir Isaac Newton.

Besides the laborious *Cape Observations*, Sir John Herschel was the author of several books, one of which at least, *On the Study of Natural Philosophy* (1830), possesses an interest which no future advances of the subjects on which he wrote can obliterate. In 1849 came the *Outlines of Astronomy*, a volume still replete with charm and instruction. His articles, "Meteorology," "Physical Geography," and "Telescope," contributed to the 8th edition of the *Encyclopædia Britannica*, were afterwards published separately. Less known are his volumes, *Familiar Lectures on Scientific Subjects* (1866) and *Collected Addresses* (1857), in which he is seen in his happiest and most instructive mood.

See also R. Grant, *History of Physical Astronomy* (1852); Lord Kelvin in the *Report of the British Association* (1871); T. Romney Robinson in the *Proceedings of the Royal Society* (vol. xx., 1872); M. C. Herschel, *Memoir of Caroline Herschel* (1876); J. H. Mädler, *Geschichte der Himmelskunde* (vol. ii., 1873); E. Dunkin, *Obituary Notices of Astronomers* (1879); A. M. Clerke, *The Herschels and Modern Astronomy* (1895) and *Popular History of Astronomy* (4th ed., 1902); *Sir J. Herschel: Scientific Papers* (Collected and edited under direction of Royal Society and Royal Astronomical Society, 2 vol., 1912); H. Macpherson, *Herschel* (1919).

Reductions, based on standard magnitudes of 919 southern stars, observed by Herschel in sequences of relative brightness, were published by W. Doberck in the *Astrophysical Journal* (vol. xi., 1900) and *Annals of the Astronomical Observatory of Harvard College* (vol. xli., 1902).

HERSCHELL, FARRER HERSCHELL, 1ST BARON (1837–1899), lord chancellor of England, was born on Nov. 2, 1837, the son of the Rev. Ridley Haim Herschell, a native of Strzelno, in Prussian Poland. He was educated at a private school and University college, London. He entered in Lincoln's Inn, and in 1858 he entered the chambers of Thomas Chitty, where so many of the great lawyers began their studies. His fellow-pupils included A. L. Smith and Charles. In 1860 he was called to the bar, and joined the still undivided northern circuit, where at first he did not find much work, and thought of going to practise in Shanghai. His prospects improved in 1866 when Quain, for whom he devilled, took silk.

In 1872 Herschell was made a queen's counsel. He had all the necessary qualifications for a leader—a clear, though not resonant, voice; a calm logical mind; a sound knowledge of legal principles; and (greatest gift of all) an abundance of common sense. He never wearied the judges by arguing at undue length, and he knew how to retire with dignity from a hopeless cause. His only weak point was cross-examination. In handling a hostile witness he had neither the insidious persuasiveness of a Hawkins nor the compelling, dominating power of a Russell. But he made up for all by his speech to the jury, marshalling such facts as told in his client's favour with the most consummate skill. He seldom made use of notes, but trusted to a carefully trained memory. Herschell entered parliament for Durham city in 1874. For the next six years he was assiduous in his attendance in the House of Commons. He was not a frequent speaker, but a few great efforts sufficed in his case to gain for him a reputation as a debater. The best examples of his style as a private member will be found in *Hansard* under the dates Feb. 18, 1876, May 23, 1878, May 6, 1879. In 1880 Gladstone appointed Herschell solicitor-general. Herschell's public services from 1880 to 1885 were of great value, particularly in dealing with the "cases for opinion" submitted by the Foreign Office and other departments. He helped controversial Government measures through the House, notably the Irish Land Act, 1881, the Corrupt Practices and Bankruptcy Acts, 1883, the County Franchise Act, 1884, and the Redistribution of Seats Act, 1885. This last halved the representation of Durham city and so gave him statutory notice to quit. He contested the North Lonsdale division of Lancashire unsuccessfully, and his prospects seemed in peril; but Selborne and James both refused the Woolsack, and in 1886 Herschell, by a sudden turn of fortune's wheel, found himself in his 49th year lord chancellor.

Herschell's chancellorship lasted barely six months, for in Aug. 1886 Gladstone's administration fell. Herschell was again lord chancellor in 1892–95. His judgments were distinguished for their acute and subtle reasoning, for their grasp of legal principles, and, whenever the occasion arose, for their broad treatment of constitutional and social questions. He was not a profound lawyer, but possessed extreme quickness of apprehension. In construing a real property will or any other document, his first impulse was to read it by the light of nature, and to decline to be influenced by the construction put by the judges on similar phrases occurring elsewhere. But when he discovered that certain expressions had acquired a technical meaning which could not be disturbed without fluttering the dovecotes of the conveyancers, he would yield to the established rule, even though he did not agree with it. He was perhaps seen at his judicial best in *Vagliano* v. *Bank of England* (1891) and *Allen* v. *Flood* (1898). His public services outside his judicial work included the chancellorship of the University of London (1893), and the chairmanship of the Imperial institute, which he held from its foundation.

In 1897 Herschell was appointed, jointly with Lord Justice Collins, to represent Great Britain on the Venezuela Boundary commission, which assembled in Paris in the spring of 1899. He also sat on the joint high commission appointed to adjust certain boundary and other questions pending between Great Britain and Canada on the one hand and the United States on the other hand. He started for America in July of that year and was received most cordially at Washington. His fellow commissioners elected him their president. In Feb. 1899 he slipped in the street and fractured a hip bone. His constitution, which at one time was a robust one, had been undermined by constant hard work and proved unequal to sustaining the shock. He died at the Shoreham hotel, Washington, on March 1, a *post-mortem* examination revealing disease of the heart. The body was brought to London in a British man-of-war and buried at Tincleton, Dorset.

A "reminiscence" of Herschell by Mr. Speaker Gully (Lord Selby) will be found in *The Law Quarterly Review* for April 1899. *The Journal of the Society of Comparative Legislation* (of which he had been president from its formation in 1893) contains, in its part for July of the same year, notices of him by Lord James of Hereford, Lord Davey, Victor Williamson (his executor and intimate friend), and also by Justice D. J. Brewer and Senator C. W. Fairbanks (both of the United States).

HERSFELD, a town of Germany, in the Prussian province of Hesse-Nassau, situated at the confluence of the Geis and Haun with the Fulda, on the railway from Frankfort-on-Main to Bebra, 24 m. N.N.E. of Fulda. Pop. (1925) 11,269. Some of the old fortifications of the town remain. The principal buildings are the Stadt Kirche, a beautiful Gothic building, erected about 1320 and restored in 1899; the old town hall (Rathaus) and the ruins of the abbey church. This church was erected on the site of the cathedral in the beginning of the 12th century; it was built in the Byzantine style and was burnt down by the French in 1761. Outside the town are the Frauenberg and the Johannesberg, on both of which are monastic ruins. The town has important manufactures of cloth, leather, machinery, vaseline and cordage; it has also dye-works The Benedictine abbey of Hersfeld was founded by Lullus, afterwards archbishop of Mainz, about 769. It was richly endowed by Charlemagne and became an ecclesiastical principality in the 12th century, passing under the protection of the landgraves of Hesse in 1423. It was secularized in 1648. Hersfeld became a town in the 12th century and in 1370 the burghers, having shaken off the abbot's authority, placed themselves under the protection of the landgraves of Hesse. Hersfeld, with electoral Hesse, was united with Prussia in 1866

HERSHEY, MILTON SNAVELY (1857–), American confectioner and philanthropist, was born in Derry Township, Dauphin county, Pa., on Sept. 13, 1857. He attended the local schools and then served for a time as a printer's devil on the *Lancaster Farmer*. After a brief period in that capacity, he turned to the manufacture of candy and at 21 years of age had his own shop in Philadelphia. He later removed to New York city. There success crowned his efforts, and within 25 years he sold his business for $1,000,000. Returning to his native home in Pennsylvania, he again began the manufacture of chocolate bars, converting the scene of his early struggles into the model industrial town of Hershey, Pa., and developing his business along lines most beneficial to his employees. About 1903 he and his wife, Mrs. Catherine S. Hershey (d. 1915), determined to found an industrial school and home for orphan boys, the school receiving its first pupils in 1910. It is open to male orphans: (1) born in Dauphin, Lebanon and Lancaster counties; (2) born elsewhere in Pennsylvania (3) born elsewhere in the United States. Boys are accepted at four or five years of age and may remain until they reach the age of 18 years. Freedom in the selection of trades is permitted, but it is required that each boy learn to be self-supporting. In 1918 Hershey transferred his entire wealth, estimated at $60,000,000, to the Hershey Trust company for maintenance of the Hershey Industrial school, making it probably the second richest school of its kind in the United States. He is chairman of the board of directors of the Hershey Chocolate company, Hershey, Pa., with 15 subsidiary companies in the United States and Cuba; president of the Hershey Trust company; and chairman of the board of directors of the Hershey Industrial school.

HERSTAL or HERISTAL, a town of Belgium, less than 2 m. N. of Liége and practically one of its suburbs. The second Pippin was born here. His grandson, Pippin the Short, died at Herstal in A.D. 768, and it disputes with Aix-la-Chapelle the honour of being the birthplace of Charlemagne. It is now a very active centre of iron and steel manufactures. The Belgian national small-arms factory and cannon foundry are here. Pop. (1925) 23,314. The name may come from *Heerstelle* (permanent camp).

HERTFORD, EARLS AND MARQUESSES OF. The English earldom of Hertford was held by members of the powerful family of Clare from about 1138, when Gilbert de Clare was created earl of Hertford, to 1314 when another earl Gilbert was killed at Bannockburn. In 1537 EDWARD SEYMOUR, viscount Beauchamp, a brother of Henry VIII.'s queen, Jane Seymour, was created earl of Hertford, being advanced ten years later to the dignity of duke of Somerset and becoming protector of England. His son EDWARD (*c.* 1540–1621) was styled earl of Hertford from 1547 until the protector's attainder and death in January 1552, when the title was forfeited; in 1559, however, he was created earl of Hertford. In 1560 he was secretly married to Lady Catherine Grey (*c.* 1538–1568), daughter of Henry Grey, duke of Suffolk, and a descendant of Henry VII. Queen Elizabeth greatly disliked this union, and both husband and wife were imprisoned, while the validity of their marriage was questioned. Catherine died on Jan. 27, 1568 and Hertford on April 6, 1621. Their son Edward, Lord Beauchamp (1561–1612), who inherited his mother's title to the English throne, predeceased his father; and the latter was succeeded in the earldom by his grandson WILLIAM SEYMOUR (1588–1660), who was created marquess of Hertford in 1640 and was restored to his ancestor's dukedom of Somerset in 1660. The title of marquess of Hertford became extinct when JOHN, 4th duke of Somerset, died in 1675, and the earldom when ALGERNON, the 7th duke, died in February 1750

In August 1750 FRANCIS SEYMOUR CONWAY, 2nd baron Conway (1718–1794), a direct descendant of the protector Somerset, was created earl of Hertford. Hertford was ambassador to France from 1763 to 1765; was lord-lieutenant of Ireland in 1765 and 1766; and lord chamberlain of the household from 1766 to 1782. In 1793 he became earl of Yarmouth and marquess of Hertford, and died on June 14, 1794 His son FRANCIS INGRAM SEYMOUR CONWAY (1743–1822), known during his father's lifetime as Lord Beauchamp, was sent as ambassador to Berlin and Vienna in 1793 and from 1812 to 1821 he was lord chamberlain. His son FRANCIS CHARLES, the 3rd marquess (1777–1842), an intimate friend of the prince regent, afterwards George IV., is the original of the "Marquis of Steyne" in Thackeray's *Vanity Fair* and of "Lord Monmouth" in Disraeli's *Coningsby*. The 4th marquess was his son, RICHARD (1800–1870), whose mother was the great heiress, Maria Emily Fagniani, and whose brother was Lord Henry Seymour (1805–1859), the founder of the Jockey Club at Paris. When Richard died unmarried in Paris in August 1870 his title passed to his kinsman, FRANCIS HUGH GEORGE SEYMOUR (1812–1884), a descendant of the 1st marquess, whose son, HUGH DE GREY (1843–1912) became 6th marquess in 1884. The 4th marquess left his great wealth and his priceless collection of art treasures to Sir Richard Wallace (1818–1890), his reputed half-brother, and Wallace's widow, who died in 1897, bequeathed the collection to the British nation. It is now in Hertford House, formerly the London residence of the marquesses of Hertford.

HERTFORD, county town of Hertfordshire, England, 24 m. N. from London. Pop. (1921) 10,702. Hertford was the scene of a synod in 673. Its communication with London by way of the Lea and the Thames gave it strategic importance during the Danish occupation of East Anglia. In 1066 and later it was a royal garrison and burgh. It made separate payments for aids to the Norman and Angevin kings; and in 1331 was governed by a bailiff. A charter of incorporation (1555) was confirmed under Elizabeth and in 1606. A grant of fairs in 1226 probably originated or confirmed those held in 1331 on the feasts of the Assumption and of St. Simon and St. Jude, their vigils and morrows, which fairs were confirmed by Elizabeth and Charles II. Another on the vigil, morrow and feast of the Nativity of the Virgin was granted by Elizabeth: its date was changed to May-day under James I. Modern fairs are on the third Saturday before Easter, May 12, July 5 and Nov. 8. The modern churches of St. Andrew and of All Saints are on old sites; the castle retains the wall and part of a tower of the Norman period. The town is one of several twin-towns in eastern England (*see* W. Page, *Archaeologia*, vol. lxix., 1918–19). Hertford has a considerable agricultural trade, and there are maltings and breweries. Brushes and gloves are also manufactured. Two miles S.E. of the town is Haileybury College, founded in 1805 by the East India Company for their civil service students, who were then temporarily housed in Hertford Castle.

HERTFORDSHIRE (abbr. Herts.; pron. haht'fŏrd-shĭr), a county of England, bounded N. by Cambridgeshire, N.W. by Bedfordshire, E. by Essex, S. by Middlesex, and S.W. by Buckinghamshire. The area is 634·6 sq.m., and is generally undulating. The north-west of the county consists of a line of chalk hills, an extension of the Chilterns, which sink gradually towards the north-east. Within the county they seldom exceed a height of 600 feet. The hills drop steeply to the north-west, and west of Tring in the south and Ashwell in the north the chalk is covered by gault clay. The chalk dips gently south-eastward until, south of St. Albans and Hertford, it disappears beneath the Eocene Reading beds, which consist of yellow clays and sands, and London clay A great part of the area is covered with glacial gravels, clays and loams. The river Lea, rising near Luton, flows south-east to Hatfield, east by north to Ware, and then south to the Thames, forming part of the eastern boundary of the county. It receives a number of tributaries on the north side, one of which, the Stort, forms the boundary with Essex. In the south-west the river Colne flows past Watford on its way to join the Thames at Staines.

Finds of artefacts point to the human occupation of the open chalk uplands, with their abundance of flints from very early times. This occupation was continued through the Bronze age, as is evidenced by finds of celts, palstaves and socketed axes. Along the chalk hills from Tring to Royston ran the ancient track of the Icknield way. About the beginning of the Christian era Verulamium was the centre of one group of British tribes, and here coins were minted, numbers of which have been found in Hertfordshire. After the Roman Conquest it became an important Roman station on the Watling street from London to the north-west. The east of the county was likewise crossed from near Waltham Cross to Royston by Ermine street. From Verulamium, in the direction of Tring, ran Akeman street, while Stane street, coming from Colchester, entered the county at Bishop's Stortford, and crossed it in the direction of Baldock. The East Saxons in the 6th century settled about Hertford, which in 673 was sufficiently important to be the meeting place of a synod, while in 675 the Witenagemot assembled at a place identified with Hatfield. In 793 Offa of Mercia founded a Benedictine abbey at St. Albans In the 9th century the district was frequently visited by the Danes; and after the peace of Wedmore the country east of the Lea was included in the Dane-law.

After the battle of Hastings William advanced on Hertfordshire and ravaged as far as Berkhampstead, where the Conquest received its formal ratification. In the confiscation of estates which followed, the church was generously endowed, the abbey of St Albans alone holding 172 hides, while Count Eustace of Boulogne, the chief lay tenant, held a vast fief in the north-east of the county.

As a shire Hertfordshire is of purely military origin, being the district assigned to the fortress which Edward the Elder erected at Hertford. It is first mentioned in the Saxon Chronicle in 1011. At the time of the Domesday survey the boundaries were approximately those of the present day, but part of Meppershall, in Bedfordshire, formed a detached portion of the shire and is still assessed for land and income tax in Hertfordshire. Of the nine Domesday hundreds, those of Danais and Tring were consolidated about 1200 under the name of Dacorum; the modern hundred of Cashio, from being held by the abbots of St. Albans, was known as Albaneston, while the remaining six hundreds correspond with those of the present day.

Hertfordshire was originally divided between the dioceses of London and Lincoln. In 1291 that part included in the Lincoln diocese formed part of the archdeaconry of Huntingdon and comprised the deaneries of Berkhampstead, Hitchin, Hertford and Baldock, and the archdeaconry and deanery of St. Albans; while that part within the London diocese formed the deanery of Braughing within the archdeaconry of Middlesex. After the Conquest a large number of religious houses were founded; the

Benedictines established priories for monks and nuns, the Austin canons established a house at Royston in 1180 and the Gilbertines one at Hitchin two centuries later. The Hospitallers and Templars were both established in the county during the 12th century and the mendicant orders also had friaries here.

Scene of Civil Wars.—During the war between John and his barons, the king's army ravaged Hertfordshire, and in 1216 Hertford castle was captured and Berkhampstead castle besieged by Louis of France, who had come over by invitation of the barons. At the time of the rising of 1381 the abbot's tenants broke into the abbey of St. Albans and forced the abbot to grant them a charter. The county was the scene of much fighting during the Wars of the Roses. On the outbreak of the Civil War of the 17th century, Hertfordshire joined with Bedfordshire and Essex in petitioning for peace, and St. Albans was at times the headquarters of the Parliamentarians. In 1535 the jurisdiction of St. Albans had been transferred to the London diocese, the division being otherwise unchanged. In 1846 the whole county was placed within the diocese of Rochester and archdeaconry of St. Albans, and in the next year the deaneries of Welwyn, Bennington, Buntingford, Bishop Stortford and Ware were created, and that of Braughing abolished. In 1864 the archdeaconries of Rochester and St. Albans were united under the name of the archdeaconry of Rochester and St. Albans. In 1878 the county, except for a few small parts in the dioceses of London, Oxford and Ely, was placed in the newly created diocese of St. Albans, and formed the archdeaconry of St. Albans, the deaneries being unchanged.

Hertfordshire was closely associated with Essex from the time of its first settlement, and the counties paid a joint fee-farm and were united under one sheriff until 1565, the shire court being held at Hertford. The hundred of St. Albans was at an early date constituted a separate liberty, with independent courts and coroners under the control of the abbot. In 1290 Hertfordshire returned two members to parliament, and in 1298 the borough of Hertford was represented. St. Albans, Bishop Stortford and Berkhampstead acquired representation in the 14th century, but from 1375 to 1553 no returns were made for the boroughs. St. Albans regained representation in 1553 and Hertford in 1623. Under the Reform Act of 1832 the county returned three members. St. Albans was disfranchised on account of bribery in 1852. Hertford lost one member in 1868, and the other by the act of 1885.

Waltham Cross marks the spot where rested the body of Eleanor, queen of Edward I., on its way to Westminster for interment. Among the churches may be mentioned those of Abbots Langley and Hemel Hempstead, both of Late Norman architecture; Baldock, a mixed Gothic building supposed to have been erected by the Knights Templars in the reign of Stephen; Royston, formerly connected with the priory of canons regular; Hitchin of the 15th century; Hatfield, dating from the 13th century but in the main later; Berkhampstead, chiefly in the Perpendicular style, with a tower of the 16th century. Sandridge church shows Norman work with the use of Roman bricks; Wheathampstead church, mainly Decorated, has pre-Norman remains. The remains of secular buildings of importance are those of Berkhampstead castle, Knebworth, the seat of the Lyttons, originally a Norman fortress, rebuilt in the time of Elizabeth in the Tudor style and restored in the 19th century and Rye House, associated with the plot to assassinate Charles II. Hatfield House is the seat of the marquis of Salisbury; Cashiobury House, of the earls of Essex; Gorhambury House was the home of the Bacons, and Panshanger House of the Cowpers.

AGRICULTURE AND TRANSPORT

Hertfordshire has always been an agricultural county, with few manufactures, and at the time of the Domesday survey its wealth was derived almost entirely from its rural manors, with their water meadows, woodlands, fisheries paying rent in eels, and water-mills, the shire on its eastern side being noticeably free from waste land. In Norman times the woollen trade was considerable, and the great corn market at Royston has been famous since the reign of Elizabeth. At the time of the Civil War the malting industry was largely carried on, and saltpetre was produced in the county. In the 17th century Hertfordshire was famous for its horses, and the 18th century saw the introduction of several minor industries, such as straw-plaiting, paper-making and silk weaving.

In 1926 the acreage under crops and grass was 313,033, and 185,982 ac. of this was arable land. Wheat, oats and barley are, in the order named, the chief grain crops. The other plants with large acreages are root crops, potatoes and beans. The acreage of rotation grasses and clover for hay was 28,983. In the south-west large quantities of cherries, apples and strawberries are grown for the London market; and on the best soils near London vegetables are forced by the aid of manure, and more than one crop is sometimes obtained in a year. A considerable industry lies in the growth of watercresses in the pure water of the upper parts of the rivers and the smaller streams. There are several rose-gardens and nurseries. There are some very rich pastures on the banks of the Stort, and also near Rickmansworth on the Colne. Some two-thirds of the area occupied by green crops is under turnips, swedes and mangolds, many cows being kept for the supply of milk and butter to London. Of cows the most common breed is the Suffolk variety; of sheep, Southdowns, Wiltshires and a cross between Cotteswolds and Leicesters. The manufacturing industries are slight; though the great brewing establishments at Watford may be mentioned, and straw-plaiting, paper-making, tanning and brick-making are carried on in various towns. The chalk is sometimes burned for lime and the marl used for cement.

Transport Facilities.—Owing to its proximity to the metropolis, Hertfordshire is particularly well served by railways. On the eastern border there is the L.N.E. (Cambridge line) with branches to Hertford and to Buntingford, while another L.N.E. line passes through the centre by Hatfield, Stevenage and Hitchin, with branches from Hatfield to Hertford, to St. Albans and to Luton and Dunstable, and from Hitchin to Baldock, Royston and so to Cambridge. One line of the L.M.S. passes through St. Albans and Harpenden, with a branch to Hemel Hempstead; another traverses the south-west by Watford, Berkhampstead and Tring, with branches to Rickmansworth and to St. Albans. The Metropolitan and Great Central joint line serves Rickmansworth, and suburban lines of the L.N.E. the Barnet district. The existence of these communications has caused many villages to become large residential centres. Water communications are supplied from Hertford, Ware and Bishop Stortford, southward to the Thames by the Lea and Stort Navigation; and the Grand Junction canal from London to the north-west traverses the south-western corner of the county by Rickmansworth and Berkhampstead. Three great highways from London to the north traverse the county. The Holyhead road passes Chipping Barnet, South Mimms and St. Albans, quitting the county near Dunstable. The Great North road branches from the Holyhead road at Barnet, and passes Potter's Bar, Hatfield, Stevenage and Baldock, with a branch from Welwyn to Hitchin and beyond. Another road follows the Lea valley to Ware, whence it runs to Royston, coincident with the Roman Ermine street and known as the Old North road.

The area of the administrative county is 404,523 ac., with a population of 333,195. The municipal boroughs are Hemel Hempstead, Hertford, St. Albans (a city) and Watford. The county is in the home circuit and assizes are held at Hertford. It has two courts of quarter sessions. All the civil parishes within 12 m. of, or in which no portion is more than 15 m. from Charing Cross, London, are included in the Metropolitan police district. It is divided into five parliamentary divisions—Hemel Hempstead, Hertford, Hitchin, St. Albans, Watford—each returning one member.

See Sir H. Chauncy, *Historical Antiquities of Hertfordshire* (London, 1700; 2nd ed., Bishop Stortford, 1826); N. Salmon, *History of Hertfordshire* (1728); R. Clutterbuck, *History and Antiquities of the County of Hertford* (1815–27); J. E. Cussans, *History of Hertfordshire* (1870–81); *Victoria County History, Hertfordshire* (1902, etc.); *see* also "Visitation of Hertfordshire, 1572–1634," in *Harleian Society's Publ.*, vol. xvii.; *1st Interim Report, Royal Commission on Ancient Monuments: Hertfordshire* (1910), and Royal Commission on Historical Monuments: *Inventory of Hertfordshire* (1910).

HERTHA or **NERTHUS,** in Teutonic mythology, the goddess of fertility, "Mother Earth," stated by Tacitus to be worshipped with orgies and mysterious rites at night by Teutonic tribes. Her veiled statue was moved from place to place by sacred cows. After the rites the image, vestments and vehicle were bathed in a lake.

HERTLING, GEORG, COUNT VON (1843–1919), German statesman, was born in Darmstadt on Aug. 31, 1843. He was appointed professor of philosophy at Bonn (1880), and at Munich (1882). From 1875 to 1890 and again from 1896 to 1912 he was a member of the Reichstag, from 1909 being for a short time the leader of the Centre (Catholic) party. In 1912 he was appointed president of the Bavarian ministry and minister for foreign affairs, and in 1914 was elevated to the rank of count by King Ludwig III. On Nov. 1, 1917 he accepted the chancellorship of the Reich, which he had refused in July of that year; and for 12 months he strove against the encroachments of the military authorities upon the political affairs of the Empire. The failure of the German offensives in 1918 finally destroyed his hopes of being able to negotiate with the Allies on anything like equal terms and feeling at last unequal to the struggle against the introduction of real parliamentary Government, he resigned on Sept. 30, 1918, and returned to his home at Ruhpolding in Upper Bavaria, where he died on Jan. 4, 1919.

In philosophy, Hertling was a Neo-Thomist. Starting from a teleological conception of the world, he elaborated a political and social philosophy, and declared the conscious furthering of the divine world plan to be a duty for man. With Baeumker, he collaborated in the production of the invaluable series, *Beiträge zur Gesch. der Phil. des Mittelalters*, himself contributing the volume, *Albertus Magnus, Beiträge zu seiner Würdigung* (1914). Hertling's other works include: *Über d. Grenzen d. mechan Naturerklarung* (1875); *Naturrecht u. Sozialpolitik* (1893); *Kleine Schriften zur Zeitgesch. u. Politik* (1897); *Recht, Staat u. Gesellschaft* (1906) and *Erinnerungen aus meinem Leben*, 2 vols. (1919). *See* also K. Hertling: *Ein Jahr in der Reichskanzlei* (1919).

HERTWIG, OSCAR (1849–1922), German embryologist, was born on April 21, 1849, at Friedberg. He studied medicine and science in Jena under Haeckel, in Zürich and in Bonn. He was professor at Jena from 1878 until 1888, when he was transferred to Berlin, where he died on Oct. 26, 1922. Hertwig was the first to show that fertilization is essentially the fusion of two nuclei—that of the egg and that of the sperm. His other contributions to biology include his investigation of the foundations of the germ-layer theory, of the parallelism in gametogenesis in the two sexes of *Ascaris*, and of the malformations of vertebrate embryos called "spina bifida."

Hertwig's publications include: *Studien zur Blättertheorie* (1879–83), *Die Cölomtheorie* (1881) and *Entwicklung des mittleren Keimblattes der Wirbelthiere* (1883—all three in collaboration with his brother Richard); *Das Problem der Befruchtung und der Isotropic des Eies* (1884); *Lehrbuch der Entwicklungsgeschichte des Menschen* (1886; 9th ed. 1910; Eng. trans., 1892); *Die Zelle und die Gewebe* (2 vols., 1893–98; Eng. trans., 2nd ed., 1909); *Der Kampf um Kernfragen der Entwicklungs- und Vererbungslehre* (1909; 2nd ed., 1920); *Die Elemente der Entwicklungslehre des Menschen und der Wirbeltiere* (1900; 4th ed., 1910); *Die Radiumkrankheit tierischer Kumzellin* (1911); *Allgemeine Biologie* (5th ed., 1920); *Das Werden der Organismen* (1916); *Dokumente zur Gesch. des Zeugungslehre* (1918), and his edition of the *Handbuch der Entwicklungslehre der Wirbeltiere* (3 vols., 1901–06).

HERTZ, HEINRICH RUDOLF (1857–94), German physicist, was born at Hamburg on Feb. 22, 1857. On leaving school he studied engineering, but abandoned it in favour of physics. Hertz went to Berlin, where he studied under Helmholtz (*q.v.*). In 1883 he went to Kiel, becoming *Privatdozent*, and there he began the studies in Maxwell's electromagnetic theory which a few years later resulted in the discoveries that rendered his name famous. These were actually made between 1885 and 1889, when he was professor of physics in the Carlsruhe Polytechnic. Helmholtz drew Hertz's attention to a prize offered by the Berlin Academy of Sciences for the experimental establishment of a relation between electromagnetic actions and the polarization of a dielectric, and promised him the assistance of the Institute if he decided to work on the subject. Hertz did not take it up seriously at that time, because he could not think of any procedure likely to prove effective. Later he was able to discover the progressive propagation of electromagnetic action through space, to measure the length and velocity of electromagnetic waves, and to show that in the transverse nature of their vibration and their susceptibility to reflection, refraction and polarization they are in complete correspondence with the waves of light and heat. The result was to establish beyond doubt the electromagnetic nature of light. In 1889 Hertz was appointed to succeed R. J. E. Clausius as ordinary professor of physics in the university of Bonn. There he continued his researches on the discharge of electricity in rarefied gases, only just missing the discovery of the X-rays described by W. C. Röntgen a few years later, and produced his treatise on the *Principles of Mechanics*. This was his last work, for after a long illness he died at Bonn on Jan. 1, 1894. By his premature death science lost one of her most promising disciples.

Hertz's scientific papers were translated into English by D. E. Jones, and published in three volumes: *Electric Waves* (1893), *Miscellaneous Papers* (1896), and *Principles of Mechanics* (1899). The preface contributed to the first of these by Lord Kelvin, and the introductions to the second and third by P. E. A. Lenard and Helmholtz, contain many biographical details.

HERTZ, HENRIK (?1797–1870), Danish poet, was born of Jewish parents in Copenhagen on Aug. 25, 1797 or 1798. In 1826–27 two plays of his were produced, *Mr. Burchardt and his Family* and *Love and Policy;* in 1828 followed the comedy of *Flyttedagen. Amor's Strokes of Genius*, a comedy in rhymed verse (1830), and the anonymous *Gengangerbrevene* (1830) made his reputation. These "Letters from a Ghost" purported to be written by Baggesen who had died four years before; the book was written in defence of J. L. Heiberg (*q.v.*) and was full of satirical humour and fine critical insight. In 1832 he published a didactic poem, *Nature and Art*, and *Four Poetical Epistles*. In 1836 his comedy of *The Savings Bank* enjoyed a great success. He gave the full measure of his genius in the romantic national drama of *Svend Dyrings Hus* (1837), a beautiful and original piece. His other important plays are the historical tragedy *Valdemar Atterdag* (1839); the lyrical drama *Kong René's Datter* (1845), which was translated into almost every European language; the tragedy of *Ninon* (1848); the romantic comedy of *Tonietta* (1849); *A Sacrifice* (1853); *The Youngest* (1854). His lyrical poems appeared in successive collections, dated 1832, 1840 and 1844. From 1858 to 1859 he edited a literary journal entitled *Weekly Leaves*. His last drama, *Three Days in Padua,* was produced in 1869. He died on Feb. 25, 1870.

Hertz is one of the first of Danish lyrical poets. His poems are full of colour and passion, his versification has more witchcraft in it than any other poet's of his age, and his style is grace itself. He has little or nothing of Scandinavian local colour, and succeeds best when he is describing the scenery or the emotions of the glowing south.

His *Dramatic Works* (18 vols.) were published at Copenhagen in 1854–73; and his *Poems* (4 vols.) in 1851–62.

HERTZ, JOSEPH HERMAN (1872–), chief rabbi of the United Hebrew Congregations of the British Empire, was born in Rebrin, Czechoslovakia, on Sept. 25, 1872. Emigrating to America as a child, he was educated at New York City college, Columbia university, where he took the degree of Ph.D., and at the Jewish theological seminary of America. He was a rabbi in Johannesburg, South Africa, from 1898 to 1911 and, during the Boer War, was expelled by President Kruger for pro-British sympathies and for advocating the removal of religious disabilities from Jews and Catholics in the South African republic. From 1906 to 1908 he was professor of philosophy at Transvaal university college. Dr. Hertz was elected to the chief rabbinate in succession to Dr. Hermann Adler, in 1913. In 1920–21 he undertook an extensive pastoral tour, visiting the Jewish communities in South Africa, Australia, New Zealand and Canada. In 1925 he was made one of the board of governors of the University of

Jerusalem.

HERTZBERG, EWALD FRIEDRICH, COUNT VON (1725–1795), Prussian statesman, was born at Lottin, Pomerania, on Sept. 2, 1725. He studied law at Halle, and entered the Prussian government service, rising rapidly until he became chief minister in 1763. For more than 40 years Hertzberg played an active part in the Prussian foreign office. In this capacity he had a decisive influence on Prussian policy, both under Frederick the Great and Frederick William II. At the beginning of the Seven Years' War (1756) he took part as a political writer in the Hohenzollern-Habsburg quarrel, both in his "Motives which have induced the king of Prussia to oppose the intentions of the court of Vienna, and to prevent them from being carried into effect" and in his *Mémoire raisonné sur la conduite des cours de Vienne et de Saxe*, based on the secret papers taken by Frederick the Great from the archives of Dresden. After the defeat at Kolin (1757) he organized the national defence in Pomerania and collected the necessary troops for the protection of the fortresses of Stettin and Colberg. In the same year he conducted the peace negotiations with Sweden, and helped to bring about the peace of Hubertsburg (1763).

In 1772, in a memoir based upon comprehensive historical studies, he defended the Prussian claims to certain provinces of Poland. He also supported by his writings the negotiations on the Bavarian succession (1778) and the peace of Teschen (1779). But in 1780 he failed to uphold Prussian interests at the election of the bishop of Münster. In 1784 appeared Hertzberg's memoir containing a thorough study of the *Fürstenbund*. He championed this creation of Frederick the Great's mainly with a view to an energetic reform of the empire, though the idea of German unity was naturally still far from his mind. In 1785 followed "An explanation of the motives which have led the king of Prussia to propose to the other high estates of the empire an association for the maintenance of the system of the empire." Though the *Fürstenbund* failed to effect a reform of the empire, it at any rate prevented the fulfilment of Joseph II.'s old desire for the incorporation of Bavaria with Austria. The last act of state in which Hertzberg took part under Frederick the Great was the commercial treaty concluded in 1785 between Prussia and the United States.

With Frederick, especially in his later years, Hertzberg stood in very intimate personal relations and was often the king's guest at Sans-Souci. Under Frederick William II. his influential position at the court of Berlin was at first unshaken. Hertzberg was raised to the rank of count in 1786; and Mirabeau would never have attacked him with such violence in his *Secret History of the Court of Berlin* (1788), if he had not seen in him the most powerful man after the king His political system remained on the whole the same under Frederick William II. as it had been under his predecessor. It was mainly characterized by a sharp opposition to the house of Habsburg and by a desire to win for Prussia the support of England, a policy supported by him in important memoirs of the years 1786 and 1787. His diplomacy was directed also against Austria's old ally, France. Hence it was chiefly owing to Hertzberg that in 1787, in spite of the king's unwillingness at first, Prussia intervened in Holland in support of the stadtholder William V. against the democratic French party (*see* HOLLAND: *History*). The success of this intervention, which was the practical realization of a plan very characteristic of Hertzberg, marks the culminating point in his career.

But the opposition between him and the new king, which had already appeared at the time of the conclusion of the triple alliance between Holland, England and Prussia, became more marked in the following years, when Hertzberg, relying upon this alliance, and in conscious imitation of Frederick II.'s policy at the time of the first partition of Poland, sought to take advantage of the entanglement of Austria with Russia in the war with Turkey to secure for Prussia an extension of territory by diplomatic intervention. According to his plan, Prussia was to offer her mediation at the proper moment, and in the territorial readjustments that the peace would bring, was to receive Danzig and Thorn as her portion. Beyond this he aimed at preventing the restoration of the hegemony of Austria in the empire, and secretly cherished the hope of restoring Frederick the Great's Russian alliance.

Deep-rooted differences between him and the king were revealed during these diplomatic campaigns. Hertzberg wished to effect everything by peaceful means, while Frederick William II. was for a time determined on war with Austria. On Polish policy, too, their ideas came into conflict, Hertzberg having always been openly opposed to the total annihilation of the Polish kingdom. The same is true of the attitude of king and minister towards Great Britain. At the conferences at Reichenbach in the summer of 1790, this opposition became more and more acute, and Hertzberg was only with difficulty persuaded to come to an agreement merely on the basis of the *status quo*, as demanded by Pitt. The king's renunciation of any extension of territory was in Hertzberg's eyes impolitic, and this view of his was later endorsed by Bismarck. A letter which came to the eyes of the king, in which Hertzberg severely criticized the king's foreign policy, and especially his plans for attacking Russia, led to his dismissal on July 5, 1791. The king showed himself more and more personally hostile to the ex-minister, and in later years pursued Hertzberg, now quite embittered, with every kind of petty persecution, even ordering his letters to be opened.

Wilhelm von Humboldt excepted, Hertzberg was the most learned of all the Prussian ministers. As a member of the Berlin Academy especially, and, from 1786 onward, as its curator, Hertzberg was active in the world of learning. His yearly reports dealt with history, statistics and political science. The most interesting is that of 1784: *Sur la forme des gouvernements, et quelle est la meilleure*. This is directed exclusively against the absolute system (following Montesquieu), upholds a limited monarchy, and is in favour of extending to the peasants the right to be represented in the diet. He spoke for the last time in 1793 on Frederick the Great and the advantages of monarchy. After 1783 these discourses caused a great sensation, since Hertzberg introduced into them a review of the financial situation, which in the days of absolutism seemed an unprecedented innovation. Hertzberg exerted himself as an academician to change the strongly French character of the Academy and make it into a truly German institution. He showed a keen interest in the old German language and literature. A special "German deputation" was set aside at the Academy and entrusted with the drawing up of a German grammar and dictionary. He also stood in very close relations with many of the German poets of the time, and in 1780 he boldly took up the defence of German literature, which had been disparaged by Frederick the Great in his famous writing *De la littérature allemande*. He died in Berlin on May 22, 1795.

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HERTZOG, JAMES BARRY MUNNIK (1866–), South African politician, was born at Wellington, Cape Colony, April 3, 1866. Educated at Victoria College, Stellenbosch and Amsterdam university, he became a judge in the Orange Free State in 1895, and served through the South African War of 1899–02. He voted against peace at Vereeniging and, frankly hostile to the British connection, he helped to keep alive this anti-British feeling after the war. On the grant of responsible government in 1907, he became attorney general and minister of education in Fischer's ministry, and forthwith began to undo the work of the Crown Colony Administration. He tried to force upon the schools in the Orange River State a system of compulsory bilingualism—Dutch and English—which was crude and impracticable. The director of education resigned, and one of the three inspectors, dismissed without enquiry, won an action for libel against Hertzog in a *cause célèbre*.

In the first Union Cabinet, in 1910, Hertzog became minister of justice under Botha, but his attitude made the position untenable. Hertzog derided Botha's work at the Imperial Conference in London, and repudiated all suggestions of state-aided immigration and of a naval contribution, which Botha was suspected to have favoured. Botha resigned in 1912, took office again, reconstructed his cabinet and left Hertzog out. Hertzog then (Dec. 1913) formed an opposition party with complete independence of Britain as its goal, and his perfervid nationalism made him a power among the old Republican Boers. He made full use of the racial appeal, and fought unremittingly against the Botha-Smuts policy of South African development within the British Empire. His original five supporters in the South African parliament were increased by 1924 to 63, and a working alliance with the Labour party gave Hertzog a majority. Smuts fell, and the Coalition came to power with Hertzog as prime minister. He disclaimed any practical application of his republican policy; the British connection did not in fact weigh heavily enough, and Hertzog was not anti-British, but pro-South African. He contented himself with a pronouncement in 1926 in favour of independent Dominion states, and with the achievement in 1928 of a new national flag of South Africa. In 1925 he brought forward proposals for the settlement of the native question, keenly disputed in South Africa and in Great Britain (*see* also SOUTH AFRICA, UNION OF).

HERULI, a Teutonic tribe belonging either to the northern or the southern portion of the Jutish peninsula. In the reign of Gallienus (A.D. 260–68), they were with the Goths ravaging the coasts of the Black Sea and the Aegean. Soon afterwards, in A.D. 289, they appeared in the region about the mouth of the Rhine. During the 4th century they frequently served together with the Batavi in the Roman armies. In the 5th century the Heruli made piratical incursions in the western seas. At the same time they had a kingdom in central Europe, in or around the basin of the Elbe.

About the beginning of the 6th century they were completely overthrown in war by the Langobardi. Part of them migrated to Sweden, while others crossed the Danube and entered the Roman service, where they were frequently recorded later in connexion with the Gothic wars. In English, Frankish and Scandinavian works they are never mentioned, and there can be little doubt that they were known among the western Teutonic peoples by some other name. Probably they were identical either with the North Suabi or with the Iuti. The name Heruli itself is identified by many with the A.S. *Eorlas* (nobles).

The Heruli remained heathen until the overthrow of their kingdom, and retained many striking primitive customs. When threatened with death by disease or old age, they were required to call in an executioner, who stabbed them on the pyre. Suttee was also customary. Entirely devoted to warfare, they served not only in the Roman armies, but also in those of all the surrounding nations. They disdained the use of helmets and coats of mail, and protected themselves only with shields.

See Georgius Syncellus; Mamertinus, *Paneg. Maximi;* Ammianus Marcellinus; Zosimus i. 39; Idatius, *Chronica;* Jordanes, *De origine Getarum;* Procopius, esp. *Bellum Goticum,* ii. 14 *et seq.; Bellum Persicum,* ii. 25; Paulus Diaconus, *Hist. Langobardorum,* i. 20.

HERVAS Y PANDURO, LORENZO (1735–1809), Spanish philologist, was born at Horcajo (Cuenca) on May 10, 1735. He joined the Jesuits on Sept. 29, 1745, and became successively professor of philosophy and humanities at the seminaries of Madrid and Murcia. When the Jesuit order was banished from Spain in 1767, Hervás settled at Forli, and devoted himself to the first part of his *Idea dell' Universo* (22 vols., 1778–92). Returning to Spain in 1798, he published his *Catálogo de las lenguas de las naciones conocidas* (6 vols, 1800–05), in which he collected the philological peculiarities of 300 languages and drew up grammars of 40 languages. In 1802 he was appointed librarian of the Quirinal Palace in Rome, where he died on Aug. 24, 1809. Max Müller credits him with having anticipated Humboldt, and with making "one of the most brilliant discoveries in the history of the science of language" by establishing the relation between the Malay and Polynesian family of speech.

HERVEY OF ICKWORTH, JOHN HERVEY, BARON (1696–1743), English statesman and writer, eldest son of John, 1st earl of Bristol, by his second marriage, was educated at Westminster school and at Clare Hall, Cambridge. In 1716 his father sent him to Paris, and thence to Hanover to pay his court to George I. He was a frequent visitor at the court of the prince and princess of Wales at Richmond, and in 1720 he married Mary Lepell, who was one of the princess's ladies-in-waiting, and a great court beauty. In 1723 he received the courtesy title of Lord Hervey on the death of his half-brother Carr, and in 1725 he was elected M.P. for Bury St. Edmunds. In 1730 he attached himself to Walpole. He was assumed by William Pulteney to be the author of *Sedition and Defamation display'd with a Dedication to the patrons of The Craftsman* (1731). Pulteney replied, and the quarrel resulted in a duel from which Hervey narrowly escaped with his life. Hervey's influence with the queen enabled him to render valuable service to Walpole. He was vice-chamberlain in the royal household and a member of the privy council. In 1733 he was called to the House of Lords by writ in virtue of his father's barony. He was lord privy seal when the fall of Walpole drove him from his office (July 1742). He predeceased his father, but three of his sons became successively earls of Bristol.

Hervey wrote detailed and brutally frank memoirs of the court of George II. from 1727 to 1737. He gave a most unflattering account of the king, and of Frederick, prince of Wales, and their family squabbles. For the queen and her daughter, Princess Caroline, he had a genuine respect and attachment, and the princess's affection for him was commonly said to be the reason for the close retirement in which she lived after his death. The ms. of Hervey's memoirs was preserved by the family, and published in 1848 under the editorship of J. W. Croker. The ms. had already been subjected to a certain amount of mutilation, and Croker himself softened in some cases the plainspokenness of the original.

HERVIEU, PAUL (1857–1915), French dramatist and novelist, was born at Neuilly (Seine) on Nov. 2, 1857. He was called to the bar in 1877, and, after serving some time in the office of the president of the council, qualified for the diplomatic service, but resigned on his nomination in 1881 to a secretaryship in the French legation in Mexico. He contributed novels, tales and essays to the chief Parisian papers and reviews, and published a series of clever novels, of which the most famous are *Peints par eux-mêmes* (1893), an ironical study written in the form of letters and *L'Armature* (1895), dramatized in 1905 by Eugène Brieux. But his most important work consists of a series of plays: *Les Paroles restent* (Vaudeville, Nov. 17, 1892); *Les Tenailles* (Théâtre Français, Sept. 28, 1895); *La Loi de l'homme* (Théâtre Français, Feb. 15, 1897); *La Course du flambeau* (Vaudeville, April 17, 1901); *Point de lendemain* (Odéon, Oct. 18, 1901), a dramatic version of a story by Vivaut Denon; *L'Enigme* (Théâtre Français, Nov. 5, 1901); *Théroigne de Méricourt* (Théâtre Sarah Bernhardt, Sept. 23, 1902); *Le Dédale* (Théâtre Français, Dec. 19, 1903); and *Le Réveil* (Théâtre Français, Dec. 18, 1905). These plays, which are nearly all *pièces à thèse,* are built upon a severely logical method, the mechanism of which is sometimes so evident as to destroy the necessary sense of illusion. The closing words of *La Course du flambeau*—"*Pour ma*

fille, j'ai tué ma mère"—illuminate the Hervieu method. The riddle in *L'Enigme* (staged at Wyndham's Theatre, London, March 1, 1902, as *Caesar's Wife*) is, however, worked out with great art, and *Le Dédale*, dealing with the obstacles to the remarriage of a divorced woman, is reckoned among the masterpieces of the modern French stage. His last play was *Le Destin est Maître* (1914). He was elected to the French Academy in 1900, and died in Paris on Oct. 25, 1915.

See A. Binet, in *L'Année psychologique*, vol. x.; and *Portrait psychologique de Paul Hervieu* (1914); H. Burckhardt, *Studien zu Paul Hervieu* (1917).

HERWARTH VON BITTENFELD, KARL EBERHARD (1796–1884), Prussian general field-marshal, born at Grosswerther on Sept. 4, 1796, entered the Guards in 1811, and served through the War of Liberation (1813–15). In the Danish War of 1864 he succeeded to the command of the Prussians when Prince Frederick Charles became commander-in-chief of the Allies, and it was under his leadership that the Prussians forced the passage into Alsen on June 29. In the war of 1866 Herwarth commanded the "Army of the Elbe" which overran Saxony and invaded Bohemia by the valley of the Elbe and Iser. His troops won the actions of Hühnerwasser and Munchengrätz, and at Königgrätz formed the right wing of the Prussian army. Herwarth himself directed the battle against the Austrian left flank. In 1870 he was employed in the home area, and in 1871 was created field-marshal before his retirement. He died at Bonn on Sept. 2, 1884.

See *G. F. M. Herwarth von Bittenfeld* (Münster, 1896).

HERWEGH, GEORG (1817–1875), German revolutionary poet, was born at Stuttgart on May 31, 1817, the son of a restaurant keeper. Called out for military service, he had hardly joined his regiment when he committed an act of flagrant insubordination, and fled to Switzerland to avoid punishment. Here he published his *Gedichte eines Lebendigen* (1841), a volume of political poems expressing the fervent aspirations of the German youth of the day. Although the book was confiscated, it soon ran through several editions. The idea of the book was a refutation of the opinions of Prince Pückler-Muskau (*q.v.*) in his *Briefe eines Verstorbenen*. Herwegh returned to Germany in 1842, visiting Jena, Leipzig, Dresden and Berlin—a journey which was described as being a "veritable triumphal progress." His military insubordination appears to have been forgiven and forgotten, for in Berlin King Frederick Willam IV. received him with the memorable words: *Ich liebe eine gesinnungsvolle Opposition* ("I admire an opposition, when dictated by principle"). Herwegh published in Paris in 1844 the second volume of his *Gedichte eines Lebendigen*, which, like the first, was confiscated by the German police. At the head of a revolutionary column of German working men, recruited in Paris, Herwegh took part in the South German rising in 1848; but his raw troops were defeated on April 27 at Schopfheim in Baden. He escaped to Switzerland, where he lived by his pen. He was later (1866) permitted to return to Germany, and died at Lichtenthal near Baden-Baden on April 7, 1875. *Neue Gedichte* (1877) appeared posthumously.

Herwegh's correspondence was published by his son Marcel in 1898. *See* also J. Scherr, *Georg Herwegh, literarische und politische Blätter* (1843); K. Henfold, *Georg Herwegh und seine deutsche Vorbilder* (1916); Baldinger, *Georg Herwegh: Die Gedankenwelt der Gedichte eines Lebendigen* (1917).

HERZBERG, a town in the Prussian province of Hanover, situated under the south-western declivity of the Harz, on the Sieber, 25 m. N.W. from Nordhausen by the railway to Osterode-Hildesheim. Pop. (1925) 4,604. It has manufactures of machinery and art silk and weaving and dyeing works. On a hill south-west of the town lies the castle of Herzberg, which in 1157 came into the possession of Henry the Lion, duke of Saxony, and was one of the residences of a branch of the house of Brunswick.

HERZBERG, a town, in the Prussian province of Saxony, on the Schwarze Elster, 25 m. S. from Jüterbog by the railway Berlin-Röderau-Dresden. It has a church (Evangelical) dating from the 13th century and a mediaeval town hall. Its industries include the founding and turning of metal, agricultural machinery and furniture. Pop. (1925) 3,788.

HERZEN, ALEXANDER IVANOVICH (1812–1870), Russian author, was born in Moscow on March 25, 1812, the illegitimate son of Ivan Yakovlev, a noble. A year later the family returned to Moscow, where Herzen attended the university. In 1834 he was arrested with other youths suspected of revolutionary tendencies, and in 1835 he was exiled to Viatka and worked as a clerk in the civil service. There he remained for seven years, at the end of which he was allowed to exchange to Vladimir, where he edited the official gazette. In 1840 he was allowed to return to Moscow, where he became one of the leaders of the westerners, but he was again arrested, and sent to serve in the Government offices at Nóvgorod until his retirement in 1842. In 1846 his father died, leaving him by his will a very large property. Early in 1847 he left Russia, never to return. From Italy, on hearing of the revolution of 1848, he hastened to Paris, whence he afterwards went to Switzerland. In 1852 he quitted Geneva for London, where he settled for some years, and established a Russian press for the publication of works which could not be printed in Russia. In 1864 he returned to Geneva, and after some time went to Paris, where he died on Jan. 9, 1870.

In 1847 appeared his novel *Kto Vinovat?* (Whose Fault?), and about the same time were published in Russian periodicals the stories which were afterwards collected and printed in London in 1854, under the title of *Prervannuie Razskazui* (Interrupted Tales). In 1850 two works appeared, translated from the Russian manuscript, *Vom anderen Ufer* (From another Shore) and *Lettres de France et d'Italie*. *Vom anderen Ufer* is perhaps his greatest work. It is the bitter fruit of disillusion after the failure of the revolution of 1848; in it he seeks to destroy the romanticism of the revolutionaries and to replace it by the will to revolution. In French appeared also his essay *Du Développement des idées révolutionnaires en Russie*, and his *Memoirs*. Herzen's *Memoirs* are indispensable in the history of the revolution in Europe for the portraits of the revolutionary leaders; and they give a true and vivid picture of his own personality and upbringing. From his "Free Russian Press" in London he issued a great number of Russian works, all levelled against the system of government prevailing in Russia. Some of these were essays, such as his *Baptized Property*, an attack on serfdom; others were periodical publications, the *Polyarnaya Zvyezda* (or Polar Star), the *Kolokol* (or Bell), and the *Golosa iz Rossii* (or Voices from Russia). The *Kolokol* soon obtained an immense circulation, and exercised an extraordinary influence. For three years, it is true, the founders of the "Free Press" went on printing, "not only without selling a single copy, but scarcely being able to get a single copy introduced into Russia"; but after the death of the emperor Nicholas in 1855 Herzen's writings, and the journals he edited, were smuggled wholesale into Russia, and their words resounded throughout that country, as well as all over Europe. For some years his influence in Russia was a living force; the circulation of his writings was a vocation zealously pursued. When the Polish insurrection of 1863 broke out, and he pleaded the insurgents' cause, his reputation in Russia received its death-blow. From that time it was only with the revolutionary party that he was in full accord.

In 1873 a collection of his works in French was commenced in Paris. A volume of posthumous works, in Russian, was published at Geneva in 1870. His *Memoirs* (Eng. trans. by C. Garnett, 6 vols., 1924–27, and by J. D. Duff, Yale, 1923), supply the principal information about his life, a sketch of which appears also in A. von Wurzbach's *Zeitgenossen*, pt. 7 (Vienna, 1871). *See* also the *Revue des deux mondes* for July 15 and Sept. 1, 1854. *Kto Vinovat?* has been translated into German under the title of *Wer ist schuld?* in Wolffsohn's *Russlands Novellendichter*, vol. iii.

HERZL, THEODOR (1860–1904), founder of modern political Zionism (*q.v.*), was born in Budapest on May 2, 1860, and died at Edlach on July 3, 1904. He received a legal education at Vienna, where he afterwards acquired high repute as a literary journalist and a dramatist. All his other claims to renown, however, sink into insignificance when compared with his work as the reviver of Jewish hopes for a restoration to political autonomy. The new nationalism of 1848 did not deprive the Jews of political rights, but it denied them both the amenities of friendly

intercourse and the opportunity of distinction in the university, the army and the professions. Many Jews refused to see in the new anti-Semitism (*q.v.*) which spread over Europe in 1881 any more than a temporary reaction against the cosmopolitanism of the French Revolution. In 1896 Herzl published his famous pamphlet "Der Judenstaat." Holding that the only alternatives for the Jews were complete merging by intermarriage or self-preservation by a national re-union, he boldly advocated the second course. He did not at first insist on Palestine as the new Jewish home, nor did he attach himself to religious sentiment; his solution was economic and political. The influence of his pamphlet, the progress of the movement he initiated, the subsequent modifications of his plans, are told at length in the article ZIONISM.

Herzl rallied the masses with sensational success, and unexpectedly gained the accession of many Jews by race who were indifferent to the religious aspect of Judaism, but he failed to convince the leaders of Jewish thought, who (with such conspicuous exceptions as Nordau and Zangwill) remained deaf to his pleading. He assembled several congresses at Basle (beginning in 1897), and at these congresses were enacted remarkable scenes of enthusiasm for his ideal of "establishing for the Jewish people a publicly and legally assured home in Palestine." Diplomatic interviews, exhausting journeys, impressive mass meetings, brilliant literary propaganda—all these methods were employed by him to the utmost limit of self-denial. In 1901 he was received by the sultan; the pope and many European rulers and statesmen gave him audiences. In 1903, the British Government offered land for an autonomous settlement in East Africa, but an extra-Palestinian site for the Jewish State was strongly opposed by many Zionists This somewhat embittered "territorial" controversy told on Herzl's failing health, and he died in the summer of 1904.

See *Theodor Herzls Tagebücher* (3 vols., 1922). *See* also A. Friedemann, *Das Leben Theodor Herzls* (1914); B. Hagani, *Le Sionisme politique et son fondateur T. Herzl* (1918).

HERZOG, HANS (1819–1894), Swiss general, was born, and died, at Aarau. In 1870 he was commander-in-chief of the Swiss army, which guarded the Swiss frontier, in the Jura, during the Franco-German War, and in February 1871, as such, concluded the Convention of Verrières with General Clinchant for the disarming and the interning of the remains of Bourbaki's army, when it took refuge in Switzerland. In 1875 he became the commander-in-chief of the Swiss artillery.

HERZOG, JOHANN JAKOB (1805–1882), German Protestant theologian, was born at Basle on Sept. 12, 1805. He died on Sept. 30, 1882, at Erlangen, where he had been professor of church history from 1854 to 1877. He prepared the *Realencyklopädie für protestantische Theologie und Kirche* (1853–68, 22 vols.), of which he undertook a new edition with G. L. Plitt (1836–80) in 1877, and after Plitt's death with Albert Hauck (b. 1845). Hauck began the publication of the third edition in 1896 (completed in 22 vols., 1909).

His other works include *Joh. Calvin* (1843), *Leben Ökolampads* (1843), *Die romanischen Waldenser* (1853), *Abriss des gesamten Kirchengeschichte* (3 vols., 1876–82, 2nd ed., 1890–92).

HERZOGENBERG, HEINRICH VON (1843–1900), Austrian musician and friend of Brahms, was born at Graz, Styria, on June 10, 1843, and studied at the Vienna conservatoire. He settled in Leipzig in 1872, and from 1875 to 1885 was conductor of the Bach *Verein*. He was later professor at the Berlin Hochschule, and at Kiel, retiring in 1888. He wrote much chamber music and scholarly church and orchestral works, all of which bear the impress of his intimacy with Brahms.

See J. Kalbeck, *Brahms, in Briefwechsel mit Heinrich und Elisabeth Herzogenberg* (2 vols., 1907).

HESILRIGE (or HESELRIG), **SIR ARTHUR,** 2ND BART. (d. 1661), English parliamentarian, was the eldest son of Sir Thomas Hesilrige, 1st baronet (*c.* 1622), of Noseley, Leicestershire. He sat for Leicestershire in the Short and Long Parliaments in 1640, and took a principal part in Strafford's attainder, the Root and Branch Bill and the Militia Bill of Dec. 7, 1641, and was one of the five members impeached on Jan. 3, 1642. He raised a troop of horse for Essex, fought at Edgehill, commanded in the West under Waller, being nicknamed his *fidus Achates*, and distinguished himself at the head of his cuirassiers, "The Lobsters," at Lansdown on July 5, 1643, at Roundway Down on July 13, at both of which battles he was wounded, and at Cheriton, March 29, 1644. On the occasion of the breach between the army and the parliament, Hesilrige supported the army, took Cromwell's part in his dispute with Manchester and Essex, and on the passing of the Self-denying Ordinance gave up his commission and became one of the leaders of the Independent party in parliament. On Dec. 30, 1647 he was appointed governor of Newcastle, which he successfully defended; he defeated the Royalists on July 2, 1648 and regained Tynemouth. In October he accompanied Cromwell to Scotland, and gave him valuable support in the Scottish expedition in 1650. Hesilrige, though he approved of the king's execution, had declined to act as judge on his trial. Cromwell's expulsion of the Long Parliament threw him into antagonism, and he opposed the Protectorate and refused to pay taxes. He was returned for Leicester to the parliaments of 1654, 1656 and 1659, but was excluded from the two former. He succeeded in again obtaining admission to the Commons in January 1658. On Cromwell's death Hesilrige refused support to Richard; after Richard's downfall he attempted to maintain a republican parliamentary administration, "to keep the sword subservient to the civil magistrate," and when Lambert expelled the parliament, Hesilrige turned to Monk for support, and helped him by securing Portsmouth on Dec 3, 1659. He marched to London, was appointed one of the council of state, and on Feb. 11 became a commissioner for the army. He was completely outwitted by Monk, and trusting to his assurance of fidelity to "the good old cause" consented to the retirement of his regiment from London. At the Restoration his life was saved by Monk's intervention, but he died in the Tower on Jan. 7, 1661.

See article on Hesilrige by C H. Firth in the *Dict. of Nat. Biography*, and authorities there quoted.

HESIOD, the father of Greek didactic poetry, probably flourished during the 8th century B.C. His father had migrated from the Aeolic Cyme in Asia Minor to Boeotia; and Hesiod and his brother Perses were born at Ascra, near Mount Helicon (*Works and Days*, 635). Here, as he fed his father's flocks, he received his commission from the Muses to be their prophet and poet, a commission which he recognized by dedicating to them a tripod—still in existence at Helicon in the age of Pausanias (*see Theogony*, 20–34, *W. and D.* 656; Pausanias ix. 38. 3)—won by him in a contest of song (*see* below) at some funeral games at Chalcis in Euboea. After the death of his father Hesiod is said to have left his native land in disgust at the result of a law-suit with his brother and to have migrated to Naupactus. There was a tradition that he was murdered by the sons of his host in the sacred enclosure of the Nemean Zeus at Oeneon in Locris (Thucydides iii. 96; Pausanias ix. 31); his remains were removed for burial by command of the Delphic oracle to Orchomenus in Boeotia, where the Ascraeans settled after the destruction of their town by the Thespians, and where, according to Pausanias, his grave was to be seen.

Hesiod's earliest poem, the famous *Works and Days*, and according to Boeotian testimony the only genuine one, embodies the experiences of his daily life and work, and, interwoven with episodes of fable, allegory, and personal history, forms a sort of Boeotian shepherd's calendar. The first portion is an ethical enforcement of honest labour and dissuasive of strife and idleness (1–383); the second consists of hints and rules as to husbandry (384–764); and the third is a religious calendar of the months, with remarks on the days most lucky or the contrary for rural or nautical employments. The connecting link of the whole poem is the author's advice to his brother, who appears to have bribed the corrupt judges to deprive Hesiod of his inheritance. In the *Works and Days* the episodes which rise above an even didactic level are the "Creation and Equipment of Pandora," the "Five Ages of the World" and the much-admired "Description of Winter" (by some critics judged post-Hesiodic). The poem also contains the earliest known fable in Greek literature, that of "The Hawk and the Nightingale." It is in the *Works and Days* especially that we glean indications of Hesiod's rank and condition in

life, that of a stay-at-home farmer of the lower class, whose sole experience of the sea was a single voyage of 40 yards across the Euripus, and an old-fashioned bachelor whose misogynic views and prejudice against matrimony have been conjecturally traced to his brother Perses having a wife as extravagant as himself.

The other poem attributed to Hesiod or his school which has come down in great part to modern times is the *Theogony*, a work of grander scope, inspired alike by older traditions and abundant local associations. It is an attempt to work into system, as none had essayed to do before, the floating legends of the gods and goddesses and their offspring. This task Herodotus (ii. 53) attributes to Hesiod, and he is quoted by Plato in the *Symposium* (178 B) as the author of the *Theogony*. The first to question his claim to this distinction was Pausanias, the geographer (A.D. 200). The Alexandrian grammarians had no doubt on the subject; and indications of the hand that wrote the *Works and Days* may be found in the severe strictures on women, in the high esteem for the wealth-giver Plutus and in coincidences of verbal expression. Although, no doubt, of Hesiodic origin, in its present form it is composed of different recensions and numerous later additions and interpolations. The *Theogony* consists of three divisions: (1) a cosmogony, or creation; (2) a theogony proper, recounting the history of the dynasties of Zeus and Cronus; and (3) a brief and abruptly terminated heroögony, the starting-point not improbably of the supplementary poem, the κατάλογος or "List of Women" who wedded immortals, of which all but a few fragments are lost.[1] The proem (1–116) addressed to the Heliconian and Pierian muses, is considered to have been variously enlarged, altered and arranged by successive rhapsodists. The poet has interwoven several episodes of rare merit, such as the contest of Zeus and the Olympian gods with the Titans, and the description of the prison-house in which the vanquished Titans are confined, with the Giants for keepers and Day and Night for janitors (735 *sqq.*).

The only other poem which has come down to us under Hesiod's name is the *Shield of Heracles*, the opening verses of which are attributed by a nameless grammarian to the fourth book of *Eoiai*. The theme of the piece is the expedition of Heracles and Iolaus against the robber Cycnus; but its main object apparently is to describe the shield of Heracles (141–317). It is clearly an imitation of the Homeric account of the shield of Achilles (*Iliad*, xviii. 479) and is now generally considered spurious. Titles and fragments of other lost poems of Hesiod have come down to us: didactic, as the *Maxims of Cheiron;* genealogical, as the *Aegimius*, describing the contest of that mythical ancestor of the Dorians with the Lapithae; and mythical, as the *Marriage of Ceyx* and the *Descent of Theseus to Hades*.

Recent editions of Hesiod include the Ἀγὼν Ὁμήρου κα Ἡσιόδου, the *Contest* (of song) *between Homer and Hesiod*, at the funeral games held in honour of King Amphidamas at Chalcis. This little tract belongs to the time of Hadrian, who is actually mentioned as having been present during its recitation, but is founded on an earlier account by the sophist Alcidamas (*q.v.*). Quotations (old and new) are made from the works of both poets, and, in spite of the sympathies of the audience, the judge decided in favour of Hesiod. Certain biographical details of Homer and Hesiod are also given.

A strong characteristic of Hesiod's style is his sententious and proverbial philosophy (as in *Works and Days*, 24–25, 40, 218, 345, 371). There is naturally less of this in the *Theogony*, yet there, too, not a few sentiments take the form of the saw or adage. He has undying fame as the first of didactic poets (*see* DIDACTIC POETRY), the accredited systematizer of Greek mythology and the rough but not unpoetical sketcher of the lines on which Virgil wrought out his exquisitely finished *Georgics*.

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On the date of Hesiod *see* T. W. Allen in *J. H. S.* (1915), xxxv., who would place his *floruit*, on astronomical and other grounds, *c.* 800 B.C.

(J. DA., J. H. F.)

[1] Part of the poem was called Eoiai, because the description of each heroine began with ἢ οἵη, "or like as." (*See* BIBLIOGRAPHY.)

HESPERIDES, in Greek mythology, maidens who guarded the golden apples which Earth gave Hera on the occasion of her marriage to Zeus. According to Hesiod (*Theogony*, 215) they were the daughters of Erebus and Night; in later accounts, of Atlas and Hesperis, or of Phorcys and Ceto (Schol. on Apoll. Rhod. iv. 1,399; Diod. Sic. iv. 27). They were usually supposed to be three in number—Aegle, Erytheia, Hesperis (or Hesperethusa); according to some, four, or even seven. They lived far away in the west at the borders of Ocean, where the sun sets. Hence the sun (according to Mimnermus *ap.* Athenaeum xi. p. 470) sails in the golden bowl made by Hephaestus from the abode of the Hesperides to the land where he rises again. According to other accounts their home was among the Hyperboreans. The golden apples grew on a tree guarded by Ladon, the ever-watchful dragon. As this is the name of an Arcadian river, Arcadia is possibly the original site of the garden. Heracles (*see* HERCULES) slew the dragon and stole the apples. The golden apples, the gift of Aphrodite to Hippomenes before his race with Atalanta, were plucked from the garden of the Hesperides. (*See* also ERIS.)

HESPERORNIS, an extinct bird from the Mid-Cretaceous of Kansas. *Hesperornis* ("western bird") was a flightless, swimming and diving bird, nearly 4 ft. in length; the bill was long and slender, with teeth set in a continuous groove, filling the lower mandible to the tip, but confined to the basal portion of the upper mandible. Of the wing, only the humerus remained. The legs were strong, directed outward at right angles to the body, and moving together like a pair of oars. (*See* ODONTORNITHES; ORNITHOLOGY.)

HESPERUS, the evening star, son or brother of Atlas [Gr. Ἕσπερος; Lat. Vesper]. Although as a mythological personality he is regarded as distinct from Phosphoros or Heosphoros (Lat. Lucifer), the morning star or bringer of light, the son of Astraeus (or Cephalus) and Eos, the two stars were early identified by the Greeks.

See Diog. Laert viii. 1. 14.; Cicero, *De nat deorum* ii. 20; Pliny, *Nat. Hist.* ii. 6 [8].

HESS, HEINRICH HERMANN JOSEF, FREIHERR VON (1788–1870), Austrian soldier, entered the army in 1805 and after distinguished service in the Napoleonic Wars, became in 1831 chief of staff to Radetzky on his appointment to the command in Austrian Italy. An excellent organizer, he assisted his chief to make the Austrian army in Italy the best in Europe. From 1834–48 he was employed in Moravia and Vienna, but on the outbreak

of revolution returned to Italy as Radetzky's chief of staff and helped to bring the campaign to its successful close. He was promoted quartermaster-general, and in 1849 chief of staff to the Emperor. After serving on various missions abroad, he commanded the Austrian forces in the Crimean War. In 1859, he was sent to Italy after the early Austrian defeats, but could not retrieve the situation. He became field marshal in 1860, and a year later, on resigning his position as chief of staff, he was made captain of the Trabant guard. He died in Vienna in 1870.

See "General Hess" in *Lebensgeschichtlichen Hinrissen* (Vienna, 1855).

HESSE, HERMANN (1877–), German writer and poet, was born at Kalw on July 2, 1877. He wrote a long series of novels, Indian travel sketches and other works. His first volume of poems appeared in 1902, and a selection in 1922. An edition of his collected works was begun in 1925.

HESSE, a republic included in Germany, known until 1866 as Hesse-Darmstadt (*q.v.*). It consists of two main parts, separated by a narrow strip of Prussian territory. The northern part is the province of Oberhessen; the southern consists of the contiguous provinces of Starkenburg and Rheinhessen. There are also a number of small exclaves about Homburg and Wimpfen on the north-west frontier of Württemberg. Oberhessen extends over the water-parting between the basins of the Rhine and the Weser. The Vogelsberg, a volcanic mass culminating in the Taufstein (2,533 ft.), lies in the east of the province. In the west it includes spurs of the Taunus. Between these two systems lies the fertile tract watered by the Wetter, a tributary of the Main. Starkenburg occupies the angle between the Main and the Rhine, and in its south-eastern part includes some of the ranges of the Odenwald. Rheinhessen is separated from Starkenburg by the Rhine, and has that river as its northern as well as its eastern frontier, except at the north-east corner. The territory is a fertile tract of low hills, rising towards the south-west into the northern extremity of the Hardt range.

The area and population of the three provinces of Hesse are as follow:

	sq. m	*1925*
Oberhessen	1269	328,490
Starkenburg	1169	634,621
Rheinhessen	530	384,168
Total	2968	1,347,279

The density per sq m. is thus 454.

The chief towns of the grand duchy are Darmstadt (the capital) and Offenbach in Starkenburg, Mainz and Worms in Rheinhessen and Giessen in Oberhessen. More than two-thirds of the inhabitants are Protestants; the majority of the remainder are Roman Catholics, with some thousands of Jews. Education is compulsory, assisted by state grants. There is a university at Giessen and a technical high school at Darmstadt. More than three-fifths of Hesse is under cultivation. Grain crops, roots, fruit, tobacco and vines are grown. Minerals, in which Oberhessen is much richer than the two other provinces, include iron, manganese, salt and some lignite.

The constitution dates from 1919. The Landtag consists of 70 members, elected by all persons over 20 years of age who have resided three years in the province. It is elected for three years. The three provinces are divided for local administration into 18 circles and 987 communes.

HISTORY

The name of Hesse refers to a country which has had different boundaries and areas at different times. The name is derived from that of a Frankish tribe, the Hessi. The earliest known inhabitants of the country were the Chatti, who lived here during the 1st century A.D. (Tacitus, *Germania, c.* 30), and whose capital, Mattium on the Eder, was burned by the Romans about A.D. 15. "Alike both in race and language," says Walther Schultze, "the Chatti and the Hessi are identical." The Hessians were converted to Christianity after the fall of the Roman empire, mainly through the efforts of St. Boniface; their land was included in the archbishopric of Mainz; and religion and culture were kept alive among them largely owing to the foundation of the Benedictine abbeys of Fulda and Hersfeld. After the accession of Otto in 936 the land quietly accepted the yoke of the mediaeval emperors. From 1137 to 1247 Hesse formed part of Thuringia; and its history properly begins only with the elevation of the landgrave Henry of Hesse to the rank of Prince of the Empire in 1292.

For nearly 300 years the history of Hesse is comparatively uneventful. The land, which fell into two main portions, upper Hesse round Marburg, and lower Hesse round Cassel, was twice divided between two members of the ruling family, but no permanent partition took place before the Reformation. A *Landtag* was first called together in 1387, and the landgraves were constantly at variance with the electors of Mainz, who had large temporal possessions in the country. In 1509 Philip (*q.v.*) became landgrave, and by his vigorous personality brought his country into prominence during the religious troubles of the 16th century. Following the example of his ancestors, Philip cared for education and the general welfare of his land, and the Protestant university of Marburg, founded in 1527, owes its origin to him. When he died in 1567 Hesse was divided among his four sons into Hesse-Cassel, Hesse-Darmstadt, Hesse-Marburg and Hesse-Rheinfels. The lines ruling in Hesse-Rheinfels and Hesse-Marburg, or upper Hesse, became extinct in 1583 and 1604 respectively, and these lands passed to the two remaining branches of the family. The small landgraviate of Hesse-Homburg was formed in 1622 from Hesse-Darmstadt. After the annexation of Hesse-Cassel and Hesse-Homburg by Prussia in 1866, Hesse-Darmstadt remained the only independent part of Hesse.

Hesse-Philippsthal, an offshoot of Hesse-Cassel, was founded in 1685 by Philip (d. 1721), son of the Landgrave William VI. Hesse-Barchfeld was founded in 1721 by Philip's son, William (d. 1761). Both these divisions were mediatized. Hesse-Nassau a province of Prussia was made in 1866 from part of Hesse-Cassel and part of the duchy of Nassau.

Hesse-Cassel.—The earliest ruler of Hesse-Cassel with much claim to remembrance is Charles (1670–1730) who was the first to adopt the system of hiring his soldiers out to foreign powers as mercenaries, as a means of improving the national finances. Frederick II. (1760–85) hired out 22,000 Hessian troops to England for about £3,191,000, to assist in the war against the North American colonies. The reign of the next landgrave, William IX. (1785–1821), was an important epoch in the history of Hesse-Cassel. For the loss in 1801 of his possessions on the left bank of the Rhine he was in 1803 compensated by some of the former French territory round Mainz, and at the same time was raised to the dignity of Elector (*Kurfürst*) as William I. In 1806 he made a treaty of neutrality with Napoleon, but after the battle of Jena the latter, suspecting William's designs, occupied his country, and expelled him. Hesse-Cassel was then added to Jerome Bonaparte's new kingdom of Westphalia; but after the battle of Leipzig in 1813 the French were driven out and on Nov. 21 the elector returned in triumph to his capital.

The elector signalized his restoration by abolishing with a stroke of the pen all the reforms introduced under the French régime, repudiating the Westphalian debt and declaring null and void the sale of the crown domains. Everything was set back to its condition on Nov. 1, 1806; even the officials had to descend to their former rank, and the army to revert to the old uniforms, and powdered pigtails. The estates, indeed, were summoned in March 1815 but the attempt to devise a constitution broke down; their appeal to the federal diet at Frankfurt to call the elector to order in the matter of the debt and the domains came to nothing owing to the intervention of Metternich; and in May 1816 they were dissolved, never to meet again. William I. died on Feb 27, 1821, and was succeeded by his son, William II. Under him the constitutional crisis in Hesse-Cassel came to a head. He was arbitrary and avaricious like his father, and moreover shocked public sentiment by his treatment of his wife, a popular Prussian princess, and his relations with his mistress, one Emilie Ortlöpp, created countess of Reichenbach, whom he loaded with wealth. The July revolution in Paris gave the signal for disturbances;

the elector was forced to summon the estates; and on Jan. 5, 1831, a constitution on the ordinary Liberal basis was signed. This constitution, though repeatedly evaded by the electors, was not formally repealed till 1852, after armed Austrian and Bavarian intervention following on the general defeat of the revolutionary movements of 1848–49. Continual dissensions followed and the 1831 constitution was restored in 1862. In 1866 when the elector threw in his lot with Austria, his troops were defeated and his lands annexed by Prussia.

Hesse-Darmstadt.—The separate history of Hesse-Darmstadt begins with the partition of Hesse in 1567. In 1622 Hesse-Homburg was cut off from it to form an apanage for Frederick (d. 1638) a brother of the reigning landgrave. Hesse-Darmstadt sided with the imperialists in the Thirty Years' War, during which it suffered very severely from the ravages of the Swedes. In this struggle Hesse-Cassel took the other side, and the rivalry between the two landgraviates was increased by a dispute over Hesse-Marburg, the ruling family of which had become extinct in 1604. This quarrel was interwoven with the general thread of the Thirty Years' War, and was not finally settled until 1648, when the disputed territory was divided between the two claimants. During the 18th century the War of the Austrian Succession and the Seven Years' War dealt heavy blows at the prosperity of the landgraviate, which was always loyal to the house of Austria. Louis IX. (1719–90), who served in the Prussian army under Frederick the Great, is chiefly famous as the husband of Caroline (1721–74), "the great Landgravine," who counted Goethe, Herder and Grimm among her friends and was described by Frederick the Great as *femina sexu, ingenio vir.* In April 1790, just after the outbreak of the French Revolution, Louis X. (1753–1830), an educated prince who shared the tastes and friendships of his mother, Caroline, became landgrave. He supported Napoleon with troops from 1805 to 1813, but after the battle of Leipzig he joined the allies. In 1815 the congress of Vienna made several changes in the area and boundaries of Hesse-Darmstadt. Louis secured again a district on the left bank of the Rhine, including the cities of Mainz and Worms, but he made cessions of territory to Prussia and to Bavaria and he recognized the independence of Hesse-Homburg, which had recently been incorporated with his lands. However, his title of grand-duke taken in 1806 was confirmed, and as grand-duke of Hesse and of the Rhine he entered the Germanic confederation. Soon the growing desire for liberty made itself felt in Hesse, and in 1820 Louis gave a constitution to the land; various forms were carried through; the system of government was reorganized, and in 1828 Hesse-Darmstadt joined the Prussian *Zollverein* (*q.v.*). Many concessions were made to the popular will by Louis III. in the revolutionary year 1848, but during the subsequent reaction these were withdrawn, and the period between 1850 and 1871, when Karl Friedrich Reinhard, Freiherr von Dalwigk (1802–80), was chiefly responsible for the government of Hesse-Darmstadt, was one of repression, although some benefits were conferred upon the people. Dalwigk was one of Prussia's enemies, and during the war of 1866 the grand-duke fought on the Austrian side, the result being that he was compelled to pay a heavy indemnity and to cede certain districts, including Hesse-Homburg, which he had only just acquired, to Prussia. In 1871 Hesse-Darmstadt became one of the states of the new German empire. After the withdrawal of Dalwigk from public life at this time a more liberal policy was adopted in Hesse. Many reforms in ecclesiastical, educational, financial and administrative matters were introduced, and in general the grand-duchy may be said to have passed largely under the influence of Prussia. Since the annexation of Hesse-Cassel by Prussia in 1866 the grand-duchy was known simply as Hesse. The grand ducal house lost its power in the revolution of Nov. 1918 together with the rest of the reigning German princes.

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HESSE-CASSEL, a former landgraviate and electorate of Germany, now the district of Cassel in the Prussian province of Hesse-Nassau. (*See* HESSE.)

HESSE-DARMSTADT, a former grand duchy of Germany, after 1866 commonly known simply as Hesse (*q.v.*).

HESSE-HOMBURG, formerly a small landgraviate in Germany, came into separate existence in 1622, and after being mediatized or absorbed for long periods was finally incorporated in Prussia in 1866. (*See* HESSE.)

HESSE-NASSAU, a province of Prussia, bounded by Westphalia, Waldeck, Hanover, the province of Saxony, the Thuringian Republic, Bavaria, Hesse and the Rhine Province. There are small detached portions in Waldeck, Thuringia, etc.; on the other hand the province enclaves the province of Oberhessen belonging to the Republic of Hesse, and the circle of Wetzlar belonging to the Rhine province. Hesse-Nassau was formed in 1867–8 out of territories which accrued to Prussia after the war of 1866, namely, the landgraviate of Hesse-Cassel and the duchy of Nassau, in addition to the territory of Frankfort-on-Main, and certain other small districts. It is now divided into the *Bezirke* of Cassel (Hesse) and Wiesbaden (Nassau *q.v.*).

The province has an area of 6,063 sq.m., and had a population in 1925 of 2,396,871, being the fourth most densely populated province in Prussia. The south-west part is composed of primary rocks, the east of secondary. The east and north parts lie in the basin of the river Fulda, which near the north-eastern boundary joins with the Werra to form the Weser. The Fulda rises in the Wasserkuppe (3,117 ft.), on the Rhöngebirge, which consists of volcanic rocks. The Main forms part of the southern boundary, and the Rhine the south-western; the western part of the province lies mostly in the basin of the Lahn. In the south-west are the Taunus, and the Westerwald, which rise to over 2,000 ft.

The province is hilly and not rich agriculturally, but its forests, the richest in Prussia, give it a large timber trade. The chief trees are beech, oak and conifers. Cattle are bred, while the vine is cultivated chiefly on the slopes of the Taunus. Iron, coal, copper and manganese are mined. The mineral springs are important, including those at Wiesbaden and Homburg. The chief manufacturing centres are Cassel, Eschwege, Frankfort, Fulda, Hanau and Hersfeld. The province is divided for administration into 41 circles (*Kreise*).

HESSE-ROTENBURG, a German landgraviate, which was founded about the year 1700 by a descendant of Maurice, landgrave of Hesse-Cassel (d. 1632), and was broken up in 1834. (*See* HESSE.)

HESSIAN. A jute fabric made as a plain cloth, in various degrees of fineness, width and quality. The original or standard, hessian was 40in. wide, weighed 10½oz. per yd., and known as an 11 Porter, which, in the finished state, contained about 12 threads and 12½ picks per inch. The chief modern types are 9 Porter and 10 Porter, but others are made as low as 4 Porter and as high as 20 Porter. The name is probably of German origin, and the fabric was originally made from flax and tow. Small quantities of cloth are still made from yarns of these fibres, but the jute fibre, owing to its comparative cheapness, has almost supplanted all others.

This useful cloth is employed in countless ways, especially for packing all kinds of dry goods, while large quantities, of different qualities, are made up into bags for sugar, flour, coffee, grain, ore, manure, sand, potatoes, onions, etc. Indeed, these bags usually form the most convenient, and at the same time the cheapest covering for any kind of goods which are not damaged by being crushed.

Certain types are specially treated, dyed black, tan or other colour, or left in their natural colour, stiffened and used for paddings and linings for cheap clothing, boots, shoes, bags and other articles. When dyed in art shades the cloth forms an attractive decoration for stages and platforms, and generally for any temporary erection, and in many cases it is stencilled and then used for

wall decoration. It is also used as a foundation for plaster on house walls and for similar purposes.

The great linoleum industry depends upon certain types of this fabric for the foundation of its products, while large quantities are used for the backs of fringe rugs, spring mattresses and the upholstery of furniture. The great centres for the manufacture of this fabric are Dundee and Calcutta, and every variety of the cloth, and all kinds of hand- and machine-sewn as well as seamless bags are made in the former city. The American name for hessian is burlap; this particular kind is 40in. wide, and is now largely made in Calcutta as well as in Dundee and other places. Since 1900 the weaving of hessian cloth has been established in many countries. (T. W.)

HESSIAN FLY (*Phytophaga destructor*), a small fly native to Europe, extremely destructive to wheat crops, especially in the United States and Canada. It is dark in colour, resembling a mosquito. Its larvae, which are greenish white, attack the stems of wheat, barley and rye. There are two generations annually in most parts of the United States, but only one generation in the more northern States and Canada. The wheat crop especially is frequently damaged by the Hessian fly to an amount which has been estimated at from ten to twenty millions of dollars. The general method of control is to sow wheat late enough to escape the fly. All volunteer wheat plants should be destroyed. The popular name is derived from the fact that the insect is supposed to have been introduced into the United States in straw bedding used for the Hessian troops during the Revolutionary War. (*See* DIPTERA; ENTOMOLOGY; PESTS.)

HESSUS, HELIUS EOBANUS (1488–1540), German Latin poet, was born at Halgehausen in Hesse-Cassel, on Jan. 6, 1488. His family name is said to have been Koch. He entered the University of Erfurt in 1504 and became professor of Latin there in 1517. He was associated with the distinguished men of the time (Johann Reuchlin, Conrad Peutinger, Ulrich von Hutten, Conrad Mutianus), and took part in the political, religious and literary quarrels of the period, finally declaring in favour of Luther and the Reformation. Through the influence of Camerarius and Melanchthon, he obtained a post at Nuremberg (1526), but, finding a regular life distasteful, he again went back to Erfurt (1533), but found his friends gone and the university deserted. In 1536 the Landgrave of Hesse made him professor of poetry and history at Marburg, where he died on Oct. 5, 1540. Hessus, who was considered the foremost Latin poet of his age, was a facile verse-maker, but not a true poet. He wrote local, historical and military poems, idylls, epigrams and occasional pieces, collected under the title of *Sylvae*. His most popular works were translations of the Psalms into Latin distichs (which reached 40 editions) and of the *Iliad* into hexameters. His most original poem was the *Heroïdes* in imitation of Ovid, consisting of letters from holy women, from the Virgin Mary down to Kunigunde, wife of the emperor Henry II.

His *Epistolae* were edited by his friend Camerarius, who also wrote his life (1553). There are later accounts of him by M. Hertz (1860), G. Schwertzell (1874) and C. Krause (1879); *see* also D. F. Strauss, *Ulrich von Hutten* (Eng. trans., 1874). His poems on Nuremberg and other towns have been edited with commentaries and 16th-century illustrations by J. Neff and V. von Loga in M. Herrmann and S. Szamatolski's *Lateinische Literaturdenkmäler des XV. u. XVI. Jahrhunderts* (1896).

HESTIA, in Greek mythology the hearth-goddess (*see* VESTA), daughter of Cronus and Rhea. She is not mentioned as a goddess in Homer, but the hearth is recognized as a place of refuge for suppliants. In post-Homeric religion she is one of the 12 Olympian deities. When Apollo and Poseidon became suitors for her hand she swore to remain a maiden forever, whereupon Zeus bestowed upon her the honour of presiding over all sacrifices. She was chiefly worshipped as goddess of the family hearth; but, as the city union is only the family union on a large scale, she had also, at least in some states, a public cult at the civic hearth in the *prytaneion* or town-hall, where the common hearth-fire round which the magistrates met was ever burning. From this fire, as the representative of the life of the city, intending colonists took the fire which was to be kindled on the hearth of the new colony.

In later philosophy Hestia became the hearth-goddess of the universe—the personification of the earth as the centre of the universe, identified with Cybele and Demeter. She is seldom represented in works of art and plays no important part in legend.

See A. Preuner, *Hestia-Vesta* (1864), the standard treatise on the subject, and his article in Roscher's *Lexikon der Mythologie;* J. G. Frazer, "The Prytaneum," etc. in *Journal of Philology,* xiv. (1885); *Homeric Hymns,* xxix., ed. T. W. Allen and E. E. Sikes (1904); L. R. Farnell, *Cults of the Greek States,* v. (1909).

HESYCHASTS, a quietistic sect which arose, during the later period of the Byzantine empire, among the monks of the Greek church, especially at Mount Athos, then at the height of its fame and influence under the reign of Andronicus the younger and the abbacy of Symeon (ἡσυχασταί, from ἥσυχος, quiet). Owing to various adventitious circumstances the sect came into great prominence politically and ecclesiastically for a few years about the middle of the 14th century. Their doctrine and practice is obviously related to certain well-known forms of Oriental mysticism, according to which in an attitude of entire bodily immobility and concentration a divine light was shed within the soul. This was maintained to be the pure and perfect essence of God Himself, that eternal light which had been manifested to the disciples on Mount Tabor at the transfiguration. The doctrine was taken to affirm two divine substances, a visible and an invisible God, and much controversy ensued until in 1351 the "uncreated light" of Mount Tabor was established as an article of faith for the Greeks, who ever since have been ready to recognize it as an additional ground of separation from the Roman Church.

See article "Hesychasten" in Herzog-Hauck, *Realencyklopädie* (3rd ed., 1900), where further references are given.

HESYCHIUS, grammarian of Alexandria, probably flourished in the 5th century A.D. He was probably a pagan; and the explanations of words from Gregory of Nazianzus and other Christian writers are later interpolations. He has left a Greek dictionary, explaining peculiar words, forms and phrases, often with a reference to the author who used them or to the district of Greece where they were current. Hence the book is of great value for the study of the Greek dialects; and in the restoration of the text of classical authors, and particularly of such writers as Aeschylus and Theocritus, who used many unusual words. Many of the explanations give important facts about the religion and social life of the ancients. Hesychius says that his lexicon is based on that of Diogenianus (itself extracted from an earlier work by Pamphilus), but that he has also used similar works by Aristarchus, Apion, Heliodorus and others.

The best edition is by M. Schmidt (1858–68); in a smaller edition (1867) he attempts to distinguish the additions made by Hesychius to the work of Diogenianus.

HESYCHIUS OF MILETUS, Greek chronicler and biographer, surnamed *Illustrius*, son of an advocate, flourished at Constantinople in the 5th century A.D. during the reign of Justinian. According to Photius, who considered him a truthful historian (cod. 69), he was the author of three important works. (1) *A Compendium of Universal History* in six books, from Belus, the reputed founder of the Assyrian empire, to Anastasius I. (d. 518). A considerable fragment has been preserved from the sixth book, a history of Byzantium from its earliest beginnings till the time of Constantine the Great. (2) *A Biographical Dictionary* (Ὀνοματόλογος or Πίναξ) *of Learned Men,* the chief sources of which were Herennius Philo and the Μουσικὴ ἱστορία of Aeluis Dionysius. Suidas incorporated much of it in his lexicon but his words leave us uncertain whether he himself epitomized Hesychius, or used an already existing epitome. The second view is more generally held, and the epitome referred to, which substituted alphabetical order for arrangement by classes, and included articles on Christian writers, is assigned from internal indications to the years 829–837. Both it and the original work are lost, with the exception of the excerpts in Photius and Suidas. A smaller compilation, chiefly from Diogenes Laërtius and Suidas, with a similar title, is the work of an unknown author of the 11th or 12th century. (3) A *History* of the Reign of Justin I. (518–527) and the early years of Justinian, completely lost.

Editions: J. C. Orelli (1820) and J. Flach (1882); fragments in

C. W. Müller, *Frag. Hist. Graec.* iv. 143 and in T. Preger's *Scriptores originis Constantinopolitanae*, i. (1901); *Pseudo-Hesychius*, by J. Flach (1880); *see* generally C. Krumbacher, *Geschichte der byzantinischen Literatur* (1897).

HETERODYNE RECEPTION is the process of receiving radio waves by combining the received current with locally generated alternating current. The locally generated frequency is commonly different from the frequency of the received current, thus producing beats. This is then called beat reception.

HETEROMORPHOSIS. Not all individuals of a given species show all characters in normal form and number. Monstrosities occur which have more members or heads than usual, or fail in the development of some part (*see* MONSTER). A special class of abnormalities is characterized by the substitution of one kind of organ or region for another. This has been termed "Heteromorphosis." If the head-end of a living being is substituted by a tail-end, or vice-versa, we speak of "Polar Heteromorphosis"; substitution of a member by one of the kind normally found on another segment of the body is "Homoeosis." We know of three causes producing Heteromorphosis: First, when very plastic forms such as hydroids are acted on by external forces their head- and tail-ends may be transposed These animals are attached by rootlike stolons to the ground. A point of the body getting into close contact with the substratum may grow such a stolon. On the other hand, when detached the posterior end may produce hydroid heads. The operating factors may be light, oxygen or gravity, the latter when the stem is turned upside down. The sensitiveness towards these factors varies with different species. The second cause of heteromorphic structures is the process of regeneration under the condition that the lost part cannot be restored as such, whereas the faculty to grow its like has not been lost in the torso. The tail of a tadpole will not be able to regenerate the body, but has been known to grow forward into a second tail. If the head of a flatworm is removed it will grow a heteromorphic head from its cut surface. In this case the inability to produce body and tail is only temporary; tail-ends will appear between the heads, each of these moving with all body regions restored. Thirdly, certain cases of heteromorphic appendages may be explained by a portion of cells getting detached in the embryo and again coalescing, but in a wrong place.

BIBLIOGRAPHY.—J. Loeb, "On some Facts and Principles of Physiological Morphology," *Biol. Lectures* (Woods Hole, 1893–94); W. Bateson, *Materials for the Study of Variation* (1894). *See* also REGENERATION IN ANIMALS and GRAFTING IN ANIMALS. (H. P.)

HETERONOMY, the state of being under the rule of another person (from Gr. ἕτερος and νόμος, the rule of another). In ethics the term is specially used as the antithesis of "autonomy," which, especially in Kantian terminology, treats of the true self as will, determining itself by its own law, the moral law. "Heteronomy" is therefore applied by Kant to all other ethical systems, inasmuch as they place the individual in subjection to external laws of conduct.

HETEROSPORY, the name given in botany to the phenomenon of plants producing two kinds of spores. (*See* PTERIDOPHYTA, PALAEOBOTANY, GYMNOSPERMS.)

HETMAN, a military title formerly in use in Poland; the *hetman wielki*, or great hetman, was the chief of the armed forces of the nation, and commanded in the field, except when the king was present in person. The office was abolished in 1792. From Poland the word was introduced into Russia in the form *ataman*, and was adopted by the Cossacks as a title for their head, who was practically an independent prince, when under the suzerainty of Poland. After the acceptance of Russian rule by the Cossacks in 1654, the post was shorn of its power. "Ataman" or "hetman" was also the name of the elected elder of the *stanitsa*, the unit of Cossack administration. *See* COSSACKS.

HETTSTEDT, a town of Germany, in Prussian Saxony, on the Wipper, and at the junction of the railways Magdeburg-Eisleben and Hettstedt-Halle, 23 m. N.W. of the last town. Pop. (1925) 8,499. Hettstedt is mentioned as early as 1046; in 1220 it possessed a castle; and in 1380 it received civic privileges. When the countship of Mansfeld was sequestrated, Hettstedt came into the possession of Saxony, passing to Prussia in 1815. It has manufactures of pianofortes and cigars. In the neighbourhood are mines of argentiferous copper. Silver, sulphuric acid, nickel and gold are also found in small quantities.

HETZER or **HAETZER, LUDWIG** (d. 1529), Swiss *Anabaptist*, was born at Bischofszell, Switzerland, and studied at Freiburg-im-Breisgau. By 1523 we find him in Zürich, where he published *Judicium Dei*, a small tract against the religious use of images. In 1524 he brought out a tract on the conversion of the Jews, and published a German version of Johann Bugenhagen's brief exposition of the epistles of St. Paul (Ephesians to Hebrews). He was expelled from Augsburg, where he had been working as corrector of the press for Silvan Ottmar, in the autumn of 1525, and made his way through Constance to Basel, where Oecolampadius received him kindly, and then to Zürich. He had gone to the length of rejecting all sacraments, and his relations with Zwingli were difficult; he therefore returned to Basel, and then went to Strasbourg, where, in 1526, he fell in with Hans Dengk or Denck, who collaborated with him in the production of his *opus magnum*, the translation of the Hebrew Prophets, *Alle Propheten nach hebraischer Sprach vertuetscht* (Worms, 1527; Augsburg 1527 and 1528). It was the first Protestant version of the prophets in German, preceding Luther's by five years. Denck died at Basel in Nov. 1527, and Hetzer was arrested at Constance in the summer of 1528. After long imprisonment and many examinations he was beheaded on Feb. 4, 1529.

Hetzer's papers included an unpublished treatise against the essential deity of Christ, which was suppressed by Zwingli; the only extant evidence of his anti-trinitarian views being contained in eight quaint lines of German verse preserved in Sebastian Frank's *Chronica*. The discovery of his heterodox Christology (which has led modern Unitarians to regard him as their protomartyr) was followed by charges of loose living, never heard of in his lifetime, and destitute of evidence or probability.

See Breitinger, "Anecdota quaedam de L. H." in *Museum Helveticum* (1746), parts 21 and 23; Wallace, *Antitrinitarian Biography* (1850); *Dutch Martyrology* (Hanserd Knollys Society) (1856); Th. Keim, in Hauck's *Realencyklopädie* (1899).

HEUGLIN, THEODOR VON (1824–1876), German traveller in north-east Africa, was born on March 20, 1824, at Hirschlanden, Württemberg. In 1850 he went to Egypt where he learnt Arabic, afterwards visiting Arabia Petraea. In 1853 he was appointed Austrian consul at Khartum He travelled in Abyssinia and Kordofan, making a collection of natural history specimens He died at Stuttgart, on Nov. 5, 1876. It is principally by his ornithological labours that Heuglin has taken rank as an independent authority.

His chief works are *Systematische Übersicht der Vögel Nordost-Afrikas* (1855); *Reisen in Nordost-Afrika, 1852–53* (Gotha, 1857); *Syst. Übersicht der Säugetiere Nordost-Afrikas* (Vienna, 1867); *Reise nach Abessinien, den Gala-Ländern*, etc., *1861–62* (Jena, 1868); *Reise in das Gebiet des Weissen Nil*, etc. *1862–64* (Leipzig, 1869); *Reisen nach dem Nordpolarmeer, 1870–71* (Brunswick, 1872–74); *Ornithologie von Nordost-Afrika* (Cassel, 1869–75); *Reise in Nordost-Afrika* (Brunswick, 1877, 2 vols.).

HEULANDITE, mineral of the zeolite group, consisting of hydrous calcium and aluminium silicate, $H_4CaAl_2(SiO_3)_6 3H_2O$. Small amounts of sodium are commonly present, replacing part of the calcium. Crystals are monoclinic, and have a characteristic coffin-shaped habit. They have a perfect cleavage parallel to the plane of symmetry on which the lustre is markedly pearly; on other faces the lustre is of the vitreous type. The mineral is usually colourless or white, sometimes brick-red. The hardness is 3½–4, and the specific gravity 2·2. It closely resembles stilbite (*q.v.*) in appearance, and differs from it chemically only in containing rather less water of crystallization.

Heulandite occurs with stilbite and other zeolites in the amygdaloidal cavities of basaltic volcanic rocks, and occasionally in gneiss and metalliferous veins. The best specimens are from the basalts of Berufjord, in Iceland and the Faroe Islands, and the Deccan traps near Bombay. Crystals of a brick-red colour are from Campsie Fells in Stirlingshire and the Fassathal in the Tirol.

HEVELIUS (HEVEL or HÖWELCKE), **JOHANN** (1611–1687), German astronomer, was born at Danzig, on Jan. 28, 1611. In 1641 he built an observatory in his house, provided with a splendid instrumental outfit; his chief work was the careful charting of the lunar surface, his *Selenographia* (1647) entitling him to be called the founder of lunar topography. He also catalogued 1,564 stars; made observations of sunspots; discovered four comets, and suggested the revolution of such bodies in parabolic paths about the sun. He published two books on comets: *Prodromus cometicus* (1665), and *Cometographia* (1668). He died on Jan. 28, 1687.

See J. F. Weidler, *Historia Astronomiae* (1741); C. B. Lengnich *Hevelius: Anekdoten und Nachrichten* (1780); J. B. J. Delambre, *Histoire de l'astronomie moderne* (1821); H. Westphal, *Leben, Studien und Schriften des Astronomen Johann Hevelius* (1820); F. Bailey, "The Catalogue of Hevelius," in *Memoirs of the Royal Astronomical Society* (vol. xiii. 1843); R Wolf, *Geschichte der Astronomie* (1890–93); *see* also J. C. Puggendorff, *Biographisch-Literarisches Handwörterbuch zur Geschichte der exacter Wissenschaften* (4 vols. Leipzig, 1863–1904); and *Allgemeine Deutsche Biographie* (ed. R. von Liliencron and F. X. Wegele, 68 vols., Leipzig, 1875–1912).

HEWART, GORDON HEWART, 1ST BARON (1870–), British lord chief justice, was born on Jan. 7, 1870, at Bury, Lancashire. A scholar of University college, Oxford, he was called to the bar in 1902 and practised on the northern circuit. After an unsuccessful contest in Northwest Manchester in 1912, in which year he took silk, he was elected as a Liberal for Leicester in 1913, and after the rearrangement of constituencies in 1918 represented the eastern division of that city from 1918 till his retirement from parliament. In Dec. 1916 he was appointed solicitor-general in Lloyd George's Coalition Government. He was made attorney-general in Jan. 1919, and was admitted to the cabinet in 1921. He gave material assistance in the conduct of reconstructive legislation, and took an active part in the final phase of the negotiations with the Sinn Feiners, being one of the signatories of the so-called Irish Treaty. He acted as president of the War Compensation Court from 1922. He had been knighted in 1916; on Jan. 16, 1918, he was sworn of the privy council, and on March 24, 1922, was appointed lord chief justice, being at the same time created Baron Hewart of Bury.

HEWER, the name applied in the North of England coalfields (*i.e.* Northumberland, Durham and Cumberland) to the miner who hews down or "gets" the coal. Elsewhere this individual is variously named pitman, collier, stallman, holer, getter or buttocker. (*See* COAL.)

HEWITT, ABRAM STEVENS (1822–1903), American manufacturer and political leader, was born in Haverstraw (N.Y.), July 31, 1822. His father, John, a Staffordshire man, was one of a party of four mechanics who were sent by Boulton and Watt to Philadelphia about 1790 to set up a steam engine for the city water-works and who in 1793–94 built at Belleville (N.J.), the first steam engine constructed wholly in America. He graduated at Columbia college in 1842, and taught mathematics at Columbia. With Edward Cooper, son of Peter Cooper, he went into the manufacture of iron girders and beams under the firm name of Cooper, Hewitt and Co. His study of the making of gun-barrel iron in England enabled him to be of great assistance to the U.S. Government during the Civil War, when he refused any profit on such orders. The men in his works never struck—indeed from 1873 to 1878 his plant was run at an annual loss of $100,000. In 1871 he was prominent in the reorganization of Tammany after the fall of the "Tweed Ring"; from 1875 until the end of 1886 (except in 1879–81) he was a Representative in Congress; he was one of the House members of the joint committee which drew up the famous Electoral Count act providing for the electoral commission. In 1886 he was elected mayor of New York city over Henry George and Theodore Roosevelt. He broke with Tammany, was not renominated, ran independently for re-election, and was defeated. He died in New York city, on Jan. 18, 1903. He gave liberally to Cooper Union, of which he was trustee and secretary.

HEWLETT, MAURICE HENRY (1861–1923), English novelist, was born on Jan. 22, 1861, the eldest son of Henry Gay Hewlett, of Shaw Hall, Addington, Kent. He was educated at the London International College, Spring Grove, Isleworth, and was called to the bar in the year 1891. He published in 1895 two books on Italy, *Earthwork out of Tuscany,* and (in verse) *The Masque of Dead Florentines. Songs and Meditations* followed in 1897, and in 1898 he won an immediate reputation by his *Forest Lovers,* a romance of mediaeval England. In the same year he printed the pastoral and pagan drama of *Pan and the Young Shepherd,* produced at the Court theatre in March 1905, when it was followed by the *Youngest of the Angels,* dramatized from a chapter in his *Fool Errant.* In *Little Novels of Italy* (1899), a collection of brilliant short stories, he showed a close knowledge of mediaeval Italy. The new and vivid portraits of Richard Coeur de Lion in his *Richard Yea-and-Nay* (1900), and of Mary, queen of Scots, in *The Queen's Quair* (1904) showed real historical sense. *The New Canterbury Tales* (1901) was another volume of stories of English life, but he returned to Italian subjects with *The Road in Tuscany* (1904); in *Fond Adventures, Tales of the Youth of the World* (1905), two are Italian tales, and *The Fool Errant* (1905) purports to be the memoirs of Francis Antony Stretley, citizen of Lucca.

Other novels followed, but his main interest was directed to verse. *The Song of the Plow* (1916) is one of the most considerable English narrative poems of the new century; it describes the fortunes of the English farm labourers from the earliest times down to the present, and contains many fine passages. Other poems were *The Village Wife's Lament* (1918) and *The Lore of Proserpine* (1913) The popularity of his earlier fiction perhaps accounts for the limited appreciation of the real strength and originality of his later work. He died on June 15, 1923, at Broad-Chalke, near Salisbury.

HEXACHORD, in music, the scale of six degrees attributed to Guido d'Arezzo (11th century) and introduced as an improvement on the Greek scale system based on tetrachords or groups of four notes. The six notes making up each hexachord received the names *ut, re, mi, fa, sol, la* from the initial syllables of the lines of a certain hymn to St. John, the melody of which happened to be such that each line began on successive degrees of the hexachordal scale. As, however, the hexachords could begin on either C, F or G the syllabic names of the notes associated with the alphabetical names were not always the same. Thus in the scale of C the note G was *sol,* or G *sol,* whereas in the scale of F it was *re* and was therefore called G *re,* while in the scale of G itself it became naturally G *ut.* Hence in the complete gamut (a word derived from the note just named, *gamma-ut*) each alphabetical note was given a compound name according to the different syllabic names which coincided with it, *e.g.,* G *sol re ut, A la mi re,* and so on. These names remained in use for centuries until the whole system was superseded with the adoption of the octave as the standard group unit and recognition of the modern principles of key-relationship. But the same syllables—*ut, re, mi,* etc.—are still retained, with the addition of *si* for the seventh note, in the musical nomenclature of France and Italy as the names for the notes of the existing diatonic scale of C major.

See Guido d'Arezzo, *Musical Notation.*

HEXAMETER, the earliest known form of classical verse in dactylic rhythm. The word indicates that each line contains six feet or measures (*μέτρα*), whereof the last is always a spondee (– –) or a trochee (– ⏑). When the last foot is a trochee, the pause at the end of the line makes up for the short syllable. The fifth foot is usually a dactyl (– ⏑ ⏑); the rest indifferently dactyls or spondees.

In Latin and Greek it is the invariable metre of epic and didactic poetry; in Latin it is also the metre of satire from the period of Horace onwards. In modern languages, Longfellow, Kingsley, Clough, and several German poets have written hexameters of a sort, substituting accent for quantity. The English verses are usually unsatisfactory, owing to the lack of any real equivalent for a spondee; and the German are much worse, owing to the scarcity of really short syllables. Accent alone cannot give the true effect of either spondee or dactyl. Even the classic Greek poets made many variations in their treatment of the hexameter.

Examples of hexameters are:

Arma vi|rumque ca|no Tro|iae qui | primus ab | oris
these lame | hexame|ters the | strong-winged | music of | Homer
weil du | Helena | hast und | Eidam | ihnen des | Zeus bist.

In ancient authors, according to age and subject matter, hexameters differ widely as regards proportion of dactyls to spondees, avoidance of elision, relation of quantity to accent, and other less obvious features.

HEXAPLA, the term for an edition of the Bible in six versions, and especially the edition of the Old Testament compiled by Origen. (*See* BIBLE: *Old Testament, Texts and Versions.*)

HEXAPODA (hĕks-ăp'ŏ-dą), an alternative name for insects (q.v.), having reference to their three pairs of walking legs.

HEXASTYLE, the term given to a temple or portico that has six columns in front.

HEXATEUCH, the name given to the first six books of the Old Testament (the Pentateuch and Joshua) to mark the fact that these form one literary whole, describing the early traditional history of the Israelites from the creation of the world to the conquest of Palestine. *See* BIBLE (Old Testament: *Canon*), and GENESIS, EXODUS, LEVITICUS, NUMBERS, DEUTERONOMY and JOSHUA.

HEXHAM, a town in Northumberland, England, 21 m. west from Newcastle on the L.N.E. railway. Pop. (1921) 8,843. It lies on the Tyne, and its market square and narrow streets bear many marks of antiquity. It is famous for its great abbey church of St. Andrew. In 1536 the last prior was hanged for being concerned in the Pilgrimage of Grace. The church is a fine monument of Early English work, with interesting Transitional details. There are also fragments of the monastic buildings remaining, and west of the churchyard is the monks' park, known as the Seal. In the town are two strong castellated 14th century towers, known as the Moot Hall and the Manor Office. Aydon castle near Corbridge is a fortified house of the late 13th century; and Dilston or Dyvilston, a typical border fortress dating from Norman times. There is an Elizabethan grammar school. Manufactures are leather gloves and other goods. In the neighbourhood are barytes and coal mines and extensive market gardens.

The church and monastery at Hexham (Hextoldesham) were founded about 673 by Wilfrid, archbishop of York. The church in 678 became the head of the new see of Bernicia, united to that of Lindisfarne about 821; after which the bishop of Lindisfarne held the lordship until it was restored to the archbishop of York by Henry II. In 1545 the archbishop exchanged Hexhamshire with the king for other property. Hexham was a borough by prescription, as early as 1276, and the same form of government continued in force until the year 1853. In 1227 a market on Monday and a fair on the vigil and day of St. Luke the Evangelist were granted and in 1320 Archbishop Melton obtained the right of holding two new fairs on the feasts of St. James the Apostle lasting five days and of SS. Simon and Jude lasting six days. The market day was altered to Tuesday in 1662, and there was a grant of a cattle market on the Tuesday after the feast of St. Cuthbert in March and every Tuesday fortnight until the feast of St. Martin. The market rights were purchased by the town in 1886.

HEYDEN, JAN VAN DER (1637–1712), the Dutch painter, was born at Gorcum in 1637, and died at Amsterdam on March 28, 1712. He was an architectural landscape painter. According to Houbraken he was first apprenticed to a glass painter. There is no evidence to show who was his master. What distinguishes his work is the careful and detailed draughtsmanship. It is said of him that he painted every brick in his buildings and the mortar in the joints. The compositions are pleasing—the clear atmosphere, the play of the sunlight, the colour of the various buildings, the green of the foliage, contribute to a fine colour scheme, the scenes enlivened by accessory figures. In 1690 he published his *Brandspiritenboek* (Fire engine book) for which he etched a number of plates. His work may be seen in most European galleries and is also found in numerous private collections. Besides his architectural pieces and landscapes he left a small number of studies of still life and some charming studies in chalk.

See Hofstede de Groot, *Catalogue of Dutch Painters* (1927); C. G.'t Hooft edited a volume of reproductions of Van der Heyden's views of Amsterdam in 1912, on the second centenary of the painter's death.

HEYLYN or **HEYLIN, PETER** (1600–1662), English historian and controversialist, was born at Burford in Oxfordshire. He entered Hart Hall, Oxford, in 1613, afterwards joining Magdalen college; and in 1618 he began to lecture on cosmography and became fellow of Magdalen. He disputed with John Prideaux, regius professor of divinity at Oxford, replied to the arguments of John Williams in his pamphlets, "A Coal from the Altar" and "Antidotum Lincolnense," assisted William Noy to prepare the case against Prynne for the publication of his *Histriomastix,* and made himself useful to the Royalist party in other ways. He joined the king at Oxford in 1642. At Oxford Heylyn edited *Mercurius Aulicus,* a vivacious but virulent news-sheet; consequently his rectory at Alresford was plundered and his library dispersed. After some years of wandering and poverty he settled in 1653 at Lacy's Court, Abingdon, where he resided undisturbed by the Government of the Commonwealth. His numerous works include *Cyprianus Anglicus, or the history of the Life and Death of William Laud,* a defence of Laud and a valuable authority for his life; *Ecclesia restaurata, or the History of the Reformation of the Church of England* (1661; ed. J. C. Robertson, 1849); and *A Survey of France* (1625), a work frequently reprinted. He died on May 8, 1662

HEYN, PIETER PIETERZOON (commonly abbreviated to **PIET**) (1578–1629), Dutch admiral, was born at Delfshaven in 1578. In Sept. 1628 he captured the Spanish fleet carrying bullion from the American mines. The total loss was estimated by the Spaniards at four millions of ducats. Soon thereafter Heyn was given command of the naval force of the Republic, with the rank of lieutenant admiral of Holland, in order to clear the Channel and the North Sea of the Dunkirkers, acting for the king of Spain in his possessions in the Netherlands. In June 1629 he severely defeated the Dunkirkers, but was killed in the fight.

See de Jonge, *Geschiedenis van het Nederlandsche Zeewezen;* I. Duro, *Armada Espanola,* iv.; der Aa, *Biograph. Woordenboek der Nederlanden.*

HEYNE, CHRISTIAN GOTTLOB (1729–1812), German classical scholar was born on Sept. 25, 1729, at Chemnitz, Saxony. In 1748 he entered the University of Leipzig. In 1752 he went to Dresden on the invitation of Count von Brühl, the prime minister, from whom, however, he got no more than a post as clerk in the count's library with a miserable salary. He published his first edition of *Tibullus* in 1755, and in 1756 his *Epictetus.* In the latter year the Seven Years' War broke out, and Heyne was compelled to support himself by tutoring, being driven from place to place by the war. The bombardment of Dresden on July 18, 1760, destroyed all his possessions, including an almost finished edition of Lucian, based on a valuable codex of the Dresden library. In the summer of 1761, although still without any fixed income, he married, and at the end of 1762 he was enabled to return to Dresden, where he was commissioned by P D. Lippert to prepare the Latin text of the third volume of his *Dactyliotheca* (an account of a collection of gems). In 1763 he obtained a professorship at Göttingen, and his growing celebrity brought him offers from other German Governments, which he persistently refused. He died on July 14, 1812. He was the first to attempt a scientific study of Greek mythology.

Of Heyne's numerous writings, the following may be mentioned. Editions, with copious commentaries, of Tibullus (ed. E. C. Wunderlich, 1817), Virgil (ed. G. P. Wagner, 1830–41), Pindar (3rd ed. by G. H. Schäfer, 1817), Apollodorus, *Bibliotheca Graeca* (1803), Homer, *Iliad* (1802); *Opuscula academica* (1785–1812), dissertations of which the most valuable are those relating to the colonies of Greece and the antiquities of Etruscan art and history. His *Antiquarische Aufsätze* (1778–79) is a valuable collection of essays connected with the history of ancient art.

See biography by A. H. Heeren (1813) which forms the basis of the interesting essay by Carlyle (*Misc. Essays,* ii.); H. Sauppe, *Göttinger Professoren* (1872); C. Bursian in *Allgemeine deutsche Biographie,* xii.; J. E. Sandys, *Hist. Class. Schol.* (1908), iii. 36–44.

HEYSE, PAUL JOHANN LUDWIG (1830–1914), German novelist, dramatist and poet, was born at Berlin on March 15, 1830, the son of the philologist K. W. L. Heyse (1797–1855). He studied classics, and then the Romance languages at Bonn, and, before he had completed his course, wrote a tragedy, *Francesca von Rimini*. After a year's stay in Italy, he was summoned, early in 1854, by King Maximilian II. to Munich. Heyse was a master of the short story. He published at Munich in 1855 four in one volume, one of which, *L'Arrabbiata*, showed his genius. Many other volumes of stories appeared in due course, and in these his most characteristic work is to be found. Heyse worked on his stories in the spirit of a sculptor; he seized upon some picturesque incident or situation, and chiselled and polished until all the effect which it was capable of producing had been extracted from it. He wrote also several novels, the more important being *Kinder der Welt* (1873), *Im Paradiese* (1875)—the one dealing with the religious and social problems of its time, the other with artist-life in Munich, *Der Roman der Stiftsdame* (1888), and *Merlin* (1892), a novel directed against the modern realistic movement of which Heyse had been the leading opponent in Germany. He was a prolific dramatist; among the best of his plays are *Die Sabinerinnen* (1859), *Hans Lange* (1866), *Kolberg* (1868), *Die Weisheit Salomos* (1886), and *Maria von Magdala* (1903). His best stage pieces were, however, the one-act plays corresponding in their scope to his short stories. There are masterly translations by him of Leopardi, Giusti and other Italian poets (*Italienische Dichter seit der Mitte des 18ten Jahrhundert*, 4 vols., 1888–1890). Some of the translations of Shakespeare in the Bodenstedt edition are by him. His collected works contain many admirable original lyrics and some admirable verse tales Heyse received the Nobel prize for literature in 1910. He died at Munich on April 2, 1914.

See his autobiography, *Jugenderinnerungen und Bekenntnisse* (1901). Also O. Kraus, *Paul Heyses Novellen und Romane* (1888); E. Petzet, *Paul Heyse als Dramatiker* (1904), and the essays by T. Ziegler (in *Studien und Studienköpfe*, 1877), and G. Brandes (in *Moderne Geister*, 1887); Spiero, *Paul Heyse* (1910); H. Raff, *Paul Heyse* (1910). A new edition of Heyse's *Gesammelte Werke* appeared in 1924 (15 vols.). *See* his *Briefwechsel* with J. Burckhardt (1916), with Th. Storm (ed. G. Plottke 1917–1918), with G. Keller (ed. Kalbeck, 1919), and with E. Geibel (ed. F. E. A. Geibel, 1922).

HEYSHAM, seaport, urban district, Lancaster parliamentary division, Lancashire, England, on the south shore of Morecambe bay, served by the L.M.S. railway. Pop. (1921) 5,027; area 1,974 acres. A harbour was opened in 1904 by the Midland (now L.M.S.) railway. The harbour is enclosed by breakwaters, and has a depth of 17 ft. at low tide. It has extensive accommodation for live stock and merchandise, and has regular services with Belfast and other Irish ports. Heysham is in some favour as a watering-place. The church of St. Peter is mainly Norman, and has fragments of even earlier date. Ruins of a very ancient oratory stand near it. This was dedicated to St. Patrick, and is traditionally said to have been erected as a place of prayer for those at sea.

HEYWOOD, JASPER (1535–1598), son of John Heywood (*q.v.*), who translated into English three plays of Seneca, the *Troas* (1559), the *Thyestes* (1560) and *Hercules Furens* (1561). He died at Naples on Jan. 9, 1598. His translations of Seneca were supplemented by other plays contributed by Alexander Neville, Thomas Nuce, John Studley and Thomas Newton. Newton collected these translations in one volume, *Seneca, his tenne tragedies translated into Englysh* (1581). The importance of this work in the development of English drama can hardly be overestimated.

See Dr. J. W. Cunliffe, *On the Influence of Seneca upon Elizabethan Tragedy* (1893).

HEYWOOD, JOHN (b. 1497), English dramatist, known to his contemporaries as "merry John Heywood," was probably the son of William Heywood, who was coroner of Coventry in 1505–06. In 1519 John Heywood was in receipt of a quarterly payment in the king's music book as "player of the virginals," and later he appears as a "singer." In 1528 he was granted a pension of £10 a year; from time to time he received emoluments and grants which show that he was in high favour at court under Edward VI. and Mary. As early as 1538 he "played an interlude with his children" before the princess Mary. He may have owed his introduction to her to Sir Thomas More, for he evidently belonged to the More circle; two at any rate of the pieces commonly attributed to him show strong evidence of More's influence. Moreover, his wife, Joan Rastell, was a daughter of the printer, John Rastell, who was More's brother-in-law He was attached to the old religion, and in 1564, when a commission was appointed by Elizabeth to enforce the Act of Uniformity, he left England and took refuge in Belgium at Malines. From there he wrote in 1575 to Lord Burleigh, saying that he was an old man of 78, and asking that his daughter might collect his rents. The date of his death is unknown.

Heywood's name was actually attached to four interludes: *The Playe called the foure PP; a newe and a very mery interlude of a palmer, a pardoner, a potycary, a pedler* (not dated), is a contest in lying, easily won by the palmer, who said he had never known a woman out of patience. *The Play of the Wether, a new and a very mery interlude of all maner of Wethers* (printed 1533), describes the chaotic results of Jupiter's attempts to suit the weather to the desires of a number of different people. *The Play of Love* (printed 1533) is an extreme instance of the author's love of wire-drawn argument. *The Dialogue of Wit and Folly* is more of an academic dispute than a play. But two pieces usually assigned to Heywood, though printed by Rastell without any author's name, are *The Mery Play between the Pardoner and the Frere, the Curate and Neybour Pratte* (printed 1533, but probably written much earlier), and the *Mery Play betwene Johan Johan the Husbande, Tyb the Wyfe, and Syr Jhan the Preest* (printed 1533). These two pieces show the strong influence of Sir Thomas More, but there does not seem to be any ground for excluding them from the list of Heywood's plays. Heywood's other works are a collection of proverbs and epigrams, the earliest extant edition of which is dated 1562; some ballads, one of them being the "Willow Garland," known to Desdemona; and a long verse allegory of over 7,000 lines entitled *The Spider and the Flie* (1556), which contains a very energetic statement of the social evils of the time, and especially of the deficiencies of the English law.

The proverbs and epigrams were reprinted by the Spenser Society in 1867; there are modern reprints of *Johan Johan* (1819), *The Foure PP* (Dodsley's *Old Plays*, 1825, 1874), and *The Pardoner and the Frere* (Dodsley's *Old Plays*, 1874). *The Spider and the Flie* was edited by A. W. Ward for the Spenser Society in 1894. For notes and strictures on that edition *see* J. Haber in *Literärhistorische Forschungen*, vol. xv. (1900). *See* also A. W. Pollard's introduction to the reprint of the *Play of the Wether* and *Johan Johan* in *Representative English Comedies* (1903); *The Dramatic Writings of John Heywood*, edited by John S. Farmer for the Early English Drama Society (1905); and A. W. Reed, *Early Tudor Drama* (1926).

HEYWOOD, THOMAS (d. 1641), English dramatist and miscellaneous author, was a native of Lincolnshire, born about 1570, and said to have been educated at Cambridge. Heywood is mentioned by Philip Henslowe as having written a book or play for the Lord Admiral's company of actors in Oct. 1596; and in 1598 he was regularly engaged as a player in the company in which he presumably had a share, as no wages are mentioned. He was later a member of other companies, of the earl of Derby's and of the earl of Worcester's players, afterwards known as the Queen's Servants. In his preface to the *English Traveller* (1633) he describes himself as having had "an entire hand or at least a main finger in 220 plays." Of this number, probably considerably increased before the close of his dramatic career, only a score survive. He wrote for the stage, not for the press, and protested against the printing of his works, which he said he had no time to revise. He was, said Tieck, the "model of a light and rapid talent," and his plays, as might be expected from his rate of production, bear little trace of artistic elaboration. Charles Lamb called him a "prose Shakespeare." It is true that Heywood had a keen eye for dramatic situations and great constructive skill, but his powers of characterization were not on a par with his stagecraft. He delighted in what he called "merry accidents," that is, in coarse, broad farce; his fancy and invention were inexhaustible. It was in the domestic drama of sentiment that he won his most distinctive success. For this he was especially fitted by

his genuine tenderness and his freedom from affectation, by the sweetness and gentleness for which Lamb praised him. His masterpiece, *A Woman kilde with kindnesse* (acted 1603; printed 1607), is a type of the *comédie larmoyante*, and *The English Traveller* (1633) is a domestic tragedy scarcely inferior to it in pathos and in the elevation of its moral tone. His first play was probably *The Foure Prentises of London: With the Conquest of Jerusalem* (printed 1615, possibly acted as early as 1592 under the title *Godfrey of Bulloigne*). The two parts of *King Edward the Fourth* (printed 1600), sometimes attributed to Heywood, and of *If you know not me, you know no bodie; Or, the Troubles of Queene Elizabeth* (1605 and 1606) are chronicle histories. His other comedies include: *The Royall King, and the Loyall subject* (acted perhaps *c.* 1602; printed 1637); *A Challenge for Beautie* (1636); *The Wise-Woman of Hogsdon* (perhaps acted *c.* 1604; printed 1638); and *Fortune by Land and Sea* (acted *c.* 1607; printed 1655), with William Rowley. The five plays called respectively *The Golden, The Silver, The Brazen* and *The Iron Age* (the last in two parts), dated 1611, 1613, 1613, 1632, are series of classical stories strung together with no particular connection except that "old Homer" introduces the performers of each act in turn. The tragedy of the *Rape of Lucrece* (1608) is varied by a "merry lord," Valerius, who lightens the gloom of the situation by singing comic songs. A series of pageants, most of them devised for the City of London, or its guilds, by Heywood, were printed in 1637. For other plays attributed to Heywood *see* the authorities mentioned in the bibliography. Thomas Heywood was buried at Clerkenwell on Aug. 16, 1641.

Besides his dramatic works, he was the author of *Troia Britannica, or Great Britain's Troy* (1609), a poem in 17 cantos "intermixed with many pleasant poetical tales" and "concluding with an universal chronicle from the creation until the present time"; *An Apology for Actors, containing three brief treatises* (1612), edited for the Shakespeare Society in 1841; *Γυναικεῖον or nine books of various history concerning women* (1624); *England's Elizabeth, her Life and Troubles during her minority from the Cradle to the Crown* (1631); *The Hierarchy of the Blessed Angels* (1635), a didactic poem in nine books, *Pleasant Dialogues, and Dramas selected out of Lucian, etc.* (1637; ed. W. Bang, Louvain, 1903); and *The Life of Merlin surnamed Ambrosius* (1641).

See A. W. Ward, *History of English Dram. Lit.* ii. 550 *seq.* (1899); the same author's Introduction to *A woman killed with kindness* ("Temple Dramatists," 1897); J. A. Symonds in the Introduction to *Thomas Heywood* in the "Mermaid" series (new issue, 1903); E. K. Chambers, *The Elizabethan Stage* vol. iii. (1923). *See* also Heywood's *Dramatic Works* (2 vols., Shakespeare Soc., ed. B. Field and J. Collier, 1842–51); *Dramatic Works*, Pearson Reprints (6 vols., 1874); *Best Plays*, "Mermaid" series (ed. A. W. Verity, 1888).

HEYWOOD, municipal borough, Heywood and Radcliffe parliamentary division, Lancashire, England, 9 m. N. of Manchester on the L.M.S. railway. Pop. (1921) 26,693. It is of modern growth. The Queen's park (opened 1879) was laid out at a cost of £11.000 with money which devolved to Queen Victoria from her duchy and county palatine of Lancaster. Heywood owes its rise to the Peels, its first manufactures being introduced by the father of the first Sir Robert Peel. It is an important seat of the cotton manufacture, and there are power-loom factories, iron foundries, chemical works, boiler-works and railway wagon works. Coal is worked extensively in the neighbourhood. Heywood was incorporated in 1881. Area, 3,658 acres.

HEZEKIAH, son and successor of Ahaz, one of the greatest of the kings of Judah. He flourished at the end of the 8th and the beginning of the 7th century B.C. in critical times. There are difficulties about the chronology of his reign, the one fixed point being 701 B.C. when Judah was invaded by Sennacherib. Whether he came to the throne before or after the fall of Samaria (722–721 B.C.) is disputed. Shortly before 701 B.C. the whole of western Asia was in a ferment; Sargon had died and Sennacherib had come to the throne (in 705); vassal kings plotted to recover their independence and Assyrian puppets were removed by their opponents. Judah was in touch with a general rising in S.W. Palestine, in which Ekron, Lachish, Ascalon (Ashkelon) and other towns of the Philistines were supported by the Kings of Muṣri and Meluḫḫa. Sennacherib completely routed them at Eltekeh (a Danite City), and thence turned against Hezekiah, who had been in league with Ekron. In this invasion Sennacherib claims entire success; 46 towns of Judah were captured, 200,150 men and many herds of cattle were carried off among the spoil, and Jerusalem itself was closely invested. Hezekiah was imprisoned "like a bird in a cage"—to quote Sennacherib.

The brief accôunt in 2 Kings xviii. 14–16, supplements the Assyrian record by the statement that Sennacherib besieged Lachish, a fact which is confirmed by a bas-relief (now in the British Museum) depicting the king in the act of besieging the town. This historical fragment is followed in 2 Kings by two narratives which tell how the king sent an official from Lachish to demand the submission of Hezekiah and conclude with the unexpected deliverance of Jerusalem. Both these stories appear to belong to a biography of Isaiah, and are open to the suspicion that historical facts have been subordinated to idealize the work of the prophet (*cf.* the similar accounts about Elijah and Elisha). *See* KINGS, FIRST AND SECOND BOOKS OF.

The narratives are (*a*) 2 Kings xviii. 13, 17–xix. 8; *cf.* Isa. xxxvi. i.–xxxvii. 8, and (*b*) xix. 9b–35; *cf.* Isa. xxxvii. 9–36 (2 Chron. xxxii. 9, *sqq.* is based on both). Jerusalem's deliverance is attributed to a certain rumour (xix. 7), to the advance of Tirhakah, king of Ethiopia (*v.* 9), and to a remarkable pestilence (*v.* 35) which finds an echo in a famous story related, not without some confusion of essential facts, by Herodotus (ii. 141; *cf.* Josephus *Antiq.* X. i. 5). It has been widely assumed that the two narratives are duplicates. It is, however, much more probable that they refer to different events. Sennacherib really made two expeditions against Judah. In the first of these, 701 B.C., the Assyrian Monarch was bought off by payment of a heavy tribute, *cf.* 2 Kings xviii. 14–16, and deprived Judah of a good deal of territory. In the second expedition which took place after the accession of Tiharkah, King of Egypt, 691 or 688 B.C. occurred the disaster described in 2 Kings xix. 9–35; *cf.* Herodotus II. § 141. An attractive solution of the chronological difficulty would be to reckon the 15 years, extension to Hezekiah from 705, in which case his reign would have been prolonged to 690.

The reforms mentioned in 2 Kings xviii. 1–8, cannot have been carried out until after 701 when the prestige of the Prophet and the Temple had been enormously enhanced by the Deliverance of Jerusalem. The most striking of the reforms was the destruction of the brazen serpent, the cult of which was traditionally traced back to the time of Moses (Num. xxi. 9).

According to Prov. xxv. 1, Hezekiah was a patron of literature (*see* PROVERBS). The hymn which is ascribed to the king (Isa. xxxviii. 9–20, wanting in 2 Kings) is of post-exilic origin (*see* Cheyne, *Introd. to Isaiah, 222 seq.*), but is further proof of the manner in which the Judaean king was idealized in subsequent ages, partly, perhaps, in the belief that the deliverance of Jerusalem was the reward for his piety.

For special discussions, *see* Stade, *Zeits. d. alttest. Wissenschaft*, 1886, pp. 173, *sqq.*; Winckler, *Alttest. Untersuch.*, 26 *sqq.*; Driver, *Isaiah, his Life and Times*, pp. 43–83; A. Jeremias, *Alte Test*, 304–310; K. Fullerton, *Bibliotheca sacra* 1906, pp. 577–634; A. Alt, *Israel u. Agypten* (Leipzig, 1909); Lewy, *Orient. Lit. Zeitung*, 1928, cols. 150–163; also bibliography to ISAIAH. (S. A. C.; G. H. B.)

HIATUS, a break in continuity. In anatomy (*q.v.*) an opening or foramen, as the *hiatus Fallopii*, a foramen of the temporal bone. In logic a hiatus occurs when a link in reasoning is wanting; and in grammar it is the pause made for the sake of euphony in pronouncing two successive vowels which are not separated by a consonant.

HIAWATHA ("he makes rivers"), a legendary chief (*c.* 1450) of the Onondaga tribe of North American Indians. The formation of the League of Six Nations, known as the Iroquois, is attributed to him by Indian tradition. In his miraculous character, Hiawatha is the incarnation of human progress and civilization. He teaches agriculture, navigation, medicine and the arts, conquering by his magic all the powers of nature which war against man. He was adopted as the hero of the well-known poem by Longfellow.

See J. N. B. Hewitt, in *Amer. Anthrop.* for April 1892.

HIBBEN, JOHN GRIER (1861–), American educator, was born at Peoria (Ill.), on April 19, 1861. He graduated at Princeton university in 1882; was a student at Princeton Theological seminary from 1883 to 1886; and later studied at Berlin. In 1887 he was ordained a minister in the Presbyterian Church and was a pastor for four years at Chambersburg, Pennsylvania. In 1891 he returned to Princeton, where he taught logic as an instructor, assistant professor, and from 1907 professor. In 1912 he succeeded Woodrow Wilson as president of the university.

His works include *Inductive Logic* (1896); *The Problems of Philosophy* (1898); *Hegel's Logic* (1902); *Logic Deductive and Inductive* (1905); *The Philosophy of the Enlightenment* (1910); *A Defence of Prejudice and Other Essays* (1911), and *The Higher Patriotism* (1915). He also edited the *Epochs of Philosophy* series.

HIBBING, a village of Saint Louis county, Minn., U.S.A., 75m. N.W. of Duluth. It is served by the Duluth, Missabe and Northern and the Great Northern railways. The population was 15,089 in 1920 (37% foreign-born white) and was estimated locally at over 19,000 in 1928. It lies in the midst of the great iron deposits of the Mesabi range and the beauties of the great "North woods." Shipments from mines in the Hibbing district totalled about 16,000,000 tons in 1923. Underground mining, which prevailed earlier, has been largely superseded by the open-pit method, in which the surface is stripped down to the ore-beds, and the ore is then dipped out with steam shovels. In North Hibbing is the largest open-pit mine in the world: 1¾m. long by ½ to 1m. wide, with a stripped area of 600ac., and an output in 1926 of 4,537,605 gross tons. Hibbing has a fine high school and junior college (built 1920–24), with provision for 3,000 students. The village was settled in 1892, when mining developments began, and was incorporated in 1893.

HIBERNACULUM, in botany a term for a winter bud; in botanical gardens, the winter quarters for plants; in zoology, the winter bud of a polyzoan.

HIBERNATION, the more or less comatose condition in which certain animals pass the winter in cold latitudes. It is commonly referred to as the "Winter-sleep." A similar state of suspended animation, known as aestivation, overtakes some animals which have to contend with prolonged periods of heat or drought. These two kindred states have apparently been evolved as a means of escape from the recurrent shortage of the food-supply, brought about by seasonal change, accompanied by cold in the one case, and by heat and drought in the other.

The persistent association of hibernation with cold weather has had the effect of distracting attention from other important factors. Many cases, indeed, can be cited in support of this belief in the influence of a low temperature; but these must be studied side by side with others which cannot thus be explained. When a survey of all the facts is taken, the importance of cold is seen to have been over-estimated. Hibernation and aestivation occur in every group of vertebrates save birds, and its pre-disposing causes, immediate and remote, are by no means uniform.

Mammals.—Among mammals hibernation occurs in insect-eating bats, hedgehogs and many rodents; among carnivores only in the Arctoidea,—the bears and allied types,—which are partly vegetarian. But we have a very wide divergence in the intensity of the phenomena: "coma" is in some profound, in others intermittent, or feebly developed. Some striking and significant differences are seen among bats. Thus Leisler's bat displays a normally continuous torpidity; while in the pipistrelle, hibernation is intermittent. The reason for this is unknown.

The common hedgehog (*Erinaceus*) displays a puzzling eccentricity in the periods of its torpidity. Careful observations on this animal made by Moffat in Ireland showed that it was only on cold nights that it was roused from its sleep. It showed, however, a progressive decrease in appearances from October to February, when it ceased to emerge altogether. Trustworthy data will only be available after a careful survey of observations taken over several degrees of latitude.

Available evidence seems to show that the state of torpidity in the dormouse is profound. By late September it has become exceedingly fat. In October or November, having finished building its winter-nest, and laid up a store of food, it retires to sleep, curling itself up into a ball with its fore-paws against its cheeks, and its tail wrapped around its head and back. And this sleep may endure for six months. The animal's breathing slows down so as to become almost imperceptible; and it becomes so cold and rigid that it can be rolled like a ball across a table. A mild day *may* arouse it for an hour or two, when it will feed before again relapsing into slumber. By the time of its final emergence, April, most of its fat has disappeared. During the few days just before and after hibernation it is extremely erratic in its behaviour, passing at frequent intervals first into a state of torpidity, then into the most lively activity. A hibernating dormouse can always be aroused, but the process takes about 20 minutes: if left, however, to itself it soon relapses. If the awakening be too rapid, as when warmth is too suddenly applied, death speedily follows. Young dormice born just before the season of retirement generally die forthwith, owing to their inability to accumulate sufficient fat to induce torpor. Certain African dormice (*Graphiurus*) hibernate when brought to Europe.

That food-supply is a more important factor than temperature seems to be shown by the fact that the Marmots of the Yakh-su Valley, Bokhara, at 6,000 ft. go into their winter sleep soon after the middle of August. Two thousand feet higher, where green food is to be had longer, they do not retire till mid-September. The Marmots (*Aretomys*) both of the Old World, and the North American species, like that of woodchucks, retire to their hibernaculum at the time of the autumnal equinox, while the weather is yet warm, and emerge at the vernal equinox before the snows of winter have vanished. Before retiring they have become loaded with fat, and this forms their only reserve for the support of life till their spring awakening. Their near relatives, however, the ground-squirrels or chipmunks, and the gophers of northern Europe and America, before hibernation lay up large stores of roots, seeds and berries for occasional feasts. But none of the true squirrels hibernate. Such as live in northern latitudes, however, it is significant to notice, hide away during the autumn stores of food for future use.

Among the carnivores, the brown bear of north-temperate Europe and Asia, as well as the American grizzly and black bears, hibernate; but there seems reason to question whether they pass into absolute coma. This because, they, like the female polar bear (in which species the adult males, and the immature of both sexes, seem to remain at large throughout the winter, migrating to open water) retire to winter quarters early in the season, being then pregnant. The young are born soon after the turn of the year. This being so, the mother must perforce remain, if not exactly "active," at any rate awake: partly because the temperature of her body and the flow of milk must be maintained. Her only source of nutriment, save accumulated fat, is the faeces expelled by the cub. It is said that defaecation on the part of the mother, at any rate in the case of the brown and black bears, is rendered impossible because the rectum is blocked by a plug known as "tappen," composed of pine-needles, which is not evacuated till the spring.

The racoon-dog (*Nyctereutes procyonides*) of north-east Asia is the only hibernating carnivore outside the Arctoidea though individuals which have failed to accumulate sufficient fat remain at large throughout the winter. The racoon, skunk and badger also pass the severest part of the winter in hibernation.

It has been suggested that hibernating mammals are imperfectly warm-blooded and during hibernation relapse into a "cold-blooded" condition. Hormones have also been shown to have marked effect on hibernation.

Other Vertebrates.—Among reptiles a "winter sleep" in temperate latitudes is the rule. The bodily temperature at no time rising but little above that of the surrounding air, this state of coma in mid-winter would seem inevitable; moreover their food-supply is practically completely cut off. Land tortoises bury themselves in the soil, water-tortoises in the mud on the banks of the stream, or on the bottom. Snakes and lizards retire to crevices in rocks, and, considerable numbers often harbour together possibly for warmth.

Frogs, toads, newts and salamanders, hibernate in dry

holes or clefts, though some frogs, (e.g., *Ranna temporaria*) retreat to the mud at the bottom of ponds. But H. Gadow remarks that though common toads (*Bufo vulgaris*), which he kept in a greenhouse, remained lively throughout the winter, they would withdraw for an occasional sleep of a few weeks at any time of the year. This suggests that a resting period is necessary.

Fishes do not normally hibernate, but some, like carp, during prolonged frost, will descend into the mud until the thaw sets in. And it seems certain that immature plaice, which haunt shallow water, burrow in the sand during the winter.

Invertebrates.—It has already been hinted that hibernation is biologically not so much a reaction to cold as to lack of food. This is shown in the case of many Lepidoptera, as for example the winter moth, December moth and mottled umber, which appear in their adult stage *only* during winter. The cold does not inhibit their vitality, and they have no need for food, since their mouth-parts are vestigial.

Many caterpillars hibernate. Late in July, the female silver-washed fritillary (*Argynnispaphia*) deposits her eggs sometimes 50 ft. above the ground, in the crevices of the bark of trees growing among or near the food plants, the dog-violet. The eggs hatch early in August. Immediately after emergence the tiny larva settles down close to the empty shell, in a crevice of the bark, and sleeps for about eight months. In spring it descends to search for its food-plant.

In the pearl-bordered fritillary (*Argynnis euphrysone*), the eggs are laid on the dog-violet during May and June, and hatch in about 15 days. The larva continues feeding till the end of July, when it hibernates, "selecting for the hibernaculum the under-side of dead crumpled-up leaves, generally two or more close together" (Frohawk). During hibernation it diminishes greatly in size. It is remarkable that "those plants which *were most subjected to cold and wet* appeared most suitable for the health of the larvae." During hibernation the caterpillars shrink to about half their previous size.

Some caterpillars, on the other hand, hibernate at the *end* of larval life, like the sand-dot (*Agrotis ripae*), which in late autumn burrows down into the sand and does not pupate till spring.

Many butterflies hibernate in the imago state; and again, long before the approach of winter. The large tortoise-shell (*Vanessa polychloris*) emerges from the chrysalis in July or August, but almost immediately hibernates. The usual time for its reappearance is April. In the brimstone butterfly (*Gonopteryx rhamni*), some imagos hibernate soon after emergence, while others remain active for some considerable time, but all hibernate before winter. Where butterflies or moths hibernate soon after emergence, pairing does not take place till the spring.

There appears to be no evidence of hibernation among spiders. Where the winter is long, they disappear, but rather because of the absence of suitable cover. If search be made among ground vegetation, or if fallen leaves are shaken over a newspaper, or search is made under stones and logs, spiders are easily found. In true hibernation, the life of the animal is brought almost to a standstill. There is here no need for this period of suspended animation; for spiders are able to fast at any time for many months without distress.

The hibernation of land-snails presents some interesting features. The common garden snail in late autumn retires into crannies, often large numbers are found attached to one another, not so much for the sake of keeping one another warm as because suitable shelter was not easily to be found. Other species retire beneath stones, under dead leaves, in fissures of rocks or walls, or bury themselves in the earth. But all close the shell by a membranous, and sometimes chalky, disc, closely fitting the shell-mouth. Slugs bury themselves, contract till they are almost spherical and secrete a mantle of slime. Some fresh-water snails retire deep into the mud. *Dreissensia*, or zebra mussel, casts off its byssus and retires to the mud in deeper water.

That the phenomena of the hibernation cannot be interpreted in terms of a single explanation is beyond dispute. The factor of cold is, at most, but a secondary agent. The accumulation of fat, again, is not unusual. There are many, which pass into the comatose condition in mid-August, before even slight night-frosts have begun. But all agree in that their winter-sleep, whether continuous, or intermittent, is their only means of escape from starvation during the winter months. All that can be said, at present, is that this common end is attained by varied means in different groups of animals.

Aestivation.—As with hibernating species, respiration, alimentation and secretion almost cease in aestivating animals. But no records seem to have been made as to the temperature of the blood in the warm-blooded types during the "summer-sleep." With some, both among "winter" and "summer-sleepers," the passage into the dormant stage seems to have become a fixed, automatic habit taking place at the appropriate season even when there can be no external stimulus. Thus the tenrec (*Centetes ecaudatus*), a large insectivore of Madagascar, aestivates during the hottest weeks of the year, when the drought induces a shortage of insect food; and captive specimens in the London zoological gardens behaved in exactly the same way, though there was no excessive heat, and an abundance of food was within reach.

Among aquatic fishes and reptiles, aestivation is enforced not so much by lack of food as by the drying up of the waters in which they live. At such times, crocodiles and alligators, bury themselves in the mud, and there remain till released by the rains. The Iberian water-tortoise (*Clemmys leprosa*), on the drying up of the water-courses, retreats under ledges of rocks, where it remains in a state of torpor for months. Even moisture-loving frogs will survive this ordeal of being enclosed in sun-baked mud, into which a retreat is made on the onset of drought.

Among fishes there are many which have to endure a prolonged period of aestivation. One of the best known of these is the African lung-fish (*Protopterus*). As the swamps in which it lives become dried up during the summer, it aestivates till the next rainy season. It dives down into the mud to a depth of about 18 in., then bends the body round till the tail covers the head. A layer of mucus exuded by the skin forms a lining wall around the flask-shaped bottom of the burrow, and at the same time envelops the body of the fish. Around the lips the mucus turns in to form a tubular funnel leading into the mouth to enable air to pass to the lungs. The animal then passes into a state of torpor. Preparatory to retirement, abundant fat is accumulated round the kidneys and gonads. During the imprisonment this is slowly absorbed, and a further source of nutriment is obtained by a partial breaking up of the muscular tissue of the tail. The South American *Lepidosiren*, a near relation of *Protopterus*, and also a swamp dweller, similarly retires to a burrow at the onset of drought.

In both these fishes the air-bladder acts as a lung. But there are other aestivating fishes wherein air-breathing apparatus is furnished within the gill-chamber, as vascular outgrowths, formed in various ways. This is true of the Indian climbing perch (*Anabas*), the Gouramis (*Osphromenidae*), the Indian "serpent heads" (*Ophiocephalidae*) and some cat-fishes (*Clarias, Heterobranchus*). The Senegambian *Clarias lazera* spends several months of the dry season in open burrows from which it emerges at night to crawl about in search of food.

Many frogs aestivate. Baldwin Spencer explored during the dry season a central Australian "clay pan," bordered with shrubs. The ground, hard as a rock, was cut away, and at about a foot below the surface, he came upon a spherical chamber with moist and slimy walls, three inches in diameter, in which lay a dirty-yellow frog (*Cheireolcptes platycephalus*) fast asleep, with the lower eyelids drawn up tightly over the eyes. Its body was puffed out till it was almost spherical, the bladder being enormously distended with water. Later another species of the same genus was found, two others of the genus *Helioporus* and several *Notadon benneti*, all of which had adopted this method of storing moisture. When it is remembered that they must be prepared to spend 12 or 18 months in such a living grave, the need for such provision will be appreciated. Another frog (*Limnodynaster ornatus*) lives in the sand of creek-beds, and emerges at night, when it is comparatively cool, to feed.

Many of the pools contained water-snails, which had developed a remarkable power of tiding over drought. *Bithinia australis*

draws its body far up into the shell, which is closed with a plug formed of earth passed through the intestine. Some specimens were put into a tin, taken to Melbourne, and forgotten for 15 months, when, placed in water, all emerged apparently none the worse. Other animals found included fresh-water mussels, a crab (*Telephusa transversa*), which in other parts of Australia lives where there is no water-failure, and a crayfish (*Engans bicarinatus*).

Some land-snails can withstand very prolonged aestivation. Thus an Egyptian desert snail (*Helix desertorum*), on the assumption that the shell was empty, was fixed to a card in the British museum in March 1846; in March 1850, traces of slime were noted on the tablet, which was immediately immersed in water, when presently the shell became detached from the card and the animal began to crawl about.

In this field, an emphatic emphasis is laid on the relative viability of animals. The plasticity they display in their response to adverse conditions has a surprising range, varying even between related species. It is clear that we can, as yet, but imperfectly interpret these elusive differences and qualities of the living tissues which manifest themselves in the phenomena of hibernation and aestivation.

For physiology of hibernation, *see* ANIMAL HEAT. (W. P. P.)

HIBERNIA, in ancient geography, one of the names by which Ireland was known to Greek and Roman writers. Other names were Ierne, Ἰουερνία, Iberio. All these are adaptations of a stem from which also Erin is descended. The island was well known to the Romans through the reports of traders, so far at least as its coasts. But it never became part of the Roman empire. Agricola (about A.D. 80) planned its conquest, which he judged an easy task, but the Roman government forbade it. (*See* ERIN.)

HIBISCUS, in botany, a genus of plants of the mallow family (Malvaceae), many of which are popularly known as rose-mallow. When broadly defined, the genus comprises about 200 species of herbs, shrubs and trees, native to temperate and tropical regions, but most abundant in the latter. They bear palmately veined, lobed or parted leaves and mostly bell-shaped, frequently very large, scarlet, pink, yellow or white flowers, with the parts, except the numerous stamens, usually in fives. A few species yield food and fibre products but in Great Britain and the United States they are grown chiefly for ornament. Representative economic species are *H. esculentus* (okra or gumbo) and *H. tiliaceus,* a tropical plant which yields a fibre. Among the best known ornamental species are *H. syriacus* (rose-of-Sharon or shrubby althea), *H. Rosa-sinensis* (rose-of-China or shoe-flower) and *H. Trionum* (flower-of-an-hour). The North American *H. Moscheutos,* one of the most popular rose-mallows in cultivation, is native to swamps near the coast from Massachusetts to Florida, and sparingly westward to Indiana and Missouri. (*See* FIBRES; MALVACEAE.)

HICHENS, ROBERT SMYTHE (1864–), English novelist, was born at Speldhurst, Kent, on Nov. 14, 1864 He was educated at Tunbridge Wells and Clifton college, and then became a student at the Royal College of Music, London. He was, however, diverted to journalism and later to fiction. He first attracted serious attention with *The Green Carnation* (1894); but his best known work in fiction was a series of novels with an Eastern setting, beginning with *The Garden of Allah* (1905) and including *The Call of the Blood* (1906) and *Bella Donna* (1909). *The Dweller on the Threshold* (1911) is a good example of his tales of the supernatural. Of his dramatized novels *Bella Donna,* produced at the St. James theatre, London, in 1911–12, and *The Garden of Allah,* produced first in New York and (1920) at Drury Lane, were the most successful.

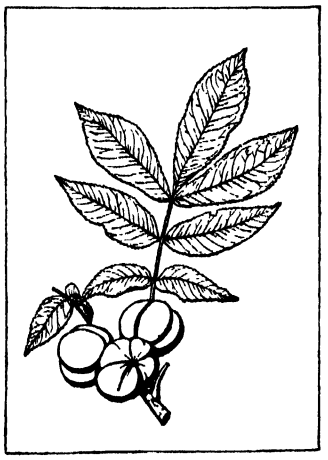
HICKES, GEORGE (1642–1715), English divine and scholar, was born at Newsham near Thirsk, Yorkshire, on June 20, 1642. In 1659 he entered St. John's college, Oxford, whence after the Restoration he removed to Magdalen college and then to Magdalen hall. In 1664 he was elected fellow of Lincoln college, and in 1675 was appointed rector of St. Ebbe's, Oxford. In 1676, as private chaplain, he accompanied the duke of Lauderdale, the royal commissioner, to Scotland. Hickes was vicar of All Hallows, Barking, London (1680), chaplain to the king (1681), and dean of Worcester (1683). He opposed both James II.'s declaration of indulgence and Monmouth's rising, and he tried in vain to save from death his nonconformist brother John Hickes, one of the Sedgemoor refugees harboured by Alice Lisle. At the revolution Hickes, as a nonjuror, was first suspended and afterwards deprived of his deanery. When he heard of the appointment of a successor he affixed to the cathedral doors a "protestation and claim of right." After remaining some time in concealment in London, he was sent by Sancroft and the other nonjurors to James II. in France to discuss episcopal succession; upon his return in 1694 he was consecrated suffragan bishop of Thetford. In 1713 he persuaded two Scottish bishops, James Gadderar and Archibald Campbell, to assist him in consecrating Jeremy Collier, Samuel Hawes and Nathaniel Spinckes as bishops among the nonjurors. He died on Dec. 13, 1715. A posthumous publication of his *The Constitution of the Catholick Church and the Nature and Consequences of Schism* (1716) gave rise to the celebrated Bangorian controversy (*see* HOADLY, BENJAMIN).

His chief writings are the *Institutiones Grammaticae Anglo-Saxonicae et Moeso-Gothicae* (1689), and *Linguarum veterum Septentrionalium Thesaurus grammatico-criticus et archaeologicus* (1703–05), a work of great learning. His two treatises, one *Of the Christian Priesthood* and the other *Of the Dignity of the Episcopal Order* (1707) were reprinted in the *Library of Anglo-Catholic Theology* (1847). There is a ms in the Bodleian Library which sketches his life to 1689, and many of his letters are extant in various collections.

See also J. H. Overton, *The Nonjurors* (1902).

HICKORY, a city of Catawba county, North Carolina, U.S.A., in the Piedmont region, at an altitude of 1,165 feet It is on Federal highway 70, and is served by the Carolina and North-western and the Southern railways. The population was 5,076 in 1920 and was estimated locally at 7,100 in 1928 (15% negroes). With the adjoining municipalities of Highland, West Hickory and Longview, the urban unit had a population of 14,000. It is in the Catawba river valley, which produces fine melons and grapes; and commands views of Mount Mitchell, Grandfather and other peaks of the Blue Ridge. Hickory manufactures farm wagons which are widely used throughout the South, and has cotton mills (32,000 spindles in 1928), hosiery mills, furniture factories and other manufacturing industries. It is the seat of Lenoir Rhyne college (opened 1891), a Lutheran institution, named after two benefactors. Hickory was founded about 1874 and chartered in 1884. Since 1913 it has had a council-manager form of government.

HICKORY, a shortened form of the American Indian name *pohickery.* Hickory trees are natives of eastern North America, and belong to the genus *Carya* (or *Hicoria* of many American botanists) of the family Juglandaceae. They are closely allied to the walnuts (*Juglans*), the chief or at least one very obvious difference being that, whilst in the hickory the husk which covers the shell of the nut separates into four valves, in the walnut it consists of but one piece, which bursts irregularly. The timber is both strong and heavy, and remarkable for its extreme elasticity. It is very extensively employed in manufacturing axle-trees, chair-backs, axe-handles, whip-handles and other articles requiring great strength and elasticity. The species which furnish the best wood are *Carya ovata* (shellbark hickory), *C. alba* (mocker-nut), *C. Pecan* (pecan or pacane nut), and *C. glabra* (pig-nut), that of the last named, on account of its extreme tenacity, being preferred for axle-trees and axe-handles. The wood of C. *ovata* splits very easily and is very elastic, so that it is much used for making



FROM CHARLES S. SARGENT, "THE SILVA OF NORTH AMERICA"

FIG. 1.—BIG BUD HICKORY (CARYA ALBA), SHOWING BRANCH WITH FRUIT

whip-handles and baskets.

Most of the hickories form fine trees of from 60 to 90 ft. in height, with straight, symmetrical trunks, well-balanced ample heads, and bold, handsome, pinnated foliage. When confined in the forest they shoot up 50 to 60 ft. without branches, but when standing alone they expand into a fine head, and produce a lofty round-headed pyramid of foliage. They have all the qualities necessary to constitute fine graceful park trees. The most ornamental of the species are pecan, the mocker-nut or big-bud hickory, and the pig-nut, all producing delicious nuts.



FROM CHARLES S. SARGENT, "THE SILVA OF NORTH AMERICA"

FIG. 2.—SHELL-BARK HICKORY (CARYA OVATA), SHOWING (A) MALE AND (B) FEMALE INFLORESCENCES

The husk of the hickory nut, as already stated, breaks up into four equal valves or separates into four equal portions in the upper part, while the nut itself is tolerably even on the surface, but has four or more blunt angles in its transverse outline. The wild hickory nuts of the American markets are chiefly the produce of *C. ovata*, called the shell-bark or shag-bark hickory because of the roughness of its bark, which becomes loosened from the trunk in long scales. The pecan-nuts, which come from the Southern States, are from 1 in. to 1½ in. long, smooth, cylindrical, pointed at the ends and thin-shelled, with the kernels full, not like those of most of the hickories divided by partitions, and of delicate and agreeable flavour. The thick-shelled fruits of the pig-nut (*C. glabra*) are generally left on the ground for swine, squirrels, etc., to devour. In *C. cordiformis*, the bitter-nut hickory, the kernel is so very bitter that even the squirrels refuse to eat it.

Since 1900 pecan culture has become widely established in the Southern States; in 1926 the total commercial crop was estimated by the U.S. Department of Agriculture at 64,046,000 lb., valued at $9,772,000, of which the states of Oklahoma and Texas produced about one-half. In 1925 the total cut of hickory lumber, principally shag-bark, pig-nut, mocker-nut and bitter-nut, amounted to 79,293,000 bd.ft. Its value per thousand at the mill was exceeded only by that of the black walnut and the white ash.

The hickory genus has an interesting geological history, some 20 or more ancestral fossil species being known, ranging from early Eocene to late Pliocene times. In the Miocene these were widespread across the continents of North America and Europe and in parts of Asia. None, however, survived the Ice Age in Europe, only one (*C. cathayensis*) remains in Asia, and those in North America became restricted chiefly to the eastern half of the United States, none occurring in or west of the Rocky Mountains, and but a single species (*C. mexicana*) in Mexico, where it is not widely distributed.

HICKS, ELIAS (1748–1830), American Quaker, was born in Hempstead, L.I., New York, U.S.A., March 19, 1748. His parents were Friends, but he took little interest in religion until he was about twenty years of age. A carpenter's apprentice and farmer, by 1775 he had "openings leading to the ministry," and in 1779 he first set out on his itinerant preaching tours. He attacked slavery in his sermons, and in *Observations on the Slavery of the Africans and their Descendants* (1811); and was influential in procuring the passage in 1817 of the act declaring free after 1827 all negroes born in New York and not freed by the act of 1799. He died at Jericho, L.I., on Feb. 27, 1830. His preaching was practical and he was heartily opposed to any set creed; hence his successful opposition at the Baltimore yearly meeting of 1817 to the proposed creed which would make the Society in America approach the position of the English Friends by definite doctrinal statements. His Doctrinal Epistle (1824) stated his position, and a break ensued in 1827–1828, Hick's followers, who called themselves the "Liberal Branch," being called "Hicksites" by the "Orthodox" party, which they for a time outnumbered. The village of Hicksville, in Nassau County, New York, 15 m. E. of Jamaica, lies in the centre of the Quaker district of Long Island and was named in honour of Elias Hicks.

See *A Series of Extemporaneous Discourses . . . by Elias Hicks* (1825); his *Journal* (1832); his *Letters* (1834); and H. W. Wilbur, *Life and Labors of Elias Hicks* (1910), also a monograph by G. W. Burnap (1851).

HICKS, HENRY (1837–99), Welsh physician and geologist, was born on May 26, 1837 at St. David's, in Pembrokeshire, where his father, Thomas Hicks, was a surgeon. He studied medicine at Guy's Hospital, London, and practised in his native place until 1871; when he removed to Hendon, where he died on Nov. 18, 1899. In conjunction with Salter, he established in 1865 the Menevian group (Middle Cambrian) characterized by the trilobite *Paradoxides*. Subsequently Hicks contributed a series of important papers on the Cambrian and Lower Silurian rocks, and figured and described many new species of fossils. Later he worked at the Pre-Cambrian rocks of St. David's, describing the Dimetian (granitoid rock) and the Pebidian (volcanic series), and his views, though contested, have been generally accepted. At Hendon Dr. Hicks gave much attention to the local geology and also to the Pleistocene deposits of the Denbighshire caves. He detected organic remains in the Morte slates, previously regarded as unfossiliferous, and these he regarded as including representatives of Lower Devonian and Silurian. His papers appeared in the *Geol. Mag.* and *Quart. Journ. Geol. Soc.* He was elected F.R.S. in 1885, and president of the Geological Society of London (1896–98).

HICKS, WILLIAM (1830–1883), British soldier, entered the Bombay army in 1849, and served through the Indian mutiny and the Abyssinian expedition of 1867–68. He retired with the honorary rank of colonel in 1880. After the close of the Egyptian war of 1882, he entered the khedive's service and was made a pasha. Early in 1883 he went to Khartum as chief of the staff of the army there, then commanded by Suliman Niazi Pasha. Camp was formed at Omdurman and a new force of some 8,000 fighting men collected—mostly recruited from the fellahin of Arabi's disbanded troops, sent in chains from Egypt. After a month's vigorous drilling Hicks led 5,000 of his men against an equal force of dervishes in Sennar, whom he defeated, and cleared the country between the towns of Sennar and Khartum of rebels. Relieved of the fear of an immediate attack by the mahdists, the Egyptian officials at Khartum intrigued against Hicks, who in July tendered his resignation. This resulted in the dismissal of Suliman Niazi and the appointment of Hicks as commander-in-chief of an expeditionary force to Kordofan with orders to crush the mahdi, who in January 1883 had captured El Obeid, the capital of that province. Hicks, aware of the worthlessness of his force for the purpose contemplated, stated his opinion that it would be best to "wait for Kordofan to settle itself" (telegram of Aug. 5). The Egyptian ministry, however, did not then believe in the power of the mahdi, and the expedition started from Khartum on Sept. 9. It was made up of 7,000 infantry, 1,000 cavalry and 2,000 camp followers and included 13 Europeans. On the 20th the force left the Nile at Duem and struck inland across the almost waterless wastes of Kordofan for Obeid. On Nov. 5, the army, misled by treacherous guides and thirst-stricken, was ambuscaded in dense forest at Kashgil, 30 m. south of Obeid. With the exception of some 300 men the whole force was killed. According to the story of Hicks's cook, one of the survivors, the general was the last officer to fall, pierced by the spear of the khalifa Mohammed Sherif.

See Sir F. R. Wingate, *Mahdiism and the Egyptian Sudan*, book iv. (1891), and J. Colborne, *With Hicks Pasha in the Soudan* (1884). *See* also EGYPT.

HIDALGO, an inland plateau, State of Mexico. Pop. (1921) 622,241. Area, 8,063 sq. miles. The northern and eastern parts are elevated and mountainous, culminating in the Cerro de Nav-

ajas (10,528ft.). A considerable area of this region on the eastern side of the State is arid and semi-barren, being part of the elevated table-land of Apam where the *maguey* (American aloe) has been grown for centuries. The southern and western parts of the State consist of rolling plains, in the midst of which is the large lake of Metztitlan. Hidalgo produces cereals, maguey, coffee, beans, sugar, cotton and tobacco. Maguey is cultivated for the production of *pulque*, the national drink. The chief industry, however, is mining, the mineral districts of Pachuca, El Chico, Real del Monte, San José del Oro and Zimapán being among the richest in Mexico. The mineral products include silver, gold, mercury, copper, iron, lead, zinc, antimony, manganese and plumbago. Coal, marble and opals are also found. Railway facilities are afforded by a branch of the Veracruz and Mexico line, which runs from Ometusco to Pachuca, the capital of the State, and by the Mexican Central. Among the principal towns are Tulancingo (pop. 10,083 in 1921), a rich mining centre 24m. E. of Pachuca, and Mineral del Monte (pop. 1921, 9,758).

HIDALGO, originally a Spanish title of the lower nobility; the hidalgo being the lowest grade of nobility which was entitled to use the prefix "don." The word is contracted from *hijo d'algo*, son of something, or somewhat. The term is now used generally to denote one of gentle birth. The Portuguese *fidalgo* has a similar history and meaning.

HIDALGO Y COSTILLA, MIGUEL (1753–1811), Mexican patriot, was born on May 8, 1753, on a farm at Corralejos, near Guanajuato. He was educated at Valladolid in Mexico, and was ordained priest in 1779. Until 1809 he was known only as a man of pious life who exerted himself to introduce various forms of industry among his parishioners at Dolores But Napoleon's invasion of Spain in 1808 caused a widespread commotion. The colonists were indisposed to accept a French ruler and showed great zeal in proclaiming Ferdinand VII. as king. The societies they formed for their professedly loyal purpose were regarded, however, by the Spanish authorities with suspicion as being designed to prepare the independence of Mexico. Hidalgo and several of his friends, among whom was Miguel Dominguez, mayor of Querétaro, engaged in preparations which the authorities considered treasonable. Dominguez was arrested, but Hidalgo was warned in time. He collected some hundred of his parishioners, and on Sept. 16, 1810, they seized the prison at Dolores. This action began what was in fact a revolt against the Spanish and Creole elements of the population. At first he met with some success and moved on the city of Mexico. But here the Spaniards and Creoles were concentrated. Hidalgo lost heart and retreated. Many of his followers deserted, and at Aculco he was attacked on Nov 7, 1810, and routed. He succeeded in collecting a mob estimated at 100,000 about Guadalajara. With this ill-armed and undisciplined crowd he took up a position on the bridge of Calderon on the river Santiago. On Jan. 17, 1811, he was completely beaten by a small force of Spanish soldiers. Hidalgo and the other leaders were betrayed to the Spaniards. Hidalgo was first degraded from the priesthood and then shot as a rebel on July 31, or Aug. 1, 1811.

See H. H. Bancroft, *The Pacific States*, vol. vii., which contains a copious bibliography.

HIDATSA. A native American people of Siouan family, one of three agricultural "village tribes" on the upper Missouri, the others being the Mandan (*q.v.*) and Arikara (*q.v.*); the surrounding groups were buffalo hunting nomads of the plains. Culturally, the Hidatsa resembled the Mandan; in speech, the Crow (*q.v.*). They are also known as Minitari and Gros Ventre of the River. Five hundred remain of the 2,100 estimated in 1804.

See W. Matthews, *Ethnography and Philology of the Hidatsa* (1877).

HIDDENITE, a green transparent variety of spodumene (*q.v.*), used as a gem-stone. It was discovered by William Earl Hidden (1853–1918) at Stonypoint (now called Hiddenite), Alexander Co., North Carolina.

HIDE. This word can most accurately be rendered by the phrase "family land"; originally it denoted the amount of land necessary for the support of a free peasant family. The actual amount of land covered by this term is still and is long likely to be a matter under discussion. In the 12th and 13th centuries, when records are first abundant, the hide commonly appears as 120 acres of arable, with the meadow and the pasture-rights locally considered appurtenant to such a tenement. But the scanty evidence which comes from an earlier time suggests that, at least in Wessex, the hide had once been much smaller than this, and there are facts which point to a pre-Conquest southern hide of 48 acres. The large hide of 120 acres is best recorded in the eastern midlands, and its appearance there may in part be due to the influence of the large Scandinavian tenements introduced into the neighbouring country by the Danish settlements of the ninth century. In any case, throughout England, the hide underlay the whole local organization of Early English society. It was the basis of the earliest taxation, the contributions made by different districts to the support of kings and ealdormen, and it seems to have formed also the basis according to which the primitive English militia, the *fyrd*, was raised. By the end of the old English period it had become unusual for a single peasant to hold an entire hide. The quarter hide, or yardland (Lat. *virgata*) had become, and long continued to be, the normal peasant tenement. Long after the Norman Conquest, however, the hide was the unit according to which assessment to national taxation, such as danegeld (*q.v.*), was expressed. The Norman administration maintained the old English system by which most villages in the midlands and the south and west of England were assessed at some round number of hides, such as 5, 10 or 25, an arrangement which undoubtedly descends from the time when the hide was the essential unit of agrarian economy. (F. M. S.)

BIBLIOGRAPHY.—The voluminous literature relating to the hide may conveniently be approached through J. H. Round, *Feudal England* (1895); F. W. Maitland, *Domesday Book and Beyond* (1897); F. Liebermann, "Hufe" in *Die Gesetze der Angelsachsen* (1898–1916); P. Vinogradoff, *English Society in the Eleventh Century* (1908). The system of assessment based on the hide will be found explained in any of the articles on Domesday Survey contributed by Round in the *Victoria History of the Counties of England*, ed. H. A. Doubleday (1900).

HIDES. The importation of hides into the United Kingdom is very large, and there is a considerable re-exportation of imported hides. The Board of Trade returns give the following figures:

United Kingdom: Imports and Re-Exports of Hides and Skins, Undressed: 1927.

Material.	Imports.	Re-exports of imported material.	Net imports.
Wet hides:			
Cwts.	811,000	247,000	564,000
Value £	3,093,000	926,000	2,167,000
Dry and dry salted hides:			
Cwts.	720,000	176,000	544,000
Value £ . . .	3,309,000	768,000	2,541,000

In addition, there were imports of £3,862,000 worth of sheep and lamb skins (of which £1,537,000 worth were re-exported), and £1,234,000 worth of goat skins (of which £700,300 worth were re-exported). (*See* LEATHER.)

HIEL, EMMANUEL (1834–1899), Belgian-Dutch poet and prose writer, was born at Dendermonde, Flanders, in May 1834. Hiels was one of the leaders of the Flemish movement in Belgium. For the 50th anniversary of Belgian independence he wrote two cantatas *Belgenland* and *Eer Belgenland*. His efforts to counteract Walloon influence and to revive Flemish as a literature made him famous in Holland, and in 1874 a volume of his poems appeared in a collection of Dutch authors. His collected poetical works were published in three volumes at Rousselaere in 1885.

HIEMPSAL, the name of the two kings of Numidia. For Hiempsal I. *see* JUGURTHA. Hiempsal II. was the son of Gauda, the half-brother of Jugurtha. In 81 he was driven from his throne by the Numidians themselves, or by Hiarbas, ruler of part of the kingdom, supported by Cn. Domitius Ahenobarbus, the leader of the Marian party in Africa. Soon afterwards Pompey was sent to Africa by Sulla to reinstate Hiempsal. From Suetonius

(*Caesar*, 71) it is evident that Hiempsal was alive in 62.

Plutarch, *Marius*, 40, *Pompey*, 12; Appian, *Bell. civ.*, i. 62. 80; Dio Cassius xli. 41.

HIERAPOLIS. 1. (Arabic *Manbij* or *Mumbij*) an ancient Syrian town occupying one of the finest sites in Northern Syria, in a fertile district about 16 m. south-west of the confluence of the Sajur and Euphrates. There is abundant water supply from large springs. The place first appears in Greek as *Bambyce*, but Pliny (v. 23) tells us its Syrian name was *Mabog*. It was doubtless an ancient Commagenian sanctuary. The Seleucids made it the chief station on their main road between Antioch and Seleucia-on-Tigris; and as a centre of the worship of the Syrian Nature Goddess, Atargatis (*q.v.*), it became known to the Greeks as the city of the sanctuary Ἱερόπολις, and finally as the Holy City Ἱεράπολις. Lucian (or some anonymous writer) has described the orgiastic luxury of the shrine in the tract *De Dea Syria*. According to this the worship was of a phallic character, votaries offering little male figures of wood and bronze. There were also huge *phalli* set up before the temple, which were climbed once a year with certain ceremonies, and decorated. For the rest the temple was of Ionic character. Inside was a holy chamber into which priests only were allowed to enter. Here were statues of a goddess and a god in gold. Between them stood a gilt *xoanon*, which seems to have been carried outside in sacred processions. Other rich furniture is described, and a mode of divination by movements of a *xoanon* of Apollo. A great bronze altar stood in front, and in the forecourt lived numerous sacred animals and birds (but not swine) used for sacrifice. The lake was the centre of sacred festivities and it was customary for votaries to swim out and decorate an altar standing in the middle of the water. Self-mutilation and other orgies went on in the temple precinct, and there was an elaborate ritual on entering the city and first visiting the shrine.

The temple was sacked by Crassus on his way to meet the Parthians (53 B.C.); but in the 3rd century of the empire the city was the capital of the Euphratensian province and one of the great cities of Syria. It was, however, in ruins when Julian collected his troops there, and Chosroes I. held it to ransom after Justinian had failed to put it in a state of defence. Harun restored it at the end of the 8th century and it became a subject of dispute between Byzantines, Arabs, and Turks. The crusaders captured it from the Seljuks in the 12th century, but Saladin retook it (1175) and later it became the headquarters of Hulagu and his Mongols, who completed its ruin. A colony of Circassians was settled here in 1879 after the Russo-Turkish War. The remains are extensive, but almost wholly of late date, as is to be expected in the case of a city which survived into Muslim times. The sacred lake survives. The first modern account of the site is in a short narrative appended by H. Maundrell to his *Journey from Aleppo to Jerusalem*. He was at Mumbij in 1699.

The coinage of the city begins in the 4th century B.C. with an Aramaic series, showing the goddess, either as a bust with mural crown or as riding on a lion. She continues to supply the chief type even during imperial times, being generally shown seated with the *tympanum* in her hand. Other coins substitute the legend Θεᾶς Συρίας Ἱεροπολιτῶν, within a wreath. It is interesting to note that from *Bambyce* (near which much silk was produced) were derived the *bombycina vestis* of the Romans and, through the crusaders, the bombazine of commerce.

See F. R. Chesney, *Euphrates Expedition* (1850); W. F. Ainsworth, *Personal Narrative of the Euphrates Expedition* (1888); E. Sachau, *Reise in Syrien*, etc. (1883); D. G. Hogarth in *Journal of Hellenic Studies* (1909).

2. A Phrygian city, altitude 1,200 ft. on the right bank of the Churuk Su (Lycus), about 8 m. above its junction with the Menderes (Maeander), situated on a broad terrace, 200 ft. above the valley and 6 m. N. of Laodicea. On the terrace are springs, that have deposited calcareous material in their neighbourhood. To these and to the "Plutonium"—a probable fissure in the limestone rocks—the place owed its celebrity and sanctity. Here, at an early date, a religious establishment (*hieron*) existed in connection with the old Phrygian Kydrara, a settlement of the tribe Hydrelitae; and the town which grew round it became one of the greatest centres of Phrygian native life but of non-political importance. The chief religious festival was the Letoia, named after the goddess Leto, a local variety of the Mother Goddess (Cybele), who was honoured with orgiastic rites in which elements of the original Anatolian matriarchate and Nature-cult survived: there was also a worship of Apollo Lairbenos.

Hierapolis was the seat of an early church (Col. iv. 13), with which tradition closely connects the apostle Philip. Epictetus, the philosopher, and Papias, a disciple of John and author of a lost work on the Sayings of Jesus, were born there. The village of Yuruks has gradually grown below the site. The goddesses of the two Hierapoleis were closely akin. The ruins of Hierapolis are remarkable for the long avenue of tombs (mostly inscribed sarcophagi on plinths) in the west of the city, and for a very perfect theatre partly excavated in the hill at the north side of the site. Stage buildings as well as auditorium are well preserved. On the south just above the terraces and largely blocked with petrified deposit, stand large baths, into which the natural warm spring was once conducted. Behind these is a fine triumphal arch, whence runs a colonnade. Ruins of several churches survive, and also of a large basilica. Over 300 inscriptions have been collected, mostly sepulchral, whence have been deduced interesting facts about the very early Christian community which existed here.

See K. Humann, *Altertumer v. Hierapolis* (1888); Sir W. M. Ramsay, *Cities and Bishoprics of Phrygia*, vol. i. (1895).

HIERARCHY, priestly government, a term commonly used in ecclesiastical language to denote the graded organization of angels or of the clergy. The word ἱεραρχία, which does not occur in any classical Greek writer, owes its present extensive currency to the celebrated writings of the pseudo-Dionysius Areopagiticus. Of these the most important are the two which treat of the celestial and of the ecclesiastical hierarchy respectively. Defining hierarchy as the "function which comprises all sacred things," or, more fully, as "a sacred order and science and activity, assimilated as far as possible to the godlike, and elevated to the imitation of God proportionately to the Divine illuminations conceded to it," the author proceeds to enumerate the nine orders of the heavenly host, which are subdivided again into hierarchies or triads, in descending order, thus: Seraphim, Cherubim, Thrones; Dominations, Virtues, Powers; Principalities, Archangels, Angels. The ecclesiastical or earthly hierarchy is the counterpart of the other. In it the first or highest triad is formed by baptism, communion and chrism. The second triad consists of the three orders of the ministry, bishop or hierarch, priest and minister or deacon (ἱεράρχης, ἱερεύς, λειτουργός). The third or lowest triad is made up of monks, "initiated" and catechumens. (*See* ORDER, HOLY, and article "Hierarchy" in the *Catholic Encyclopaedia*.

HIERATIC, priestly or sacred (Gr. ἱερατικός, ἱερός, sacred), a term applied to a simplified cursive form of hieroglyphic in ancient Egyptian writing. The name was first given by Champollion (*see* EGYPTIAN LANGUAGE).

HIERO I., the brother of Gelo, and tyrant of Syracuse from 478 to 467 B.C. During his reign he greatly increased the power of Syracuse. He removed the inhabitants of Naxos and Catana to Leontini, peopled Catana (which he renamed Aetna) with Dorians, concluded an alliance with Acragas (Agrigentum), and espoused the cause of the Locrians against Anaxilaus, tyrant of Rhegium. His most important achievement was the defeat of the Etruscans at Cumae (474), by which he saved the Greeks of Campania. A bronze helmet (now in the British Museum), with an inscription commemorating the event, was dedicated at Olympia. Though despotic in his rule, Hiero was a liberal patron of literature. He died at Catana in 467.

See Diod. Sic. xi. 38–67; Xenophon, *Hiero*, 6. 2; E. Lübbert, *Syrakus zur Zeit des Gelon und Hieron* (1875); for his coins *see* NUMISMATICS (section *Sicily*).

HIERO II., tyrant of Syracuse from 270 to 216 B.C., was the illegitimate son of a Syracusan noble, Hierocles, who claimed descent from Gelo. On the departure of Pyrrhus from Sicily (275) the Syracusan army and citizens appointed him commander of the troops. He materially strengthened his position by marrying the daughter of Leptines, the leading citizen. In the meantime, the

Mamertines, a body of Campanian mercenaries who had been employed by Agathocles, had seized the stronghold of Messana, whence they harassed the Syracusans. They were finally defeated in a pitched battle near Mylae by Hiero, who was only prevented from capturing Messana by Carthaginian interference. His grateful countrymen then chose him king (270). In 264 he again returned to the attack, and the Mamertines called in the aid of Rome. Hiero at once joined the Punic leader Hanno, who had recently landed in Sicily; but being defeated by the consul Appius Claudius, he withdrew to Syracuse. Pressed by the Roman forces, in 263 he was compelled to conclude a treaty with Rome, by which he was to rule over the south-east of Sicily and the eastern coast as far as Tauromenium (Polybius i. 8–16; Zonaras viii. 9). From this time till his death in 216 he remained loyal to the Romans, and frequently assisted them with men and provisions during the Punic wars (Livy xxi. 49–51, xxii. 37, xxiii. 21). He kept up a powerful fleet for defensive purposes, and employed his famous kinsman Archimedes in the construction of those engines that, at a later date, played so important a part during the siege of Syracuse by the Romans.

A picture of the prosperity of Syracuse during his rule is given in the 16th idyll of Theocritus, his favourite poet. *See* Diod. Sic. xxii. 24–xxvi. 24; Polybius i. 8–vii. 7; Justin xxiii 4.

HIEROCLES OF ALEXANDRIA (fl. *c.* A.D. 430), a Neoplatonist, was a pupil of Plutarch at Athens, and taught for some years in his native city. Banished from Alexandria, he went to Constantinople, where his religious opinions led to his imprisonment. His commentary on the *Carmina Aurea* of Pythagoras, which enjoyed a great reputation in middle age and Renaissance times, is extant. Several other writings, especially one on providence and fate, are referred to by Photius and Stobaeus. The collection of some 260 witticisms (ἀστεῖα) called Φιλόγελως (ed. A. Eberhard, Berlin, 1869), attributed to Hierocles and Philagrius, has no connection with Hierocles of Alexandria, but is probably a later compilation. It is now agreed that the fragments of the *Elements of Ethics* (Ἠθικὴ στοιχείωσις) preserved in Stobaeus are by a Stoic named Hierocles, contemporary of Epictetus, who has been identified with the "Hierocles Stoicus vir sanctus et gravis" in Aulus Gellius (ix. 5. 8). This theory is confirmed by the discovery of a papyrus (ed. H. von Arnim in *Berliner Klassikertexte,* iv. 1906; *see* also C. Prächter, *Hierokles der Stoiker,* 1901).

The commentary was edited by F. W. Mullach in *Frag. philos. Graec.* (1860); there is an Eng. trans. by N. Rowe (1906). *See* W. Christ, *Gesch. der griech. Literatur* (1898); Überweg, *Grund. der gesch. der Phil.,* pt. 1 (1926) and Zeller, *Phil. der Griechen.*

Another Hierocles, who flourished under Justinian, was the author of a list of provinces and towns in the Eastern Empire, called Συνέκδημος ("fellow-traveller"; ed. A. Burckhardt, 1893); it was one of the chief authorities used by Constantine Porphyrogenitus in his work on the "themes" of the Roman Empire (*see* C. Krumbacher, *Gesch. der byzantinischen Literatur,* 1897).

HIEROGLYPHS, sacred carvings, the picture characters of ancient Egyptian writing, and of analogous scripts found in Crete, Asia Minor and Syria (Hittite), the Sinai peninsula, etc. The ancient Egyptian system seems to have originated, developed and finally expired strictly within the limits of the Nile valley, its only ascertained offshoot being the Meroitic (*q.v.*). It is essentially Egyptian and adapted only to the expression of the Egyptian language, for Egyptian monumental use by Egyptians. It was carried by conquest up the Nile into Nubia, and across the Sinai desert and the Levant into Palestine and Syria, and may have contributed to the formation of the Phoenician alphabet and other modes of writing in Asia.

The discovery by Champollion (*q.v.*) of the key to Egyptian writing in 1822 brought about the first effective entry of historical investigation into a vast ancient world of monuments before the age of Greece and Rome, but the century that has passed since then has brought our knowledge and understanding of the language and writing to a wonderful completeness.

From the 4th Dynasty onwards the mode of writing in Egypt was essentially that extinguished by the fall of paganism in the 4th century A.D. Its elements in the hieroglyphic form were pictorial, but each hieroglyph had one or more well-defined functions, fixed by convention in such a manner that the Egyptian language was expressed word by word in writing never intended to convey merely an idea. How far this holds good for the period before the 4th Dynasty, it is difficult to say. The known inscriptions of the earlier times are so brief and so limited in range that the system on which they were written cannot yet be fully investigated. In the 1st Dynasty, phonograms (*see* below) were in full use. But the spelling then was very concise; it is possible that some of the slighter words, such as prepositions, were omitted in the writing and were supplied from the context. As a whole, we gain the impression that a really distinct and more primitive stage of hieroglyphic writing by a substantially vaguer notation of words lay not far behind the time of the 1st Dynasty.

It must be clearly realised that the Egyptian hieroglyphic system did not provide for the notation of vowels; only consonants were recorded.

The employment of the signs is of three kinds: any given sign represents either (1) a whole word or root; or (2) a sound as part of a word, or (3) pictorially defines the meaning of a word the sound of which has already been given by a sign or group of signs preceding. Thus signs, according to their employment, are said to be (1) "word-signs," (2) "phonograms," or (3) "determinatives." Phonograms may be used also as word-signs and word-signs as determinatives, but phonograms rarely occur as determinatives.

Word-signs.—The word value of a sign is, in the first place, the name of the object it represents, or of some material, or quality, or action, or idea suggested by it. Thus  is *ḥr*, "face";  a vase of ointment, is *mrḥ.t* "ointment";  is *wdb*, "turn." No other system of writing bears upon its face so clearly the history of its development, yet much investigation is still required to establish the origins of the values of the signs; in some cases the connection between the pictures and the *primary* values seems to be curiously remote. Probably all the signs in the hieroglyphic signary can be employed in their primary sense. The secondary value expresses the consonantal root of the name or other primary value, and any, or almost any, derivative from that root; as when  , a mat with a cake upon it, is not only *ḥtp*, an "offering-mat," but also *ḥtp* in the sense of "conciliation," "peace," "rest," "setting" (of the sun), with many derivatives. In the third place, some signs may be transferred to express another root having the same consonants as the first; thus, from the middle kingdom onwards,  , the ear, by a play upon words can express not only *śḏm*, "hear," at that time changed to *sḏm*, but also *śḏm*, "paint the eyes."

Phonograms.—The limited number of signs found with this use are of the greatest importance. By searching throughout the whole mass of normal inscriptions, earlier than the periods of Greek and Roman rule when great liberties were taken with the writing, probably no more than one hundred different phonograms can be found. The number of those commonly employed in good writing is between seventy and eighty. The most important phonograms were the *uniliteral* or *alphabetic* signs, twenty-four in number in the Old Kingdom and without any homophones; later these were increased by homophones to thirty. Of *biliteral* phonograms—each expressing a combination of two consonants—there were about fifty commonly used: some fifteen or twenty were rarely used. As Egyptian roots seldom exceeded three letters, there was no need for *triliteral* phonograms to spell them. There is, however, one triliteral phonogram, the eagle  *tyw* or *tiu* (?), used for the plural ending of adjectives in *y* formed from words ending in *t* (whether radical or the feminine ending).

The phonetic values of the signs are derived from their word-sign values, and consist usually of the bare root, though there are rare examples of the retention of a flexional ending; they often ignore also the weaker consonants of the root, and on the same principle reduce a repeated consonant to a single one, as when the hoe  *ḥnn*, has the phonetic value *ḥn*. The history of some of the alphabetic signs is still very obscure, but it is nearly certain that the values of all were obtained on the same prin-

ciples. It seems that "acrophony" (giving to a sign the value of the first letter of its name) was indulged in only by priests of the latest age, inventing fantastic modes of writing for the decoration of temple walls. Some of the ancient words from which the phonetic values were derived probably fell very early into disuse, and may never be discoverable in the texts that have come down to us. The following are among those most easily explained:—

forearm, value *ʿ(y)*; from , *ʿ(y)*, "hand."

mouth, value *r*; from , *r*, "mouth."

udder and vulva, value *ḥ*; from , *ḥ.t.*, "belly."

(The feminine ending *t* is here, as usual, neglected.)

tank, value *ś*, from , *ś*, "tank."

slope of earth, or brickwork, value *q*; from , *q*, "slope," "height."

(The doubled weak consonant is here neglected.)

For some alphabetic signs more than one origin might be found, while for others, again, no clear evidence of origin is yet forthcoming.

The writing expresses only consonants. In the Graeco-Roman period various imperfect attempts were made to render the vowels in foreign names and words by the semi-vowels, as also by , the consonant *y* which originally represented having been reduced in speech by that time to the power of ꜣ only. Thus, Πτολεμαιος is spelt *Ptwrmys*, Antoninus, *ʿNtʾnynws* or *Intnyns*. Much earlier, throughout the New Kingdom, a special "syllabic" orthography, in which the alphabetic signs for the consonants are generally replaced by groups or single signs having the value of a consonant followed by a semi-vowel, was used for foreign names and words, *e.g.*, מרכבה, "chariot," was written , *ml-rı-kı-bw-tl.* מגדל, "tower" was written , *mi-gı-dl-rr.*

If this represents an endeavour to express the vocalization, it was carried out with very little system. In practice, the semi-vowels are generally negligible. This method of writing can be traced back into the Middle Kingdom, if not beyond, and it greatly affected the spelling of native words in New Egyptian and demotic.

Determinatives.—Most signs can on occasion be used as determinatives, but those that are very commonly employed as phonograms or as secondary word-signs are seldom employed as determinatives, and when they are so used they are often somewhat differentiated. Certain generic determinatives are very common, *e.g.*, of motion; , of acts involving force; , of a person or a man's name; , of buildings; , of inhabited places; , of foreign countries.

In the earliest inscriptions the use of determinatives is restricted to the , , etc., after proper names, but it developed immensely later, so that few words beyond the particles were written without them in the normal style after the Old Kingdom.

Some few signs ideographic of a group of ideas are made to express particular words belonging to that group by the aid of phonograms which point out the special meaning. In such cases the ideogram is not merely a determinative nor yet quite a word-sign. Thus = , "Semite"; = , "Libyan," etc., but cannot stand by itself for the name of any particular foreign people. So also in monogram is *śm* "go," is *sb* "conduct."

Orthography.—The most primitive form of spelling in the hieroglyphic system would be by one sign for each word, and the monuments of the 1st Dynasty show a decided tendency to this mode. Examples of it in later times are preserved in the royal cartouches, for here the monumental style demanded special conciseness. Thus, for instance, the name of Tethmosis III., *MN-ḫpr Rʿ*, is spelled (as *Rʿ* is the name of the sun-god, with customary deference to the deity it is written first, though pronounced last).

A number of common words—prepositions, etc.—with only one consonant, are spelled by single alphabetic signs in ordinary writing. Word-signs used singly for the names of objects are generally marked with I in classical writing, as , *ib*, "heart," , *ḥr* "face," etc.

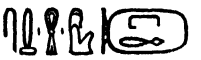
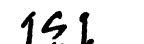
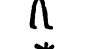
But the use of bare word-signs is not common. Flexional consonants are almost always marked by phonograms, except in very early times, as when the feminine word = *ḥ.t.* "belly," is spelled . The rule is one sign one value, but as some signs having the most diverse origins were liable to confusion with each other in variable writing, such were generally provided with "phonetic complements," a group being less easily misread than a single letter. *E.g.*, the reel of cord , *wz*, is regularly written *wz(w)*, but the mace , *ḥz*, is written *ḥz(z)*. This practice also distinguished determinatives from phonograms. Thus the root or syllable *ḥn* is regularly written to avoid confusion with the determinative . Redundance in writing is the rule; for instance, *bı* is often spelled , *(b)bı(ı)*. Biliteral phonograms are very rare as phonetic complements, nor are two biliteral phonograms employed together in writing the radicals of a word.

Spelling of words purely in phonetic or even alphabetic characters is not uncommon, the determinative being generally added. Thus in the pyramid texts we find *ḫpr* "become," written in one copy of a text, in another . Such variant spellings are very important for fixing the readings of word-signs. Though words were so freely spelled in alphabetic characters, especially in the time of the Old Kingdom, no advance was ever made towards excluding the cumbersome word-signs and biliteral phonograms, which by a judicious use of determinatives could have been rendered superfluous.

Abbreviations.—We find strictly *ʿnḫ z ś* standing for the ceremonial *vivat ʿnḫ wzı śnb.* "Life, Prosperity and Health," and in course of time the determinative was used in accounts instead of *dmz*, "total."

Monograms are frequent and are found from the earliest times. Thus , mentioned above are monograms, the association of and having no pictorial meaning. Another common monogram is , *i.e.*, and for *Ḥwt-Ḥrw* "Hathor." A word-sign may be compounded with its phonetic complement, as *ḥz* "white," or with its determinative, as *ḥz* "silver."

The decorative value of hieroglyphics was fully appreciated in Egypt. The aim of the artist-scribe was to arrange his variously-

DEMOTIC		EGYPTIAN	HIEROGLYPHIC	
APPROX. PRON & MEAN9	FORM	HIERATIC	ORIGINAL FORM	TRANSCRIPTION
Perso ("PHARAOH")				*Perso snh wz, snb*
yôt, "FATHER" . .				*itf*
'ônkh, "LIVE" . .				*snh*
cine, "CARRY" . .				*in*
ms (PHON) . . .				*ms*
s (ALPH)				*s*

THE THREE VARIETIES OF ANCIENT EGYPTIAN WRITING: HIEROGLYPHIC, SACRED TO THE PRIESTS; HIERATIC, A CURSIVE FORM OF THE HIEROGLYPHIC, AND THE DEMOTIC, THE ULTIMATE SIMPLIFIED POPULAR SCRIPT

shaped characters into square groups, and this could be done in great measure by taking advantage of the different ways in which many words could be spelt. Thus *ḥs* could be written  , *ḥsy*  , *ḥs-f*  , *ḥs-n-f*  . But some words in the classical writing were intractable from this point of view. The alphabetic signs obviously played a very important part in the formation of the groups, and many words could only be written in alphabetic signs. A great advance was therefore made when several homophones were introduced into the alphabet in the middle and New Kingdoms, partly as the result of the wearing away of old phonetic distinctions, giving the choice between  and  for *s*,  ,  and  for *t*, and  for *m*,  and for *n*, and  and for *w*. In later times the number of homophones in use increased greatly throughout the different classes, the tendency being helped by the habit of fanciful writing; but few of these homophones found their way into the cursive script. Occasionally a scribe of the old times indulged his fancy in "sportive" or "mysterious" writing, either inventing new signs or employing old ones in unusual meanings. Short sportive inscriptions are found in tombs of the 12th Dynasty; some groups are so written cursively in early medical papyri, and certain religious inscriptions in the royal tombs of the 19th and 20th Dynasties are in secret writing. Fanciful writing abounds on the temples of the Ptolemaic and Roman periods.

Hieroglyphic is normally written from right to left, the signs facing to the commencement of the line; hieratic and demotic follow the same direction. But monumental hieroglyphic may also be written from left to right, and is constantly so arranged for purposes of symmetry, *e.g.*, the inscriptions on the two jambs of a door are frequently turned in opposite directions; the same is frequently done with the short inscriptions scattered over a scene amongst the figures in order to distinguish one label from another.

In modern founts of type, the hieroglyphic signs are made to run from left to right in order to facilitate the setting where European text is mixed with the Egyptian. The table shows them in their more correct position, in order to display more clearly their relation to the hieratic and demotic equivalents.

Clement of Alexandria states that in the Egyptian schools the pupils were first taught the "epistolographic" style of writing (*i.e.*, demotic), secondly the "hieratic" employed by sacred scribes, and finally the "hieroglyphic" (*Strom.* v. 657). It is doubtful whether they classified the signs of the huge hieroglyphic syllabary with any strictness. The only native work on the writing that has come to light as yet is a fragmentary papyrus of Roman date which has a table in parallel columns of hieroglyphic signs, with their hieratic equivalents and words written in hieratic describing them or giving their values or meanings. The list appears to have comprised about 460 signs, including most of those that occur commonly in hieratic. They are to some extent classified. The bee heads the list as a royal sign, and is followed by figures of nobles and other human figures in various attitudes, more or less grouped among themselves, animals, reptiles and fishes, scorpions, animals again, twenty-four alphabetic characters, parts of the human body carefully arranged from  to  , 32 in number, parts of animals, celestial signs, terrestrial signs, vases. The arrangement down to this point is far from strict, and beyond it is almost impossible to describe concisely, though there is still a rough grouping of characters according to resemblance of form, nature or meaning. (In modern lists the signs are classified according to the nature of the objects they depict, as human figures, plants, vessels, instruments, etc.) Horapollon's *Hieroglyphica* may be cited as a native work, but its author, if really an Egyptian, had no knowledge of good writing. His production consists of two elaborate complementary lists, the one describing sign-pictures and giving their meanings, the other cataloguing ideas in order to show how they could be expressed in hieroglyphic. Each seems to us to be made up of curious but perverted reminiscences eked out by invention, but they might some day prove to represent more truly the usages of mystics and magicians in designing amulets, etc., at a time approaching the middle ages.

The early scribe's outfit, often carried slung over his shoulder, is seen in the hieroglyph  . It consisted of reed pens, a small pot of water and a palette with two circular cavities in which black and red ink were placed, made of finely powdered colour solidified with gum. In business and literary documents red ink was used for contrast, especially in headings; in demotic, however, it is very rarely seen. The pen became finer in course of time, enabling the scribe to write very small.

PALAEOGRAPHY

Hieroglyphic.—The main division is into monumental or epigraphic hieroglyphs and written hieroglyphs. The former

may be rendered by the sculptor or the painter in stone, on wood, etc., with great delicacy of detail, or may be simply sunk or painted in outline. When finely rendered they are of great value to the student investigating the origins of their values. Monumental hieroglyphic did not cease till the 3rd century A.D. (Temple of Esna). The written hieroglyphs, formed by the scribe with the reed pen on papyrus, leather, wooden tablets, etc., have their outlines more or less abbreviated, leading to the cursive scripts, hieratic and demotic, (*q.v.*). The written hieroglyphs were employed at all periods, especially for religious texts.

Hieratic.—A kind of cursive hieroglyphic or hieratic writing is traceable even in the 1st Dynasty, and though few examples have survived on papyrus or elsewhere from the old kingdom, it was already well characterised in the 6th Dynasty. When it reappears in the Middle Kingdom it has changed considerably and in its most cursive form seems hardly to retain any definable trace of the original hieroglyphic pictures; there is again a great change of style about the time of Akhenaten. The most cursive forms of hieratic appear in accounts and memoranda, but, however cursive, the hieratic was intended to be a transcript of hieroglyphic rendered sign by sign. With the deterioration of orthography at the end of the new kingdom this principle began to break down, and by the time of the 22nd Dynasty the cursive, at least of the conservative Thebais, had become very obscure. In the course of the reign of Amasis II. a better form from Lower Egypt drove this out completely and is the true demotic (*q.v.*), which, unlike hieratic, is something more than a variety of hieroglyphic. The employment of hieratic was thenceforth almost confined to the literal transcription of religious and traditional hieroglyphic texts in a clear and formal hand. Hieratic was at all times used for graffiti, whether in ink or cut in stone, until demotic appeared, and some formal engraved records, especially of the 22nd Dynasty, are in this script.

It may be observed that demotic continued to be employed after hieroglyphic writing had ceased until the end of paganism in the 5th century, and that a few signs were taken to complete the Greek alphabet in its adaptation to Coptic. These last remnants of the ancient Egyptian hieroglyphic system thus live on in church use to the present day.

See A. H. Gardiner, *Egyptian Grammar,* Oxford, 1927, especially pp. 432–527; G. Moller, *Hieratische Paläographie,* 3 vols. Leipzig, 1909–12. (F. Ll. G.)

HIERONYMITES, a common name for certain congregations of hermits living according to the rule of St. Augustine with supplementary regulations taken from St. Jerome's writings. The most important of these were the Spanish Hieronymites, established near Toledo in 1374. They possessed some of the most famous monasteries in the Peninsula, including the royal monastery of Belem near Lisbon, and the magnificent monastery built by Philip II. at the Escurial. Though the manner of life was very austere the Hieronymites devoted themselves to studies and to the active work of the ministry, and they possessed great influence both at the Spanish and the Portuguese courts. The order decayed during the 18th century and was suppressed in 1835.

Information on this and the other orders called by the same name will be found in Max Heimbucher, *Orden und Kongregationen,* 1896, i. § 70; article "Hieronymiten" in Herzog-Hauck, *Realencyklopädie;* article "Hieronymites" in the *Catholic Encyclopaedia.*

HIERONYMUS OF CARDIA, Greek general and historian, contemporary of Alexander the Great. After the death of the king he joined Eumenes. He was taken prisoner by Antigonus, who pardoned him and appointed him superintendent of the asphalt beds in the Dead Sea. Demetrius *Poliorketes* made him polemarch of Thespiae, and he died at the court of Antigonus Gonatas at the age of 104. He wrote a history of the Diadochi and their descendants, from the death of Alexander to the war with Pyrrhus (323–272 B.C.), which was used by Diodorus Siculus (xviii. xx) and by Plutarch in his life of Pyrrhus. He made use of official papers and was careful in his investigation of facts.

See Lucian, *Macrobii,* 22; Plutarch, *Demetrius,* 39; Diod. Sic. xviii. 42, 44, 50, xix. 100; Dion. Halic. *Antiq. Rom.* i. 6; Pausanias I. 9. 8. F. Brückner, "De vita et scriptis Hieronymi Cardii," in *Zeitschrift für die Alterthumswissenschaft* (1842); F. Reuss, *Hieronymos von Kardia* (1876); C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895); fragments in C. W. Müller, *Frag. hist. Graec.,* ii. 450–461. *See* also Jacoby's article in Pauly-Wissowa viii. 2.

HIERRO or **FERRO,** an island forming part of the Spanish archipelago of the Canary islands (*q.v.*). Pop. (1920) 8,344; area 107 sq.m. Hierro is the smallest island of the group. Its length is about 18 m., its greatest breadth about 15 m., and its circumference 50 m. It lies 92 m. W.S.W. of Teneriffe. Fresh water is scarce, but there is a sulphurous spring, with a temperature of 102° F. The once celebrated and almost sacred Til tree, which was reputed to be always distilling water in great abundance from its leaves, no longer exists. Valverde (pop. about 5,000) is the principal town. Geographers were formerly in the habit of measuring all longitudes from Ferro, the most westerly land known to them. The longitude assigned at first has, however, turned out to be erroneous; and the so-called "Longitude of Ferro" does not coincide with the actual longitude of the island.

HIGDON or **HIGDEN, RANULF** (*c.* 1299–*c.* 1363), English chronicler, was a Benedictine monk of the monastery of St. Werburg in Chester, in which he lived, it is said, for 64 years, and died "in a good old age," probably in 1363. Higdon was the author of the *Polychronicon,* a summary of general history popular in the 15th century. More than a hundred mss. of it exist. Higdon's part of the work is said to go no farther than 1326 or 1327 at latest, after which time it was carried on by two continuators to the end. Three early translations of the *Polychronicon* exist. The first was made by John of Trevisa, chaplain to Lord Berkeley, in 1387, and was printed by Caxton in 1482; the second by an anonymous writer, was written between 1432 and 1450; the third, based on Trevisa's version, with the addition of an eighth book, was prepared by Caxton.

The *Polychronicon,* with the continuations and the English versions, was edited for the Rolls Series (No. 41) by Churchill Babington (vols. i. and ii.) and Joseph Rawson Lumby (1865–86).

HIGGINSON, HENRY LEE (1834–1919), American banker, was born in New York city on Nov 18, 1834. He entered the banking house of S. and E. Austin, of Boston, but later went to Vienna for a year, where he studied music. In the Civil War he served as a volunteer officer. In 1863 he was severely wounded and honourably discharged. In 1868 he joined the banking firm of Lee, Higginson and Co., of Boston, with whom he remained until his death.

His interest in music led to his founding the Boston Symphony orchestra in 1881. A long line of distinguished directors placed this organisation in the first rank and won full recognition abroad. In 1891, as a memorial to certain friends who died in the Civil War, he presented Soldiers' Field to Harvard university. In 1899 he erected the Harvard union as a general meeting-place for all undergraduates. For many years a fellow of Harvard university, he died in Boston (Mass.), on Nov. 14, 1919.

See Bliss Perry, *The Life and Letters of Henry Lee Higginson* (1921).

HIGGINSON, THOMAS WENTWORTH (1823–1911), American author and soldier, was born of Puritan stock in Cambridge (Mass.), Dec. 22, 1823, and died there on May 9, 1911. Graduating from Harvard in 1841, he was a schoolmaster for two years, a student of theology at the Harvard divinity school, and pastor of the First Religious Society (Unitarian) of Newburyport (Mass.), and of the Free Church at Worcester. He was such an ardent abolitionist that he felt moved to resign his first pulpit. In the Civil War he was captain in the 51st Massachusetts volunteers, and from Nov. 1862 to Oct. 1864, when he was retired because of a wound received earlier, he was colonel of the 1st South Carolina Volunteers, the first regiment recruited from former slaves for the Federal service.

In *Army Life in a Black Regiment* (1870) he described his experiences. The rest of his life was spent chiefly in literary work at Newport (R. I.), and at Cambridge. His writings show a deep love of nature, art and humanity; they are marked by vigour of thought, sincerity of feeling, grace and finish of style. In his *Common Sense about Women* (1881), and his *Women and Men*

(1887), he advocated equality of opportunity and equality of rights for the two sexes.

Among his numerous books are *Outdoor Papers* (1863); *Malbone: an Oldport Romance* (1869); *Young Folks' History of the United States* (1875); *Life of Margaret Fuller Ossoli* (1884); *Travellers and Outlaws* (1889); *The Afternoon Landscape* (1889), poems and translations; *Life of Francis Higginson* (1891); *Procession of the Flowers and Kindred Papers* (1897); *Henry Wadsworth Longfellow* (1902); *John Greenleaf Whittier* (1902); *Reader's History of American Literature* (1903); "Lowell Institute lectures" edited by H. W. Boynton; and *Life and Times of Stephen Higginson* (1907). His volumes of reminiscence, *Cheerful Yesterdays* (1898), *Old Cambridge* (1899), *Contemporaries* (1899), and *Part of a Man's Life* (1905) are characteristic and charming works.

A definitive edition of his writings was published in seven volumes (1900). A biography by his second wife, Mary T. Higginson, *Thomas Wentworth Higginson: The Story of His Life,* was issued in 1914.

HIGHAM FERRERS, a market town and municipal borough of Northamptonshire, England, on the Nene, 63 m. N.N.W. from London, on branches of the L.M S. railway. Pop. (1921) 2,850. Higham (Hecham, Heccam, Hegham Ferers) was a large village before the Domesday survey. It was then held by William Peverel of the king, but passed to the families of Ferrers and later to de Valence and then to the crown. The castle, which may have been built before Henry III. visited Higham in 1229, is mentioned in 1322, but had been destroyed by 1540. To the Early English chancel of the church of St. Mary a very wide north aisle, resembling a second nave, was added in the Decorated period, and the general appearance of the chancel, with its north aisle and Lady-chapel, is Decorated. The west front was partially rebuilt in the 17th century. Close to the church stands a beautiful Perpendicular building, the school-house founded in 1422. The Bede House is a somewhat similar structure. In the town are remains of Chichele's college. Higham Ferrers, now almost continuous with Rushden (*q.v.*), makes boots and shoes.

HIGH-BUSH CRANBERRY: *see* GUELDER ROSE.

HIGH COMMISSION, COURT OF. The Act of Supremacy (1534) recognized Henry VIII. as "Supreme Head in earth of the Church of England" and assigned to the Crown the power of ecclesiastical visitation. The Act of Supremacy (1559) recognized Elizabeth as "Supreme Governor of this realm . . . as well in all spiritual or ecclesiastical things or causes as temporal" and empowered the Crown to nominate persons by letters patent to exercise "all manner of jurisdictions . . . touching . . . any spiritual or ecclesiastical jurisdiction . . . and to . . . amend all such errors, heresies, schisms, abuses, offences, contempts and enormities whatsoever," which by any manner of spiritual authority ought to be reformed. But the act of 1559 purported explicitly (as did the act of 1534 implicitly) merely to "restore" to the Crown "the ancient jurisdictions" "usurped" by the bishop of Rome. It was, therefore, "not a statute introductory of a new law, but declaratory of the old." The Crown, then, could without statutory authority delegate to commissioners the fullest ecclesiastical jurisdiction; and thus, in *Caudrey's Case* (1591), "it was resolved by all the judges that the king or queen of England for the time being may make such an ecclesiastical commission as is before mentioned by the ancient prerogative and law of England."

Heresy and Visitation.—The Reformation settlement called for a greater measure of supervision and discipline than the rather meagre authority of the bishops was able to provide; moreover, the consequent deprivations and the like led to a mass of litigation with which the ordinary ecclesiastical courts were too ineffectual to cope adequately. What was the use of such penalties as excommunication when "laymen cheerfully remained excommunicated for years"? Hence, the origin of the later court of high commission is to be found "in the systematic attempt to suppress a peculiar type of heresy by the machinery of a commission in which ecclesiastics, ministers of state and lawyers sat side by side, and whose procedure was a compound of the old heresy trial, the ordinary ecclesiastical procedure, and the judicial traditions of the privy council." This device of an ecclesiastical privy council "dealing with heresy and the visitation of the church" was first employed about 1535, when Thomas Cromwell was appointed vicegerent, invested with the plenitude of royal authority in ecclesiastical affairs, and directed to delegate part of it from time to time to such persons as he thought fit.

But "the first general commission of this nature directed to a number of men" was issued by Edward VI. in 1549, and the substance and form of the letters patent assumed final shape in the general commission issued by Mary in 1557, and were not essentially altered until Stuart times. Then, to meet the criticism of opponents, considerable modifications took place. But, though framed more explicitly and at greater length, the later letters patent may be said to have confined the powers of the commissioners within narrower limits than the more vaguely drawn commissions of earlier days.

Evolution of the Court.—Until 1565 the work performed by these commissioners was mainly visitatorial. Granted for a specific purpose, their authority was regarded as temporary and was supposed to lapse as soon as the work was done; and their activities were strictly controlled by the council. But the permanence of the Elizabethan settlement; the development of additional administrative functions by the commission itself, the gradual delegation to it by the overworked privy council of the routine ecclesiastical business hitherto transacted by the council itself, and finally the growing habit of referring petitions of an ecclesiastical nature to the commissioners, gave the latter "a sufficiently permanent tenure to enable them to establish those traditions and judicial forms which, in time, caused contemporaries to call the sessions of her majesty's commissioners in causes ecclesiastical 'The court of high commission'." The term "high commission" begins to appear by 1570, the title "court" about ten years later. By then the organization, procedure and jurisdiction had been defined and delimited. This involved a relaxation of the privy council's control and "a lighter emphasis on the visitatorial functions which had been the original business of the commission."

The total membership varied between 24 in 1549 and 108 in 1633, but of these any three were usually empowered to act, provided one of them was "of the quorum" (the quorum numbered 11 in 1549, 68 in 1633). The lord chief justice, a colleague and the attorney general sat on the earlier commissions, but, as the latter developed into an ecclesiastical court, the common law judges, though more of them were appointed, ceased to attend. The commission originally sat anywhere in the province of Canterbury, but came later to sit only in London on certain fixed days and to keep the law terms. Its jurisdiction, best summarized in connection with the other ecclesiastical courts as concurrent, appellate and equitable, though vague, was by no means unlimited. The court could assume jurisdiction only *in personam,* in criminal matters (though here the interpretation was rather free and loose), and could not initiate cases of party and party. The chief point about its procedure, which statute and letters patent had left to its discretion, was the use of the oath *ex officio, i.e.,* imposed by the judge himself by virtue of his office, and the penalties it inflicted were almost exclusively fine and imprisonment. There appears to be no authority whatsoever for the allegations that the court resorted to torture, mutilation or the penalty of death.

Opposition.—Its functioning was sometimes beneficent, sometimes tyrannical, but always efficient. That it was widely popular is proved by the enormous number of suitors who flocked to it voluntarily even to the last. But with two sections of the community it could not fail to be unpopular. The Puritans resented its enforcement of vestments, ritual and ceremonies, and when in 1584 Whitgift's Twenty-four Articles, upon which the commissioners proposed to examine them after they had taken the oath *ex officio,* turned a visitatorial investigation into a judicial hearing they not unnaturally complained that a man was thereby compelled to convict himself. And they were encouraged in their opposition by the common lawyers and, more especially, by the common law judges. No doubt the latter were actuated to some extent by jealousy and self-interest, by the desire to extend their own jurisdiction in order to increase their fees, but they had nobler motives as well. The duality of judicial authority in England, of a law temporal and of a law ecclesiastical, was in itself

offensive to men who dreamt of a time when the common law should embrace all jurisdiction whatsoever.

Moreover, the two jurisdictions overlapped; the boundaries between them were vague; each was inclined to trespass on the other. And, lastly, but not least to a judicial mind, "the commission was a hybrid, half ecclesiastical, half temporal in membership; using ecclesiastical procedure, but inflicting temporal penalties; a law court and a visitatorial commission at the same time." Led by the disgruntled Coke, who had himself in earlier days played a large part in building up the authority of the court, the common law judges by prohibitions and pronouncements first of all attempted to confine the commission within what they considered to be its proper limits, and then, encouraged by the popularity of their proceedings and the example of recalcitrant Puritans, embarked on a vigorous attack on its jurisdiction and procedure. They wrongly and contradictorily (since in 1591 in Caudrey's case the judges themselves had unanimously adopted another view) dated the "origin" of the commission from the act of 1559, allowed it no other authority for its existence, and interpreted the words of that statute in a ludicrously and indefensibly narrow fashion. They took exception to the penalties of fine and imprisonment, because these were not, strictly speaking, ecclesiastical penalties, and they challenged the legality of the *ex officio* oath, mainly because that procedure was so different from that of the common law as to appear necessarily illegal to common lawyers.

Suppression.—Opposition on legal and judicial grounds, however, collapsed after 1611. The letter of the law was against the Puritans, the judges could not hope to enforce their views so long as the State supported the commission, and in 1616 Coke was dismissed from the bench. The struggle was henceforth not legal, but political. It was fought, not in the law courts, but in parliament. Already in 1607 and in 1609–10 bills on the subject had been brought in, read twice and dropped; and on July 7, 1610, a petition of grievances had declared the act of 1559 "inconvenient and of dangerous extent."

In 1641, when the parliamentary cause at last triumphed, "the clause of the Act of Supremacy which gave the Crown power to exercise its supremacy through commissioners was repealed; the court was abolished, and it was provided that no similar court should be again set up. . . . At the Restoration the criminal and corrective jurisdiction of the other ecclesiastical courts was revived; but the court of high commission was explicitly exempted from the act." Nevertheless, it was re-established by James II. in 1686 by virtue of the powers belonging to the king as supreme governor of the Church, to be finally condemned after the revolution in the Bill of Rights (1689) as "illegal and pernicious."

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(F. L. B.)

HIGHER EDUCATION: *see* WOMEN, EDUCATION OF.

HIGHGATE, a northern district of London, England, partly in the borough of St. Pancras, but extending into Middlesex. It lies high (max. 426 ft.). The Great North Road passes through Highgate, which is supposed to have received its name from the toll-gate erected by the bishop of London when the road was formed through his demesne in the 14th century. Bacon died here in 1626; Coleridge and Andrew Marvell, the poets, were residents. Cromwell House, now a convalescent home, was presented by Oliver Cromwell to his eldest daughter Bridget on her marriage with Henry Ireton. Lauderdale House, now attached to the public grounds of Waterlow Park, belonged to the duke of Lauderdale, one of the "Cabal" of Charles II. Among various institutions may be mentioned Whittington's almshouses, near Whittington Stone, at the foot of Highgate Hill, on which the future mayor of London is reputed to have been resting when he heard the peal of Bow bells and "turned again." Highgate grammar school was founded (1562–65) by Sir Roger Cholmley, chief-justice.

HIGHLAND PARK, a residential city of Lake county, Ill., U.S.A., 23m. N. of Chicago, on Lake Michigan. It is served by the Chicago and North Western and the Chicago, North Shore and Milwaukee railways. The population was 6,167 in 1920, and was estimated locally at 14,000 in 1928.

HIGHLAND PARK, a city of Wayne county, Michigan, adjoining Detroit. The population was 46,499 in 1920 (27% foreign-born white) and was estimated locally at 65,000 in 1928. It is a residential and industrial suburb, with automobile factories employing 43,000 men. Its total factory output in 1925 was valued at $390,249,842; and the assessed valuation of property in 1927 was $207,882,500. In 1900 Highland Park was a village of 427 inhabitants. Between 1900 and 1910 the population was multiplied by nearly 10; and between 1910 and 1920 by more than 10. The city was incorporated in 1918.

HIGHLANDS, THE, that part of Scotland north-west of a line drawn from Dumbarton to Stonehaven, sometimes including the Inner and Outer Hebrides and the county of Bute, but excluding the Orkneys and Shetlands, Caithness, the flat coastal land of the shires of Nairn, Elgin and Banff, and all East Aberdeenshire (*see* SCOTLAND). This area is to be distinguished from the Lowlands by language and race, the long persistence of the Gaelic speech being characteristic. Even in a historical sense the Highlanders were separate from the Lowlanders, with whom, during many centuries, they shared nothing in common. The town of Inverness is usually regarded as the capital of the Highlands.

HIGHNESS, literally the quality of being lofty or high, a term used, as are so many abstractions, as a title of dignity and honour, to signify exalted rank or station. These abstractions arose in great profusion in the Roman empire, both of the East and West, and "highness" is to be directly traced to the *altitudo* and *celsitudo* of the Latin and the ὑψηλότης of the Greek emperors. *See* FORMS OF ADDRESS.

HIGH PLACE, is the literal translation of the Heb. *bāmāh.* This rendering is etymologically correct, as appears from the poetical use of the plural but in prose *bāmāh* is always a place of worship. It has been surmised that it was so called because the places of worship were originally upon hill-tops, or that the *bāmāh* was an artificial platform or mound, but neither view is historically demonstrable. The word was probably adopted from the Canaanites together with the holy places themselves.

In old Israel every town and village had its own place of sacrifice which was often on the hill above the town, as at Ramah (1 Sam. ix. 12–14); there was a stelè (*maṣṣēbāh*), the seat of the deity, and a wooden post or pole (*ashērāh*), which marked the place as sacred and was itself an object of worship; there was a stone altar, on which offerings were burnt; a cistern for water, and perhaps low stone tables for dressing the victims; sometimes also a hall (*lishkāh*) for the sacrificial feasts.

Around these places the religion of the ancient Israelite centred; at festival seasons, or to make or fulfil a vow, he might journey to more famous sanctuaries, but ordinarily the offerings were paid at the *bāmāh* of his own town. The building of royal temples in Jerusalem or in Samaria made no change in this respect; they simply took their place beside the older sanctuaries to which they were, indeed, inferior in repute.

The religious reformers of the 8th century assail the popular religion as corrupt and as fostering the monstrous delusion that immoral men can buy the favour of God by worship; but they make no difference in this respect between the high places of Israel and the temple in Jerusalem; Hosea stigmatizes the whole cultus as pure heathenism—Canaanite baal-worship.

HIGH POINT, a city of Guilford county, North Carolina, U.S.A., in the Piedmont region, at an altitude of 940ft., 99m. W. by N. of Raleigh. It is on Federal highways 70 and 311, and is served by the Southern Railway system, and High Point, Randleman, Asheboro and Southern, the High Point, Thomasville and Denton railways. The population was 14,302 in 1920 (20% negroes); 22,279 in 1922, after annexations of territory, and was estimated locally at 32,000 in 1928. It is an important manufacturing centre, with 73 furniture and wood-working factories and 29 textile mills in 1928. The factory output in 1925 was valued at $32,132,296. The Southern Furniture exposition is held here twice a year, and two journals devoted to the interests of the trade are published here. High Point was settled about 1855 and incorpo-

rated in 1899. Since 1916 it has had a commission-manager form of government. The population increased considerably more than threefold between 1900 and 1920.

HIGH RELIEF: *see* ALTO-RELIEVO.

HIGH SEAS, the open seas or those parts of the sea not under the dominion of any State. Claims have at times been made to exclusive dominion over large areas of the sea as well as over wide margins, such as 100m., 60m., range of vision, etc., from land. The general interests of navigation, however, have brought States to adopt a limitation first enunciated by Bynkershoek in the formula "terrae dominium finitur ubi finitur armorum vis." Thenceforward cannon-shot range or three marine miles determined the limits of marginal waters known as "territorial waters." With the exception of these marginal waters, inland waters, gulfs, arms of the sea of certain dimensions or waters allowed by immemorial usage to rank as territorial, all waters form part of the high sea. The use of the high sea is free to all the nations of the world, subject only to such restrictions as result from respect for the equal rights of others, and to those which nations may agree *inter se* to observe.

HIGH SPEED STEEL, a tungsten-chromium tool steel of great importance in machining various grades of iron and steel, was developed almost simultaneously by American and European metallurgists. It is the outcome of significant research by F. W. Taylor and Maunsel White. By the Taylor-White method a heat treatment was developed which applies substantially to all the "high speed" steels. It consists of two essential parts: (*a*) heating the forged tool unusually hot (in fact, until the sharp edges start melting and appear to sweat) and then cooling in oil or an air blast, (*b*) reheating in a lead bath at 625° C and cooling in air. Such combination of high-quench and high-draw induces the quality of "red-hardness," whereby the tool retains its useful hardness even when working so fast that the tip is heated red-hot by friction of the chip.

When given the Taylor-White heat treatment such improved steels cut at about 100 ft. per minute, whereas steels formerly used did not exceed 60 ft. per minute. The addition of a fractional per cent of vanadium, due to the work of John A. Mathews, marks a further step. High speed steel with properly adjusted chemical analysis, made with utmost care in the steel mill, properly shaped and hardened, produces tools capable of cutting at a speed greater than 150 ft. per minute. A ten-fold increase in machinery speed has thus been accomplished between 1875 and 1915. Whether 4% of cobalt is a worthwhile addition is debatable; in 1927 it was definitely shown that 10 to 15% increases the red-hardness sufficiently so that Hadfield's manganese steel, hitherto non-machineable, can be cut.

About 13,500 tons of high speed steel were made in the United States in 1926, of which four-fifths were high tungsten alloys, whose chemical analysis is shown in the first column of the accompanying table. The slightly cheaper low-tungsten tools, shown in the second column, are preferred in America for deep cuts on rough forgings; this is probably more popular in Great Britain for general purposes than the high tungsten variety. A theoretical study of the Taylor-White method of heat treatment is difficult and cannot be given in this article.

Approximate Analysis of High Speed Steel

	High tungsten	Low tungsten
Carbon, per cent . .	0·65 to 0·70	0·60 to 0·75
Silicon ,, . . .	0·25 to 0·30	0·25
Manganese ,, . . .	0·25 to 0·30	0·25
Sulphur ,, . . .	0·025 max.	0·025 max.
Phosphorus ,, . . .	0·025 max.	0·025 max.
Tungsten ,, . . .	18·0	14·0
Chromium ,, . . .	4·0	4·0 to 4·5
Vanadium ,, . . .	0·8 to 1·0	1·6 to 2·0

BIBLIOGRAPHY.—F. W. Taylor, *On the Art of Cutting Metals* (1906); many papers in *Transactions*, American Society for Steel Treating. (*See* also IRON AND STEEL.) (E. E. T.)

HIGH TEMPERATURE CARBONIZATION: *see* COKE.

HIGH TENSION MAGNETO: *see* MAGNETO, HIGH TENSION.

HIGH TREASON: *see* TREASON.

HIGHWAY. This word, which in England is used to indicate any road of size and importance, has been specifically applied to a network of national roads in the United States with which this article is concerned. For the law of Highways *see* ROADS AND STREETS, *Laws of Highways*.

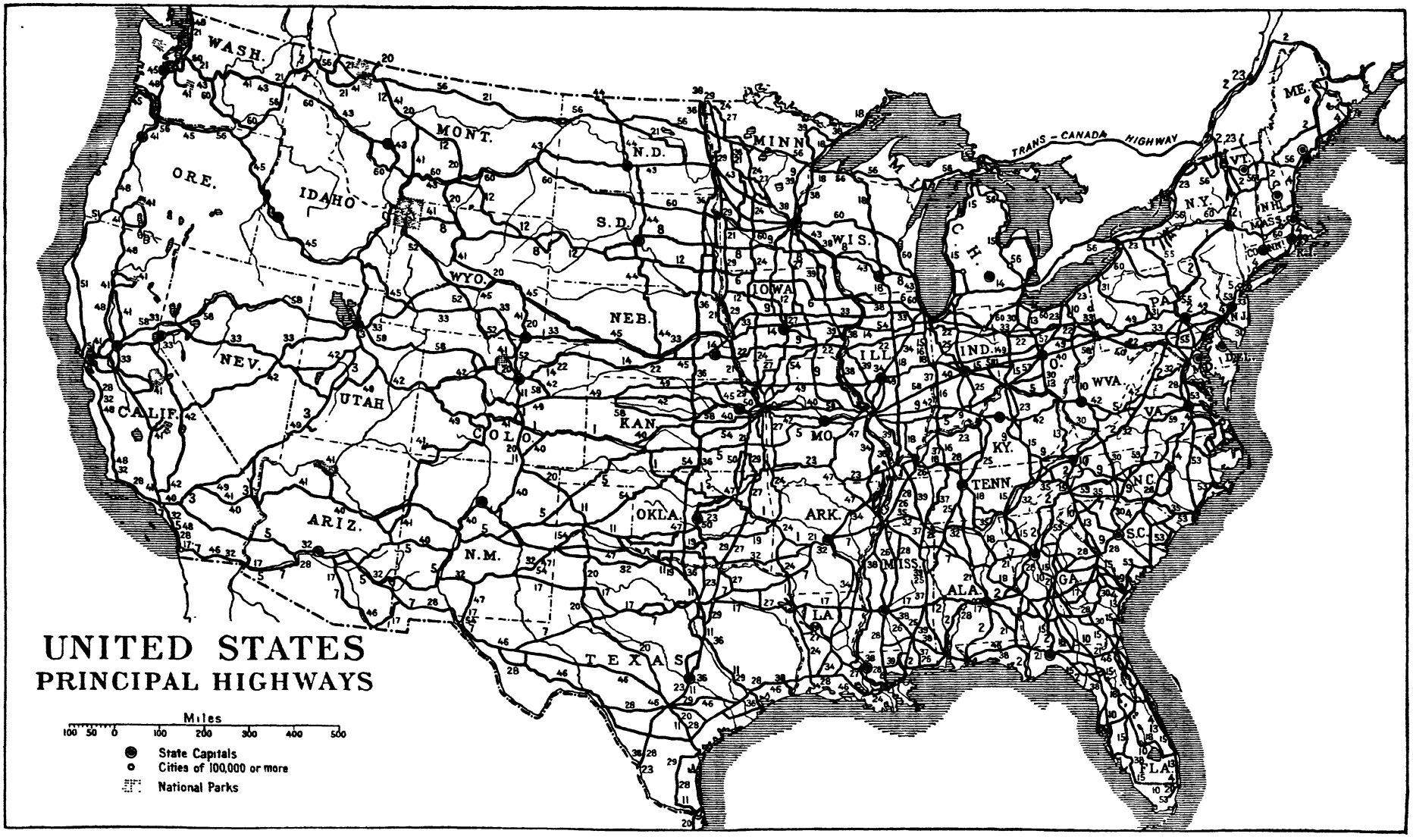
As European peoples went to America they first settled along the seaboard. They therefore first used the sea and adjacent waterways for intercommunication. The few intercommunity roads then built, closely followed coast lines. Even as the desire to move inland developed, the vast waterways were used for transportation and roads were not required The founders of the Republic, however, had the vision to see the future need of roads. In 1780 George Washington conceived the building of a national road to the West and in 1802 Congress passed a financing act for that purpose on admitting Ohio into the Union. This was the beginning of the later building by the Federal Government of a road leading from Washington, D.C., to Santa Fe. This road, known variously as the "Cumberland road," the "National pike," "the Santa Fe trail," and now the "National Old Trails road" (*q.v.*), is the only national road built by the U.S. Government.

As the country grew, needed transportation facilities were supplied by the rapid extension of railroad mileage. Most road building was confined to centres of population and these early roads were mostly of soft dirt. Such intercommunity roads as were built were often financed by private capital through charters allowing the collection of tolls. These toll roads, beginning in 1795 were called "turnpikes" and were later built of broken stone crushed into place by passing horse-drawn vehicles. Some of these turnpikes like the Old York road from Philadelphia towards New York, the Baltimore and Lancaster pikes, also out of Philadelphia, remained until well after the close of the last century; but many of them were abandoned by 1850. Their financial failure was due to the development of steam railroads taking away their business.

With the advent of the bicycle came the organization in 1880 of the League of American Wheelmen, the first national organization to arouse general public interest to the need of improved roads. It gave an impetus to road building then done entirely by towns or townships and counties. New Jersey in 1891 first passed a law giving "State aid" to her counties to help them financially in carrying forward the building of good roads. By 1903, 11 States were giving aid and ten years later in 1913, 42 States were giving aid. But even in 1913 most roads were being built around centres of population and not so much to connect those at any considerable distance from each other. The need for interstate roads was just beginning to be felt. Because of this need there arose a strong public demand that the U.S. Government should again contribute financially towards road building. This demand took definite form in 1916 in the passage by Congress of the first Federal aid bill providing for financial aid to the States to build roads, to be administered by the Department of Agriculture through the Bureau of Public Roads. When this bill was passed all but three States were giving aid and these did so the following year.

Until 1890 broken stone, gravel, shell and slag were about the only materials used for road surfacing. By 1904 there were about 150,000 m. of surfaced highways. Only 141 m. of these were of the higher type of bituminous, tar, asphalt or brick. But the motor vehicle was then beginning to indicate the need of hard and paved roadways. In 1928 there were about 600,000 m. of surfaced highways with 2,400,000 more miles of roads still of native soil to be improved. These surfaced roads had about 90,000 m. paved, 40,000 m. hard surfaced and 470,000 m. surfaced with material such as gravel, sand clay, sand oil and other types not paved or hard.

The Federal Aid Act was amended and extended in 1919, resulting later in the Federal Highway Act of 1921. The entrance of the Federal Government into road building resulted in the creation in all the States of State highway commissions to lay out and build a system of State highways with Federal aid. These State



1 ALBERT PIKE HIGHWAY, Hot Springs, Ark.–Colorado Springs, Colo.
2 APPALACHIAN SCENIC HIGHWAY GULF TO ST. LAWRENCE, Quebec and Buffalo–Tampa and New Orleans
3 ARROWHEAD TRAIL, Salt Lake City–Los Angeles.
4 ATLANTIC HIGHWAY, Calais, Me.–Miami, Fla.
5 ATLANTIC-PACIFIC HIGHWAY, New York City–Los Angeles.
6 ATLANTIC YELLOWSTONE PACIFIC HIGHWAY, Chicago–Sioux Falls, S. Dak.
7 BANKHEAD HIGHWAY, Washington–San Diego, Calif.
8 BLACK AND YELLOW TRAIL, Chicago–Yellowstone Nat'l Park.
9 BOONE WAY, DANIEL BOONE TRAIL–THE BOONE ROUTE, Duluth, Minn.–Savannah, Ga.
10 CLEVELAND-MARIETTA-ASHEVILLE-FLORIDA HIGHWAY LAKES TO OCEAN, Cleveland–Tampa and Miami.
11 COLORADO TO GULF HIGHWAY, Denver–Galveston and Brownsville, Tex
12 CUSTER BATTLEFIELD HIGHWAY, Des Moines, Ia.–Glacier Nat'l Park.
13 DETROIT-ASHEVILLE-MIAMI HIGHWAY–LAKES TO FLORIDA SHORT ROUTE, Detroit–Miami
14 DETROIT-LINCOLN-DENVER HIGHWAY
15 DIXIE HIGHWAY, Sault Ste. Marie, Mich., and Chicago–Miami.
16 DIXIE BEE LINE, Chicago–Nashville, Tenn.
17 DIXIE OVERLAND HIGHWAY, Savannah, Ga.–San Diego
18 FLORIDA SHORT ROUTE, Port Arthur, Ont.,–Ft. Myers, and Palm Beach, Fla
19 FORT SMITH, PAULS VALLEY & WICHITA FALLS HIGHWAY, Ft. Smith, Ark.–Wichita Falls, Tex
20 GLACIER TO GULF MOTORWAY, Calgary, Alta.–Tampico, Mex.
21 GLACIER TRAIL, Seattle–Miami.
22 HARDING HIGHWAY, Washington–Denver
23 INTERNATIONAL PEACE HIGHWAY, Quebec–Mexico City
24 ITASCA PARK HIGHWAY–CANADA AND GULF ROUTE, Winnipeg–New Orleans
25 JACKSON HIGHWAY, Chicago–New Orleans.
26 JEFF DAVIS HIGHWAY, Fairview, Ky.–Biloxi, Miss
27 JEFFERSON HIGHWAY, Winnipeg, Man.–New Orleans.
28 JEFFERSON DAVIS NATIONAL HIGHWAY, Washington–San Francisco.
29 KING OF TRAILS, Winnipeg–Brownsville, Tex
30 LAKES TO FLORIDA HIGHWAY, Detroit–Jacksonville
31 LAKES TO SEA HIGHWAY, Erie, Pa.–Atlantic City.
32 LEE HIGHWAY, New York–San Francisco
33 LINCOLN HIGHWAY, New York–San Francisco.
34 LONE STAR ROUTE, Chicago–Lake Charles, La
35 MEMPHIS-ASHEVILLE-WILMINGTON HIGHWAY
36 MERIDIAN HIGHWAY, Winnipeg–Galveston, Tex. and Mexico City.
37 MISSISSIPPI GULF COAST TO CHICAGO HIGHWAY–MAGNOLIA ROUTE, Chicago–Gulfport, Miss
38 MISSISSIPPI RIVER SCENIC HIGHWAY, Winnipeg–Ft. Myers, Fla; Port Arthur, Ont., Galveston
39 MISSISSIPPI VALLEY HIGHWAY–Ely, Minn.–Gulfport
40 NATIONAL OLD TRAILS ROAD, Washington and Baltimore–Los Angeles.
41 NATIONAL PARK-TO-PARK HIGHWAY, Circle Connecting National Parks.
42 NATIONAL ROOSEVELT MIDLAND TRAIL, Washington and Newport News, Va.–Los Angeles.
43 NATIONAL PARKS HIGHWAY–NORTHWEST TRAIL, Boston and New York–Seattle
44 NORTH AND SOUTH PIKE, Prince Albert, Sask.–Kearney, Nebr.
45 OLD OREGON TRAIL, Independence, Mo.–Seaside, Ore. and Olympia, Wash.
46 OLD SPANISH TRAIL, St. Augustine, Fla.–San Diego.
47 OZARK TRAILS, St. Louis–El Paso, Tex.
48 PACIFIC HIGHWAY, Vancouver, B.C.–San Diego.
49 PIKE'S PEAK OCEAN TO OCEAN HIGHWAY, New York–Los Angeles.
50 RED STAR ROUTE, Topeka, Kan.–Oklahoma City.
51 REDWOOD HIGHWAY, Grants Pass, Ore.–San Francisco.
52 ROCKY MOUNTAIN HIGHWAY, Denver–Yellowstone Nat'l Park.
53 SOUTH ATLANTIC COASTAL HIGHWAY, New York–Miami.
54 SOUTHWEST TRAIL, Chicago–El Paso, Texas.
55 SUSQUEHANNA TRAIL, Buffalo, N.Y.–Washington.
56 THEODORE ROOSEVELT INTERNATIONAL HIGHWAY, Portland, Me.–Portland, Ore.
57 THREE "C" HIGHWAY, Cleveland–Cincinnati.
58 VICTORY HIGHWAY, New York–San Francisco.
59 WASHINGTON - ASHEVILLE - ATLANTA HIGHWAY, Washington–Atlanta.
60 YELLOWSTONE TRAIL, Plymouth Rock–Puget Sound.

highways in 1928 aggregated about 300,000 m. to about 200,000 m. to which Federal aid contributed. Of this Federal aid mileage approximately 100,000 m. have been designated as "United States Highways" and are so marked and numbered with the shield of the United States. They are the primary trunk interstate highways of the Nation.

Thousands of organizations were formed to advocate not only good roads in general but a specific good road in particular. By 1913 there were over 50 major good roads organizations and over 500 minor ones, while so-called trail associations, advocating the improvement of a particular through road, were being formed with surprising rapidity. In 1911 the National Highways Association was organized, and over 10,000 organizations have since become members of or affiliated with this association.

The principal national highways (for fuller description *see* under separate headings) in the United States are the ocean to ocean highways: the National Old Trails road extending from Washington, D.C., to Los Angeles; the Lincoln highway extending across the north central United States; the Pikes Peak Ocean to Ocean highway from New York city to San Francisco; the Yellowstone trail from Plymouth rock on the Atlantic to Seattle on Puget sound; the Lee highway from Washington, D.C., to San Diego, Calif.; the Old Spanish trail from St. Augustine, Fla., to San Diego; and the better known north and south alignments: the Atlantic highway from Maine to Florida; the Dixie highway from Lake Michigan to Florida; the Meridian road from Canada to Mexico; and the Pacific highway from Vancouver, Canada, to the Mexican boundary line south of San Diego, Calif. (C. Dav.)

HILARION, ST. (*c.* 290–371), abbot, the first to introduce monasticism into Palestine, was born of heathen parents at Tabatha near Gaza, and was educated at Alexandria where he became a Christian. About 306 he visited St. Anthony and, embracing the eremitical life, lived for many years as a hermit in the desert by the marshes on the Egyptian border. Many disciples put themselves under his guidance in south Palestine. In 356 he returned to Egypt; but the accounts given in St. Jerome's *Vita* of his later travels must be taken with caution. It is there said that he went from Egypt to Sicily, and thence to Epidaurus, and finally to Cyprus where he met Epiphanius and died in 371.

See O. Zöcker, "Hilarion von Gaza," *Neue Jahrb. f. deutsche Theol.* (1894); A. Butler, *Lives of the Saints* for Oct. 21, and Herzog-Hauck, *Realencyklopädie.*

HILARIUS, ST. (*c.* 300–367), bishop of Poitiers, was born of pagan parents at Poitiers, but later became a Christian, and about 353 was unanimously elected bishop of his native town. Almost at once, he secured the excommunication of Saturninus, the Arian bishop of Arles and of Ursacius and Valens, two of his prominent supporters, and wrote to the emperor Constantius a remonstrance against the persecutions by the Arians. But at the synod of Biterrae (Beziers), summoned in 356 by Constantius, Hilary was banished to Phrygia, continuing, however, to govern his diocese.

He wrote there the important *De synodis* or *De fide Orientalium,* an epistle addressed in 358 to the Semi-Arian bishops in Gaul, Germany and Britain, expounding the views of the Oriental bishops on the Nicene controversy, and the *De trinitate.* In 359 Hilary attended the convocation of bishops at Seleucia in Isauria, where, with the Egyptian Athanasians, he joined the Homoiousian majority against the Arianizing party headed by Acacius of Caesarea; thence he went to Constantinople, and through a petition (*Ad Constantium Augustum liber secundus*) personally presented to the emperor, was sent back to his diocese. In 364 he impeached Auxentius, bishop of Milan, and a man high in the imperial favour, as heterodox; he was summoned to appear before the emperor Valentinian at Milan, but being unable to maintain his charges, was expelled from the city. In connection with the controversy, he published the *Contra Arianos vel Auxentium Mediolanensem liber,* and the *Contra Constantium Augustum liber.*

Hilary is sometimes regarded as the first Latin Christian hymn-writer, but none of the compositions assigned to him is indisputable. Augustine termed him "the illustrious doctor of the churches." His feast is celebrated in the West on Jan. 13.

Hilary's works were edited by Erasmus (Basel, 1523, 1526, 1528); P. Coustant (Paris, 1693); Migne (*Patrol Lat.* ix., x., 1844–45). The *Tractatus de mysteriis,* ed. J. F. Gamurrini (Rome, 1887), and the *Tractatus super Psalmos,* ed. A. Zingerle in the Vienna *Corpus scrip. eccl. Lat.* xxii. Translation by E. W. Watson in *Nicene and Post-Nicene Fathers,* ix.

Bibliography.—The life by (Venantius) Fortunatus *c.* 550 is almost worthless. More trustworthy are the notices in Jerome (*De vir. illus.* 100), Sulpicius Severus (*Chron.* ii. 39–45) and in Hilary's own writings. H. Reinkens, *Hilarius von Poictiers* (1864); Barbier, *Vie de S. Hilaire* (1882); L. Dubois, *Saint Hilaire* (1902); A. Beck, *Die Trinitätslehre des St. Hilarius* (1903); A. F. Feder, *Studien zu Hilarius von Poitiers* (1910). *See* also O. Bardenhewer, *Patrologie;* A. Harnack, *Hist. of Dogma,* in Herzog-Hauck's *Realencyk.*

HILARIUS (Hilary), **ST.** (*c.* 403–449), bishop of Arles, was born probably in northern Gaul. In early youth he entered the abbey of Lérins, then presided over by his kinsman Honoratus (St. Honoré), and succeeded Honoratus in the bishopric of Arles in 429. He held the rank of metropolitan of Vienne and Narbonne, and attempted to realize the sort of primacy over the church of south Gaul which seemed implied in the vicariate granted to his predecessor Patroclus (417). Hilarius deposed the bishop of Besançon (Chelidonus), for ignoring this primacy, and for claiming a metropolitan dignity for Besançon. An appeal was made to Rome, and Leo I. used it to extinguish the Gallican vicariate (A.D. 444). Hilarius was deprived of his rights as metropolitan to consecrate bishops, call synods or exercise ecclesiastical oversight in the province, and the pope secured the edict of Valentinian III., so important in the history of the Gallican church, "ut episcopis Gallicanis omnibusque pro lege esset quidquid apostolicae sedis auctoritas sanxisset." The papal claims were made imperial law, and violation of them subject to legal penalties (*Novellae Valent.* iii. tit. 16). Hilarius died in 449, and is commemorated on May 5.

His writings are printed in Migne's *Patrol. Lat.* vol. 1. *See* O. Bardenhewer, *Patrologie* (1894); and Herzog's *Realencyklopädie.*

HILARIUS or **HILARUS** (d. 468), bishop of Rome from 461 to 468, is known to have acted as legate of Leo the Great at the "robber" synod of Ephesus in 449. There he so vigorously opposed the condemnation of Flavian of Constantinople that he was thrown into prison, whence he escaped to Rome. He was chosen to succeed Leo on Nov. 19, 461. In 465 he held at Rome a council which put a stop to some abuses, particularly to that of bishops appointing their own successors. His pontificate was also marked by the extension of papal authority in France and Spain. Hilarius died on Nov. 17, 467.

His briefs and decrees are published in A. Thiel's *Epistolae pontificum Romanorum* (Braunsberg, 1868). See *Liber Pontificalis* (ed. Duchesne), and Jaffé, *Regesta Pont. Rom.*

HILARIUS (*fl.* 1125), a Latin poet who is supposed to have been English. He was a pupil of Abélard to whom he addressed a copy of verses with its refrain in the vulgar tongue, "*Tort avers vos li mestre.*" Later Hilarius made his way to Angers. His works consist chiefly of light verses of the goliardic type. Of his three miracle plays in rhymed Latin with an admixture of French, two, *Suscitatio Lazari* and *Historia de Daniel repraesentanda,* are of purely liturgical type. The third, *Ludus super iconia Sancti Nicholai,* is founded on a foolish legend and Petit de Julleville sees in it a satiric intention.

A rhymed Latin account of a dispute in which the nuns of Ronceray at Angers were concerned, contained in a cartulary of Ronceray, is also ascribed to the poet, who there calls himself Hilarius Canonicus. The poem is printed in the *Bibliothèque de l'Ecole des Chartes* (vol. xxxvii. 1876), and is dated by P. Marchegay from 1121. The Paris ms. containing the genuine poems of Hilarius was edited in 1838 by Champollion Figeac. *See* notice in *Hist. litt. de la France* (xii. 251–254), supplemented (in xx. 627–630), *s.v.* Jean Bodel, by Paulin Paris; also Wright, *Biographia Britannica literaria, Anglo-Norman Period* (1846); and Petit de Julleville, *Les Mystères* (vol. i. 1880).

HILARY TERM, the first of the four terms of legal administration held by the High Courts of Justice. It begins on Jan. 11, and follows the custom of being named according to the festival of the saint nearest the date of the commencement of the term. It is also one of the dining terms of the Inns of Court. *See* Inns of Court.

HILBERSEIMER, LUDWIG (1885–), German architect, was born at Karlsruhe. Like Le Corbusier in France, he has latterly devoted perhaps as much time to town-planning as to the erection of individual buildings. An original and logical thinker, he sees the solution of town-planning problems in a vertical building system, *i.e.*, to some extent, two cities one on top of the other, the dwelling-house of each worker being as far as possible above his place of business. Vehicular traffic would be on the ground level, with streets and cross-streets for pedestrians above. Hilberseimer shares with Le Corbusier the aim of industrializing building, advocating ferro-concrete construction and simple interiors with as much built-in furniture as possible, and disclaims the aesthetic element as an end in itself; "like all other elements it is co-ordinated in the whole." Among the larger buildings erected to his designs the Rheinlandhaus, Berlin, a well-articulated unity, pleasantly airy in effect, illustrates his conception of modern non-domestic building.

HILDA, ST., strictly Hild (614–680), was the daughter of Hereric, a nephew of Edwin, king of Northumbria. She was converted to Christianity before 633 by Paulinus. About 650 she became abbess of Hartlepool, where she remained several years. From Hartlepool Hilda moved to Whitby, and in 657 founded the famous double monastery which in her time included among its members five future bishops, Bosa, Aetta, Oftfor, John and Wilfrid II. as well as the poet Caedmon. Hilda exercised great influence in Northumbria, and ecclesiastics from all over England and from Strathclyde and Dalriada visited her monastery. In 655 after the battle of Winwaed Oswio, King of Northumbria, entrusted his daughter Aelfled to Hilda, with whom she went to Whitby. At the synod of Whitby in 664 Hilda sided with Colman and Cedd against Wilfrid, and in spite of the defeat of the Celtic party, remained hostile to Wilfrid until about 679. Hilda died in 680.

See Bede, *Hist. eccl.* (ed. C. Plummer, Oxford, 1869); Eddius, *Vita Wilfridi* (Raine, *Historians of Church of York*, Rolls Series, vol. i., 1879), c. liv.

HILDBURGHAUSEN, a town of Germany, in the republic of Thuringia, situated on the river Werra, 19 m. S.E. of Meiningen, on the railway Eisenach-Coburg. Pop. (1925) 6,515. Hildburghausen (in records *Hilpershusia* and *Villa Hilperti*) belonged in the 13th century to the counts of Henneberg, from whom it passed to the landgraves of Thuringia and then to the dukes of Saxony. In 1683 it became the capital of a principality which in 1826 was united to Saxe Meiningen.

It has a former ducal palace erected 1685–95, and an old town hall. The manufactures include toys, baskets, turnery, agricultural machines, knives, mineral waters and condensed soups.

HILDEBERT OF LAVARDIN (*c.* 1055–1133), archbishop of Tours, was born at Lavardin, near Vendôme. He was probably a pupil of Berengarius of Tours, and became master of the school at Le Mans; in 1091 he was made archdeacon and in 1096 bishop of Le Mans. While he was absent in Rome in 1111, Henry of Lausanne spread heretical doctrines and denounced the bishop. In 1125 he was translated unwillingly to the archbishopric of Tours, and there he came into conflict with the French king Louis VI. over ecclesiastical patronage and with the bishop of Dol about the authority of his see in Brittany. He presided over the synod of Nantes in 1127, and died at Tours about Dec. 18, 1133.

The writings of Hildebert which include letters, poems, a few sermons and lives of Hugo, abbot of Cluny and of St. Radegunda, were published in Paris in 1708 and later in Migne's *Patrol. Lat.*

See B. Hauréau, *Les Mélanges poétiques d'Hildebert de Lavardin* (1882); and *Notices et extraits de quelques manuscrits latins de la Bibliothèque nationale* (1890–93); P. de Déservillers, *Un Evêque au XIIe siècle, Hildebert et son temps* (1876); E. A. Freeman, *The Reign of Rufus*, vol. ii. (Oxford, 1882); L. Dieudonné, *Hildebert de Lavardin* (1898); F. Barth, *Hildebert von Lavardin* (Stuttgart, 1906). *See* also Herzog's *Realencyklopädie.*

HILDEBRAND, ADOLF VON (1847–1921), German sculptor, born in Marburg on Oct. 6, 1847. He studied at the art school in Nuremberg, under K. v. Zumbusch in Munich and under Siemering in Berlin. From 1867–68 he was in Rome, where he met his lifelong friends, Hans von Marées, the painter, and Konrad Fiedler, the writer on art. He returned to Italy in 1874 and settled in the neighbourhood of Florence. In 1897 he built himself a house in Munich. He died there on Jan. 1, 1921. His work combined lifelike realism with classic conception of form. He modelled many portrait busts, among which may be mentioned Clara Schumann, Hermann von Helmholtz, Max von Pettenkofer, Wilhelm von Bode, Henriette Hertz. For the market place in Jena he designed the Bismarck fountain (1894); for Munich the Wittelsbach fountain (1895) and the Hubertus fountain (1907); for Strasbourg a fountain with the bronze figure of Father Rhine (1903), the architectural part of which was destroyed in 1919 and the figure placed in a park; for Meiningen he created a monument of Brahms (1898) and one of the poet Otto Ludvig (1898); for Bremen a monument of Bismarck (1910); for Nürnberg a monument of Schiller (1911).

His small book entitled *Das Problem der Form* (Stuttgart, 1893), in which he analysed the optical laws underlying the artistic representation of form, exercised a revolutionary influence on art criticism. It was widely read and theorists in art such as C. Fiedler, H. Wölfflin and J. Strzygowski have founded their writings on it.

See A. Heilmeyer, *Adolf Hildebrand* (Leipzig, 1902).

HILDEBRAND, LAY OF (*Das Hildebrandslied*), a unique example of Old German alliterative poetry, written about the year 800 on the first and last pages of a theological manuscript by two monks of the monastery of Fulda. The fragments only extend to 68 lines, and are clearly a transcript of an older original, which the copyists imperfectly understood. The language of the poem shows a curious mixture of Low and High German forms; as the High German elements point to the dialect of Fulda, the inference is that the copyists were reproducing an originally Low German lay in the form in which it was sung in Franconia.

The fragment is mainly taken up with a dialogue between Hildebrand and his son Hadubrand. When Hildebrand followed his master, Theodoric the Great, who was fleeing eastwards before Odoacer, he left his young wife and an infant child behind him. At his return to his old home, after 30 years' absence among the Huns, he is met by a young warrior and challenged to single combat. Hildebrand asks for the name of his opponent, and discovering his own son in him, tries to avert the fight, but in vain; Hadubrand only regards the old man's words as the excuse of cowardice. The Old High German *Hildebrandslied* is dramatically conceived and written in a terse, vigorous style; it is the only remnant that has come down from early Germanic times of an undoubtedly extensive ballad literature, dealing with the national sagas.

The ms. of the *Hildebrandslied* is now in the Landesbibliothek at Cassel. The literature on the poem will be found in K. Müllenhoff and W. Scherer, *Denkmaler deutscher Poesie und Prosa aus dem VIII. bis XI. Jahrh.*, 3rd ed. (1892), and in W. Braune, *Althochdeutsches Lesebuch*, 5th ed. (1902). The poem was discovered and first printed (as prose) by J. G. von Eckhart, *Commentarii de rebus Franciae orientalis* (1729), i. 864 ff.; the first scholarly edition was that of the brothers Grimm (1812). Facsimile reproductions of the ms. have been published by W. Grimm (1830), E. Sievers (1872), G. Konnecke in his *Bilderatlas* (1887; 2nd ed., 1895) and M. Ennecerus (1897). *See* also K. Lachmann, *Über das Hildebrandslied* (1833) in *Kleine Schriften*, i. 407 ff.; C. W. M. Grein, *Das Hildebrandslied* (1858, 2nd ed., 1880); O. Schröder, *Bemerkungen zum Hildebrandslied* (1880); H. Möller, *Zur althochdeutschen Alliterationspoesie* (1888); R. Heinzel, *Über die ostgotische Heldensage* (1889); B. Busse, "Sagengeschichtliches zum Hildebrandslied," in Paul and Braune's *Beiträge*, xxvi., pp. 1 ff. (1901); R. Koegel, *Geschichte der deutschen Literatur bis zum Ausgang des Mittelalters*, i., pp. 210 ff. (1894); and R. Koegel and W. Bruckner, in Paul's *Grundriss der germanischen Philologie*, 2nd ed., ii. pp. 71 ff. (1901).

HILDEBRANDSSEN, HUGO HILDEBRAND (1838–1925). Swedish meteorologist, was professor of meteorology and director of the Meteorological Institute at Upsala from 1878 to 1906. He was an associate member of the Comité Permanent International Météorologique from 1882 to 1885, ordinary member from 1891 and general secretary from 1900 to 1907. In 1886 he undertook, in conjunction with Ralph Abercromby, the classification of cloud forms, and he published in 1896 his *Atlas international des nuages* (with Riggenbach and L. Teisserenc de Bort), together with *Les bases de la météorologie dynamique* (1898–

1907), in collaboration with Teisserenc de Bort. He died on July 29, 1925.

HILDEBRANDT, EDUARD (1818–1869), German landscape painter, was born at Danzig, on Sept. 9, 1818, the son of a house painter. He studied under Wilh. Krause in Berlin and under E. Isabey in Paris. His most important work was in water-colour and he travelled all over the world in search of subjects. In 1862–64 he travelled round the world by order of Frederick William IV. of Prussia, who was his patron, "to learn from personal view the phenomena that the sea, the air, and the solid earth bring forth beneath the most various skies." He returned with 300 water-colours, a selection of which were published. Among his works are: "Castle Kronborg" (1857), in the National Gallery, Berlin; "Moonrise in Madeira," Corcoran Gallery, Washington; "The Bay of Naples," Metropolitan Museum of Art, New York; "Sunset on Rio de Janeiro" (1851), in the museum at Hamburg. The interest of his work lies in the subject represented. His colour effects are often crude, though his execution is not without technical merit.

See F. Arndt, *Eduard Hildebrandt, der Maler des Kosmos* (1869).

HILDEGARD, ST. (1098–1179), German abbess and mystic, was born of noble parents at Böckelheim, near Sponheim, and from her eighth year she was educated at the Benedictine cloister of Disibodenberg by Jutta, sister of the count of Sponheim, whom she succeeded as abbess in 1136. From childhood she experienced visions, which in her 43rd year she divulged to her friend, the monk Godefridus, who committed them to writing (1141–50), entitling them *Scivias*. She corresponded with Anastasius IV. and Adrian IV. and the emperors Conrad III., and Frederick I., also the theologian Guibert of Gembloux, who submitted numerous questions in dogmatic theology for her determination. After she migrated with 18 of her nuns to a new convent on the Rupertsberg near Bingen, she continued to exercise the gift of prophecy and to record her visions in writing. She died on Sept. 17, 1179; she has never been canonized, but her name is in the Roman martyrology.

Though Hildegard's claims to Divine inspiration prevented her from citing profane authors, she seems to have combined fragments of Aristotle and Galen with elements derived from St. Augustine, Isidore, Bernard of Tours, Hugh of St. Victor and from the Salernitan school. She elaborates the traditional doctrines of the macrocosm and the microcosm, indicates the relation between them, and around these ideas weaves her interesting physiological, psychological and theological opinions.

Her works, which include the above-named *Scivias*, the curious *Liber divinorum operum*, the *Liber vitae meritorum*, medical treatises, homilies, letters, hymns and lives of St. Disibode and of St. Rupert, were published in Migne's *Patrol. Lat.* vol. 197 and in Pitra's *Analecta sacra* (1882) which contain the contemporary biographies by the monks Theodoric, Godefrid and Guibert. *See* J. P. Schmalzeis, *Das Leben und Wirken der hl. Hildegardis* (Freiburg i/B., 1879); F. W. Roth, *Lieder und unbekannte Sprache der hl. Hildegardis* (Wiesbaden, 1880); P. Franche, *S. Hildegarde* (1903); J. May, *Die hl. Hildegard* (1911); F. M. Steel, *Life and Visions of St. Hildegarde* (1914); C. Singer, *Studies in the Hist. of Science* (1917); L. Bronarski, *Die Lieder der hl. Hildegard* (Leipzig, 1922).

HILDEN, a town in the Prussian Rhine province on the Itter, 9 m. S.E. of Düsseldorf by rail. Pop. (1925) 20,014. Its manufactures include silks, calico-printing, tanning, machinery and brick-making.

HILDESHEIM, a town and episcopal see in the Prussian province of Hanover, at the north foot of the Harz mountains, on the right bank of the Innerste, 18 m. S.E. of Hanover by railway, and on the main line from Berlin, via Magdeburg to Cologne. Pop. (1925) 58,181.

Hildesheim owes its rise and prosperity to the fact that in 822 it was made the seat of the bishopric which Charlemagne had founded at Elze a few years before. St. Bernward, bishop from 993 to 1022, walled the town, and stimulated the art of working in metals. In the 13th century Hildesheim became a free city of the empire; in 1249 it received municipal rights and about the same time it joined the Hanseatic league. Its bishops gradually became practically independent, and carried on wars with neighbouring princes, especially with the house of Brunswick-Lüneburg, under whose protection Hildesheim placed itself several times. The extent of their lands depended on the fortune of war, but at the beginning of the 19th century the extent of the prince bishopric was 682 sq.m. In 1801 the bishopric was secularized and in 1813 it was transferred to Hanover. In 1866, along with Hanover, it was annexed by Prussia. In 1803 a new bishopric of Hildesheim, a spiritual organization only, was established, and this has jurisdiction over all the Roman Catholic churches in the centre of north Germany.

The town consists of an old and a new part, and is surrounded by ramparts. Its streets contain many old houses with overhanging upper storeys and adorned wooden façades. The Roman Catholic cathedral (mid. 11th century) occupies the site of a building of the early 9th century. The Romanesque church of St. Godehard was built in the 12th century and restored in the 19th. The church of St. Michael, founded by Bishop Bernward early in the 11th century and restored after injury by fire in 1186, contains a unique painted ceiling of the 12th century, the sarcophagus and monument of Bishop Bernward, and a bronze font; it is now a Protestant parish church, but the crypt is used by the Roman Catholics. The church of the Magdalene possesses two candelabra, a gold cross, and various other works in metal by Bishop Bernward; and the Lutheran church of St. Andrew has a choir dating from 1389. In the suburb of Moritzberg there is an abbey church founded in 1040, the only pure columnar basilica in north Germany.

The chief secular buildings are the town-hall (Rathaus), which dates from the 15th century and was restored in 1883–92, adorned with frescoes illustrating the history of the city; the Tempelherrenhaus, in Late Gothic, erroneously said to have been built by the Knights Templars; the Knochenhaueramthaus, formerly the gild-house of the butchers, restored after a fire in 1884, and probably the finest specimen of a wooden building in Germany; the Michaelis monastery, used as a lunatic asylum; and the old Carthusian monastery. The buildings of Trinity hospital, partly dating from the 14th century, are now a factory; and the Wedekindhaus (1598) is now a savings-bank. Hildesheim is the seat of considerable industry. Its chief productions are sugar, tobacco and cigars, stoves, machines, vehicles, rubber and gutta percha, paper, oil, agricultural implements and bricks. Other trades are brewing and tanning.

HILFERDING, RUDOLF (1877–), German statesman, was born on Aug. 10, 1877, at Vienna. He took his degree in medicine in Vienna University. In 1907 he joined the staff of *Vorwärts* in Berlin as political director, and became one of the most important publicists of the social-democratic party. He opposed the decision of the party to vote war credits in 1914, and conducted pacifist propaganda. After the war he acquired German citizenship and then conducted the *Freiheit* (1918–22) an organ of the majority socialist party, and was one of the most effective opponents of the communists. When, however, the new communist party broke off from the independent social democratic party, he became the leader of the independent social democrats and worked for their reunion, accomplished in 1922, with the social democratic party. Dr. Hilferding was one of the German experts at the Genoa conference (April–May 1922) and from August to October 1923 finance minister in the Stresemann cabinet. Having failed to stop the devaluation of the mark, he had to retire, but remained the financial expert of the social democratic party, until appointed minister of finance in the Müller cabinet of 1928. Hilferding edited *Marx-studien* (1904–1922, 4 vols.) and *Gesellschaft* (1924 *seq.*), an international socialist review. His principal single work was *Das Finanz Kapital* (1910, 2nd ed. 1920).

HILL, AARON (1685–1750), English author, was born in London, the son of George Hill, of Malmesbury abbey, Wiltshire. On leaving Westminster school at 14 he was sent to travel in the Near East. After his return in 1709 he engaged in all kinds of commercial enterprises, wrote a play, and was for a brief time a theatrical manager. In 1730 he wrote *The Progress of Wit, being a caveat for the use of an Eminent Writer.* The "eminent writer" was Pope, who had introduced him into *The Dunciad* as one of the competitors for the prize offered by the goddess of Dullness,

though the satire was qualified by an oblique compliment. Hill died on Feb. 8, 1750. The best of his plays were *Zara* (acted 1735) and *Merope* (1749), both adaptations from Voltaire. He also published two series of periodical essays, *The Prompter* (1735) and, with William Bond, *The Plaindealer* (1724).

The Works of the late Aaron Hill, consisting of letters . . . original poems. . . . With an essay on the Art of Acting appeared in 1753, and his *Dramatic Works* in 1760. His *Poetical Works* are included in Anderson's and other editions of the British poets. A full account of his life is provided by an anonymous writer in Theophilus Cibber's *Lives of the Poets*, vol. v.

HILL, AMBROSE POWELL (1825–1865), American Confederate soldier, was born in Culpeper county, Va., on Nov. 9, 1825, and graduated at West Point in 1847, being appointed to the 1st U.S. artillery. He served in the Mexican and Seminole Wars, was promoted first lieutenant in Sept. 1851, and in 1855–1860 was employed on the U.S. coast survey. In March 1861, just before the outbreak of the Civil War, he resigned his commission, and when his State seceded he was made colonel of a Virginian infantry regiment, winning promotion to the rank of brigadier-general on the field of Bull Run. In the Peninsular campaign of 1862 he gained further promotion, and as a major-general was one of the most prominent and successful divisional commanders of Lee's army in the Seven Days', Second Bull Run, Antietam and Fredericksburg campaigns. His division formed part of "Stonewall" Jackson's corps, and he was severely wounded in the flank attack of Chancellorsville in May 1863. After Jackson's death Hill was made a lieutenant-general and placed in command of a corps of Lee's army, which he led in the Gettysburg campaign of 1863, the autumn campaign of the same year, and the Wilderness and Petersburg operations of 1864–65. He was killed in front of the Petersburg lines on April 2, 1865. His reputation as a troop leader in battle was one of the highest among the generals of both sides.

See James P. Mathews, "How General A. P. Hill met his Fate," in *Southern Hist. Soc. Papers*, vol. xxvii., p. 26–38 (1899).

HILL, DANIEL HARVEY (1821–1889), American Confederate soldier, was born in York district, South Carolina, July 12 1821. He graduated at the United States military academy in 1842, and became a major in the Mexican War. From 1849 until the outbreak of the Civil War he was professor of mathematics at Washington college (Washington and Lee university), at Davidson college, North Carolina, and superintendent of the North Carolina military institute. As colonel of a Confederate infantry regiment he won the action of Big Bethel, June 10 1861. As major-general he led a division with great distinction in the battle of Fair Oaks and the Seven Days, in the second Bull Run campaign. In the Antietam campaign the resistance of his division enabled Lee to concentrate for battle. It was conspicuous in the battles of the Antietam and Fredericksburg. In 1863 he commanded one of Bragg's corps in the victory of Chickamauga. In 1866–69 he edited *The Land We Love*, at Charlotte (N.C.). He became president of the University of Arkansas in 1877 and in 1885 of the Military and Agricultural College of Georgia. He died at Charlotte on Sept. 24 1889.

HILL, DAVID JAYNE (1850–), American diplomat, was born at Plainfield, N.J., on June 10, 1850. After graduating in 1874 from the University of Lewisburg, Pa.—later known as Bucknell university—he became instructor in Greek and Latin there and from 1877 professor of rhetoric. In 1879 he was elected president of Bucknell, and in 1888 of the University of Rochester. In 1896 he resigned and went abroad to study public law. In 1898 he was appointed assistant secretary of State by President McKinley. While in Washington he was also professor of European diplomacy in the school of comparative jurisprudence and diplomacy. In 1903 he was appointed minister to Switzerland, and in 1905 was transferred to Holland. He was a delegate to the Second Peace Conference at The Hague in 1907. From 1908–11 he was ambassador to Germany.

Hill's best-known work is his *History of Diplomacy in the International Development of Europe*, embracing *The Struggle for Universal Empire* (1905), *The Establishment of Territorial Sovereignty* (1906) and *The Diplomacy of the Age of Absolutism* (1914). His other writings include *World Organization as Affected by the Nature of the Modern State* (1911, lectures delivered at Columbia university); *Impressions of the Kaiser* (1918); *Present Problems in Foreign Policy* (1919); *American World Policies* (1920); and *The Problem of a World Court* (1927).

HILL, GEORGE BIRKBECK NORMAN (1835–1903), English author, editor of Boswell and commentator on Samuel Johnson, was born at Tottenham, Middlesex, the son of Arthur Hill, head master of Bruce Castle school. He was educated in his father's school and at Pembroke college, Oxford. In 1858 he began to teach at Bruce Castle school, and from 1868 to 1877 was head master. In 1869 he became a regular contributor to the *Saturday Review*. He settled at Oxford in 1887, but from 1891 onwards his winters were usually spent abroad. He died at Hampstead, London, on Feb. 27, 1903. His works include: *Dr. Johnson, his Friends and his Critics* (1878); an edition of Boswell's *Correspondence* (1879); a laborious edition of *Boswell's Life of Johnson, including Boswell's Journal of a Tour to the Hebrides, and Johnson's Diary of a Journey into North Wales* (6 vols., 1887); *Wit and Wisdom of Samuel Johnson* (1888); *Select Essays of Dr. Johnson* (1889); *Footsteps of Dr. Johnson in Scotland* (1890); *Letters of Johnson* (1892); *Johnsonian Miscellanies* (2 vols., 1897); an edition (1900) of Edward Gibbon's *Autobiography;* Johnson's *Lives of the Poets* (3 vols., 1905), and other works on the 18th-century topics. Dr. Birkbeck Hill's elaborate edition of Boswell's *Life* is a monumental work, invaluable to the student.

See a memoir by his nephew, Harold Spencer Scott, in the edition of the *Lives of the English Poets* (1905), and the *Letters* edited by his daughter, Lucy Crump, in 1903.

HILL, JAMES J. (1838–1916), American railway capitalist, was born near Guelph (Ont.), Canada, Sept. 16, 1838, and attended Rockwood (Ont.) academy, a Quaker institution. In 1856 he settled in St. Paul (Minn.). He became a clerk in the office of a firm of river steamboat agents and shippers, and later was agent for a line of river packets; he established (about 1870) transportation lines on the Mississippi and on the Red river (of the North). He effected a traffic arrangement between the St. Paul Pacific railroad and his steamboat lines; and when the railway failed in 1873 for $27,000,000, Hill interested Sir Donald A. Smith (Lord Strathcona), George Stephen (Lord Mount Stephen), and other Canadian capitalists, in the road and in the wheat country of the Red river valley; he reorganized the road as the St. Paul, Minneapolis and Manitoba, and in 1883 he became its president. He was president of the Great Northern railway from 1893 until April 1907, when he became chairman of its board of directors, serving in that capacity until 1912. The Hill interests obtained control not only of the Great Northern system, but of the Northern Pacific and the Chicago, Burlington and Quincy, and proposed the construction of another northern line to the Pacific coast. Hill was the president of the Northern Securities Co., which in 1904 was declared by the U.S. Supreme Court to be in conflict with the Sherman Anti-Trust law. Feeling that the farmers and millers of the northwest needed a large financial institution near at hand, in 1913 he secured control of the First and Second National banks of St. Paul, and merged them. He wrote *Highways of Progress* (1910).

HILL, JOHN (*c.* 1716–1775), called from his Swedish honours, "Sir" John Hill, English author, edited the *British Magazine* (1746–50), and for two years (1751–53) wrote a daily letter, "The Inspector," for the *London Advertiser and Literary Gazette*. He also produced novels, plays and scientific works.

He was involved in many literary quarrels. Henry Fielding attacked him in the *Covent Garden Journal*, Christopher Smart wrote a mock-epic, *The Hilliad*, against him, and David Garrick replied to his strictures against him by two epigrams, one of which runs:—

> "For physics and farces, his equal there scarce is;
> His farces are physic, his physic a farce is."

He had other literary passages-at-arms with John Rich, who accused him of plagiarizing his *Orpheus*, also with Samuel Foote and Henry Woodward. From 1759 to 1775 he was engaged on a huge botanical work—*The Vegetable System* (26 vols.)—adorned

by 1,600 copperplate engravings. Hill's botanical labours were undertaken at the request of his patron, Lord Bute, and he was rewarded by the order of Vasa from the king of Sweden in 1774. He had a medical degree from Edinburgh, and he now practised as a quack doctor, making considerable sums by the preparation of vegetable medicines. He died in London on Nov. 21, 1775. He is said to have been the author of the second part of *The Oeconomy of Human Life* (1751), the first part of which is by Lord Chesterfield, and Hannah Glasse's famous manual of cookery was generally ascribed to him (*see* Boswell, ed. Hill, iii. 285). Dr. Johnson said of him that he was "an ingenious man, but had no veracity."

See a *Short Account of the Life, Writings and Character of the late Sir John Hill* (1779), which is chiefly occupied with a descriptive catalogue of his works; also *Temple Bar* (1872, xxxv. 261–266).

HILL, MATTHEW DAVENPORT (1792–1872), English lawyer and penologist, was born on Aug. 6, 1792, at Birmingham. He was a brother of Sir Rowland Hill. In 1819 he was called to the bar at Lincoln's Inn. In 1832 he was elected one of the Liberal members for Kingston-upon-Hull, but he lost his seat at the next election in 1834. On the incorporation of Birmingham in 1839 he was chosen recorder; and in 1851 he was appointed commissioner in bankruptcy for the Bristol district. In his charges to the grand juries, as well as in special pamphlets, he advocated many important reforms in the methods of dealing with crime. He was supported by his brother Frederick Hill (1803–96), whose *Amount, Causes and Remedies of Crime,* the result of his experience as inspector of prisons for Scotland, marked an era in the methods of prison discipline. Hill was a promoter of the Society for the Diffusion of Useful Knowledge, and the originator of the *Penny Magazine.* He died at Stapleton, near Bristol, on June 7, 1872.

His principal works are *Practical Suggestions to the Founders of Reformatory Schools* (1855); *Suggestions for the Repression of Crime* (1857), consisting of charges addressed to the grand juries of Birmingham; *Mettray* (1855); *Papers on the Penal Servitude Acts* (1864); *Journal of a Third Visit to the Convict Gaols, Refuges and Reformatories of Dublin* (1865); *Addresses delivered at the Birmingham and Midland Institute* (1867). See *Memoir of Matthew Davenport Hill,* by his daughters Rosamond and Florence Davenport Hill (1878).

HILL, OCTAVIA (1838–1912) and **MIRANDA** (1836–1910), English pioneers in housing reform, were born in London, being daughters of James Hill and granddaughters of Dr. Southwood Smith, the pioneer of sanitary reform. Octavia Hill's attention was early drawn to the bad condition of the housing of the working classes and of the poor in London. With the help of John Ruskin Octavia Hill purchased the 56 years' lease of three houses in one of the poorest courts of Marylebone. The houses were put in repair, and let out in sets of two rooms. The experiment proved to be financially sound. What specially distinguished this scheme was that Miss Hill herself collected the rents, thus coming into contact with the tenants and helping to enforce regular and self-respecting habits. The success of her first attempt encouraged her to continue. Six more houses were bought and treated in a similar manner. A yearly sum was set aside for the repairs of each house, and whatever remained over was spent on such additional appliances as the tenants themselves desired. This encouraged them to keep their tenements in good repair. By the help of friends Octavia Hill was now enabled to enlarge the scope of her work. Several large owners of tenement houses, notably the ecclesiastical commissioners, entrusted to her the management of property, and consulted her about plans of rebuilding.

See Charles E. Maurice, *Life of Octavia Hill as told in her Letters* (1913).

HILL, ROWLAND (1744–1833), English preacher, sixth son of Sir Rowland Hill, Bart. (d. 1783), was born at Hawkstone, Shropshire, on Aug. 23, 1744. He was educated at Shrewsbury, Eton and St. John's college, Cambridge. Having inherited considerable property, he built for his own use Surrey chapel, in the Blackfriars road, London (1783). Hill conducted his services in accordance with the forms of the Church of England, in whose communion he always remained. Both at Surrey chapel and in his provincial "gospel tours" he had great success. His oratory was specially adapted for rude and uncultivated audiences. He possessed a voice of great power, and according to Southey "his manner" was "that of a performer as great in his own line as Kean or Kemble." He helped to found the Religious Tract society, the British and Foreign Bible society, and the London Missionary society, and was a stout advocate of vaccination. His best-known work is the *Village Dialogues,* which first appeared in 1810, and reached a 34th edition in 1839. He died on April 11, 1833.

See *Life* by E. Sidney (1833); *Memoirs,* by William Jones (1834); and *Memorials,* by Jas. Sherman (1857).

HILL, SIR ROWLAND (1795–1879), English administrator and educationist, author of the penny postal system, a younger brother of Matthew Davenport Hill, and third son of T. W. Hill, who named him after Rowland Hill the preacher, was born on Dec. 3, 1795, at Kidderminster. At the age of 12 he began to teach mathematics at his father's school at Hilltop, Birmingham. At Rowland's suggestion the school was removed in 1819 to larger premises at Hazelwood, of which he was the architect, in order to carry out his improved system of education, expounded by him in *Plans for the Government and Education of Boys in Large Numbers* (1822; 2nd enl. ed., 1827). The system, whose principal feature was "to leave as much as possible all power in the hands of the boys themselves," was so successful that after six years it was announced that "the head master had never once exercised his right to veto on their proceedings." The experiment is described in *Public Education* (1822), by Matthew Davenport Hill. Rowland Hill ranks with Arnold of Rugby, who was probably influenced by him, as an educationist, and was equally successful in making moral influence the predominant power in school discipline. After his marriage in 1827 Hill removed to a new school at Bruce Castle, Tottenham, which he conducted until compelled by failing health to retire in 1833.

Hill then became interested in various inventions, and for the purpose of exploiting them was joined by Sir John Shaw-Lefevre, and Prof. Wheatstone, the inventor of the electric telegraph. Hill invented a successful rotary printing-press but the objections raised by the Treasury delayed the introduction of the method for another 35 years.

About this time (1835) he became secretary of Gibbon Wakefield's scheme for colonizing South Australia, the objects of which he had explained in 1832 in a pamphlet on *Home Colonies,* afterwards partly reprinted during the Irish famine under the title *Home Colonies for Ireland.*

In 1835 the large surplus in the revenue turned his attention to the possibility of using it to improve the existing postal system, which he had seen was a great burden to the poor. He had already in 1826 considered the possibility of a travelling post office, but had never published his scheme. He failed to obtain admission to the Post Office, but with the aid of a great mass of statistical information succeeded in demonstrating that the chief expense of letter carriage was in receiving and distribution, and that the cost varied so little with the distance that a uniform rate of postage was the fairest and most practical course. The principle is now so much a commonplace that it is not easy to realize how startling it was to Hill's contemporaries. He had observed that during the previous 20 years the postal revenue in England had diminished, instead of increasing, whereas in France where lower rates were in operation, it had increased considerably. He prophesied that the decrease in the postal rate would be made good by the increase of correspondence, and by the saving obtained from prepayment (at that time unusual), simplified accountancy, and smaller costs of distribution. He recommended within the United Kingdom a penny rate for letters not exceeding half an ounce in weight. He submitted his proposals privately to Lord Melbourne's government in Jan. 1837, but as no result followed, soon afterwards published them in pamphlet form, under the title *Post Office Reform: Its Importance and Practice.* The employment of postage stamps is suggested in the following words, which have interest as the earliest definition of a postage stamp: "Perhaps the difficulties might be obviated by using a bit of paper just large enough to bear the stamp, and covered at the back with a glutinous wash

which by applying a little moisture might be attached to the back of the letter." On Nov. 23, 1837 the House of Commons appointed a committee to examine the subject, and on July 17, 1838 recommended, by the casting vote of the chairman, a uniform rate of twopence the half ounce. The government was opposed to the measure, but was eventually compelled to yield to public opinion, and penny postage was included in the budget and carried by the House of Commons on July 12, 1839. After an intermediate rate of fourpence had been in operation from Dec. 5 that year, the penny rate commenced on Jan. 10, 1840.

Hill received an appointment in the Treasury to introduce his reforms, but was dismissed (1842) soon after the Liberal government resigned office. By way of compensation for his losses, and in public appreciation of his services, he was in 1846 presented by public subscription, with the sum of £13,360. On the Liberals returning to office in the same year he was appointed secretary to the Postmaster General, and in 1854 he was made chief secretary. His ability as a practical administrator enabled him to improve his original scheme, taking advantage of increasing facilities of communication. During the period 1838–64 the number of chargeable letters rose from seventy-six millions to six hundred and forty-two millions. On his retirement in 1864 he received from parliament a grant of £20,000 and was allowed to retain his salary of £2,000 a year as a retiring pension. He died at Hampstead on Aug. 27, 1879, and was buried in Westminster Abbey.

See G. Birkbeck Hill, *Life of Sir Rowland Hill* (1880).

HILL, ROWLAND HILL, 1ST VISCOUNT (1772–1842), British general, was the second son of (Sir) John Hill, of Hawkstone, Shropshire, and nephew of the Rev. Rowland Hill (1744–1833), was born at Prees Hall near Hawkstone on Aug. 11, 1772. He entered the army in 1790, and had already seen much active service when in 1808 he was appointed to a brigade in the force sent to Portugal From Vimeira to Vittoria, in advance or retreat, he proved himself Wellington's ablest and most indefatigable coadjutor. He led a brigade at Vimeira, at Corunna and at Oporto, and a division at Talavera (*see* PENINSULAR WAR). His capacity for independent command was fully demonstrated in the campaigns of 1810, 1811 and 1812. In 1811 he annihilated a French detachment under Girard at Arroyo-dos-Molinos, and early in 1812, having now attained a rank of lieutenant-general (Jan. 1812) and become a K.B. (March), he carried by assault the important works of Almaraz on the Tagus. Hill led the right wing of Wellington's army in the Salamanca campaign in 1812 and at the battle of Vittoria in 1813. Later in this year he conducted the investment of Pampeluna and fought with the greatest distinction at the Nivelle and the Nive. In the invasion of France in 1814 his corps was victoriously engaged both at Orthez and at Toulouse. Hill was one of the general officers rewarded for their services by peerages, his title being at first Baron Hill of Almaraz and Hawkstone, and he received a pension, the thanks of parliament and the freedom of the city of London. In 1815 Hill was appointed to one of the two corps commands in Flanders. At Waterloo he led the famous charge of Sir Frederick Adams's brigade against the Imperial Guard, and continued with the army in France until its withdrawal in 1818. When Wellington became premier in 1828, he received the appointment of general commanding-in-chief, and on resigning this office in 1842 he was created a viscount. He died on Dec. 10 of the same year.

See E. Sidney, *Life of Lord Hill, G.C.B.* (1845).

HILL, a natural elevation of the earth's surface. The word was formerly applied to mountains of any height but is now usually confined to fairly low elevations.

HILLAH, a town in 'Iraq, about 60 m. south of Baghdad, in 32° 28′ N. and 44° 48′ E. It lies on the Hillah branch of the Euphrates, 11 m. below the fork at Hindieh. The population is estimated at 30,000, mostly Shiah Arabs, but includes a number of Jews. The town lies on the Baghdad-Basra railway line, and on the land routes along the river. There is also a certain amount of river traffic. There is a telegraph and post office and a small garrison. Saddlery and similar industries are carried on in the town, but the principal trade is in grain—wheat, barley and rice —and there are a large number of grain stores. The two halves of the town are connected by a bridge of boats. Along the river there are flourishing palm groves although these have been threatened by periodic bursting of the Hindieh barrage and the drying up of the channel. The country round Hillah is essentially agricultural and is improving in production owing to renovation of the ancient canals. To the north lie the ruins of Babylon, which have been looted to build the town, while 14 miles east is Tell Oheimer, the ancient Kish. The bazaars of Hillah are large and good and the whole town appears to be very flourishing.

HILLEBRAND, KARL (1829–1884), German author, born at Giessen on Sept. 17, 1829, was a student at Heidelberg when he was caught in the revolutionary movement in Baden and had to leave Germany. He was for some months secretary to Heine in Paris, and finally settled in Florence, where he died on Oct. 19, 1884. He wrote fluently in English and French, as well as German, and was a good cosmopolitan critic of European literature. The best known of his many works is *Zeiten, Völker und Menschen* (Berlin, 7 vols., 1874–85), being collections of essays on different subjects.

See H. Homberger, *Karl Hillebrand* (Berlin, 1884).

HILLEL (*c.* 70 B.C.–*c.* A.D. 10), Jewish rabbi, was of Babylonian origin and descended from the family of David. When about 40, he went to study in the schools of Shemaiah and Abtalion at Jerusalem. There he became numbered among the leaders of the Pharisaic scribes, and tradition assigns him the highest dignity of the Sanhedrin, under the title of *nasi* ("prince") about 30 B.C. Hillel is said to have laid down seven rules for the interpretation of the Scriptures, which became the foundation of rabbinical hermeneutics. He founded a more lenient school in opposition to that of his colleague Shammai, and introduced the well known institution of the Prosbol (προσβολή), which was intended to avert the evil consequences of the scriptural law of release in the seventh year (Deut. xv. 1).

Hillel lived in the memory of posterity as the great teacher who enjoined and practised the virtues of charity, humility, patience and true piety.

Of the sayings ascribed to him, many of which bear a remarkable resemblance to the teaching of Christ, the following are typical—"My abasement is my exaltation"; "What is unpleasant to thyself that do not to thy neighbour; this is the whole Law, all else is but its exposition"; "If I am not for myself, who is for me? And if I am for myself alone, what then am I? And if not now, then when?" "Separate not thyself from the congregation"; "Judge not thy neighbour until thou art in his place"; "He who wishes to make a name for himself loses his name; he who does not increase [his knowledge] decreases it; he who does not learn is worthy of death; he who works for the sake of a crown is lost"; "He who has acquired the words of doctrine has acquired the life of the world to come."

It is noteworthy that no miraculous legends are connected with Hillel's life. A scholastic tradition, however, tells of a voice from heaven which made itself heard when the wise men had assembled in Jericho, saying: "Among those here present is one who would have deserved the Holy Spirit to rest upon him, if his time had been worthy of it." And all eyes turned towards Hillel (*Tos. Sotah,* xiii. 3). He was lamented after his death as "the humble, the pious, the disciple of Ezra."

HILLEL II., one of the patriarchs belonging to the family of Hillel I., lived in Tiberias about the middle of the 4th century, and introduced the arrangement of the calendar through which the Jews of the Diaspora became independent of Palestine in the uniform fixation of the new moons and feasts.

The Rabbi HILLEL, who in the 4th century made the remarkable declaration that Israel need not expect a Messiah, because the promise of a Messiah had already been fulfilled in the days of King Hezekiah (Babli, *Sanhedrin,* 99a), is probably Hillel, the son of Samuel ben Naḥman, a well-known expounder of the scriptures.

See Taylor, *Sayings of the Jewish Fathers* (1877); F. Delitzsch, *Jesus und Hillel* (3rd ed. 1879); Schürer, *The Jewish People in the Time of Christ* (1891); Grätz, *Hist. of the Jews* (1894); Herzog's *Realencyklopädie* and *Jewish Encyclopedia.*

HILLER, FERDINAND (1811–1885), German composer, was born at Frankfort-on-Main, on Oct. 24, 1811, and studied first under Aloys Schmitt and then under Hummel in Weimar. There he devoted himself to composition, among his work being the entr'actes to *Maria Stuart*, through which he made Goethe's acquaintance. With Hummel he went in 1827 to Vienna, where he met Beethoven and produced his pianoforte quartet. Later he went to Paris where he spent seven years and did good work in making the works of Beethoven and Bach known in French musical circles. Subsequently he joined his friend Mendelssohn in Leipzig, where in 1843–1844 he conducted a number of the Gewandhaus concerts and produced his oratorio, *Die Zerstörung Jerusalems*, one of his best works. Later he became a power at Cologne as conductor of the Gürzenich concerts and head of the Conservatorium. He retired in 1884, and died May 12, 1885 in the following year. Hiller frequently visited England. He composed a work for the opening of the Royal Albert Hall, his *Nala and Damayanti* was performed at Birmingham, and he gave a series of pianoforte recitals of his own compositions at the Hanover Square Rooms in 1871. His compositions, numbering about two hundred, include six operas, two oratorios, six or seven cantatas, much chamber music and a once-popular pianaforte concerto.

HILLER, JOHANN ADAM (1728–1804), German musical composer, was born near Görlitz, in Silesia, on Dec. 25, 1728. He studied law at Leipzig, but adopted music as a profession. In 1789 he became cantor of the Thomasschule, and died at Leipzig, where practically the whole of his life was spent, on June 16, 1804. Hiller played an important part in the German musical life of his day. To him was due the foundation of the famous Gewandhaus concerts in Leipzig. He had much to do with the re-establishment in favour of the *Singspiel* and the general popularization and development of light opera, while he helped materially also in the cultivation and development of the German *Lied* as against the Italian operatic aria. He did good propagandist work for Handel also, and the *Messiah* was first given in Berlin (more than 40 years after it was composed) under his bâton. He was a prolific author as well as a copious composer, his literary works including his autobiography to be found in the volume *Lebensbeschreibungen berühmter Musikgelehrten und Tonkünstler* (1784) and also, more accessibly, in Einstein's *Lebenläufe deutscher Musiker von ihnen selbst erzählt* (1915).

HILLIARD, LAWRENCE (d. 1640), English miniature painter, the son of Nicholas Hilliard The date of his birth is not known, but he died in 1640. He adopted his father's profession and worked out the unexpired time of his licence after Nicholas Hilliard died. It was from Lawrence Hilliard that Charles I. received the portrait of Queen Elizabeth now at Montagu House, since van der Dort's catalogue describes it as "done by old Hilliard, and bought by the king of young Hilliard." In 1624 he was paid £42 from the Treasury for five pictures, but the warrant does not specify whom they represented. His portraits are of great rarity, two of the most beautiful being those in the collections of Earl Beauchamp and J. Pierpont Morgan. They are as a rule signed L.H., but are also to be distinguished by the beauty of the calligraphy in which the inscriptions round the portraits are written. The writing is as a rule very florid, full of exquisite curves and flourishes, and more elaborate than the more formal handwriting of Nicholas Hilliard The colour scheme adopted by the son is richer and more varied than that used by the father, and Lawrence Hilliard's miniatures are not so hard as are those of Nicholas and are marked by more shade and a greater effect of atmosphere. (G. C. W.)

HILLIARD, NICHOLAS (*c.* 1537–1619), the first true English miniature painter, is said to have been the son of Richard Hilliard of Exeter. He was appointed goldsmith, carver and portrait painter to Queen Elizabeth, and engraved the Great Seal of England in 1586. He was in high favour with James I. as well as with Elizabeth, and from the king received a patent of appointment (May 5, 1617), which granted him a sole licence for the royal work for twelve years. He is believed to have been the author of an important treatise on miniature painting, now preserved in the Bodleian Library, but it seems more probable that the author of that treatise was John de Critz, Serjeant Painter to James I. It is probable, however, that the treatise was taken down from the instructions of Hilliard, for the benefit of one of his pupils, perhaps Isaac Oliver. Donne, in a poem called "The Storm" (1597) praises Hilliard's work. He painted a portrait of himself at the age of thirteen, and is said to have executed one of Mary queen of Scots when he was eighteen years old He died on Jan. 7, 1619, and was buried in St. Martin's-in-the-Fields, Westminster.

It seems to be pretty certain that he visited France, and that he is the artist alluded to in the papers of the duc d'Alençon under the name of "Nicholas Belliart, peintre anglois" who was painter to this prince in 1577, receiving a stipend of 200 livres.

For further information respecting Hilliard's sojourn in France, *see* the privately printed catalogue of the collection of miniatures belonging to J. Pierpont Morgan, compiled by Dr. G. C. Williamson.

HILLSBORO, a city of Illinois, U.S.A., 50m. N.E. of Saint Louis; the county seat of Montgomery county. It is served by the Chicago and Eastern Illinois, the Big Four and the Illinois Traction (electric) railways. The population in 1920 was 5,074 (92% native white). Farming, dairying and coal-mining are the principal occupations of this region. There is a large electric-power plant in the city, as well as zinc smelters, a fruit-jar factory, and brick, tile and concrete works. Hillsboro was settled about 1823. It was incorporated as a town in 1855, and as a city in 1882.

HILLSBORO, a village of south-western Ohio, U.S.A., 48m. E. by N. of Cincinnati; the county seat of Highland county. It is on Federal highway 50, and is served by the Baltimore and Ohio and the Norfolk and Western railways. The population in 1920 was 4,356 (13% negroes). It has factories making bells, hardware and furniture, a poultry-packing house and flour-mills.

HILLSBORO, a city of Texas, U.S.A , 55m. S. by E of Fort Worth; the county seat of Hill county. It is on Federal highway 81, and is served by the Missouri-Kansas-Texas, the St. Louis Southwestern and the Trinity and Brazos Valley railways. The population was 6,952 in 1920 (15% negroes), and was estimated locally at 8,300 in 1928. Grain, cotton and live stock are raised in this region. Hillsboro was settled about 1846 and incorporated in 1853.

HILLSDALE, a city of southern Michigan, U.S.A., 90 m. W.S.W. of Detroit; county seat of Hillsdale county. It is served by the New York Central railway. The population was 5,476 in 1920 (96% native white). It is the trading centre and shipping point for a rich farming region; manufactures screen doors, clothing, metal dies and punches, gas engines and various other commodities; and is the seat of Hillsdale college (Free Baptist, opened at Spring Arbor, Mich., in 1844, and established here in 1853). Hillsdale was settled in 1837, incorporated as a village in 1847, and chartered as a city in 1869.

HILL TIPPERA: *see* TRIPURA.

HILTON, JOHN (1804–1878), British surgeon, was born at Castle Hedingham, in Essex, in 1804. He entered Guy's hospital in 1824, and was connected with the hospital all his life. In 1867 he was president of the Royal College of Surgeons. As Arris and Gale professor (1859–62) he delivered a course of lectures on "Rest and Pain" (published 1863; 5th ed., edited by W. H. A. Jackson, 1892), which have become classics. He was surgeon-extraordinary to Queen Victoria. Hilton was the greatest anatomist of his time, and was nicknamed "Anatomical John." It was he who, with Joseph Towne, the artist, enriched Guy's hospital with its unique collection of models. In his grasp of the structure and functions of the brain and spinal cord he was far in advance of his contemporaries. His anatomical knowledge is indicated by the method for opening deep abscesses which is known by his name, and he was the first to reduce a case of obturator hernia by abdominal section, and one of the first to practice lumbar colostomy. He died at Clapham on Sept. 14, 1878.

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Biographical History of Guy's Hospital (1892).

HILTON, WILLIAM (1786–1839), English painter, born at Lincoln on June 3, 1786, son of a portrait-painter, studied at the Royal Academy schools. He became A.R.A. in 1813, and R.A. in 1820, his diploma picture being "Ganymede." Hilton's most famous work is "Christ Crowned with Thorns" (1823) which was purchased later by the Chantrey Bequest. His portrait of John Keats is in the National Portrait Gallery. Hilton died in London on Dec. 30, 1839.

HILVERSUM, a town in the province of North Holland, 18 m. by rail S.E. of Amsterdam. Pop. (1926) 47,510 It is situated in the middle of the Gooi, a stretch of hilly country extending from the Zuider Zee to about 5 m south of Hilversum, and composed of pine woods and sandy heaths. Hilversum is a summer resort and residential centre and manufactures large quantities of carpets.

HIMALAYA, that portion of the mountain region between India and Tibet enclosed within the arms of the Indus and the Brahmaputra, having, therefore, a length of 1,500 m., and a width from 100 to 150 miles. North-west of the Indus the region of mountain ranges which stretches to a junction with the Hindu Kush, south of the Pamirs, is usually known as Trans-Himalaya Thus the Himalaya represents the southern face of the great central elevated region—the plateau of Tibet—the northern face of which is buttressed by the Kuen Lun

Geographical Classification of the Himalaya.—For this purpose the Himalayan mountain system is divided into three parallel longitudinal zones which have marked differences in orographical features.

(1) *The Great Himalayas.*—The main ranges, which lie in the north, rise above the snow line and have an average elevation of 20,000 ft. above the sea. Here occur the highest peaks, *e.g.*, Everest, K_2 (Godwin Austen), Kanchinjanga, etc.

(2) *The Lesser Himalayas.*—The middle ranges, which are closely related to and lie south of the Great Himalayas. They form an intricate mountain system, with an average height of 12,000 to 15,000 ft. above the sea.

(3) *The Outer Himalayas.*—These comprise the Siwalik ranges, lie between the Lesser Himalayas and the plains, and have an average height of 3,000 to 4,000 ft. above the sea.

The Great Northern Watershed.—On the north and north-west of Kashmir, the great water-divide which separates the Indus drainage area from that of the Yarkand and other rivers of Chinese Turkestan, is the Mustagh range which, with the Karakoram, trends south-eastwards, forming a continuous mountain barrier and the true water-divide west of the Tibetan plateau. Shutting off the sources of the Indus affluents from those of the Central Asian system of hydrography, this great water-parting is distinguished by a group of peaks of which the altitude is hardly less than that of the Eastern Himalaya. Mount Godwin-Austen (K_2) (28,250 ft. high), only 750 ft. lower than Everest, affords an excellent example of a dominating, peak-crowned water-parting or divide. From Kailas on the far west to the extreme north-eastern sources of the Brahmaputra, little is known of the great northern water-parting of the Indo-Tibetan highlands. For some 500 or 600 m. E. of Kailas it appears to be lost in the mazes of the minor ranges and ridges of the Tibetan plateau. Nor can it be said to be well defined to the east of Lhasa.

Eastern Tibet.—The Tibetan plateau, or Chang, breaks up about the meridian of 92° E., to the east of which the affluents of the Tsanpo (the same river as the Dihang and subsequently as the Brahmaputra) drain no longer from the elevated plateau, but from wild, rugged mountain slopes. In this region are hidden the sources of all the great rivers of Burma and China. Neither immediately beyond the great bend of the Brahmaputra nor in the Himalayan regions lying north of Assam and east of Bhutan, have scientific investigations yet been systematically carried out; but it is known that the largest of the Himalayan affluents of the Brahmaputra west of the bend derive their sources from the Tibetan plateau, and break down through the containing bands of hills, carrying deposits of gold from their sources to the plains, as do all the rivers of Tibet.

Although the northern limits of the Tsanpo basin are not sufficiently well known to locate the Indo-Tibetan watershed even approximately, there exists some evidence of the nature of that strip of Northern Himalaya on the Tibeto-Nepalese border which lies between the line of greatest elevation and the trough of the Tsanpo. Recent investigations show that all the chief rivers of Nepal flowing southwards to the Tarai take their rise north of the line of highest crests, the "Great Himalayas," and that some of them drain long lateral high-level valleys enclosed between minor ridges whose trend is parallel to that of the Himalayas and, occasionally, almost at right angles to the course of the main drainage channels breaking down to the plains. This formation brings the southern edge of the Tsanpo basin to the immediate neighbourhood of the banks of that river, which runs at its foot like a drain flanking a wall. North of Bhutan, between the Himalayan crest and Lhasa, this formation is approximately maintained; farther east, although the same natural forces first resulted in the same effect of extensive curves of ridge and furrow, the abundant rainfall and the totally distinct climatic conditions which govern the processes of denudation subsequently led to the erosion of deeper valleys enclosed between forest-covered ranges which rise steeply from the river banks.

Height of Himalayan Peaks.—It is now proved that Mount Everest, which appears from the Tibetan plateau as a single dominating peak, has no rival amongst Himalayan altitudes. The main features of Nepalese topography are now fairly well defined So much controversy has been aroused on the subject of Himalayan altitudes that the present position of scientific analysis in relation to them may be shortly stated. The heights of peaks determined by exact processes of trigonometrical observation are bound to be more or less in error for at least three reasons: (1) the extraordinary geoidal deformation of the level surface at the observing stations in submontane regions; (2) ignorance of the laws of refraction when rays traverse rarefied air in snow-covered regions; (3) ignorance of the variations in the actual height of peaks due to the increase, or decrease, of snow.

Geology.—The Himalaya have been formed by violent crumpling of the earth's crust along the southern margin of the great tableland of Central Asia Outside the arc of the mountain chain no sign of this crumpling is to be detected except in the Salt Range; and the Peninsula of India has been entirely free from folding of any importance since early Palaeozoic times, if not since the Archaean period itself. But the contrast between the Himalaya and the Peninsula is not confined to their structure: the difference in the rocks themselves is equally striking. In the Himalaya the geological sequence (Cambrian to Eocene) is almost entirely marine; there are occasional breaks in the series, but during nearly the whole of this long period the Himalayan region, or at least its northern part, must have been beneath the sea—the Central Mediterranean Sea of Neumayr or Tethys of Suess. In the peninsula, however, no marine fossils have yet been found of earlier date than Jurassic and Cretaceous, and these are confined to the neighbourhood of the coast; there can be no doubt that, at least since the Carboniferous period, nearly the whole of the Peninsula has been land. Between the folded marine beds of the Himalaya and the nearly horizontal strata of the peninsula lies the Indo-Gangetic plain, covered by an enormous thickness of alluvial and wind-blown deposits of recent date. Deep borings here have failed to reach the rocky bottom, or even to indicate the approach of the base of the alluvium. It is clear, then, that in front of the Himalaya there is a great depression, but there is no indication that this depression was ever beneath the sea.

Geologically, the Himalaya may be divided into three zones. The northern (*Tibetan zone*), in which fossiliferous beds of the Palaeozoic and Mesozoic age are largely developed—excepting in the north-west, no such rocks are known on the southern flanks. The second (*Himalayan zone*) comprises most of the Lesser and Great Himalayas, and is composed chiefly of crystalline and metamorphic rocks, together with unfossiliferous sedimentary beds supposed to be of Palaeozoic age. The southern (*sub-Himalayan zone*) consists entirely of Tertiary beds, and especially of the Upper Tertiaries. The oldest beds which have yielded

fossils occur in the Spiti valley and belong to the Cambrian system (the "Haimanta" system). These are underlain by Archaean gneisses. There appears to be no break in the Lower Palaeozoic beds in the Spiti region but in other parts of the Central Himalayas the conglomerate at the base of the Permian rests unconformably upon older formations. This conglomerate forms an important datum line. From the Permian to the Lias the sequence in the central Himalaya shows no sign of a break. The Spiti shales follow, and although they contain Middle and Upper Jurassic fossils no break has yet been proved at their base. The Spiti shales are succeeded conformably by Cretaceous beds (Giumal sandstone below and Chikkim limestone above), and these are followed without a break by Nummulitic beds of Eocene age The beginning of the Tertiary period was marked by violent igneous activity, in which intrusion and extrusion occurred. The next succeeding deposit is a sandstone, often highly inclined, which rests unconformably upon the Nummulitic beds and resembles the Lower Siwaliks of the sub-Himalaya (Pliocene) but which as yet has yielded no fossils of any kind. The whole is overlaid unconformably by the younger Tertiaries of Hundes, which are perfectly horizontal and have been folded.

It is evident that in the northern part of the Himalayan belt, at least in the Spiti area, there can have been no post-Archaean folding of any magnitude until after the deposition of the Nummulitic beds, and that the folding was completed before the later Tertiaries of Hundes were laid down. It was, therefore, during the Miocene period that the elevation of this part of the chain began, while the disturbance of the Siwalik-like sandstone indicates that the folding continued into the Pliocene period. Along the southern flanks of the Himalaya the history of the chain is still more clearly shown. The sub-Himalaya are formed of Tertiary beds, chiefly Siwalik or Upper Tertiary, while the Lower Himalaya proper consist mainly of pre-Tertiary rocks without fossils. Throughout the whole length of the chain, wherever the junction of the Siwaliks with the pre-Tertiary rocks has been seen, it is a great reversed fault (the "Main Boundary Fault"). The hade of the fault is constantly inwards, towards the centre of the chain, and the older rocks, which form the Himalaya proper, have been pushed forward over the younger beds of the sub-Himalaya Moreover, nearly everywhere the fault formed the northern boundary of deposition of the Siwalik beds, and only in a few instances do any of these deposits extend even to a short distance beyond it. The fault, in fact, was being formed by the deposition of the Siwalik beds, and as they were laid down, the Himalaya were pushed forward over them, so that they were folded and upturned during the process. The Siwaliks are fluviatile and torrential deposits similar to those which are now being formed at the foot of the mountains in the Indo-Gangetic plain. The "Main Boundary Fault" is really one of a series of approximately parallel faults, all of which formed the northern boundary of deposition of the deposits immediately south of them. The Himalaya grew southwards in a series of stages. A reversed fault was formed at the foot of the chain, and upon this fault the mountains were pushed forward over the beds deposited at their base, crumpling and folding them in the process, and forming a sub-Himalayan ridge in front of the main chain. This process was repeated several times and the earthquakes of to-day in this region can be traced to the fault lines and show that crustal equilibrium has not yet been reached.

Topographical Results of Evolution.—The uplift of the Himalayas was a gradual process protracted over a very long period and the process had a very marked effect upon the scenery, the topography and the river system. The latter is not consequent upon the structure, but the principal rivers were of an age anterior to the Tertiary earth-movements and the drainage is spoken of as "antecedent." During the slow process of uplift, folding and faulting the rivers were able to keep, for the most part, to their original courses, although their erosive power was increased owing to increased gradients. Thus we find the rivers cutting through the main chains in deep transverse gorges after flowing for long distances parallel to the trend of the chain. Examples of this are the Indus and the Brahmaputra.

In the outer valleys of the Himalaya the sides are generally steep, so steep that landslides frequently occur, whilst the streams are still cutting down the river beds and have not yet reached their base level. Here and there a valley has become filled with alluvium, owing to some local obstruction, and when this occurs there is usually to be found a fertile and productive field for agriculture. The straits of the Jhelum, below Baramula, probably account for the lovely vale of Kashmir, which is in form (if not in principles of construction) a repetition on a grand scale of the Maidan of the Afridi Tirah, where the drainage from the slopes of a great amphitheatre of hills is collected and then arrested by the gorge which marks the outlet to the Bara.

Other rivers besides the Indus and the Brahmaputra begin by draining a considerable area north of the snowy range—the Sutlej, the Kosi, the Gandak and the Subansiri, for example. All these rivers break through the main snowy range ere they twist their way through the southern hills to the plains of India. Here the "antecedent" theory will not suffice, for there is no sufficient catchment area north of the snows to support it. Their formation is explained by a process of "cutting back," by which the heads of these streams are gradually eating their way northwards owing to the greater rainfall on the southern than on the northern slopes. The result of this process is well exhibited in the relative steepness of slope on the Indian and Tibetan sides of the passes to the Indus plateau. On the southern or Indian side the routes to Tibet and Ladakh follow the levels of Himalayan valleys with no remarkably steep gradients till they near the approach to the water-divide. The slope then steepens with the ascending curve to the summit of the pass, from which point it falls with a comparatively gentle gradient to the general level of the plateau. The Zoji La, the Kashmir water-divide between the Jhelum and the Indus, is a prominent case in point, and all the passes from the Kumaon and Garhwal hills into Tibet exhibit this formation. Taking the average elevation of the central axial line of snowy peaks as 19,000 ft., the average height of the passes is not more than 10,000 owing to this process of cutting down by erosion and gradual encroachment into the northern basin. (*See* also TIBET, LEH.)

Climate.—Independently of the enormous variety of topography the vast altitude of the mountains alone is sufficient to cause very great modifications of climate. One-half of the total mass of the atmosphere and three-fourths of the water suspended in it in the form of vapour lie below the average altitude of the Himalaya; and of the residue, one-half of the air and virtually almost all the vapour come within the influence of the highest peaks. The mean winter temperature at 7,000 ft. (which is about the average height of Himalayan "hill stations") is 44° F and the summer mean about 65° F, but in the valleys a temperature of 90 to 100° F may be felt during the day in May and June. At 9,000 ft. the mean temperature of the coldest month is 32° F. At 12,000 ft. the thermometer remains above freezing-point from the end of May to the middle of October, but at 15,000 ft. is seldom above that point even in the height of summer. It should be noted that the thermometrical conditions of Tibet vary considerably from those of the Himalaya. At 12,000 ft. in Tibet the mean of the hottest month is about 60° F and of the coldest about 10° F, while at 15,000 ft. the frost is only permanent from Nov. 1 to May 1. In Tibet the daily range may be 60° and often reaches 50°. The temperature of the sandy surface varies even more and records of 2° and 96° have been taken within 24 hours by the Everest expedition. The soil beneath the surface is far more constant in temperature. The difference of temperature between forest-clad ranges and the Indian plains is twice as much in April and May as in December or January; and the difference between the temperature of a well-wooded hill top and the open valley below may vary from 9° to 24° within twenty-four hours. The general relations of temperature to altitude as determined by Himalayan observations are as follows: (1) The decrease of temperature with altitude is most rapid in summer. (2) The annual range diminishes with the elevation. (3)The diurnal range diminishes with the elevation.

Rainfall is chiefly related to the monsoonal rainfall of India of which the Himalayas catch a large portion. There is more

rain, and rain for a longer season, in the east than in the west. The east may have 50 to 80 in. of rain against southward hill slopes and in certain spots even higher totals are reached, for example Darjeeling gets 120 inches. The rainfall diminishes westward to 40 inches near the place where the Ganges leaves the mountains and falls to 30 towards the emergence of the Indus from the mountains, while in places in a rain-shadow the fall may be only 15 in. though they are in a zone that on the whole averages 30 or more. In the arid zone protected from the rainy winds the rainfall goes below 15 in. and in Tibet for the most part well below 10 inches.

In Tibet the rapid heating of the plains by the morning sun brings a fierce wind down daily from the eternal snows and some air may thus drift through such partial gaps as there are in the great range from India to the Tibetan table-land.

In the eastern Himalaya the ordinary winter limit of snow is 6,000 ft. and it never lies for many days even at 7,000 ft. In Kumaon, on the west, it usually reaches down to the 5,000 ft. level and occasionally to 2,500 feet. Snow has been known to fall at Peshawar. At Leh, in western Tibet, hardly 2 ft. of snow are usually registered and the fall on the passes between 17,000 and 19,000 ft. is not generally more than 3 ft., but on the Himalayan passes farther east the falls are much heavier. Even in September these passes may be quite blocked and they are not usually open till the middle of June. The snow-line, or the level to which snow recedes in the course of the year, ranges from 15,000 to 16,000 ft. on the southern exposures of the Himalaya that carry perpetual snow, along all that part of the system that lies between Sikkim and the Indus. It is not till December that the snow begins to descend for the winter, although after September light falls occur which cover the mountain sides down to 12,000 ft., but these soon disappear. On the snowy range the snow-line is not lower than 18,500 ft. and on the summit of the table-land it reaches to 20,000 ft. On all the passes into Tibet vegetation reaches to about 17,500 ft., and in August they may be crossed in ordinary years up to 18,400 ft. without finding any snow upon them; and it is as impossible to find snow in the summer in Tibet at 15,500 ft. above the sea as on the plains of India.

The glaciers of the Himalayas seem to be in retreat. On the north side of Everest the Rongbuk glacier ends at about 16,500 ft. and the Kyetrak glacier at 15,400 feet. In the Kinchinjunga group the glaciers may come down to 13,000 ft. while in Kumaon they reach 12,000 ft. and in Kashmir, in special situations, they may come as low as 8,000 feet. The level reached is, as in Europe, 3,000–5,000 ft. below the limit of perpetual snow. The air temperatures at the ends of the glaciers are about as in Europe, namely, nearly 60° in July and diminishing slowly until the end of September. Several glaciers are 11–16 m. long, the higher figure being attained in the Kinchinjunga series. Italian geologists have investigated the moraines of the Karakoram Mts. and have given evidence of the great ice sheets of the Pleistocene glaciation, ice sheets which may have been one continuous mass over the whole of central Asia. They have further shown that there is evidence of phases of variation during the Pleistocene Ice Age which seem to correspond with those observed in Europe.

Plants.—A valuable study of the ecology of the Himalayan forests of Osmaston (*Journ. Ecology,* Cambridge, England, 1922, vol. x., p. 129), and the observations taken by the Everest expeditions have added considerably to knowledge of the plants of this region.

The European flora of the Mediterranean reaches the Himalaya, but very few of its members attain the eastern end of the chain. Some Japano-Chinese forms such as *Aucuba, Helwingia, Skimmia, Adamia, Goughia* reach the east of the chain, but do not spread far to the west. It is naturally at fairly high levels that the European forms are found, but *Tilia, Fagus, Arbutus, Erica, Azalea* and the *Cistaceae* are absent. An African element is claimed to reach the western Himalayas.

The eastern section is very warm and damp and intertropical plants live even at 7,000 ft. above sea, while the forest reaches up to nearly 13,000 ft. in places. In the west the corresponding levels are 5,000 and under 12,000 ft., the dry season being more marked and the variation of temperature greater.

Using Osmaston's general classification of the forests we have: (1) The *Shorea* (-Sal) *Anogeissus-Pinus* formation in the warm moist valleys, and up to about 6,500 ft. in places. The warm temperature implies heavy evaporation and rapid decomposition of humus. This forest may be called warm subtropical, the trees form an open canopy and belong to species that either shed their leaves in the warm weather before the rains, or are needle-leaved conifers. *Pinus longifolia* is specially able to survive fires and *Anogeissus* has special powers of coppicing so that it survives grazing and lopping. *Anogeissus* lives up to a 4,000-ft. level in large groups and reaches west as far as the neighbourhood of Srinagar (Kashmir). (2) The *Quercus-Abies* formation on the moist hill sides from 5,000 ft. to 11,500 ft., where the rainfall is typically 50–80 in. per annum, and some of it is snow. The parts which face south are apt to get dry in November and December and from April to June and in the latter season there are often forest fires. The heat and rainfall prevent accumulation of much humus on the south side except under special circumstances, but the north side has humus, and there forest fires are rare. The general covering is dense on the north, but less so on the south; evergreen oaks are the commonest trees, epiphytic ferns abound and on higher levels mosses and lichens encrust the tree-trunks. (3) The *Pinus-Cedrus* formation on the drier mountain flanks from 9,000 ft. to 12,000 ft. with a rainfall of 10 to 40 in., but in winter the precipitation is mainly snowfall and the temperature is low. Slopes facing the sun are apt to be very dry and suffer from fires. Trees and grass often occur together, both giving place to shrubs in some areas with long dry periods. *Cedrus* itself reaches the 8,000-ft. level in the moist zone, but the 10,000-ft. level in the dry one, it grades into cypress below and blue-pine above. The cypress suffers specially from fires and perhaps for this reason is rarely found near grassland in the Himalayas; it favours rather the steep rocky hill sides. (4) The *Betula-Rhododendron* formation has a general distribution between the 9,000- and the 13,500-ft. contours with vegetative activity chiefly during the monsoon rains. The cold soil makes absorption by the roots slow even if there be abundant moisture, as there is in some parts. The rainfall varies very much and a large proportion is really snowfall, and the formation generally occurs where insolation is low because of a north aspect, or cloudiness. The formation makes a dense covering, but there are no large trees and the branches often bend down and are flexible. It is sometimes quite absent in the moist zone in which oak forest may be succeeded above by grass; much has to be allowed in this matter for the depredations of grazing animals. Sometimes one finds a *Rhododendron-Lonicera* shrubby group, sometimes a *Betula-Abies* tree-group, but it is difficult to distinguish different conditions for them. *Lonicera obovata* is restricted to the higher part of the zone. (5) The *Caragana-Lonicera-Artemisia* formation in the arid Tibetan zone 9,000 ft. to 15,000 ft. above sea with extremely dry conditions during the short period in which vegetative activity is possible. The sun is strong and the dry atmosphere gives it unusual power. The strong daily wind down from the peaks transports sand and dust. Trees and shallow rooted grasses are almost absent, shrubs have branches bent down and very flexible and the leaves are deciduous. *Salix* and *Myricaria* form associations related to No. 5, but choosing moister spots near streams. Only a few plants, save willows and junipers, grow taller than 2 ft. or so. The small amount of grass, and shoots of shrubs are a precious resource to yaks and other animals of the heights and water weeds of the cold lakes are also useful to them. The mouse-hares lay up stores of seeds in their burrows for the winter and perhaps on the whole help in this way to maintain some species of plants.

Animals.—On the outer fringes the Himalayan fauna grades into that of the surrounding regions. Towards India, for example, the langur (*Semnopithecus sp.,* a monkey) elephant, rhinoceros, tiger, leopard, civet, mongoose (*Herpestes*), toddy cat (*Paradoxurus*), cat-bear (*Aelurus*), *Helictis* (an aberrant badger), linsang (an aberrant civet), the last two of Malayan affinities, and the bamboo-rat (Rhizomys) of the base of eastern Himalayas. The Himalayan fauna in the stricter sense, especially on the Tibetan

side, is, however, mainly northern in its affinities. The fossils of the Siwalik beds include remains of 84 species of mammals akin to those of Miocene and Pliocene Europe. The langur reaches as high as the 12,000-ft. level and bears, martens and related forms and several cats are features of the forests, while moles abound, though they are unknown in India; foxes and wolves are unknown in the forest area, but both, and also the lynx, ounce, marten, ermine and wild ass occur on the Tibetan side, also musk-deer, antelope (2 species) and sheep. The wild dog (*Cyon*) is found in the forest area, so is the wild pig, a form of which reaches very high levels, but the gaur or wild ox is confined to the lower lands; two species of the scaly anteater (*Manis*) reach the eastern Himalayas, but the chevrotain, another southeast Asiatic form, is absent. Goat-like animals called the serow (*Nemorhaedus*), goral (*Cemas*), and tahr (*Hemitragus*) are found, and the tahr ranges up to great heights. The yak and other animals of the great altitudes will be discussed below.

The bird life of the Himalayas is wonderfully rich. Eagles, vultures and many birds of prey soar to great heights. Gorgeous colouring occurs among sun-birds, trogons, kingfishers, etc., but of the parrot family only parrakeets and a small lory are known. The peacock occurs in the forests bordering the plains on the Indian side, and pheasants and partridges include varieties adapted to life on the snow at great altitudes. Waders and waterfowl are not very important features.

Among the snakes the python is found on the Indian side and the cobra penetrates as high as some 8,000 ft. above sea. Lizards and frogs abound and reach remarkable elevations, the lizard, *Phrynocephalus*, and a frog being found even in Tibet. Of the fishes only two Acanthopterygii enter the mountains, most of the fish of the region belonging either to the catfish family (*Siluridae*) or the carp family (*Cyprinidae*), a few of the former and a number of the latter live in Tibetan waters. Most of the fishes of high mountain-torrents have suckers with which to hold on to rocks. The salmon family is absent from the region

The butterflies are renowned for their magnificence and include among others *Papilionidae*, *Nymphalidae*, *Morphidae*, and *Danaidae*. Insect life of all kinds is very rich and locust-swarms are carried up by the winds even to the perpetual snow.

Major Hingston of the Indian Medical Service has given valuable accounts of the natural history of animals at great altitudes in the Himalayas. Protective colouring, usually in browns and greys akin to those of the desert-like surface of Tibet, is almost universal. The mouse-hare (*Ochotona*) is common and even the sheep and gazelles are coloured like the soil. Most of the birds are protectively coloured, though some show bright colours when on the wing. Unlike the large mammals, the large birds are not protected in colour, and the eagles, kites, ravens and choughs abound. It is said that the birds living among the villages are not protectively coloured. That type of coloration is common among insects, spiders, etc.

The intense cold of the great heights is made still more trying by the fierce winds that rush down from the snows to the plateau as the latter warms up in the morning sun. As a protection most mammals have thick hair and the dogs have wool as well; even the pig is thickly covered with hair. The yak has a coat of wool over which is the long hair that forms a protective skirt under the belly, while the tail may be described as a unique windscreen. The hair under the belly is thought by Major Hingston to keep the animal's legs warm when it is resting. The yak stands with its hindquarters to the wind. The smaller animals and the birds mostly shelter among the rocks and stones when the wind becomes strong, but many of them illustrate its power of damaging fur and feathers. The birds generally face the wind and the great vultures are able to some extent to make use of it. The butterflies may protect themselves by pressing their wings against a stone in as sheltered a nook as can be found. Major Hingston found *Parnassius* sp. as high as 17,000 ft. above sea-level.

The sharp changes of temperature within a few hours, known in all mountain regions, are accentuated here and may be very trying in winter. Many animals of the high mountains are protected from this by the habit of hibernation in burrows where, a little beneath the snow and the surface soil, the temperature is much more uniform. The mouse-hare was seen by Major Hingston as high as 17,000 ft. above sea and he thinks it may reach 20,000 ft. as a stray. Several birds go up to 20,000 ft. and more on the mountain side, and choughs followed the Everest climbers as high as 27,000 ft.; they seem least incommoded by the great heights. The habits of mammals and birds have been noticed to change on the great heights; thus birds which elsewhere are of the wild, live there on and around the villagers' houses, while communities (even some of birds and mammals) are a characteristic development with mutual aid in view.

See D. N. Wadia, *Geology of India* (1919); G. Dainelli, *Relazione Scientifiche della Spedizione Italiana De Filippi nell' Himalaia, Caracorum e Turchestan Cinese* (1913–14) Serie II Resultati Geologici e Geografici, 10 vols; E. Argand, *La Tectonique de l'Asie* (Liége, 1924); A. E. Osmaston, "Forest Communities of the Garhwal Himalayas," *Journ Ecology* (Cambridge, 1922); E. Trinkler, "Tibet" *Mitt. Geogr. Ges. München* Bd. 15, 1922 and the literature of the Everest Expeditions.

HIMERA, an ancient city on the north coast of Sicily, on a hill above the west bank of the Himeras Septentrionalis, south of the present railway station of Buonforello 6 m. east of Termini Imerese. It was founded in 648 B.C. by Chalcidian inhabitants of Zancle and Syracusan exiles. Early in the 5th century the tyrant Terillus, son-in-law of Anaxilas of Rhegium and Zancle, appealed to the Carthaginians, who came to his assistance, but were utterly defeated by Gelon of Syracuse in 480 B.C., on the same day, it is said, as the battle of Salamis. Thrasydaeus, son of Theron of Agrigentum, seems to have ruled the city oppressively, but an appeal made to Hieron of Syracuse, Gelon's brother, was betrayed by him to Theron; the latter massacred all his enemies and in the following year resettled the town. In 408 Hannibal, after capturing Selinus, destroyed Himera, founding a new town close to the hot springs (Thermae Himeraeae), 8 m. to the west, which, however, soon became a Greek city. The only relic of the ancient town now visible above ground is a small portion (four columns, lower diameter 7 ft) of a Doric temple, the date of which (whether before or after 480 B.C) is uncertain.

HIMERIUS (*c.* A.D. 315–386), Greek sophist and rhetorician, was born at Prusa in Bithynia. He completed his education at Athens, whence he was summoned to Antioch in 362 by the emperor Julian to act as his private secretary. After the death of Julian in the following year Himerius returned to Athens, where he established a school of rhetoric, to which pupils came from all over the world; among them were Gregory of Nazianzus and Basil the Great, bishop of Caesarea; in his later years he became blind and he died of epilepsy. Although a heathen, who had been initiated into the mysteries of Mithra by Julian, he shows no prejudice against the Christians. Himerius is a typical representative of the later rhetorical schools. Photius (cod. 165, 243 Bekker) had read 71 speeches by him, of 36 of which he has given an epitome; 24 have come down to us complete and fragments of 10 or 12 others. They consist of epideictic or "display" speeches after the style of Aristides, the majority of them having been delivered on special occasions, such as the arrival of a new governor, visits to different cities (Thessalonica, Constantinople), or the death of friends or well-known personages.

The *Polemarchicus* is a panegyric of those who had given their lives for their country. Other declamations, only known from the excerpts in Photius, were imaginary orations put into the mouth of famous persons—Demosthenes advocating the recall of Aeschines from banishment, or Themistocles inveighing against the king of Persia. Himerius is more of a poet than a rhetorician, and his declamations are valuable as giving prose versions or even the actual words of lost poems by Greek lyric writers. The prose poem on the marriage of Severus and his greeting to Basil at the beginning of spring are quite in the spirit of the old lyric. Himerius possesses vigour of language and descriptive powers, though his productions are spoilt by too frequent use of imagery, allegorical and metaphorical obscurities, mannerism and ostentatious learning. But they are valuable for the history and social conditions of the time, although lacking the sincerity characteristic of Libanius.

See Eunapius, *Vitae sophistarum;* Suidas, *s.v.;* editions by G. Wernsdorf (1790), with valuable introduction and commentaries, and by F. Dübner (1849) in the Didot series; C. Teuber, *Quaestiones Himerianae* (Breslau, 1882); on the style, E. Norden, *Die antike Kunstprosa* (1898).

HIMMEL, FREDERICK HENRY (1765–1814), German composer, was born on Nov. 20, 1765 at Treuenbrietzen, Brandenburg. The production of his oratorio *Isaaco* (1792) procured his appointment as court Kapellmeister to the king of Prussia. His Italian operas, successively composed for Stockholm, St. Petersburg and Berlin, were all received with great favour in their day. Of greater importance than these, however, is an operetta to German words by Kotzebue, called *Fanchon,* a good specimen of the German *Singspiel* Himmel's gift of melody is shown in the still popular anthem "Incline thine ear." He died in Berlin on June 8, 1814.

HIMYARITES: *see* ARABIA: *History.*

HINCKLEY, a market town of Leicestershire, England, 14½ m. S.W. from Leicester by rail, and near the Ashby-de-la-Zouch canal. Pop. of urban district (1921) 13,652. The church of St. Mary is a Decorated and Perpendicular structure. The ditch of a castle erected by Hugh de Grentismenil in the time of William Rufus is still to be traced. Hinckley is the centre of a stocking-weaving district, and its speciality is circular hose. It also possesses a boot-making industry. There are mineral springs in the neighbourhood.

HINCKS, SIR FRANCIS (1807–1885), Canadian statesman, was born at Cork, Ireland, and migrated to Canada, where he settled in business at Toronto. After ten years of political life he became premier of Canada (1851–54), and co-operated with Lord Elgin in negotiating the reciprocity treaty of 1854 with the United States. In 1855 he was chosen governor of Barbados and the Windward Islands, and subsequently governor of British Guiana. He was finance minister (1869–73) in the cabinet of Sir John Macdonald. In 1879 the failure of the Consolidated Bank of Canada, of which he was president, led to his being tried for issuing false statements. Though found guilty on a technicality (see *Journal* of the Canadian Bankers' Association, April 1906), judgment was suspended and his personal credit remained unimpaired. He died on Aug 18, 1885

His writings include *The Political History of Canada between 1840 and 1855* (1877); *The Political Destiny of Canada* (1878), and his *Reminiscences* (1884).

HINCMAR (*c.* 805–882), archbishop of Reims, was born of noble parents and received his education at St. Denis under the direction of abbot Hilduin who brought him in 822 to the court of the emperor Louis the Pious. When Hilduin was disgraced in 830 for supporting Lothair, Hincmar accompanied him into exile at Corvey, but returned with him when the abbot was reconciled with the emperor. Through the influence of Charles the Bald, he received the abbacies of Notre-Dame at Compiègne and St. Germer de Fly, and in 845, the archbishopric of Reims. Archbishop Ebbo had been deposed in 835 at the synod of Thionville (Diedenhofen) for having broken his oath of fidelity to the emperor Louis, but on the death of Louis, he regained possession of his see for some years (840–844), until in 844 Pope Sergius II. confirmed his deposition

From the beginning of his episcopate Hincmar was in conflict with the clerks who had been ordained by Ebbo during his reappearance. His view that their ordination was invalid was confirmed in 853 at the council of Soissons, and in 855 by Pope Benedict III. This conflict, however, bred an antagonism of which Hincmar was later to feel the effects During the next 30 years the archbishop of Reims played a very prominent part in political and religious affairs. In the latter sphere, his first encounter was with Gottschalk (*q.v.*), whose predestinarian doctrines were claimed to be drawn from St Augustine. Hincmar secured the condemnation of these doctrines at Quierzy (853) and Valence (855), and the decisions of these two synods were confirmed at the synods of Langres and Savonnières, near Toul (859). To refute the predestinarian heresy he composed his *De praedestinatione Dei et libero arbitrio,* and against certain propositions advanced by Gottschalk on the Trinity he wrote his *De una et non trina deitate.* The question of the divorce of Lothair II., king of Lorraine, who had repudiated his wife Theutberga to marry his concubine Waldrada, engaged Hincmar's literary activities in another direction.

In the middle of the 9th century there appeared in Gaul the collection of false decretals known as the Pseudo-Isidorian Decretals. Rothad, bishop of Soissons, one of those who favoured the pseudo-Isidorian theories, came into collision with his archbishop. Deposed in 863 at the council of Soissons, presided over by Hincmar, Rothad appealed to Rome. Pope Nicholas I. supported him, and in 865, in spite of the protests of the archbishop of Reims, Arsenius, bishop of Orta and legate of the Holy See, was instructed to restore Rothad to his episcopal see. Hincmar experienced another check when he endeavoured to prevent Wulfad, one of the clerks deposed with Ebbo, from obtaining the archbishopric of Bourges Nicholas I. pronounced in favour of the deposed clerks, and Hincmar had to submit. He was more successful in his contest with his nephew Hincmar, bishop of Laon, who refused to recognize the authority of his metropolitan. Hincmar exposed his errors in a treatise *Opusculum LV. capitulorum,* and procured his deposition at the synod of Douzy (871). A more serious conflict arose between Hincmar on the one side and Charles and the pope on the other in 876, when Pope John VIII., at the king's request, entrusted Ansegisus, archbishop of Sens, with the primacy of the Gauls and of Germany, and created him vicar apostolic. Hincmar regarded this as an encroachment on the jurisdiction of the archbishops, and published his *De jure metropolitanorum.* At the same time he wrote a life of St. Remigius to prove the supremacy of the church of Reims over the other churches. Charles the Bald, however, upheld the rights of Ansegisus at the synod of Ponthion On Charles's death, he helped to secure the submission of the nobles to Louis the Stammerer, whom he crowned at Compiègne (Dec. 8, 877).

To Carloman, on his accession in 882, Hincmar addressed his *De ordine palatii,* partly based on a treatise (now lost) by Adalard, abbot of Corbie (*c.* 814), in which he set forth his system of government and his opinion of the duties of a sovereign, a subject he had already touched in his *De regis persona et regio ministerio,* and in his *Instructio ad Ludovicum regem.* In 882 an irruption of the Normans forced him to take refuge at Epernay, where he died on Dec. 21, 882.

Hincmar's works, which besides the above include many theological tracts and a continuation from 861 of the *Annales Bertiniani,* written by Prudentius, bishop of Troyes, were printed in Paris (1645) and in Migne, *Patrol. Latina,* vol. cxxv. and cxxvi. *See* J. C. Prichard, *Life of Hincmar* (1849); C. von Noorden, *Hinkmar, Erzbischof von Reims* (Bonn, 1863); H. Schrörs, *Hinkmar, Erzbischof von Reims* (Freiburg-i-B., 1884); Abbé Lesne, *La Hiérarchie épiscopale en Gaule et en Germanie* (1905); Hefele, *Konziliengeschichte IV.* (Freiburg-i-B., 1879).

HIND, the female of the red-deer, usually taken as being three years old and over, the male being known as a "hart." It is sometimes applied to the female of other deer.

In Scotland the "hind" is a farm servant, with a cottage on the farm, and duties and responsibilities that make him superior to the rest of the labourers. Similarly "hind" is used in certain parts of northern England as equivalent to "bailiff."

HINDEMITH, PAUL (1895–), German composer, was born at Hanau on Nov. 16, 1895, and studied at the Hoch conservatorium in Frankfurt. For eight years (1915–23) he was first leader and then conductor of the opera there. In 1923 he joined the Amar quartet as viola-player. Hindemith is one of the most important of the younger school of German composers and among much which is frankly experimental and subversive he has produced a good deal also which has secured the genuine approbation of even conservatively-inclined musicians. His works include three one-act operas, *Mörder, Hoffnung der Frauen* (1921), *Das Nusch-Nuschi* (1921), *Sancta Susanna* (1922); *Cardillac* (1927) and much chamber music, amongst which are four string quartets, a string trio, a wind quintet, and six works for chamber orchestra with one solo instrument (*Kammermusik* Nos. I.–VI.).

See F. Wilms, "Paul Hindemith," in *Von neuer Musik* (1925); Heinrich Strobel, *Paul Hindemith* (1928).

HINDENBURG, PAUL VON (1847–), German soldier and president of the German Reich. Paul Ludwig Hans von Beneckendorf und von Hindenburg was born in Posen Oct. 2, 1847, the son of a Prussian officer. His childhood was spent in his parents' house, and later in Pinne and Glogau. In 1858 he entered the cadet school at Wahlstatt in Silesia, afterwards joining the chief cadet academy in Berlin. At an early age the severity of the training in the Prussian cadet corps lent a note of inflexibility to his character, and developed in him strength of will, resolution and cool-headedness. Intellectually, he developed relatively late, owing to early illnesses and to his too rapid physical growth. Ambition awoke in him slowly; but as success crowned his efforts it grew unceasingly, and won him the reputation of a particularly gifted pupil. At the age of 18 he entered the 3rd Foot Guards at Danzig as a second-lieutenant in 1866, and soon after made his first appearance on the battlefield. At the battle of Königgrätz he stormed with his squadron an Austrian battery under fire. He took part in the war of 1870–71 as adjutant to a battalion, and after gaining distinction at St. Privat, became adjutant to the regiment.

After three years at the staff college in Berlin, he served with the general staff in 1877, and was soon promoted to the rank of captain. The next years were spent as company commander and chief of battalion and in various posts on the general staff. In 1883 he became an instructor at the Staff College in Berlin; and later, on the general staff under Count Schlieffen, he was the spiritual pupil and assistant of that strategist of genius. Several years' labour in the Prussian War Office developed his talent for organisation. After serving from 1893 to 1896 as commander of the 91st infantry regiment (Oldenburg), he was promoted major-general, and for four years served as chief of the general staff of the VIII. Army Corps at Coblenz, subsequently commanding the 28th Div. at Karlsruhe for three years. In 1903 he became general in command of the IV. Army Corps at Magdeburg. In 1911, being 65 years old, he was placed on the retired list.

The Outbreak of War.—The outbreak of the World War found him leading a life of seclusion in Hanover. It was in response to the threatening development of the opening campaign in the East against the Russians that on Aug. 22, 1914, he was appointed commander-in-chief of the VIII. German Army, and had assigned to him Maj.-Gen. Ludendorff as chief of staff. Though hardly acquainted with one another previously, a reciprocal confidence soon resulted, which, despite divergence of character, led to a unity of thought and deed without analogy in history. Hindenburg has given a detailed account of his relations with Ludendorff in his memoirs. When, in Germany, after the War, from personal and political motives, attempts were made to make a scapegoat of Ludendorff, the marshal denied these accusations, saying: "We belong to one another till death. Gen. Ludendorff acted in constant accord with me. He who strikes at him strikes at me." General Ludendorff, too, in his war memoirs, fully reciprocates this attitude of complete trust and confidence.

It must be recognised that the disposition of Ludendorff was the more active, that a daemonic spirit resided in him which was responsible for those decisive acts which changed the course of the world's history. His memoirs of the War and his demeanour in German politics after the War are instinct with the vehement passions of one who has been subjected to many attacks, just or unjust. During the War it was only the presence of the marshal's authority that prevented the vivid, sensitive and at times well-nigh fanatical temperament of his colleague from losing self-control. The character of Ludendorff was the harder, that of Hindenburg the greater. Their processes of thought ran upon separate lines, but each tested his own conclusions and completed them by reference to the other. Ludendorff bore the whole burden of the technical execution of the decisions, a task which he carried through with titanic strength. Hindenburg remained predominantly in the sphere of pure thought, supplying rather the static element in leadership, and leaving the dynamic side in the other's hands.

Hindenburg possessed a gift of inestimable value, and Ludendorff enabled him to develop it—that of economising his own mental energy and guarding it against strain and premature exhaustion. He was thus enabled to retain his nerve force until the end of the War, when he was then able to assume a heavier and more thankless task, that of saving his fellow-countrymen from the whirlpool of the revolution. In the political sphere, Gen. Ludendorff's vigorous intervention frequently involved the marshal in spite of all his distaste for political activities, in questions which he would probably have otherwise avoided. Hindenburg as a soldier was hampered by mistrust of his own political ability. Ludendorff frequently had to convince the chief of the general staff of the necessity for taking political decisions. Only the constraint of conscience and the sense of moral responsibility caused Hindenburg and Ludendorff to intervene at all in political questions.

Tannenberg.—The battle of Tannenberg, which lasted from Aug. 26 to 31, 1914, found its origin in the dispositions, involving the assembly of strong forces on the south-west flank, adopted by the superseded Gen. von Prittwitz after breaking off the engagement at Stallupönen (Gumbinnen). Hindenburg's merit lay in converting the possibility thus acquired of a successful defence against Samsonov's Russian Army of the Narew into a victory, whereby despite the numerical inferiority of the Germans the enemy were twice encircled and practically annihilated. The most brilliant feature of the operations was the concentration of all available forces in order to overwhelm this enemy, despite the threats to Hindenburg's rear, first by Rennenkampf in the north and later by new Russian forces which were approaching from the south. In the subsequent battle of the Masurian Lakes, Sept. 7–12, the Niemen army under Rennenkampf was so thoroughly dispersed in the wood and marsh lands as to be unfit for further operations for weeks. In the opening of his campaign in East Prussia Hindenburg showed consummate mastery in the employment of interior lines and in using a central position to prevent hostile forces which were advancing from different directions from uniting on the battlefield. His plan was to overwhelm the first of these with lightning swiftness, and then to turn with all his strength upon the others.

Hindenburg was unable to follow up his victories in East Prussia by advancing across the Lower Narew; the Austro-Hungarian allies had suffered a heavy defeat in Galicia, and the German commander was compelled to hasten to their immediate aid with the bulk of the German forces available in the East. This led to the combined offensive of the German IX. Army through Southern Poland towards the Vistula and of the Austrians in Galicia across the San. The German advance met with little resistance, but the roads were mere morasses. On Oct. 8 the Vistula was reached between Jozefoff and Deblin (Iwangorod) after an advance along the Opatow-Radom line. The attempt to cross the river failed, and the Austrian allies, too, came to a standstill. Finally, the German offensive drew upon itself greatly superior Russian forces which, advancing past Warsaw, assailed its left flank. In this way the ally was relieved. Hindenburg himself succeeded in escaping the threatened envelopment from the north by a timely withdrawal upon Upper Silesia. With the vision of genius he grouped the great bulk of his forces about the railway line running to West Prussia, and at the beginning of Nov. advanced in a surprise attack from the Wrzesnía-Thorn line upon the right flank of the main Russian forces lying in southern Poland. He succeeded at the battle of Lódz in bringing the "Russian steamroller" to a standstill, and eventually compelled the enemy to withdraw behind the Bzura and Rawka.

Further Operations in the East.—Hindenburg in the meantime had been appointed marshal and commander-in-chief of all the German forces in the East. His next blow was in Masuria in Feb. 1915 against the northern wing of the Russian Army on the Upper Bobr, and led to the annihilation of the X. Russian Army. But the attempt to advance across the Narew to Bialystok failed, owing to a powerful Russian counter-offensive at Prazasnysz. The general eastern campaign, directed by Gen. von Falkenhayn, was now concentrated upon Galicia, where on May 8 the break-through at Gorlice-Tarnow initiated a promis-

ing offensive. The front line of the army group of Hindenburg, stretching from the upper Vistula as far as Courland, remained stationary throughout this period, except for local offensives and a large scale cavalry raid. Not until the middle of July was Hindenburg's front-line set in motion, in co-operation with the victorious progress of the offensive in Galicia and southern Poland. But Gen von Falkenhayn and the Marshal differed fundamentally in their attitude towards the cardinal problem of the War. Hindenburg's conviction, founded on the teaching of Clausewitz, was that the salvation of the Central Powers depended on the destruction of the Russian colossus. He believed that a great "Cannae" was attainable in the East, and that with such a victory all political and military considerations which fettered the commander in his power of decision would vanish.

Falkenhayn, on the other hand, held that it was sufficient by means of a "campaign with limited objectives" to keep the Russian Army at bay and to cripple its offensive power. Hindenburg's proposal was to take the offensive on his extreme left flank on the Niemen northwards past Kovno in the direction of Wilna and beyond, and thus to sever the northern arteries of the Russian Army—namely, the railways. This plan was rejected by Falkenhayn in favour of the advance across the lower Narew, which proved successful, for in conjunction with the successes of Mackensen and of the Austrians in southern Poland it caused the whole Russian front line to waver Yet it was only gradually and in consequence of continual front-line engagements that the enemy allowed themselves to be driven back upon their rear-guard communications towards the East Several times during the operations Hindenburg brought up the question of his original project; he also carried out unaided the attack upon the fortress of Kovno, which fell on Aug. 18. Eventually, early in Sept., Falkenhayn gave way ostensibly, without, however, placing at Hindenburg's disposal the strength requisite for carrying out his plans. The offensive upon Wilna, begun too late, encountered powerful Russian forces, and it was only possible to press back the Russian front line, no decisive encounter having taken place

From the autumn of 1915 onwards Gen von Falkenhayn treated the East as a merely subsidiary seat of war; for while he was striving to wear down the French forces at Verdun the German eastern front was condemned to inactivity. This facilitated the great Russian successes in June and July against the Austro-Hungarian front, which was broken through and almost shattered at Luck. In Aug when the danger was at its greatest, the whole of the eastern front from the Gulf of Riga to Galicia was united under Hindenburg. He brought order where chaos had reigned. On the upper Sereth, at Brody and on the Styr a new rampart arose, which, however, proved tenable only where German troops stiffened their allies' resistance. Meanwhile the struggle for Verdun continued to rage, and the battle on the Somme reached its culminating point.

At Headquarters.—When in Aug. Rumania joined the Entente, the Marshal, who was now the national hero, was appointed chief of the general staff in place of Falkenhayn, while Gen. Ludendorff remained with him as quartermaster-general. The new German High Command found itself confronted with innumerable heavy tasks While the campaign against Rumania had to be improvised, it was necessary to stand on the defensive in the West. The offensive against Verdun was abandoned, not without the French having gained numerous local successes towards the end of the year. Hindenburg expressed his final aim in the words: "We intend, not to hold out to the end, but to conquer." An intensive submarine campaign was carried out as a reply to England s hunger blockade.

In the East every nerve had to be strained to force Russia to make a separate peace, while in the West the defensive campaign continued. The end of 1917 found the Quadruple Alliance, despite the tremendous demands made upon their strength—nay, despite the fact that they were almost exhausted—considerably nearer to their objective. The U-boat warfare was slowly but surely producing its effect. The Italians had in a brief but powerful offensive been, not indeed annihilated, but decisively defeated. In the East the German hammerblows at Tarnopol, Riga and Osel (Saaremma) had broken the fighting spirit of the new Russian ruler Kerensky, and carried the Bolsheviks into power. Peace was negotiated with them and with Rumania at Brest-Litovsk and Bucharest and, under military pressure, was finally attained in the winter of 1918. There remained the last and hardest task, the reckoning with France and England in the West, before America should be in a position to intervene as a military factor in the War on land.

In the spring of 1918 Hindenburg set himself to place the cornerstone upon the structure of his military achievements. All available effectives were utilised for this decisive conflict. The great offensive on both sides of St. Quentin was to break through the front line of the French and British on the southern flank of the latter, to roll them up towards the north and drive them towards the coast. From the tactical point of view the first blow in the direction of Amiens was a brilliant success. But it led to no practical advantage, and was supplemented by the attack upon the Lys front. But, here, too, the operations for a break-through miscarried, resulting only in a second massive concentration on the enemy front Hindenburg, notwithstanding, clung to his resolve to deal the British a decisive blow in Flanders

It was necessary, however, to effect a diversion in order to draw off the French reserves and to occupy them elsewhere. This led to loss of time, from which the enemy derived advantage. For the intervention of America loomed threateningly near. The first diversion at the Chemin des Dames gained considerable ground and drew in a large number of the French reserves, but not enough to pave the way for the decisive blow in Flanders. A new diverting attack on both sides of Rheims failed, whereupon Marshal Foch seized the initiative and from Villers Cotterêts attacked the German Marne position on the flank with strong forces. The Americans now appeared in the capacity of attacking troops. Hindenburg abandoned the Marne salient and held up the break-through on the Vesle. But from henceforth the initiative remained steadily in the hands of the French generalissimo, while the German reserves melted steadily away.

From a military standpoint the War was lost with the reverse of Aug. 8. Yet Hindenburg still hoped to cripple the fighting spirit of the enemy by a strategic defensive and to secure a peace compatible with the dignity of the German people. But Bulgaria's defection caused the complete collapse of the Macedonian front, and Hindenburg realised that an immediate armistice was necessary to give the army breathing space With a just appreciation of their prospects of victory, the enemy took their time over granting an armistice, and summoning the full strength of their tremendous material superiority proceeded to force the German Army to throw in its last reserves. Meanwhile Turkey and Austria abandoned their rôles as allies of Germany, who found herself flung entirely upon her own resources in the final struggle. Hindenburg and Ludendorff wished to rouse the people to a final heroic effort of exertion; but the Cabinet of Prince Max of Baden lacked the capacity to check the revolution, and Germany was handed over unconditionally to the dictates of the enemy.

The marshal, victor in countless battles, had to return home, therefore, not as supreme war-lord but as a beaten general. Yet even in misfortune and profound humiliation his spirit remained unbroken, and he succeeded in extricating his country from the disorder of the revolution.

After the war Hindenburg lived in retirement, taking no active part in political life, until the presidential elections following the death of President Ebert. The anti-socialist parties in Germany then combined, and induced him to stand for the presidency as a national figure, representing, indeed, conservative views, but standing to some extent above party. He was elected president on April 26, 1925.

Neither the fears of France, who saw in Hindenburg's election the first step towards a war of revenge, nor the hopes of the German monarchists, were realised. Although openly acknowledging his own monarchist sympathies, Hindenburg remained absolutely loyal to the Republic of which he was president, nor did

he in any sense encourage a provocative foreign policy. He involved himself personally in few disputes, but on May 5, 1926, he issued, without consulting the Reichstag, a decree authorising diplomatic missions and consulates abroad to fly the German commercial flag beside the Republican flag—a move which brought the hostility between monarchists and republicans to a head and led to the fall of the chancellor; and a few days later (May 19) expressed himself strongly in a private letter, which was published in the press, against the justice of the referendum for expropriating the former reigning houses. His few subsequent excursions into politics aroused far less controversy. His emphatic repudiation of Germany's war-guilt at a speech made at Tannenberg (Sept. 18, 1927), was echoed through nearly all Germany, and his appointment of General Groener as minister of defence (Jan. 19, 1928) was welcomed by the republicans. The simplicity, dignity and fidelity with which he has borne himself as president have earned him the name of a great gentleman as well as a great patriot.

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HINDENBURG (ZABRZE), a town of Germany, in the extreme south-east of Prussian Silesia, on the railway between Gleiwitz and Königshütte. Pop. (1925) 72,856. Like other towns in this region, it is an important manufacturing centre, having coal-mines, iron, wire, glass, chemical works, breweries, etc.

HINDENBURG LINE, BATTLES OF 1918. On Aug. 26, 1918, began the third stage of the series of offensive operations which formed the British share of the Allied advance to victory. This stage culminated on Oct. 5 in the capture of the last and strongest system of German defence, known as the Hindenburg Line. The first stage had been the attack by Rawlinson's IV. Army, assisted by the French I. Army under Debeney, eastwards and southeastwards from Amiens with the object of freeing the Paris-Amiens railway. In the second phase the British III. Army under Byng had extended the front of the attack northwards by a successful thrust towards Bapaume. The British I. Army under Horne was now to broaden the front of attack by driving eastwards from Arras with the object of turning the German positions on the Somme battlefields.

Hindenburg Line Described.—The Hindenburg Line consisted of a heavily wired system of trenches which ran northwards from St. Quentin to the village of Bantouzelle approximately parallel to the Schelde Canal. This portion was known to the Germans as the Siegfried Line. From Bantouzelle the main line of trenches ran northwest to Havrincourt, whence it turned north and followed the line of the Canal du Nord to Moeuvres. From Moeuvres it ran northwest past Quéant and Bullecourt to the original German front line east of Arras. Within this northern bend in the system, and covering the approaches to Cambrai, lay several switch lines and defensive positions, the most formidable of which were the Drocourt-Quéant Line, which ran in a northerly direction from the Hindenburg Line at Quéant, and the Canal du Nord, which passed by Moeuvres to the Sensée.

On the night of Aug. 25–6 the British line extended from a point northwest of Chaulnes, where the right of the British IV. Army joined the left of the French I. Army, east of Bray, west of Bapaume to Croisilles, and thence northwest to the old British line, southeast of Arras. The IV. Army had the Australian and III. Corps in line; the III. Army, which extended northwards from a point east of Albert, had the V., IV., VI. and XVII. Corps. The I. Army front was held by the Canadian Corps and the VIII. and I. Corps, of which only the Canadian Corps, astride the Scarpe, was involved in the operations to be described. The German troops who were to bear the brunt of the impending blow were the left wing of Bülow's XVII. Army, the II. Army under Marwitz and the right wing of Hutier's XVIII. Army.

The Offensive Launched.—At 3:00 A.M. on Aug. 26 the Canadian Corps under Sir A. Currie attacked the German positions astride the Scarpe on a front of 5½ miles. The attack was carried out by the 2nd and 3rd Canadian Divs. and the 51st Highland Div. supported by 45 tanks and some 600 guns. The XVII. Corps of the III. Army co-operated on the right. The attack was a complete success. The Bavarian II. Corps and Bavarian I. Res. Corps were driven back through Wancourt, Guémappe, Monchy and Roeux, and by evening, in spite of strong counter-attacks, the Canadian Corps had established itself well to the east of those villages. On Aug. 27 the attack was continued by the same divisions, and Chérisy, Vis-en-Artois and Gavrelle fell into their hands. On the following day the Canadian 3rd Div. made further progress, and that night both divisions were relieved, the Canadian 2nd Div. by the Canadian 1st, while the British 4th Div. relieved the Canadian 3rd. During the next few days considerable progress was made. This advance brought the British to within assaulting distance of the formidable trench system known to the Allies as the Drocourt-Quéant Line, and to the Germans as the Wotan Line. The capture of this system, would, it was anticipated, turn the whole of the German organized positions for some distance southwards. Preparations were put in hand to launch the attack on Sept. 2. The XXII Corps took over the front north of the Scarpe held by the 51st Div. and relieved that division by the 11th.

The Drocourt-Quéant Line Attacked.—By the evening of Sept. 1 all preparations for the attack of the Drocourt-Quéant Line were complete. The main attack was to be carried out by the Canadian Corps, whose principal task was to break through the defences between Hendecourt and Sailly. The XXII. Corps, also of the I. Army astride the Scarpe, was to secure the Canadian left, while the XVII. Corps of the III. Army, advancing on the right of the Canadians, was to capture the maze of trenches at the junction of the Drocourt-Quéant and Hindenburg lines, and turn the last named defensive position from the north. The XVII. and Canadian Corps were then to push on up to and if possible beyond the Canal du Nord.

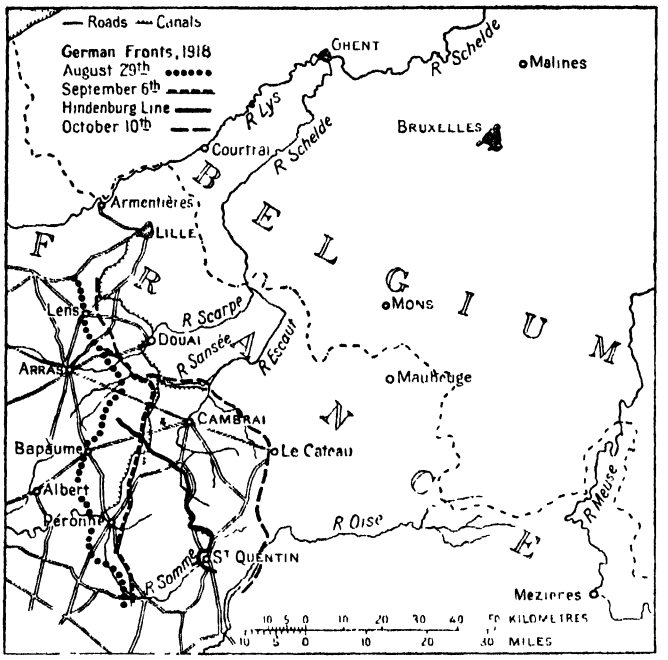
The attack of the Canadian Corps was launched at 5:00 A.M. by the Canadian 1st and 4th and the British 4th Divs., supported by some 500 guns and 40 tanks, on a front of 4½ miles. All resistance on the first objective was speedily overcome, and by 9:15 A.M. the whole system of trenches on the front of the Canadian Corps was in the hands of the assaulting troops. On the XVII. Corps front, the attack was launched at the same hour and met with equal success. The 52nd Div stormed the network of trenches at the junction of the two systems, and after heavy fighting succeeded in overcoming all resistance. The 57th Div., attacking north of the 52nd, pressed forward south of the Canadians, and by nightfall had swung round to the right and were threatening the villages of Quéant and Pronville from the north. The 63rd Div., which passed through to exploit the success, had heavy fighting during the afternoon, but by dark had reached the railway east of Quéant.

During the afternoon the Canadian Corps met with increased opposition, particularly from machine-guns on the British 4th Div. front, but by the evening an advance of some 3m. had been made and British troops had captured Cagnicourt, Villers and Dury, and were approaching the outskirts of Buissy. Eight thousand prisoners and many guns were captured, bringing the total captures on the I. Army front alone since Aug. 26 to 16,000 prisoners and 200 guns. In eight days the 10 British and Canadian divisions employed by the I. Army had defeated 13 German divisions and driven them back 10m., out of all their organized positions in front of Cambrai. Troops of the III. and IV. Armies prolonged the attack southward on Sept. 2, and substantial progress was made, though the fighting was severe.

The results of this most successful operation became obvious at once, as on the night of Sept. 2–3 the Germans fell back to the line of the Canal du Nord from Péronne to Hermies The following day they commenced to withdraw from the Somme, south of Péronne, and by the night of Sept. 8 they were back on a line Vermand (6m. west of St. Quentin)-Epehy-Havrincourt and thence along the east bank of the Canal du Nord to the Sensée.

Preparatory Operations Continued.—The Canal du Nord, behind which the German forces facing the I. Army and left of the III. Army had now established themselves, was far too

strong a natural position to warrant attack without very careful preparation. The next three weeks were therefore devoted by the British forces on this front to the organization of an operation which eventually took place on Sept. 27. South of Havrincourt the German main line of resistance was the Hindenburg Line, but strong forces were still occupying advanced positions in the trenches which formed the old British and German lines



MAP SHOWING SUCCESSIVE GERMAN FRONTS BETWEEN AUG 29 TO OCT 10, 1918 AND THE GENERAL TREND OF THE HINDENBURG LINE

prior to the German offensive in March 1918. These had to be captured before the Hindenburg Line itself could be assaulted, and to this end operations were undertaken by the British III. and IV. Armies.

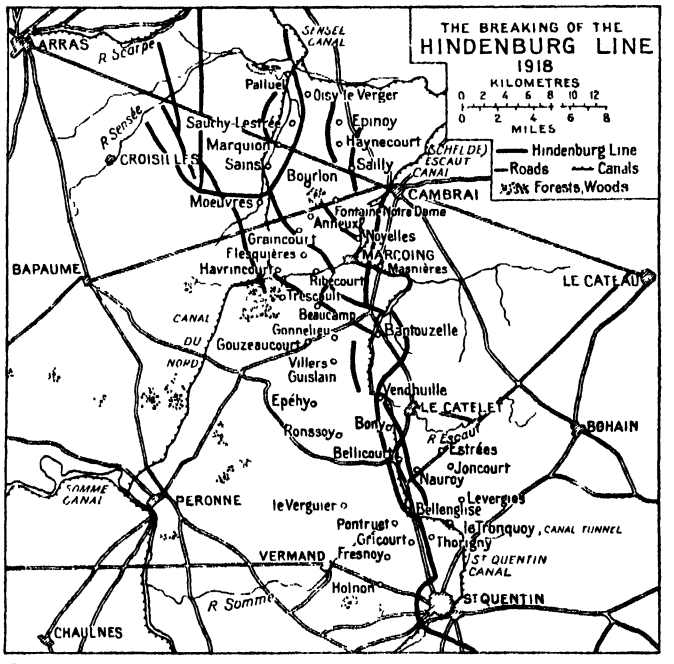
On Sept. 12 the III. Army attacked with the IV. Corps and the VI. Corps on a 5m. front in the neighbourhood of Havrincourt Wood. A considerable advance was made and the villages of Trescault and Havrincourt were captured. Meantime the IV. Army had continued to press the German withdrawal, and between Sept. 11 and 17 the line had been pushed forward at several points. On Sept. 18 a much more extensive operation was undertaken, in which the IV. Army in conjunction with the III. Army attacked the German forces on a 17m. front from Holnon to Gouzeaucourt. The French I. Army co-operated on the right. The final objective of the main attack was the old British outpost line running past Pont Ruet, west of Bellicourt, Bony and Vendhuille. It was not intended that this final objective must necessarily be reached on the first day—and in fact it was not reached until after several days of very severe fighting.

At 7:00 A.M. on Sept. 18 the IV. and III. Armies attacked in heavy rain. The attack was supported by 23 tanks and 978 guns, and in some sectors dummy tanks were used with considerable success. The IX. Corps advanced on the right with the 6th and 1st Divisions. The first objectives were taken at 9·00 A.M., but the 6th Div. was checked at Holnon and west of Fresnoy. The 1st Div. was more successful, but was unable to reach Pont Ruet, and both divisions suffered severe casualties. The Australian Corps had very heavy fighting, particularly in and about Le Verguier, and was held up in front of its final objective till dusk. During the night a successful attack was made which completed the operation on the Australian front.

North of the Australians the III. Corps attacked with the 74th, 18th, 12th and 58th Divs., and met with very stubborn resistance. Ronssoy was captured by the 18th Div. and Epéhy by the 12th and 58th Divs., but little progress was made beyond these places. The V. Corps of the III. Army continued the front of attack to the north and all divisions made considerable progress, though it was not found possible to take Gouzeaucourt on this day. Minor operations were undertaken during the succeeding week, which resulted in the capture of Gricourt and Pontruet by the IX. Corps, and by Sept. 26 the British line had been advanced to a position from which the attack on the main Hindenburg system could be launched. In this last series of operations 15 divisions of the British III. and IV. Armies had driven back 29 divisions of the German II. and XVII. Armies into the Hindenburg defences, and inflicted on them a loss of 12,000 prisoners and 100 guns.

The Storming of the Hindenburg Line.—All was now ready for the great effort to break through the Hindenburg Line. The strategic plan decided on by Marshal Foch and the Allied Commanders-in-Chief involved the launching of four convergent and practically simultaneous offensive operations. The Americans were to attack west of the Meuse in the direction of Mézières. The French offensive, also against Mézières, was to be launched west of the Argonne. The British were to break through the Hindenburg Line between St. Quentin and the river Sensée and advance on Maubeuge, while an Allied force (British, French and Belgian) under the King of the Belgians, was to attack in Flanders in the direction of Ghent. The results to be obtained from these offensive operations depended in no small degree on the success of the British attack in the centre, where a threat to the German vital systems of lateral communication would re-act on their defences elsewhere. It was here, too, that the German system of defence was most highly organized.

In accordance with the above general strategic plan the French and Americans attacked on Sept. 26; the British offensive commenced on the 27th, and the Allied attack in Flanders was launched on the 28th Haig's plan was to strike first with his left wing in the direction of Cambrai, while the right wing, which was faced by the more formidable defences, was to attack later after a very heavy preliminary bombardment. It was hoped



DETAIL MAP SHOWING THE HINDENBURG LINE, WHICH WAS A SERIES OF STRONGLY FORTIFIED WORKS— NOT A SINGLE OR CONTINUOUS LINE

that any success obtained by the left wing would draw off the German reserves, and deceive their higher command as to the point where the main blow was to fall.

A very heavy bombardment was opened on the night of Sept. 26–27 on the front of the British I., III. and IV. Armies, and at 5.20 A.M. on the 27th four corps attacked on a front of 13m. from Gouzeaucourt to the neighbourhood of Sauchy Lestrée. On the northern flank the Canal du Nord was too formidable an obstacle to be carried in face of opposition, and consequently the plan was conceived of crossing on a comparatively narrow front,

and then of turning the line of the canal farther north by a divergent attack from the point of crossing. This difficult manoeuvre was most successfully carried out. On the right the 5th and 42nd Divs. of the IV. Corps established and held a strong flank between Beaucamp and Ribecourt. On their left the VI. Corps advanced with the 3rd and Guards Divs., and captured Ribecourt and Flesquières, while the 62nd and 2nd Divs., passing through, continued the advance in the direction of Marcoing. Farther north the 52nd and 63rd Divs. of the XVII. Corps forced the passage of the canal and, after heavy fighting, established themselves in Graincourt, and the 57th Div., in close co-operation with the Canadians, reached Anneux.

On the I. Army front the Canadian Corps attacked with the Canadian 4th and 1st Divs., and in the half light of dawn stormed the canal on the line Moeuvres-Sains-Marquion. With irresistible impetus the Canadian 4th Div. pushed on to Bourlon village and wood where the Canadian 3rd Div., taking up the attack, advanced towards Fontaine Notre Dame and Sailly. On the left the Canadian 1st Div. was equally successful, and, having captured Sains and Marquion, advanced rapidly towards Haynecourt and Sauchy Lestrée, while the British 11th Div. passed through and captured Epinoy and Oisy-le-Verger. Meanwhile the 56th Div. of the XXII. Corps crossed the canal, west of Sauchy Lestrée, cleared that village and advanced on Palleul. By the evening of Sept. 27 over 10,000 prisoners and 200 guns had been taken. As soon as the crossings of the canal were secured the British and Canadian engineers began to construct the necessary bridges, and in spite of heavy artillery fire completed their task with remarkable speed, and contributed in no small degree to the success of the operation.

On Sept. 28 the advance was continued and Gouzeaucourt, Marcoing, Noyelles, Fontaine Notre Dame, Sailly and Palleul were taken, and a footing was obtained on the east bank of the Schelde Canal at Marcoing. At 5:50 A.M. on the morning of Sept. 29, after a preliminary bombardment lasting over two days, in which some 1,600 guns were employed, the British IV. Army advanced to the attack, covered by an intense artillery barrage. The front of attack extended from Holnon to Vendhuile, a distance of about 12 miles. On the right the IX. Corps met with complete success. The 1st Div., advancing south of the bend in the canal at Bellenglise, established a flank facing south-east from Gricourt to the Le Tronquoy tunnel. The 46th Div., which was faced by a most formidable task, advanced with the greatest gallantry, and with the assistance of rafts, mats and even life-belts, stormed the canal at and north of Bellenglise and rushed the German trench system west of the canal. The German defences here faced south, and the British troops swung to the right and took them in flank and rear, capturing many prisoners and guns. By 3:00 P.M. the 46th Div. had broken through the Hindenburg Line to a depth of 3 miles, routed four German divisions, and taken over 4,000 prisoners and 70 guns at the small cost of 800 casualties. The 32nd Div., passing through, completed the capture of the Hindenburg Reserve Line, and by nightfall had taken 800 more prisoners and 20 guns.

Work of the American Corps.—On the left of the IX. Corps the American II. Corps had been superimposed on the Australian Corps. The task of the American troops was to break through the Hindenburg Line at and north of Bellicourt, where the St. Quentin Canal passes through a tunnel. The Australian 5th and 3rd Divs. were then to take up the attack and advance on more distant objectives. The Americans advanced with the greatest gallantry, but owing to the uncertain issue of a preliminary attack that had been made to secure a good starting line, their left division (the 27th) started half a mile behind the barrage—which the Army Command were reluctant to bring back. Without this protection its attack was quickly shattered with great loss. The Australian 3rd Div., following it up, could make but little headway and was finally checked in front of Bony. The American 30th Div. on the right was more successful, but also suffered heavily from German reserves who came up from their shelter in the tunnel, and it was only after very heavy fighting that the Australian 5th Div., passing through, finally succeeded in reaching the Hindenburg Reserve Line about Nauroy

On the left the III. Corps carried out their task of securing the left flank of the IV. Army. On the same day the III. Army achieved an important success by securing the canal crossings at Masnières and northward as far as Cambrai, while the I. Army front was advanced northwest of that town On Sept. 30 the break in the Hindenburg system was widened by the capture by the IX. Corps of Thorigny and Le Tronquoy, and on the same day the Germans abandoned Villers Guislain and Gonnelieu. On Oct. 1, in co-operation with the French I. Army who occupied St. Quentin, the IX. Corps took Levergies and the Australians captured Joncourt, Estrées and Bony. The III. and I. Armies also achieved important successes. During the first week in Oct. the XIII. Corps relieved the III. Corps north of the Australians and a series of successful minor operations were carried out on the fronts of all three armies, and by Oct. 5 the whole of the rearward lines of the Hindenburg system were in British hands.

Results of the Offensive.—During this nine days' battle 30 British and two American divisions had broken through the last and most powerfully organized system of German defences, had overwhelmed 39 German divisions and captured 36,000 prisoners and 380 guns. The effect of the British victory was decisive on the subsequent course of the campaign, and though there was still to be hard and bitter fighting before the termination of hostilities on Nov. 11, only natural obstacles such as woods, rivers and villages now lay between the British Armies and their objective at Maubeuge.

BIBLIOGRAPHY.—F. A. Mackenzie, *Through the Hindenburg Line* (1918), G. H. F. Nichols (Quex), *Pushed and the Return Push* (1919); R. E Priestly, *Breaking the Hindenburg Line* (1919); A A Montgomery, *The Story of the Fourth Army in the Battle of the Hundred Days, August 8 to November 11, 1918* (1920); G. A. B. Dewar and J. H. Boraston, *Sir Douglas Haig's Command, 1915–1918* (1922). (*See* also WORLD WAR: BIBLIOGRAPHY.)

HINDERSIN, GUSTAV EDUARD VON (1804–1872), Prussian general, was born at Wernigerode near Halberstadt on July 18, 1804. He entered the Prussian artillery in 1820, and in 1841, while still a subaltern, he was posted to the great general staff, in which he afterwards directed the topographical section. He served in the suppression of the Baden insurrection (1849), and was ennobled for his services in the Danish war of 1864, where he directed the artillery operations against the lines of Düppel. Soon afterwards he became inspector-general of artillery. His experience at Düppel had convinced him that the days of the smooth-bore gun were past, and he now rearmed and reorganized the Prussian artillery. The available funds were small, and grudgingly voted by the parliament. There was a strong feeling moreover that the smooth-bore was still tactically superior to its rival. Under Hindersin manoeuvres were instituted, and the smooth-bores were, except for ditch defence, eliminated from the armament of the Prussian fortresses. But far more important was his work in connection with the field and horse batteries. In 1864 only one battery in four had rifled guns, but the outbreak of war with Austria one and a half years later found the Prussians with ten in every sixteen batteries armed with the new weapon. But the battles of 1866 revealed a lack of tactical efficiency in the Prussian artillery, and Hindersin was now able to secure the establishment of a school of gunnery. The consequent improvement in the Prussian field artillery between 1866 and 1870 was extraordinary; indeed, the German artillery played the most important part in the victories of the Franco-German war. Hindersin accompanied the king's headquarters as chief of artillery, as he had done in 1866, and was present at Gravelotte, Sedan and the siege of Paris. He died on Jan. 23, 1872, at Berlin

See Bartholomäus, *Der General der Infanterie, von Hindersin* (1895), and Prince Kraft zu Hohenlohe-Ingelfingen, *Letters on Artillery* (translated by Major Walford, R A.), No. xi.

HINDĪ, EASTERN, one of the "intermediate" Indo-Aryan languages. It is spoken in Oudh, Baghelkhand and Chhattisgarh It is derived from the Apabhraṁśa form of Ardhamāgadhī Prakrit (*see* PRAKRIT), and possesses a large and important literature. Its most famous writer was Tulsī Dās, the poet and reformer, who died early in the 17th century, and since his time it has been

the North-Indian language employed for epic poetry. Eastern Hindī has been an Intermediate language since, at least, the institution of Jainism (say, 500 B.C.), and is much less subject to the influence of the Midland than is Punjabi. To its east it has Bihari, and, to the south Marathi as its neighbour, both Outer languages.

Tulsī Dās was one of the greatest writers that India has produced, and his influence on the language has been as great as that of Shakespeare on English. The peasantry are continually quoting him without knowing it, and his style, simple and yet vigorous, thoroughly Indian and yet free from purism, has set a model which is everywhere followed except in the large towns where Urdu or Sanskritized Hindī prevails. Eastern Hindī is written in the Nāgarī alphabet, or in the current character related to it called "Kaithi" (*see* BIHARI).

Dialects.—The only important dialect of Eastern Hindī is Awadhī, spoken in Oudh, and possessing a large literature of great excellence. Chhattīsgaṛhī and Baghēlī, the other dialects, have scanty literatures of small value. A detailed sketch of the grammar of Eastern Hindī is given in vol. vi. of the *Linguistic Survey of India* (1904).

HINDĪ, WESTERN, the Indo-Aryan language of the middle and upper Gangetic Doab, and of the country to the north and south. Its standard dialect is Braj Bhāshā, spoken near Muttra, which has a considerable literature mainly devoted to the religion founded on devotion to Krishna. Another dialect spoken near Delhi and in the upper Gangetic Doab is the original from which Hindostani, the great *lingua franca* of India, has developed (*see* HINDOSTANI). Western Hindī is descended from the Apabhraṁśa form of Śaurasēnī Prakrit (*see* PRAKRIT) and represents the language of the Madhyadēśa or Midland, as distinct from the Intermediate and Outer Indo-Aryan languages. Western Hindī has four main dialects, Bundēlī of Bundelkhand, Braj Bhasha (properly "Braj Bhāṣā") of the country round Mathurā (Muttra), Kanaujī of the central Doab and the country to its north, and vernacular Hindostani of Delhi and the Upper Doab. West of the Upper Doab, across the Jumna, another dialect, Bāngarū, is also found. It possesses no literature. Kanauji is very closely allied to Braj Bhasha, and these two share with Awadhī the honour of being the great literary speeches of northern India. Nearly all the classical literature of India is religious in character, and, as a broad rule, Awadhī literature is devoted to the Ramaite religion and the epic poetry connected with it, while that of Braj Bhasha is concerned with the religion of Krishna.

BIBLIOGRAPHY.—*See* vol. ix. of the *Linguistic Survey of India* for extensive lists of grammars, dictionaries and specimens. The sketch of Western Hindī grammar and phonology is clear and of great practical value.

HINDKI, the name given to the Hindus of the Khatri class who inhabit Afghanistan. It is also loosely used on the upper Indus, in Dir, Bajour, etc., to denote the speakers of Punjabi or any of its dialects.

HINDLEY, an urban district, Westhoughton parliamentary division, Lancashire, England, 2 m. south-east of Wigan, on L.M.S. and L.N.E. railways. Pop. (1921) 23,563. Cotton-spinning and weaving are the principal industries and there are extensive coal mines in the neighbourhood.

HINDOSTAN is a Persian word, and in modern Persian is pronounced "Hindūstān." It means the country of the Hindūs. In mediaeval Persian the word was "Hindōstān," with an *ō*, but in the modern language the distinctions between *ē* and *ī* and between *ō* and *ū* have been lost. Indian languages borrowed Persian words in their mediaeval form. The word "Hindu" is in mediaeval Persian "Hindō," representing the ancient Avesta *hendava* (Sanskrit, *saindhava*), a dweller on the *Sindhu* or Indus. Owing to the influence of scholars in modern Persian the word "Hindū" is now established in English and, through English, in the Indian literary languages; but "Hindō" is also often heard in India. "Hindostan" with *o* is much more common both in English and in Indian languages, although "Hindustan" is also employed. Up to the days of Persian supremacy inaugurated in Calcutta by Gilchrist and his friends, every traveller in India spoke of "Indostan" or some such word, thus bearing testimony to the current pronunciation. Gilchrist introduced "Hindoostan," which became "Hindustan" in modern spelling. The word is not an Indian one, and both pronunciations, with *ō* and with *ū*, are current in India at the present day, but that with *ō* is unquestionably the one demanded by the history of the word and of the form which other Persian words take on Indian soil. On the other hand, "Hindu" is firmly established in English. The word "Hindī" has another derivation, being formed from the Persian *Hind*, India (Avesta *hindu*, Sanskrit *sindhu*, the Indus). "Hindī" means "of or belonging to India," while "Hindu" now means "a person of the Hindu religion." (*Cf.* Sir C. J. Lyall, *A Sketch of the Hindustani Language*, p. 1.)

HINDOSTANI LANGUAGE (properly Hindōstānī, of or belonging to Hindostan), the name given by Europeans to an Indo-Aryan dialect (whose home is in the upper Gangetic Doab and near the city of Delhi), which, owing to political causes, has become the great *lingua franca* of modern India. The name is not employed by Indians, except as an imitation of the English nomenclature. Hindostani is not a mongrel "pidgin" form of speech made up of contributions from the various languages which met in the Delhi bazaars, but an actual living dialect of Western Hindī, and the direct descendant of Saurasēnī Prakrit. It represents Western Hindī merging into Punjabi (Braj Bhasha being admittedly the standard of the language). It was the natural language of the people in the neighbourhood of Delhi, who formed the bulk of those who resorted to the bazaar, and hence it became the bazaar language. From here it became the *lingua franca* of the Mogul camp and was carried everywhere in India by the lieutenants of the empire. It has several recognized varieties, Dakhini, Urdu, Rēkhta and Hindī. Dakhini or "southern," is the form current in the south of India, and was the first to be employed for literature. It contains many archaic expressions now extinct in the standard dialect. Urdu, or *Urdū zabān* "the language of the camp," is the name usually employed for Hindostani by natives, and is now the standard form of speech used by Muslims. All the early Hindostani literature was in poetry, and this literary form of speech was named "Rēkhta" or "scattered," from the way in which the words borrowed from Persian were "scattered" through it. The name is now reserved for the dialect used in poetry, Urdu being the dialect of prose and of conversation. The introduction of these borrowed words, which has been carried to even a greater extent in Urdu, was facilitated by the fact that Persian was the official language of the Mogul court. In this way Persian (and, with Persian, Arabic) words came into current use, and, though the language remained Indo-Aryan in its grammar and essential characteristics, it soon became unintelligible to anyone who had not at least a moderate acquaintance with the vocabulary of Iran. This extreme Persianization of Urdu was due rather to Hindu than to Persian influence. Although Urdu literature was Muslim in its origin, the Persian element was first introduced in excess by the pliant Hindu officials employed in the Mogul administration, and acquainted with Persian, rather than by Persians and Persianized Moguls, who for many centuries used only their own languages for literary purposes. Prose Urdu literature took its origin in the English occupation of India and the need for textbooks for the college of Fort William. It has had a prosperous career since the commencement of the 19th century, but some writers, especially those of Lucknow, have so overloaded it with Persian and Arabic that little of the original Indo-Aryan character remains, except, perhaps, an occasional pronoun or auxiliary verb. The Hindī form of Hindostani was invented simultaneously with Urdu prose by the teachers at Fort William. It was intended to be a Hindostani for the use of Hindus, and was derived from Urdu by ejecting all words of Persian or Arabic birth, and substituting for them words either borrowed from Sanskrit (*tatsamas*) or derived from the old primary Prakrit (*tadbhavas*) (*see* INDO-ARYAN LANGUAGES). Owing to the popularity of the first book written in it, and to its supplying the need for a *lingua franca* which could be used by the most patriotic Hindus without offending their religious prejudices, it became widely adopted, and is now the recognized vehicle for writing prose by those inhabitants of northern India who do not employ Urdu. At the present day,

Hindī is beginning to be used for poetry but for this the indigenous dialects (usually Awadhī or Braj Bhasha) are still preferred by Hindus. Urdu, on the other hand, having had a natural growth has a vigorous poetical literature. Modern Hindī prose is often disfigured by the free borrowing of Sanskrit words and is rapidly becoming a Hindu counterpart of the Persianized Urdu, neither of which is intelligible except to persons of high education.

Urdu has adopted a Persian vocabulary and a few peculiarities of Persian construction, and these, perhaps, combined with the use of high-flown and pedantic Persian and Arabic words in place of common and yet chaste Indian words, and the general use of the Persian instead of the Nāgarī character, have induced some to regard Hindostani or Urdu as a language distinct from Hindī. We must define Urdu as the Persianized Hindostani of educated Muslims, while Hindī is the Sanskritized Hindostani of educated Hindus. Urdu, from the number of Persian words which it contains, can only be written conveniently in the Persian character, while Hindī, for a parallel reason, can only be written in the Nagari or one of its related alphabets (*see* SANSKRIT). On the other hand, "Hindustani" implies the great *lingua franca* of India, capable of being written in either character, and, without purism, avoiding the excessive use of either Persian or Sanskrit words when employed for literature. It is easy to write this Hindostani, for it has an opulent vocabulary of *tadbhava* words understood everywhere by both Muslims and Hindus. While "Hindostani," "Urdu," and "Hindī" are thus names of dialects, the terms "Western Hindī" and "Eastern Hindī" connote, not dialects, but languages.

The epoch of Akbar was the period of the formation of the language. But its final consolidation did not take place till the reign of Shah Jahān. Changes are comparatively immaterial until we come to the time when European sources began to mingle with those of the East. Like the greater part of those from Arabic and Persian, the contributions from these sources are chiefly nouns, and are casual excrescences rather than ingredients duly incorporated in the speech. In the case of the Persian and Arabic element, indeed, we find instances in which nouns have been furnished with a Hindī termination; but the European element cannot be said to have at all woven itself into the grammar of the language. It consists solely of nouns, principally substantive nouns, which on their admission into the language are spelt phonetically, or according to the corrupt pronunciation they receive in the mouths of the natives, and are declined like the indigenous nouns by means of the usual postpositions or case-affixes. Portuguese, the first in order of seniority, contributes a few words. Of French and Dutch influence scarcely a trace exists. English has contributed a number of words, some of which have even found a place in the literature of the language. Some borrowed words are distorted into the shape of genuine Hindustani words familiar to the speakers; *e.g.*, the English railway term "signal" has become *sikandar,* the Indian name for Alexander the Great, and "signal man" is *sikandar-mān,* or "the pride of Alexander." The free use of Anglicisms of late years has greatly increased in the language of the educated, especially in the case of technical terms.

BIBLIOGRAPHY.—See C. J. Lyall, *A Sketch of the Hindostani Language* (1880); J. T. Platts, *A Grammar of the Hindustani or Urdu Language* (1874); *Linguistic Survey of India,* vol. ix. (1914), where an extensive bibliography will be found and a detailed sketch of the grammar.

HINDŌSTĀNĪ LITERATURE. Hindōstānī is the vernacular of the part of India called Hindōstān,—that is, the Jumna and Ganges valleys as far east as the river Kōsi, Rajpūtānā, Central India (Bundēlkhaṇḍ and Baghēlkhaṇḍ), the Narmadā valley as far west as Khandwā, and the N. half of the Central Provinces. It does not include the Punjab (though the town population there speak Hindōstānī) or Lower Bengal.

In this region various dialects prevail. The people of the towns use chiefly the form of the language called *Urdū* or *Rēkhta,* stocked with Persian words and phrases, and ordinarily written in the Persian character. *Urdū* is a Turkish word meaning a camp or army and is the origin of *horde. Rēkhta* means "scattered," referring to the way in which Persian words are intermixed with those of Indian origin; it is used chiefly for literary Urdū. The far more numerous country folk speak different forms of *Hindī,* derived from the Prākrits and literary Sanskrit, written in the Dēvanāgarī or Kaithī character. Of these the most important from a literary point of view are *Mārwāṛī* and *Jaipurī* (spoken in Rajpūtānā), *Brajbhāshā* (about Mathurā and Agra), *Kanaujī* (the lower Ganges-Jumna Doāb and W. Rohilkhaṇḍ), *Eastern Hindī,* also called *Awadhī* and *Baiswārī* (Eastern Rohilkhaṇḍ, Oudh and the Benares division of the United Provinces) and *Bihārī* (Bihār or Mithilā, comprising several dialects). *High Hindī* is a modern literary development of the dialect of Western Hindī spoken about Delhi and northwards to the Himālaya, which has formed the vernacular basis of Urdū; the Persian words in Urdū have been replaced by words of Sanskritic origin, and the indigenous order of words in the sentence is more strictly adhered to than in Urdū, which under the influence of Persian has admitted many inversions.

Nearly all the early vernacular literature of Hindōstān is in verse. The only known exceptions are a work in Hindī called the *Chaurāsī Vārtā* and a few commentaries on poems. Both Hindī and Urdū are, as literary languages, at first intruders upon ground occupied by Sanskrit and Persian, representing respectively Hindū and Muslim culture. They differ in that the elevation of Hindī to a literary speech represents, mainly, a revolt against Brahman monopoly while Urdū has been cultivated by authors who have themselves appreciated and used the polished Persian. Both Sanskrit and Persian continue to be employed by Indian writers, but for popular purposes the vernaculars are now used almost exclusively.

The subject may be conveniently divided as follows:—

1. Early Hindī, of the period during which the language was being fashioned as a literary medium out of the ancient Prākrits, represented by the old heroic poems of Rajpūtānā and the literature of the early *Bhagats* or Vaishnava reformers, *i.e.*, from about A.D. 1100 to 1550;

2. Middle Hindī, representing the best age of Hindī poetry, from about 1550 to the end of the 18th century,

3. The rise of literary Urdū, from about the end of the 16th century, reaching its height during the 18th;

4. The modern period, marked by the growth of a prose literature in both dialects, and dating from the beginning of the 19th century.

1. **Early Hindī.**—Our knowledge of the ancient metrical chronicles of Rajpūtānā is still imperfect, and is chiefly derived from Tod's *Annals and Antiquities of Rājāsthān* (published in 1829–1832), which is founded on them. It is in the nature of compositions of this character to be perpetually revised; they are the production of the family bards of the dynasties whose fortunes they record, and they are constantly added to, and their language modified. Round an historical nucleus legends accumulate; later redactors endeavour to systematize and to assign dates, but the mass has the character of ballad literature. The materials used by Tod are nearly all still unprinted, and his important manuscripts are now deposited in the library of the Royal Asiatic Society in London.

Omitting a few fragments, the earliest author of whom any portion has as yet been published in the original text is Chand Bardāī, court bard of Prithwī-Rāj, the last Hindū sovereign of Delhi. His poem, entitled *Prithi-Rāj Rāsau* (or *Rāysā*) is a vast chronicle in 69 cantos, comprising a general history of his period. Of this a small portion has been printed, under the editorship of Mr. John Beames and Dr. Rudolf Hoernle, by the Asiatic Society of Bengal; but the difficult nature of the task prevented both scholars from making much progress. A fresh critical edition of the text by Paṇḍit Mōhan Lāl Vishnu Lāl Paṇḍia at Benares, under the auspices of the *Nāgarī Prachārinī Sabhā,* was completed in 1913. Chand was a native of Lahore, which had for nearly 170 years (since 1023) been under Muslim rule when he flourished, and the poem contains many Persian words. In its present form the work is a redaction made by Amar Singh of Mēwār (early 17th century), more than 400 years after Chand's death. There is, therefore, considerable doubt whether we have in it much of Chand's original composition. The detailed dates contained in the Chronicle have been shown by Kabirāj Syāmal Dās to be in every case

about ninety years astray. The Mongols (Book XV.) are brought on the stage more than 30 years before they actually set foot in India, and are related to have been vanquished by the redoubtable Prithwī-Rāj. The Chronicle, nevertheless, appears to contain a considerable element which, from its language, may belong to Chand's age, and represents the earliest surviving document in Hindī. "We have certainly in his writings some of the oldest known specimens of Gaudian literature, abounding in pure Apabhramśa Śaurasēnī Prākrit forms" (Grierson).

It is difficult to form a just estimate of the poem as literature. The language, essentially transitional in character, consists largely of obsolete and obscure words. Chand appears to exhibit the merits and defects of ballad chroniclers. There is much that is spirited in his descriptions; and the characters of the Rājpūt warriors are often sketched with skill and animation. Sound, however, frequently predominates over sense, and the narrative is carried on with wearisome iteration.

Chand may be taken as the representative of a long line of successors, still continued in Rājpūt states. Many of their compositions are still popular as ballad literature, but are known only in the oral versions of professional singers. One of the most famous is the *Ālhā-khaṇḍ*, reputed to be the work of a contemporary of Chand called Jagnīk or Jagnāyak, of Mahōbā in Bundēlkhaṇḍ, who sang the praises of Rājā-Parmāl, a ruler whose wars with Prithwī-Rāj are recorded in the Mahōbā-Khaṇḍ of Chand's work. Ālhā and Ūdal, the heroes of the poem, are famous warriors in popular legend, and the stories connected with them exist in an eastern recension, current in Bihār, as well as in the Bundēlkhaṇḍī or western form which is best known. Another celebrated bard was Sārangdhar of Rantambhōr, who flourished in 1363, and sang the praises of Hammīr Dēo (Hamir Deo), the Chauhān chief of Rantambhōr who fell in a heroic struggle against Sultān 'Alā'uddīn Khiljī in 1300. He wrote the *Hammīr Kāvya* and *Hammīr Rāsau*, of which an account is given by Tod. Another, but much later, work is the long chronicle, *Chhattra-Prakās*, or the history of Rājā Chhatarsāl, the Bundēlā rājā of Pannā, who was killed, fighting for Prince Dārā-Shukōh, in the battle of Dhōlpur won by Aurangzēb in 1658. The author, Lāl Kabi, has given in this work a history of the valiant Bundēlā nation (translated by Captain W. R. Pogson in 1828, and printed at Calcutta).

Mention may be made here of a remarkable composition, a poem entitled the *Padmāwat*, the materials of which are likewise derived from the heroic legends of Rajpūtānā. The author Malik Moḥammed of Jā'is, in Oudh, was a Muslin devotee, to whom the Hindu rājā of Amēṭhi was greatly attached. Malik Moḥammed wrote the Padmāwat in 1540, the year in which Shēr Shāh Sūr ousted Humāyūn from the throne of Delhi. The poem is composed in pure vernacular Awadhī, with no admixture of traditional Hindu learning, and is generally found written in the Persian character, though the metres and language are thoroughly Indian. It professes to tell the tale of Padmāwatī or Padminī, a princess celebrated for her beauty who was the wife of the Chauhān rājā of Chītōr in Mēwār. The story turns upon the attempts of 'Alā'uddīn Khiljī, the sovereign of Delhi, to gain possession of her person. The heroic and tragic tale of the siege of Chītōr in 1303 by 'Alāuddīn will be found related in Tod's *Rājāsthān*, i. 262 sqq. Malik Moḥammed takes great liberties with the history, and explains at the end of the poem that all is an allegory. A critical edition of this notable and popular poem has been prepared by Sir G. A. Grierson and Paṇḍit Sudhākar Dwivēdi and a later edition (1924) has been published by the Nāgarī-prachāriṇī Sabhā, Benares.

The literature of the *Bhagats*, or Vaishnava saints, who propagated the doctrine of *bhakti*, or faith in Vishnu, as the popular religion of Hindōstān, has exercised a powerful influence upon the national speech and poetic literature. It is also of high intrinsic interest. Nearly the whole of subsequent Hindī poetry is impressed with Vaishnava doctrine, which, like Buddhism many centuries before, was essentially a reaction against caste and Brahmanical influence. Many of the writers were non-Brahmans, often of the lowest castes. As Śiva was the popular deity of the Brahmans, so was Vishnu of the people; and while the literature of the Śaivas and Śāktas is almost entirely in Sanskrit, and exercised little influence on the popular mind in N. India, that of the Vaishnavas is largely in Hindī, and constitutes the great bulk of what has been written in that language.

The Vaishnava doctrine is commonly carried back to Rāmānuja, a Brahman who was born about the end of the 11th century, at Perambur near the modern Madras. His works, which are in Sanskrit and consist of commentaries on the Vēdānta Sūtras, are devoted to establishing "the personal existence of a Supreme Deity, possessing every gracious attribute, full of love and pity for the sinful beings who adore him, and granting the released soul a home of eternal bliss near him." The Deity has on several occasions become incarnate for the salvation of mankind, and of these incarnations two, Rāmachandra, the prince of Ayōdhyā, and Kṛishṇa, the chief of the Yādava clan and son of Vasudēva, are pre-eminently those in which it is most fitting that he should be worshipped. Both incarnations had for many centuries attracted popular veneration, and their histories had been celebrated in epics and in *Purānas* or "old stories"; but it was apparently Rāmānuja's teaching which secured for them their exclusive place as the objects of *bhakti*—ardent faith and personal devotion. The adherents of Rāmānuja were, however, all strict Brahmans; the new doctrine had not yet penetrated to the people.

Rāmānuja himself dealt mainly with philosophic conceptions of the Divine Nature. His *mantra*, or formula of initiation, if Wilson was correctly informed, implies devotion to Rāma; but Vāsudēva (Krishna) is also mentioned as a principal object of adoration. It is stated that in his worship of Krishna he joined with that god as his *Śaktī*, or Energy, his wife Rukminī; while the later varieties of Krishna-worship prefer to honour his mistress Rādhā. The great difference between these two forms of Vaishnava faith appears to be a later development; but by the time of Jaidēo (about 1250) the theme of Krishna and Rādhā, and the use of passionate language drawn from the relations of the sexes to express the longings of the soul for God had become fully established; thenceforward the two types of Vaishnavism diverged more and more.

The cult of Rāma is founded on family life. Its morality springs from the sources of human piety which in all religions have wrought most in favour of pureness of life, of fraternal helpfulness and of humble devotion to a loving Parent, who desires the good of mankind. That of Krishna, on the other hand, had for its basis the legendary career of a hero, whose exploits are marked by a kind of elvish wantonness; it has more and more developed that side of devotion which is perilously near to sensual thought. It is claimed for its first leaders that their hearts were pure, and that the language of erotic passion which they use is mystical and allegorical. This is probable; but the fervent impulses of adoration undoubtedly made way in later times for those of lust and lasciviousness.

The worship of Krishna, especially in his infant and youthful form (which appeals chiefly to women), is widely popular in the neighbourhood of Mathurā, the capital of that land of Braj where he lived as a boy. Its literature is mainly composed in the local dialect called Brajbhāshā. That of Rāma, though general throughout Hindōstān, has since the time of Tulsī Dās adopted for poetic use the language of Oudh, called Awadhī or Baiswārī, a form of Eastern Hindī. These two dialects are to this day the standard vehicles of poetic expression.

Subsequently to Rāmānuja his doctrine appears to have been set forth, about 1250, in the vernacular of the people by Jaidēo, a Brahman of Bengal, author of the Sanskrit *Gītā Gōvinda*, and by Nāmdēo or Nāmā, a tailor of Mahārāshtra, of both of whom verses are preserved in the *Ādi Granth* of the Sikhs. But it was not until the beginning of the 15th century that the Brahman Rāmānand, a prominent *Gōsāīn* of the sect of Rāmānuja, having had a dispute with the members of his order, left the community, migrated to N. India and addressed himself to those outside the Brahman caste, thus initiating the teaching of Vaishnavism as the popular faith of Hindōstān. Among his twelve disciples was a Muslim weaver, the celebrated KABĪR (*see* separate article). One short Hindī poem by Rāmānand is contained in the *Ādi Granth*, and Sir G. A. Grierson has collected hymns (*bhajans*)

attributed to him and still current in Mithilā or Tirhūt. Both Rāmānand and Kabīr were adherents of the cult of Rāma, who is regarded as identical with the Deity. A contemporary of Rāmānand, Bidyāpati Thākur, is celebrated as the author of numerous lyrics in the Maithilī dialect of Bihār, expressive of the other side of Vaishnavism, Krishna-worship, the aspirations of the worshipper being mystically conveyed in the character of Rādhā, the cowherdess beloved of Krishna. These stanzas of Bidyāpati afterwards inspired the Vaishnava literature of Bengal, whose most celebrated exponent was Chaitanya (b. 1484). Mirā Bāī, "the one great poetess of northern India" (Grierson), was daughter of Rājā Ratiyā Rānā, Rāṭhōr, of Mērtā in Rajpūtānā, and was married in 1413 to Rājā Kumbhkaran of Mēwār. She was devoted to Krishna in the form of Raṇchhōṛ, and her songs have a wide currency in northern India.

An important compilation of the utterances of the early Vaishnava saints or *Bhagats* is contained in the sacred book, or *Ādi Granth*, of the Sikh *Gurus*. Nānak, the founder of this sect (1469–1538), took his doctrine from the *Bhagats* (*see* KABĪR); and each of the 31 *rāgs*, forming the body of the *Granth*, is followed by texts from the utterances of Vaishnava saints, chiefly of Kabīr, while the book's *bhōg* or conclusion contains more verses by the same authors, as well as by a celebrated Sūfī, Shēkh Farīd of Pākpaṭṭan. The body of the *Granth* (*q.v.*), being in old Panjābī, falls outside the scope of this article; but the old Hindī extracts included in it are a precious store of specimens of authors some of whom have left no other record. The *Ādi Granth*, which was put together about 1600 by Arjun, fifth *Guru*, sets forth the Sikh creed in its original pietistic form, before it assumed its militant character

THE GOLDEN AGE

2. **Middle Hindī.**—The second period, that of middle Hindī, begins with the reign of the emperor Akbar (1556–1605); and it is not improbable that his sympathy with his Hindū subjects, and the peace which his organization of the empire secured had an important effect on the great development of Hindī poetry which now set in. Akbar's court was itself a centre of poetical composition, and Sanskrit works were translated into Persian. The court musician Tān Sēn is still renowned, and many verses composed by him in the emperor's name survive to this day. Akbar's favourite minister and companion, Rājā Bīrbal, was a musician and a poet, and held the title of *Kabi-Rāy*, or poet laureate; his verses and witty sayings are still popular in northern India. Other nobles of the court were also poets, among them the *Khān-khānān*, 'Abdur-Raḥīm, whose *dōhās* and *kabittas* are still esteemed, and Faiẓī, brother of the annalist Abul-Faẓl

By this time the worship of Krishna as the lover of Rādhā (*Rādhā-ballabh*) had been systematized, with its chief habitation at Gokul, near Mathurā, by Vallabhāchārya, a Brāhman from Madras. Born in 1478, in 1497 he chose Braj as his headquarters, thence making missionary tours throughout India. He wrote chiefly in Sanskrit; but among his immediate followers, and those of his son Biṭṭhalnāth (who succeeded him in 1530), were some of the most eminent poets in Hindī. Four disciples of Vallabhāchārya and four of Biṭṭhalnāth, who flourished between 1550 and 1570, are known as the *Aṣṭ Chhāp*, or "Eight Seals," and are the acknowledged masters of the literature of Brajbhāshā. Their names are Krishna-Dās Pay-ahārī, Sūr Dās (the Bhāṭ), Parmānand Dās, Kumbhan Dās, Chaturbhuj Dās, Chhīt Swāmī, Nand Dās and Gōbind Dās. Of these the most celebrated is Sūr Dās, who was descended, as he claims, from the bard Chand Bardāī. The traditional dates of his birth (1483) and death (1573) seem to be placed too early. His many hymns (*bhajans*) to Krishna have been collected in the *Sūr Sāgar*, said to contain 60,000 verses. This work is considered the high-water mark of Braj devotional poetry.

The great glory of this age (coinciding with the Elizabethan age of English literature) is Tulsī Dās (*q.v.*). He and Sūr Dās between them are held to have exhausted the possibilities of the poetic art.

A period of artifice and reflection followed, when many works were composed dealing with the rules of poetry and the analysis and the appropriate language of sentiment. Especially famous is Kēsab Dās, a Brahman of Bundēlkhaṇḍ, who flourished in the reigns of Akbar and Jahāngīr. His works are the *Rasik-priyā*, on composition (1591), the *Kavi-priyā*, on the laws of poetry (1601), the *Rāmachandrikā*, dealing with the history of Rāma (1610), and the *Vigyān-gītā* (1610). This elaboration of the poetic art reached its highest point in Bihārī Lāl, whose *Sat-saī*, or "seven centuries" (1662), is the most remarkable example in Hindī of the rhetorical style in poetry.

Side by side with this literary cultivation of the themes of Rāma and Krishna, there grew up a class of compositions dealing with the lives of the holy men who guided the development of the popular religion. The most famous is the *Bhakta-mālā*, or "Roll of the *Bhagats*," by Nārāyan Dās, Nābhā Dās, or Nābhājī, a Dom of the Deccan, who had in his youth seen Tulsī Dās, and flourished in the early 17th century. His work consists of 108 stanzas in *chhappāī* metre, each setting forth the characteristics of some holy personage, and expressed in a brief and obscure style. Its date falls between 1585 and 1623. The book was furnished with an *īkā* (supplement or gloss) in the *kabitta* metre, by Priyā Dās in 1713, gathering up, in an allusive and disjointed fashion, the stories related of each saint. This again was expanded about a century later by Lachhman into a work called the *Bhakta-sindhu*. From these nearly all our knowledge of the lives of the Vaishnava authors is derived, and much of it is of a dubious character. Another work, dated 1551, named the *Chaurāsī Vārta*, is devoted to stories of the followers of Vallabhāchārya. It is attributed to Gōkulnāth, son of Biṭṭhalnāth, son of Vallabhāchārya.

The themes of the many authors who succeeded the great period of Hindī poetical composition which extended through the reigns of Akbar, Jahāngīr and Shāh Jehān exhibit no novelty. (*See* the list of Hindī authors drawn up by Sir G. A. Grierson, and printed in the *Journal of the Asiatic Society of Bengal* in 1889.) The courts of Chhatarsāl, rājā of Pannā, who died in 1658, and of several rājās of Bāndhō (now Rewah) were famous for their patronage of poets; and the Mogul court itself kept up the office of poet laureate even during the fanatical reign of Aurangzēb.

Such, in brief outline, is the character of Hindī literature during the period when it grew and flourished through its own original forces. Founded by a popular and religious impulse comparable to that which, nearly 1,600 years before, had produced the doctrine and vernacular literature of Jainism and Buddhism, and cultivated largely by non-Brahman authors, it was the legitimate descendant in spirit, as Hindī is in speech, of Prākrit literature. Entirely in verse, it adopted and elaborated Prākrit metrical forms, and carried them to a high pitch of perfection. It covers a wide range of style, and, at its best, expresses a rich variety of human feeling. It deserves much more attention in Europe than it has received. The few who have explored it speak of it as an "enchanted garden" (Grierson), abounding in beauties. Above all it is genuinely popular. The ballads of Rajput prowess, the aphorisms of Kabīr, Tulsī Dās's *Rāmāyan*, and the *bhajans* of Sūr Dās are to this day carried about everywhere by wandering minstrels, and have found their way to the hearts of the people.

3. **Literary Urdū.**—The *origines* of Urdū as a literary language are somewhat obscure. The popular account refers its rise to the time of Tīmūr's invasion (1398). It is even claimed that a *dīwān*, or collection of poems, was composed in *Rēkhta* by Mas'ūd, son of Sa'd, in the late 11th or early 12th century, and that Sa'di of Shīrāz and his friend Amīr Khusrau of Delhi made verses in that dialect before the end of the 13th century. This, however, is improbable. During the early centuries of Muslim rule in India Muslim writers used the language and metrical forms of the country. Persian words early made their way into the popular speech; they are common in Chand, and in Kabīr's Hindī verses. Much confusion is due to the want of a clear understanding of what Urdū really is.

Literary Urdū differs from Hindī rather in its form than in its substance. The grammar, and, mainly, the vocabulary, of both are the same. The really vital point of difference is the *prosody*. Hardly one of the metres taken over by Urdū poets from Persian agrees with those used in Hindī. In the latter language it is the

rule to give the short *a* inherent in every consonant or *nexus* of consonants its full value in scansion (though in prose it is no longer heard), except occasionally at the metrical pause; in Urdū this is never done, the words being scanned generally as pronounced in prose. Most Hindī metres are scanned by the number of *mātrās* or syllabic instants—the value in time of a short syllable—of which the lines consist; in Urdū, as in Persian, the metre follows a special order of long and short syllables.

The question, then, is not: When did Persian first become intermixed with Hindī in the literary speech?—for this process began with the first entry of Muslim conquerors and continued for centuries before a line of Urdū verse was composed—nor: When was the Persian character first employed to write Hindī?—for the written form is but a subordinate matter. We must ask: When was the first verse composed in Hindī according to the forms of Persian prosody? Then, and not till then, did Urdū poetry come into being. This appears to have happened, as already mentioned, about the end of the 16th century. Meantime the vernacular vocabulary had been gradually influenced by Persian. The translation, under Akbar, of Sanskrit works into Persian had brought the indigenous and the foreign literatures into contact. The Hindī spoken about Delhi and northwards was naturally the form of the vernacular most subject to foreign influences; and with the extension of Mogul territory, this idiom was carried abroad by the Imperial armies, and was adopted by the Muslim kingdoms of the Deccan as their court language some time before their overthrow by Aurangzēb.

The first impulse to literary composition in Urdū was given, not in the north, but at the Mohammedan courts of Gōlkondā and Bījāpur in the south, both situated amid an indigenous population speaking Dravidian languages. The literature thus inaugurated had nothing to do with the idiom or ideas of the local people, but was from the beginning an imitation of Persian models. The *qaṣīda* or laudatory ode, the *ghazal* or love-sonnet, usually of mystical import, the *marṣiya* or dirge, the *maṣnavī* or narrative poem with coupled rhymes, the *hijā* or satire, the *rubā'ī* or epigram—these were the types which Urdū took over ready-made. And with the forms were appropriated also all the conventions of poetic diction. The Persians had elaborated a system of rhetoric and a stock of poetic images which, in the exhaustion of original matter, made the success of the poet depend chiefly upon artifice and conceit. Few of the most eloquent passages of later Persian verse admit of satisfactory translation into any other language. The same is true of Urdū poetry. Until quite modern times, there is scarcely anything in it which can be called original. Differences of school, which are made much of by native critics, are to us hardly perceptible.

Shujā'uddīn Nūrī, a native of Gujarāt, a contemporary of Akbar, is mentioned as the most ancient Urdū poet after Amīr Khusrau. Several *ghazals* by him are said to survive. Kulī Kuṭb Shāh of Gōlkondā, who reigned from 1581, and his successor 'Abdullāh Kuṭb Shāh, have both left collections of verse. During the reign of the latter Ibn Nishāṭī wrote two works which are still famous as models of composition in Dakhni; they are *maṣnavīs* entitled the *Tūṭī-nāma*, or "Tales of a Parrot," and the *Phūl-ban*. The first is an adaptation of a Persian work by Nakhshabī, but derives ultimately from a Sanskrit original; this collection has been frequently rehandled in Urdū, and is the original of the *Tōṭā-Kahānī*, one of the first works in Urdū prose, composed in 1801 by Muḥammad Ḥaidar-bakhsh Ḥaidarī of the Fort William College. The *Phūl-ban* is a love tale, likewise translated from a Persian work. Another famous work which probably belongs to the same place and time is the *Story of Kāmrūp and Kalā* by Taḥsīnuddīn. It was published (1836) by M. Garcin de Tassy. Though the work of a Muslim, its personages are Hindu. The incidents somewhat resemble those of the tale of as-Sindibād in the *Thousand and One Nights*.

The court of Bījāpur was equally distinguished. Ibrāhīm 'Ādil Shāh (1579–1626) was the author of a work in verse on music entitled the *Nau-ras* or "Nine Savours," which, however, appears to have been in Hindī rather than Urdū. A successor of this prince, 'Alī 'Ādil Shāh, had as his court poet a Brahman known poetically as Nuṣratī, who in 1657 composed a *maṣnavī* entitled the *Gulshan-i 'Ishq*, or "Rose-garden of Love," a romance on an Indian theme. The same poet is author of a long *maṣnavī* entitled the *'Alī-nāma*, celebrating the Shāh.

The first generally accepted standard of form, however, a standard which suffered little change in two centuries, was established by Walī of Aurangābād (about 1680–1720) and his contemporary and fellow-townsman Sirāj. The former of these is commonly called "the Father of Rēkhtah"—*Bābā-e Rēkhta;* and the immense development attained by Urdū poetry in northern India during the 18th century was due to his initiative. Little is known of Walī's life. His *Kullīyāt* or complete works have been published by M. Garcin de Tassy, with notes and a translation of selected passages (Paris, 1834–1836).

The first of the Delhi school of poets was Zuhūruddīn Hātim, who was born in 1699 and died in 1792. In 1719 the *dīwān* of Walī reached Delhi. Hātim was the first to imitate it in the Urdū of the north, and was followed by his friends Nājī, Mazmūn and Ābrū. Two *dīwāns* by him survive. One of his pupils was Rafī us-Saudā, the most distinguished poet of northern India Khān Ārzū (1689–1756) was another of the fathers of Urdū poetry in the north. He is chiefly renowned as a Persian scholar, but his Urdū works are also highly esteemed. He was the master of Mīr Taqī, who ranks next to Saudā as the most eminent Urdū poet. Ārzū died at Lucknow, whither he betook himself after the devastation of Delhi by Nādir Shāh (1739). Another eminent Delhi poet was In'āmullāh Khān Yaqīn, who died during the reign of Ahmad Shāh (1748–54), aged twenty-five. Another was Mīr Dard, pupil of Shāh Gulshan (who is said to have instructed Walī); his *dīwān* is extremely popular. He died in 1793.

Saudā and Mīr Taqī are the most distinguished Urdū poets. The former was born at Delhi about the beginning of the 18th century. He left Delhi after its devastation, and settled at Lucknow, where the Nawāb Āṣafuddaulah gave him a *jāgīr*, and where he died in 1780. His poems are numerous, and cover all styles of Urdū poetry; but it is to his satires that his fame is chiefly due, and in these he surpassed all other Indian poets. Mīr Taqī was born at Agra, but early removed to Delhi, and in 1782 repaired to Lucknow, where he likewise received a pension; he died at an advanced age in 1810. His works are voluminous, including six *dīwāns*. Mīr is counted the superior of Saudā in the *ghazal* and *maṣnavī*, while the latter excelled him in the satire and *qaṣīda*.

The rapid decay of the Mogul empire in the 18th century transferred the literary centre from Delhi to Lucknow, the capital of the flourishing state of Oudh. Ārzū, Saudā and Mīr all ended their days there; they were followed by a school of Lucknow poets hardly inferior to those who had made Delhi illustrious. Here they were joined by Mīr Hasan (d. 1786), Mīr Sōz (d. 1800) and Qalandar-bakhsh Jur'at (d. 1810), also refugees from Delhi, and illustrious poets. Mīr Hasan was a collaborator of Mīr Dard, and first settled at Faizābād and subsequently at Lucknow; he excelled in the *ghazal, rubā'ī, maṣnavī* and *marṣiya*, and is counted the third, with Saudā and Mīr Taqī, among Urdū poets. His fame chiefly rests upon a much admired *maṣnavī* entitled the *Siḥru-l-bayān*, a romance relating the loves of Prince Bē-nazīr and the Princess Badr-i Munīr; his *maṣnavī* called the *Gulzār-i Iram*, in praise of Faizābād, is likewise highly esteemed. Mīr Muḥammadī Sōz was an elegant poet, remarkable for his compositions in the dialect of the harem called *Rekhtī*, but somewhat licentious in his verse. Jur'at was also a prolific poet, but his poems are licentious and full of double meanings. He imitated Saudā in satire with much success; he also cultivated Hindī poetry. Miskīn was another Lucknow poet of the same period, whose *marṣiyas* are especially admired. The school of Lucknow continued to flourish till the dethronement of the last king, Wājid 'Alī, in 1856. Ātash and Nāsikh (who died respectively in 1847 and 1841) excelled in the *ghazal;* Mīr Anīs and his contemporary Dabīr, the former of whom died in December 1875 and the latter a few months later, in the *marṣiyah*. Rajab Alī Beg Surūr, who died in 1869, was the author of a much-admired romance in rhyming prose entitled the *Fisānah-e 'Tjāib* or "Tale of Marvels," besides a *dīwān*. The dethroned prince Wājid 'Alī himself, poetically styled Akhtar, was

also a poet; he published three *dīwāns*, among them a quantity of poetry in the rustic dialect of Oudh which is philologically of much interest.

Delhi, meanwhile, was not altogether eclipsed. Among the last Moguls several princes were themselves creditable poets. Shāh Ālam II. (1761–1806), who wrote under the name of Āftāb, his son Sulaimān-shukoh, and his nephew Bahādur Shāh II., the last titular emperor of Delhi (d. 1862), who wrote under the name of Zafar, and was a pupil of Shaikh Ibrāhīm Ẓauq, a distinguished writer, were all poets. Maṣḥafī (Ghulām-i Ḥamdānī), who died about 1814, was one of the leaders of the revived poetic school of Delhi. Leaving Lucknow for Delhi in 1777, he held conferences of poets, at which several notable authors formed their style. Qāim (Qiyāmuddīn 'Alī) was one of his society, and died in 1792; he has left several works of merit. Ghālib, otherwise Mirzā Asadullāh Khān, laureate of the last Mogul, who died in 1869, was the most eminent of the modern Delhi poets. He wrote chiefly in Persian, of which language he was a master; but his Urdū *dīwān*, though short, is excellent in its way. To this school, though he lived and died at Agra, may be attached Mīr Walī Moḥammed Naẓīr (who died in 1832); his *maṣnavīs* as well as his *dīwān* are extremely popular. His language is often obscene, but less artificial than that of most Urdū poets, and some of his poems are as much esteemed by Hindus as by Muslims

4. **Modern Period.**—Such, in outline, is the history of the literary schools of the Deccan, Delhi and Lucknow. Meanwhile a fourth, at Calcutta, was to give no less an impulse to the cultivation of Urdū prose than had a hundred years before been given to that of poetry by Walī. At the commencement of the 19th century Dr. John Gilchrist was the head of the Fort William college, and he set to work to collect a body of literature suitable as textbooks for the study of Urdū by European officers. To this we owe the elaboration of the vernacular as an official speech. He gathered together the leading vernacular scholars, and their works, due to his initiative, are still notable as specimens of admirable prose composition, not only in Urdū, but also in Hindī The chief authors of this school are Ḥaidarī (Sayyid Moḥammed Ḥaidar-bakhsh), Ḥusainī (Mīr Bahādur 'Alī), Mīr Amman Luṭf, Ḥafīẓuddīn Aḥmad, Shēr 'Alī Afsōs, Nihāl Chand of Lahore, Kāzim 'Alī Jawān, Lallū Lāl Kavi, Mazhar 'Alī Wilā and Ikrām 'Alī.

Ḥaidarī composed the *Toṭā-Kahānī* (1801), a prose redaction of the *Ṭūṭī-nāmah* mentioned above; a romance *Ārāish-i Maḥfil*; the *Gul-i Maghfirat* or *Dah Majlis*, an account of the holy persons of Islam; the *Gulzār-i Dānish*, a translation of a Persian work containing stories descriptive of the failings of women; and the *Tārīkh-i Nādirī*, a translation of a Persian history of Nādir Shāh. Ḥusainī is the author of an imitation in prose of Mīr Ḥasan's *Siḥru-l-bayān*, under the name of *Naṣr-i-Bēnazīr*, and of a work adapted from a Persian version of the Hitopadeśa, named *Akhlāq-i Hindī*, or "Indian Morals," both composed in 1802. Mīr Amman wrote the *Bāgh o Bahār* (1801–02), an adaptation of Amīr Khusrau's Persian romance, the *Chahār Darwēsh*. Amman's much admired work is not itself directly modelled on the Persian, but is a rehandling of an almost contemporary rendering by Tahsīn of Etāwā. Amman also composed an imitation of Husain Wā'iz Kāshifī's *Akhlāq-i Muḥsinī* under the name of the *Ganj-i Khūbī*. Ḥafīẓuddīn Aḥmad was a professor at the College; in 1803 he completed a translation of Abu-l-Fazl's *'Iyār-i Dānish*, under the name of the *Khirad-afrōz*. The *'Iyār-i Dānish* is an imitation of the originally Sanskrit collection of apologues known in Persian as the *Fables of Bīdpāī*, or *Kalīlah and Dimna*. Afsōs was one of the most illustrious of the Fort William school; originally of Delhi, he left that city as a boy, finally joined the college in 1800, and died in 1809. He is the author of a much esteemed *dīwān;* but his two chief works are in prose and of great excellence, the *Ārāish-i Maḥfil* (1805), an account of India adapted from the introduction of the Persian *Khulāṣatu-t-tawārikh* of Sujān Rāe, and the *Bāgh-i Urdū* (1808), a translation of Sa'dī's *Gulistān*. Nihāl Chand translated into Urdū a *maṣnavī*, the *Gul-i Bakāwalī*, under the name of *Mazhab-i 'Ishq;* this is in prose intermingled with verse, and was composed in 1804. Jawān was originally of Delhi and afterwards of Lucknow; he joined the College in 1800. He is the author of a version in Urdū, called *Sakuntalā Nāṭak*, of the well-known story of Sakuntalā. He also composed a *Bārah-māsā*, or poetical description of the twelve months, with accounts of Hindu and Mohammedan festivals, entitled the *Dastūr-i Hind*. Ikrām 'Ali translated, under the name of the *Ikhwānu-ṣ-ṣafā* (1810), a chapter of a famous 10th century Arabian collection of treatises on science and philosophy entitled *Rasāilu Ikhwāni-ṣ-ṣafā*. The complete collection, due to different writers who dwelt at Baṣra, has been made known to European readers by the translation of Dr. F. Dieterici (1858–79). Kram 'Ali's translation is one of the best of the Fort William productions.

Srī Lallū Lāl was a Brahman of Gujerati extraction. What was done by the other Fort William authors for Urdū prose was done by Lallū Lāl almost alone for Hindī. He in fact created "High Hindī" as a literary language. His *Prem Sāgar* and *Rājnīti*, the former a version in pure Hindī of the 10th chapter of the *Bhāgavata Purāṇa*, detailing the history of Krishṇa, and founded on a previous Braj-bhāshā version by Chaturbhuj Misr, and the latter an adaptation in Braj-bhāshā prose of the *Hitopadēśa* and part of the *Pancha-tantra*, are unquestionably the most important works in Hindī prose. The *Prem Sāgar* was begun in 1804 and ended in 1810; it enjoys immense popularity in northern India. The *Rājnīti*, composed in 1809, is much admired for its sententious brevity and the purity of its language Lallū Lāl was also the author of a collection of a hundred anecdotes in Hindī and Urdū entitled *Laṭāif-i Hindī*, an anthology of Hindī verse called the *Sabhā-bilās*, a *Sat-saī* in the style of Bihāri-Lāl called *Sapta-satika* and several other works. He and Jawān worked together at the *Singhāsan Battīsī* (1801), a redaction in mixed Urdū and Hindī of a famous collection of legends of King Vikramāditya; and he also aided Jawān in writing the *Sakuntalā Nāṭak*. Mazhar 'Alī Wilā was his collaborator in the *Baitāl Pachīsī*, a collection of stories similar to the *Singhāsan Battīsī;* and he aided Wilā in the Urdū *Story of Mādhōnal*, a romance originally composed in Braj-bhāshā by Mōtī Rām.

The works of these authors, though compiled and published under European superintendence and intended for the instruction of the Company's officers, are essentially Indian in taste and style, enjoyed a very wide reputation, and set the standard of prose composition in Urdū and Hindī for fifty years. Meanwhile, among the Muslims of northern India, another almost contemporaneous impulse did much for the expansion of Urdū, and, like the work of the Vaishnava reformers in moulding literary Hindī, gave an invaluable impetus to composition. This was the reform in Islam led by Sayyid Aḥmad and his followers.

Sayyid Ahmad was born in 1782, and received his early education at Delhi; his instructors were two learned Muslims, Shāh 'Abdul-l-'Azīz, author of a celebrated commentary on the Qur'ān, and his brother 'Abdu-l-Qādir, the first translator of the Qur'ān into Urdū. Under their guidance Sayyid Aḥmad embraced the doctrines of the Wahhābīs. He gathered round him a large number of disciples, among others Ismā'īl Ḥājī, nephew of 'Abdu-l'Azīz and 'Abdu-l-Qādir, the chief author of the sect. After a course of preaching and apostleship at Delhi, Sayyid Aḥmad set out in 1820 for Calcutta, attended by numerous adherents. Thence in 1822 he started on a pilgrimage to Mecca, whence he went to Constantinople, and there gained many disciples. He travelled for nearly six years in Turkey and Arabia, and then returned to Delhi The religious degradation and coldness which he found in his native country strongly impressed him, and he and his disciples established a propaganda throughout northern India, reprobating the superstitions which had crept into the faith and preaching holy war against the Sikhs. In 1828 he started for Peshāwar, attended by, it is said, upwards of 100,000 Indians, and accompanied by his chief followers, Ḥājī Ismā'īl and 'Abdu-l-Ḥayy. He was furnished with means by a general subscription. At the beginning of 1829 he declared war against the Sikhs, and in time made himself master of Peshāwar. His Afghān allies, however, deserted him. He fled across the Indus and, with Ḥājī Ismā'īl, was slain in 1831 in combat with the Sikhs. Wahhābī doctrines have spread in India, and still occasion much controversial writing.

The translation of the Qur'ān by 'Abdu-l-Qādir was finished in

1803, and first published by Sayyid 'Abdullāh, disciple of Sayyid Aḥmad, in 1829. The *Tambīhu-l-ghāfilīn*, or "Awakener of the Heedless," a work in Persian by Sayyid Aḥmad, was rendered into Urdū by 'Abdullāh, and published at the same press in 1830. Hājī Ismā'īl was the author of a treatise in Urdū entitled *Taqwiyatu-l-Īmān* ("Confirmation of the Faith"), which had great vogue among the following of the Sayyid. Other works were also composed by the disciples of the *Tarīqah-e Muḥammadiyyah*, as the new preaching was called.

Printing was first used for vernacular works by the College Press at Fort William, at the end of the 18th and the beginning of the 19th century, and all the compositions prepared for Dr. Gilchrist and his successors mentioned above were printed But the expense of this method precluded its extensive use and movable types were not well suited to the Persian characters. Lithography was introduced about 1837, when the first press was set up at Delhi, and immediately gave a powerful stimulus to the multiplication of literature. In 1832 the vernaculars were substituted for Persian as the official language of the courts and the acts of the legislature, and this at once led to a great increase in vernacular technical terms. Thirdly, the spread of education in subjects of Western learning not only greatly enlarged the popular vocabulary, but led to the use of a simpler style, and the abandonment wholesale of florid ornament Lastly, the establishment of a vernacular newspaper press had far-reaching cultural and literary consequences.

All these revolutionary agencies were already at work when, following on the Mutiny of 1857, the transfer of the government of India from the Company to the Crown inaugurated a new era. Since 1860 their operation has become extremely rapid and far-reaching. The use of lithography annually gives birth to hundreds of works. The extension of education has created a mass of schoolbooks, and the spread of instruction in English and the activity of translators have filled the vernaculars with new words drawn from that language The newspaper press, in Urdū and Hindī, now counts hundreds of journals. Of this great body of literary production it is possible to speak only in general terms. Style and vocabulary are still in a somewhat fluid condition, and the subjects treated are almost as various as they are in European literatures. Much of the work produced has little claim to literary excellence, and we may content ourselves with mentioning a few writers whose influence and authority make it probable that they will hereafter be known as leaders in the new culture.

One of the first effects of the new literary inspiration seemed to be the extinction of poetical composition as previously practised. With the deaths of Zauq (1854) and Ghālib (1869) of the Delhi school, and those of Anīs (1875) and Dabīr (1876) of Lucknow, the end of Urdū poetry appeared to have come. The new age was intensely practical and had no time for sentiment, or taste for mystical conceits Moreover, poetical composition in India has always owed much to court patronage. The thrones of Delhi and Lucknow had passed away, and only at Hyderabad in the Deccan, under the patronage of the Nizam, were laureates still honoured; the last of these, Mirzā Khān Dāgh (1831–1905), enjoyed a wide reputation as a graceful and eloquent poet.

But prose and material prosperity did not succeed in monopolizing the genius of the people. The great movement of reform and liberalism in Islām led by Sir Sayyid Aḥmad Khān (1817–1898) found its bard in Sayyid Altāf Ḥusain of Pānipāt, poetically styled Ḥālī. Ḥālī was a pupil of the famous Ghālib, whose life he wrote and of whose writings he published an able criticism. At the age of forty he came under the influence of Sir Sayyid Aḥmad Khān, and devoted his great poetic gifts to the service of his co-religionists. He published much verse, of which an interesting specimen will be found in the edition of his *Rubā'īs* or quatrains (101 in number), with an English translation, by Mr. G. E. Ward (Oxford, 1904); in this is included a famous poem setting forth his ideals in poetry—simplicity, avoidance of exaggeration and unreality, direct appeal to the heart, and above all sincerity. He inaugurated a new and vigorous poetic school. He died in 1915.

Perhaps the most memorable of all Ḥālī's compositions is his long poem in six-line stanzas (called *musaddas*) on "the flow and ebb of Islam" (1879), which had an extraordinary influence in stimulating enthusiasm in the cause of Muhammadan progress. In it he draws, in simple but eloquent language, a sketch of the past glories of Islam, and contrasts with this its subsequent degradation in Hindōstān. The poem is still recited and imitated in the Punjab and United Provinces. Ḥālī also wrote an admirable life of Sir Sayyid Aḥmad Khān, entitled *Ḥayāt-i Jāvīd*.

Another writer whose work, though chiefly in prose, deals with poetry and poetic style, is Maulavī Moḥammed Ḥusain Āzād, professor of Arabic at the Government college, Lahore. His biographies of Urdū poets, with criticisms of their works, entitled *Āb-i Ḥayāt*, is a standard work. His style is much admired. Āzād was the pupil of Zauq, of whose poems he has published an annotated edition. Among his other works in prose are *Nairang-i Khayāl*, an allegory dealing with human life; and *Darbār-i Akbarī*, an account of the reign of Akbar. He died in 1910.

Sir Sayyid Aḥmad Khān's life and work are dealt with elsewhere. Among his literary achievements may be mentioned the *Āsāruṣ-Ṣanādid* ("Vestiges of Princes"), an excellent account of Delhi and its monuments, first lithographed in 1847. His essays and occasional papers, published in the *Alīgarh Institute Gazette* (started in 1864), and afterwards (from 1870 onwards) in a periodical entitled *Tahẓībul-Akhlāq* (or "Mohammedan Social Reformer"), handle all the problems of religious, social and educational advancement among Indian Muslims—the cause to which his life was devoted. His great *Commentary on the Qur'ān*, in seven volumes, the last finished only a few days before his death in 1898, is carried to the end of *Sūrah* xx., a little more than half the book. In him Urdū prose found its most powerful wielder for the diffusion of modern ideas, and the movement which he set on foot has been the spring of the best literature in the language during recent years.

Another excellent writer of Urdū is Shamsul-'Ulamā Maulavī Naẓīr Aḥmad of Delhī, who is the author of a series of novels of domestic life, which have had a wide popularity, and have been specially serviceable in the education of Indian women. These are entitled the *Mir'ātul-'Arūs*, *Taubatun-Naṣūḥ*, *Banātun-Na'sh*, *Ibnul-Wʻaqt* and *Ayāmā*. Naẓīr Aḥmad was the principal translator into Urdū of the *Indian Penal Code* (1861), which is reckoned a masterpiece in the exact rendering of European legal ideas; and he is the author of the best Urdū version of the Quran. He was closely associated with Sir Sayyid Aḥmad Khān.

The novel is one of the most noteworthy features of recent literary composition in Urdū. India has always been rich in stories and romances; but the modern novel, as understood in Europe, is a new development. The most admired Urdū novel is a work entitled *Fisāna-e Āzād*, by Paṇḍit Ratan-nāth Sarshār of Lucknow. The story is remarkable for its vivid pictures of Lucknow society, and its faithful delineation of character. Another good writer is Maulavī 'Abdul-Ḥalīm Sharar. He was editor of a monthly Lucknow periodical called the *Dil-gudāz*, composed in European style, and in it his novels, which are all of an historical character, in the style of Sir Walter Scott, originally appeared. The best are *'Azīz and Virginā*, a tale of the Crusades, and *Manṣūr and Mōhinā*, a story of India at the time of the invasions of Maḥmūd of Ghaznī.

Although Urdū chiefly represents Muslim culture, its use is by no means confined to Muslims. Not only is the most popular Urdū novelist a Hindū, but the statistics of the vernacular press show that this form of the language is widely used by Hindūs.

"High Hindī" has scarcely adapted itself to modern requirements with the thoroughness displayed by Urdū. It is taught in the schools where the population is mainly Hindū, and books of science have been written in it with a terminology borrowed from Sanskrit. But Sanskrit is far removed from the daily life of the people, and most works in this style are read only by Paṇḍits, the great bulk of them dealing with religion, philosophy and the ancient literature. There are a fair number of Hindī and Hindī-Urdū journals; but many of them are exclusively religious in character, and several, though written in Dēvanāgarī, employ a language akin to Urdū. The old dialects of literature, Awadhī and Braj-bhāshā, are now only used for poetry.

The most noticeable authors in Hindī since the middle of the 19th century have been Bābū Harishchandra and Rājā Siva Prasād, both of Benares. The former (1850–1885) was an enthusiastic cultivator of the old (dialect) poetic art. He published, in the *Sundarī Tilak,* an anthology of Hindī poetry, and, as well, a quantity of old texts, with much added matter. He also wrote biographies and critical studies. In history especially he cleared up many problems. In his *Kashmīr Kusum,* or history of Kashmīr, a list is given of about a hundred works by him. He was also the real founder of the modern Hindī drama. Rājā Siva Prasād (1823–1895) published many educational works which have greatly contributed to the formation of a form of Hindī not excessively Sanskritized, and not rejecting current Persian forms. The society at Benares called the *Nāgarī Prachāriṇī Sabhā* ("Society for promoting the use of the Nāgarī character") has, since the death of Harishchandra, been active in the publication of useful works in Hindī, besides conducting a systematic search for old mss.

BIBLIOGRAPHY.—The best account in English of Hindī literature is Dr. G. A. Grierson's *Modern Vernacular Literature of Hindōstān,* issued by the Asiatic Society of Bengal in 1889; the dates in this work, which is founded on indigenous compilations, have, however, in many cases to be received with caution Before it appeared, Garcin de Tassy's admirable *Histoire de la littérature Hindouie et Hindoustanie,* and his annual summaries of the progress made from 1850 to 1877, were our chief authority. For the religious literature of the Vaishnava sects, Professor H. H. Wilson's *Essay on the Religious Sects of the Hindus* (vol i. of his collected works) has not yet been superseded.

For Urdū poets, Professor Āzād's *Āb-i Ḥayāt* (in Urdū) is the most trustworthy record. The catalogues by Professor Blumhardt of Hindōstānī and Hindī books in the libraries of the British Museum and the India Office will give some idea of the scope of recent productions. (C J. L)

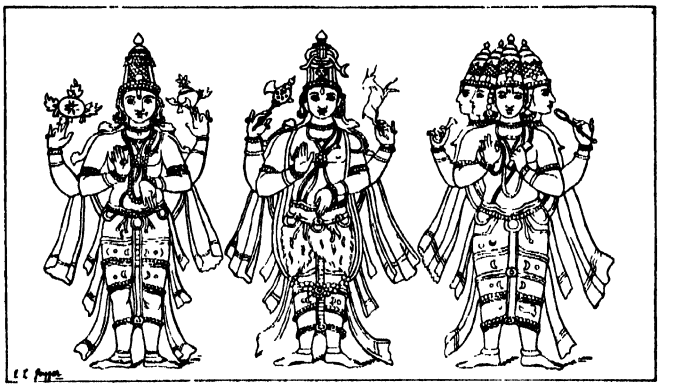
HINDUISM, a term generally employed to comprehend the social institutions, past and present, of the great majority of the people of India as well as their religious beliefs. Hinduism is also used in a narrower sense, as denoting more especially the modern phase of Indian social and religious institutions from the earlier centuries of the Christian era down to our own days

Therefore, here are four main elements: religion, race, country, and social organization They may not be separated. Each is bound up and is an integral factor in the life of the others. It is a living whole forged by the organic stresses of history and a long past, from diverse sources, from various materials, and it is still a living, vigorous whole.

Uniformity could not be expected as a feature of the religious experience of 232,000,000 people of different racial origins, of different history, of different environment, tradition, language, and social structure. Yet there is a true Hindu polity; there are features common to North and South, to East and West. Much of it belongs obviously to the universal pattern for the age-long problems, whose presentations, at various times, in differing modes, constitute the stimulus to religious activity and are based ultimately on certain definite universal experiences and facts. Man is born of woman, grows and withers like the grass. Whence and whither and why? The debate of fate, foreknowledge, freewill, follows inevitably certain lines, and the solutions to these problems conform to type because they are universal problems, wherever, as is markedly the case in India, thought has turned to the scrutiny and analysis of experience.

Main Doctrines.—The characteristic tenets of orthodox Brahmanism (*q.v.*) consist in the conception of an absolute, all-embracing spirit, the Brahma (neutr.), being the one and only reality, itself unconditioned, and the original cause and ultimate goal of all individual souls (*jiva, i.e.,* living things). As Sir Charles Eliot shows, there are at least two doctrines held by nearly all who call themselves Hindus. "One may be described as polytheistic pantheism . . . the second doctrine is commonly known as metempsychosis, the transmigration of souls or re-incarnation, the last-named being the most correct." Here most certainly are elements which Hinduism shares with and derives from lowlier cults. From these very elements and beliefs the social fabric draws its strength. They make for the stability of social structure. They validate morality. They have a survival value.

The ceaseless working of the Absolute Spirit as a creative, conservative, and destructive principle is represented by the divine personalities of Brahma (masc.), Vishnu, and Siva, forming the Trimūrti or Triad. These latter two gods were in early days favourite objects of popular adoration. Sectarianism goes back beyond the formulation of the Brahmanical creed, right up to the Vedic age. Siva, so far from being merely the destroyer, is the



THE THREE GRAND ATTRIBUTES OF THE DEITY—CREATION, PRESERVATION AND DESTRUCTION, PERSONIFIED IN BRAHMA, VISHNU AND SIVA

representative of generative and reproductive power in nature. Brahma, having performed his legitimate part in the mundane evolution by his original creation of the universe, has retired into the background The Trimūrti has retained to this day at least its theoretical validity in orthodox Hinduism and has exercised influence in promoting feelings of toleration towards the claims of rival deities and a tendency towards identifying divine figures newly sprung into popular favour with one or other of the principal deities, and thus helping to bring into vogue that notion of avatars, or periodical descents or incarnations of the deity, so prominent in later sectarian belief.

At all times orthodox Brahmanism has had to wink at, or ignore, all manner of gross superstitions and repulsive practices, along with the popular worship of countless hosts of godlings, demons, spirits, and ghosts, and mystic objects and symbols of every description. Fully four-fifths of the people of the Southern area, whilst nominally acknowledging the spiritual guidance of the Brahmans, worship nondescript local village deities (*grāma-devatā*), with animal sacrifices, frequently involving the slaughter, under revolting circumstances, of thousands of victims. These local deities are nearly all of the female, not the male, sex. In the estimation of these people Siva and Vishnu may be more dignified beings, but the village deity is regarded as a more present help in trouble, and more intimately concerned with the happiness and prosperity of the villagers. This represents a religion, more or less modified in various parts of South India by Brahmanical influence. Many of the deities themselves are of quite recent origin, and it is easy to observe a deity in making even at the present day.

From the point of view of social organization (*see* CASTE) the cardinal principle which underlies the system of caste is the preservation of purity of descent, and purity of religious belief and ceremonial usage. Hindu polity is aristocratic, not egalitarian. It recognizes, utilizes, and explains the inequalities of individuals and of groups of individuals. It is based on a sense of duty and of reciprocal obligation permeating the whole society from the king to the peasant. *Dharma* is duty. In the caste system, with its hierarchical gradations, its complex relations, its jealous endogamy, its fissiparous nature, it expresses an exclusiveness which at first sight seems to create a rigid barrier, but its process of proselytization is by the absorption of whole communities, and that process is still active.

In the sphere of religious belief we find the whole scale of types represented from the lowest to the highest. In their theory of a triple manifestation of an impersonal deity, the Brahmanical theologians elaborated a doctrine which could only appeal to the sympathies of a comparatively limited portion of the people. The

religious belief of the Aryan classes underwent changes in post-Vedic times, due to aboriginal influences, and the later creeds offer many features in which one might suspect influences of that kind. The two epic poems, the *Mahabharata* and *Ramayana,* still show us in the main the *personnel* of the old pantheon; but the gods have become anthropomorphized and almost purely mythological figures. A number of the chief gods, sometimes four, but generally eight, now appear as *lokapulas* or world-guardians, having definite quarters or intermediate quarters of the compass assigned to them as their special domains. One of them, Kubera, the god of wealth, is a new figure; whilst another, Varuna, the most spiritual and ethical of Vedic deities—the king of the gods and the universe; the nightly star-spangled firmament—has become the Indian Neptune, the god of waters. Indra, their chief, is virtually a kind of superior rajah, residing in *svarga,* and as such is on visiting terms with earthly kings, driving about in the air with his charioteer Matali, and is actually defeated in battle by the son of the demon-king of Lanka (Ceylon), and kept there a prisoner till ransomed by Brahma and the gods conferring immortality on his conqueror. Hanuman, the deified chief of monkeys, probably represents the aboriginal tribes of Southern India, whose wonderful exploits as Rama's ally on the expedition to Lanka Indian audiences will never weary of hearing recounted The Gandharvas figure already in the Veda, either as a single divinity, or as a class of genii, conceived of as the body-guard of Soma and as connected with the moon. In the later Vedic times they are represented as being fond of and dangerous to women; the Apsaras, apparently originally water-nymphs, were closely associated with them. In the heroic age the Gandharvas have become the heavenly minstrels plying their art at Indra's court, with the Apsaras as their wives or mistresses. Hence also the universal reverence paid to serpents (*naga*) since those early days. (*See* SERPENT CULTS.) In addition to such essentially mythological conceptions, we meet in the religious life of this period with an element of more serious aspect in the two gods, on one or other of whom the religious fervour of the large majority of Hindus has ever since concentrated itself, viz., Vishnu and Siva. Both these divine figures have grown out of Vedic conceptions, the genial Vishnu mainly out of a not very prominent solar deity of the same name; whilst the stern Siva, *i.e.,* the kind or gracious one—doubtless a euphemistic name—has his prototype in the old fierce storm-god Rudra, the "Roarer," with certain additional features derived from other deities, especially Pushan, the guardian of flocks and bestower of prosperity, worked up therewith In the epic poems which took final shape in the early centuries before and after the Christian era, their popular character appears in full force; whilst their cult is likewise attested by the coins and inscriptions of the early centuries of our era. The co-ordination of the two gods in the Trimūrti does not exclude a certain rivalry between them; but, on the contrary, a supreme position as the true embodiment of the Divine Spirit is claimed for each of them by their respective votaries, without, however, an honourable place being refused to the rival deity, who is often represented as another form of the favoured god. The people's polytheistic instincts extended the pantheon by groups of new deities in connection with them. Two such new gods actually pass as the sons of Siva and his consort Parvati, viz., Skanda—also called Kumara (the youth), Karttikeya, or Subrahmanya (in the south)—the six-headed war-lord of the gods, and Ganesa, lord (or leader) of Siva's troupes of attendants, who is at the same time the elephant-headed, paunch-bellied god of wisdom. A third, Kama (Kamadeva) or Kandarpa, the god of love, gets his popular epithet of Ananga, "the bodiless," from his having once, in frolicsome play, tried the power of his arrows upon Siva, whilst engaged in austere practices, when a single glance from the third (forehead) eye of the angry god reduced the mischievous urchin to ashes. For his chief attendant, the great god (Mahadeva, Mahésvara) has already with him the "holy" Nandi—identical in form as in name with Siva's sacred bull of later times, the symbol of the god's reproductive power. Thus we meet in the epics with the prominent feature of the worship of Siva and his consort all over India, viz., the feature represented by the *linga,* or phallic symbol. (*See* PHALLICISM.)



BY COURTESY OF THE NORTHERN BAPTIST CONVENTION

A HIGH CASTE HINDU

As regards Vishnu, the epic poems, including the supplement to the Mahabharata, the Harivamsa, supply the framework of legendary matter on which the later Vaishnava creeds are based. The theory of Avataras makes the deity—also variously called Narayana, Purushottama, or Vasudeva—periodically assume some material form in order to rescue the world from some great calamity, the ten universally recognized "descents" being enumerated in the larger poem. The incarnation theory is peculiarly characteristic of Vaishnavism; and the fact that the principal hero of the Ramayana (Rama), and one of the prominent warriors of the Mahabharata (Krishna) become in this way identified with the supreme god, and remain to this day the chief objects of the adoration of Vaishnava sectaries, naturally imparts to these creeds a human interest and sympathetic aspect which is wholly wanting in the worship of Siva.

Sectarianism.—During the early centuries of our era, whilst Buddhism, where countenanced by the political rulers, was still holding its own by the side of Brahmanism, sectarian belief in the Hindu gods made steady progress. The caste-system, by favouring unity of religious practice within its social groups, must naturally have contributed to the advance of sectarianism. Even greater was the support it received later on from the Puranas, a class of poetical works of a partly legendary, partly discursive, and controversial character, mainly composed in the interest of special deities, of which 18 principal (*maha-purana*) and as many secondary ones (*upa-purana*) are recognized, the oldest of which may go back to about the 4th century of our era. During this period, probably, the female element was first definitely admitted to a prominent place amongst the divine objects of sectarian worship, in the shape of the wives of the principal gods viewed as their *sakti,* or female energy, theoretically identified with the *Maya,* or cosmic illusion, of the idealistic Vedanta, and the *Prakriti,* or plastic matter, of the materialistic Sankhya philosophy, as the primary source of mundane things. The connubial relations of the deities may thus be considered "to typify the mystical union of the two eternal principles, spirit and matter, for the production and reproduction of the universe." But whilst this privilege of divine worship was claimed for the consorts of all the gods, it is principally to Siva's consort, in one or other of her numerous forms, that adoration on an extensive scale came to be offered by a special sect of votaries who therefore are known as the *Saktas.*

Sankara.—An attempt was made, about the latter part of the 8th century, by the distinguished Malabar theologian and philosopher, Sankara Acharya, to bring about a uniform system of orthodox Hindu belief. The practical result of his labours was the foundation of a new sect, the *Smartas, i.e.,* adherents of the *smriti* or tradition, which has a numerous following amongst southern Brahmans, and is usually classed as one of the Saiva sects, its members adopting the horizontal sectarial mark, peculiar to Saivas, of a triple line, the *tripundra,* prepared from the ashes of burnt cow-dung and painted on the forehead.

Worship.—Since the time of Sankara, the gods Vishnu and Siva, or *Hari* and *Hara* as they are also commonly called—with their wives, especially that of the latter god—have shared between them the practical worship of the vast majority of Hindus. But, though the people have thus been divided between two different religious camps, sectarian animosity has upon the whole kept within reasonable limits. In fact, the respectable Hindu, whilst owning special allegiance to one of the two gods as his *ishṭā devatā* (favourite deity), will not withhold his tribute of adoration from the other gods of the pantheon. The high-caste Brahman will probably keep at his home a śālagrām stone, the favourite symbol of Vishnu, as well as the characteristic emblems

of Siva and his consort, to both of which he will do reverence in the morning; and when he visits some holy place of pilgrimage he will not fail to pay his homage at both the Saiva and the Vaishnava shrines there. The same spirit of toleration shows itself in the celebration of the numerous religious festivals. Widely different, however, as is the character of the two leading gods are also the modes of worship practised by their votaries.

Siva.—The favourite god of the Brahmans has always been Siva. He is said to have first appeared in the beginning of the present age as *Sveta*, the White, for the purpose of benefiting the Brahmans, and he is invariably painted white. His worship is widely extended, especially in Southern India. Indeed, there is hardly a village in India which cannot boast of a shrine dedicated to Siva, and containing the emblem of his reproductive power; for almost the only form in which the "great god" is adored is the *linga*, consisting usually of an upright cylindrical block of marble or other stone, mostly resting on a circular perforated slab. The mystic nature of these emblems seems, however, to be but little understood by the common people; and it requires a rather lively imagination to trace any resemblance in them to the objects they are supposed to represent. The worship of Siva has never assumed a really popular character, especially in Northern India. The temple, which usually stands in the middle of a court, is as a rule a building of very moderate dimensions, consisting either of a single square chamber, with a pyramidal structure, or of a chamber for the linga and a small vestibule.



FROM RUSSELL, "TRIBES AND CASTES OF CENTRAL INDIA"

A MENDICANT, ONE OF THE MANY HINDUS THROUGHOUT INDIA WHO SEEK DETACHMENT FROM THE WORLD AS A MEANS OF SPIRITUAL WELFARE

Avatars.—From early times Vishnu proved to the lay mind a more attractive object of adoration on account of his genial character and the additional elements he has received through the theory of periodical "descents" (*avatāra*) or incarnations applied to him At least one of his avatars is clearly based on the Vedic conception of the sun-god, viz., that of the dwarf who claims as much ground as he can cover by three steps, and then gains the whole universe by his three mighty strides. Of the ten or more avatars, only two have entered to any considerable extent into the religious worship of the people, viz, those of *Rama* (or Ramachandra) and *Krishna*, the favourite heroes of epic romance.

It may not be without significance, from a racial point of view, that Vishnu, Rama, and Krishna have various darker shades of colour attributed to them, viz., blue, hyacinthine, and dark azure or dark brown respectively. The names of the two heroes meaning simply "black" or "dark," the blue tint may originally have belonged to Vishnu, who is also called *pītavasas*, dressed in yellow garment, *i.e.*, the colours of sky and sun combined.

By these two incarnations, especially that of Krishna, a new spirit was infused into the religious life of the people by the sentiment of fervent devotion to the deity, as expressed in certain portions of the epic poems, especially the *Bhagavadgita*, and in the *Bhagavata-purana* (as against the more orthodox Vaishnava works of this class such as the Vishnu-purana), and formulated into a regular doctrine of faith in the *Sandilya-sutra*, and ultimately translated into practice by the Vaishnava reformers.

Eroticism and Krishna Worship.—The Vaishnava sects, in their adoration of Vishnu and his incarnations, Krishna and Ramachandra, usually associate with these gods their wives, as their *saktis*, or female energies, to enhance the emotional character of the rites of worship. In some of the later Vaishnava creeds, the favourite object of adoration is the juvenile Krishna, Govinda or Bala Gopala, "the cowherd lad," the foster son of the cowherd, Nanda of Gokula, taken up with his amorous sports with the *Gopis* or wives of the cowherds of Vrindavana (Brindaban, near Mathura on the Yamuna), especially his favourite mistress Radha or Radhika. This episode in the legendary life of Krishna bursts forth full-blown in the Harivansa, the Vishnu-purana, the Narada-Pancharatra, and the Bhagavata-purana, the tenth canto of which, dealing with the life of Krishna, has become, through vernacular versions, especially the Hindi *Prem-sagar*, or "ocean of love," a favourite romance all over India. Krishna's favourite Radha makes her appearance in the Brahma-vaivarta, in which Krishna's amours in Nanda's cow-station are dwelt upon in detail; whilst the poet Jayadeva, in the 12th century, made her love for the gay and inconstant boy the theme of his beautiful, if highly voluptuous, lyrical drama, *Gita-govinda*.

Saktipuja.—The Saktas are worshippers of the *sakti*, or the female principle as a primary factor in the creation and reproduction of the universe. And as each of the principal gods is supposed to have associated with him his own particular *sakti*, as an indispensable complement enabling him to perform properly his cosmic functions, adherents of this persuasion might be expected to be recruited from all sects. In connection with the Saiva system an independent cult of the female principle has been developed; whilst in other sects, and in the ordinary Saiva cult, such worship is combined with, and subordinated to, that of the male principle. The theory of the god and his Sakti as cosmic principles is perhaps foreshadowed in the Vedic couple of Heaven and Earth, an entirely primitive concept. In the speculative treatises of the later Vedic period, and in the post-Vedic Brahmanical writings, the assumption of the self-existent being dividing himself into a male and a female half usually forms the starting-point of cosmic evolution. In the later Saiva mythology this theory finds its artistic representation in Siva's androgynous form of Ardha-narisa, or "half-woman-lord," typifying the union of the male and female energies; the male half in this form of the deity occupying the right-hand, and the female the left-hand side In accordance with this type of productive energy, the Saktas divide themselves into two distinct groups, according to whether they attach the greater importance to the male or to the female principle, viz., the *Dakshinacharis*, or "right-hand-observers" (also called *Dakshina-margis*, or followers "of the right-hand path"), and the *Vamacharis*, or "left-hand-observers" (or *Vama-margis*, followers "of the left path"). Only in the numerous Tantras are Sakta topics fully and systematically developed.

The principal seat of Sakta worship is the north-eastern part of India—Bengal, Assam, and Behar. The great majority of its adherents profess to follow the right-hand practice; and apart from the implied purport and the emblems of the cult, their mode of adoration does not seem to offer any very objectionable features. And even amongst the adherents of the left-hand mode of worship, many of these are said to follow it, as a matter of family tradition, in a sober and temperate manner; whilst only an extreme section carry on the mystic and licentious rites taught in many of the Tantras.

The divine object of the adoration of the Saktas is Siva's wife —the *Devi* (goddess), *Mahadevi* (great goddess), or *Jagan-mata* (mother of the world)—in one or other of her numerous forms, benign or terrible. The forms in which she is worshipped in Bengal are of the latter category, viz., *Durga*, "the unapproachable," and *Kali*, "the black one," or, as some take it, the wife of *Kala*, "time," or death the great dissolver, viz., Siva. In honour of the former, the *Durga-puja* is celebrated during ten days at the time of the autumnal equinox, in commemoration of her victory over the buffalo-headed demon, Mahishasura; when the image of the ten-armed goddess, holding a weapon in each hand, is worshipped for nine days, and cast into the water on the tenth day, called the Dasahara, whence the festival itself is commonly called Dasara in Western India. *Kali*, on the other hand, the most terrible of the goddess's forms, has a special service performed to her, at the *Kali-puja*, during the darkest night of the succeeding month; when she is represented as a naked black woman, four-armed, wearing a garland of heads of giants slain by her, and a string of skulls round her neck, dancing on the breast of her husband (Mahakala), with gaping mouth and protruding tongue, and when she has to be propitiated by the slaughter of goats, sheep, and buffaloes. On other occasions also Vamacharis commonly offer animal sacrifices, usually one or

more kids; the head of the victim, which has to be severed by a single stroke, being always placed in front of the image of the goddess as a blood-offering (*bali*), with an earthen lamp fed with ghee burning above it, whilst the flesh is cooked and served to the guests attending the ceremony, except that of buffaloes, which is given to the low-caste musicians who perform during the service. Even some adherents of this class have, however, discontinued animal sacrifices, and use certain kinds of fruit, such as coco-nuts or pumpkins, instead. The use of wine, at one time very common on these occasions, is now restricted; and only members of the extreme section adhere to the practice of the so-called five *m's* prescribed by some of the Tantras, viz., *mamsa* (flesh), *matsya* (fish), *madya* (wine), *maithuna* (sexual union), and *mudra* (mystical finger signs).



FROM RUSSELL, "TRIBES AND CASTES OF CENTRAL INDIA"

A JOGI MENDICANT

Jogis are famous for soothsaying and feats of jugglery, which the public regards as evidence of superhuman powers attained by the performer's ascetic life

Tantric theory has devised an elaborate system of female figures representing either special forms and personifications or attendants of the "great goddess." They are generally arranged in groups, the most important of which are the *mahavidyas* (great sciences), the eight (or nine) *mataras* (mothers) or *mahamataras* (great mothers), consisting of the wives of the principal gods; the eight *nayikas* or mistresses; and different classes of sorceresses and ogresses, called *yoginis, dakinis,* and *sakinis*. A special feature of the Sakti cult is the use of obscure Vedic *mantras,* often changed so as to be quite meaningless and on that very account deemed the more efficacious for the acquisition of superhuman powers; as well as of mystic letters and syllables called *bija* (germ), of magic circles (*chakra*) and diagrams (*yantra*), and of amulets of various materials inscribed with formulae of fancied mysterious import.

Since by the universally accepted doctrine of *karma* (deed) or *karmavipaka* ("the maturing of deeds") man himself—either in his present, or some future, existence—enjoys the fruit of, or has to atone for, his former good and bad actions, Hindu thought has no precise belief in the remission of sin by divine grace or vicarious substitution. The "descents" or incarnations of the deity have for their object the deliverance of the world from some material calamity threatening to overwhelm it. Indeed, any man credited with exceptional merit or achievement, or even remarkable for some strange incident connected with his life or death, might ultimately be looked upon as a veritable incarnation of the deity, capable of influencing the destinies of man, and become an object of local adoration. The transmigration theory, which makes the spirit of the departed hover about for a time in quest of a new corporeal abode, lent itself to superstitious notions of this kind.

The worship of the *Pitris* ("fathers") or deceased ancestors, enters largely into the everyday life and family relations of the Hindus. (*See* ANCESTOR WORSHIP.) At stated intervals, to offer reverential homage and oblations of food to the forefathers up to the third degree is one of the most sacred duties the devout Hindu has to discharge. The periodical performance of the commemorative rite of obsequies called *Sraddha—i.e.,* an oblation "made in faith" (*sraddha,* Lat. *credo*)—is the duty and privilege of the eldest son of the deceased, or, failing him, of the nearest relative who thereby established his right as next-of-kin in respect of inheritance; and those other relatives who have the right to take part in the ceremony are called *sapinda, i.e.,* sharing in the *pindas* (or balls of cooked rice, constituting along with libations of water the usual offering to the Manes). The first *Sraddha* takes place as soon as possible after the *antyeshti* ("final offering") or funeral ceremony proper, usually spread over ten days; being afterwards repeated once a month for a year, and subsequently at every anniversary and otherwise voluntarily on special occasions. Moreover, a simple libation of water should be offered to the fathers twice daily at the morning and evening devotion called *sandhya* ("twilight"). Anxious care was caused to the "fathers" by the possibility of the living head of the family being afflicted with failure of offspring, this dire prospect compelling them to use but sparingly their little store of provisions, in case the supply should shortly cease altogether. At the same time any irregularity in the performance of the obsequial rites might cause the fathers to haunt their old home and trouble the peace of their undutiful descendant, or even prematurely draw him after them to the Pitri-loka or world of the fathers. Terminating as it usually does with the feeding and feeing of a greater or less number of Brahmans and the feasting of members of the performers' own caste, the Sraddha, especially its first performance, is often a matter of very considerable expense; and more than ordinary benefit to the deceased is supposed to accrue from it when it takes place at a spot of recognized sanctity, such as one of the great places of pilgrimage like Prayaga (Allahabad, where the three sacred rivers, Ganga, Yamuna, and Sarasvati, meet), Mathura, and especially Gaya and Kasi (Benares). The pilgrimage to holy bathing-places is in itself an act of piety conferring religious merit. The number of such places is legion, and is constantly increasing. The water of the Ganges, the Jumna, the Narbada, and the Kistna rivers, is supposed to be imbued with the essence of sanctity capable of cleansing the pious bather of all sin and moral taint. To follow the entire course of one of the sacred rivers from the mouth to the source on one side and back again on the other in the sun-wise (pradakshina) direction—that is, always keeping the stream on one's right-hand side—is held to be a highly meritorious undertaking which requires years to carry through. Water from these rivers, especially the Ganges, is sent and taken in bottles to all parts of India to be used on occasion as healing medicine or for sacramental purposes. Sick persons are frequently conveyed long distances to a sacred river to heal them of their maladies; and for a dying man to breathe his last at the side of the Ganges is devoutly believed to be the surest way of securing for him salvation and eternal bliss.

Conclusion.—Who can venture to say what the future of Hinduism is likely to be? Is the regeneration of India to be brought about by the modern theistic movements, such as the Brahma-samaj (*q.v.*) and Arya-samaj (*q.v.*) as so close and sympathetic an observer of Hindu life and thought as Sir A. Lyall held? "The Hindu mind," he remarked, "is essentially speculative and transcendental; it will never consent to be shut up in the prison of sensual experience, for it has grasped and holds firmly the central idea that all things are manifestations of some power outside phenomena. And the tendency of contemporary religious discussion in India, so far as it can be followed from a distance, is towards an ethical reform on the old foundations, towards searching for some method of reconciling their Vedic theology with the practices of religion taken as a rule of conduct and a system of moral government. One can already discern a movement in various quarters towards a recognition of impersonal theism, and towards fixing the teaching of the philosophical schools upon some definitely authorized system of faith and morals, which may satisfy a rising ethical standard, and may thus permanently embody that tendency to substitute spiritual devotion for external forms and caste rules which is the characteristic of the sects that have from time to time dissented from orthodox Brahmanism." Purified from within, Hinduism, in its highest expression, by which it, as any other religion has a right to be judged, with its great vitality, its power of adaptation, its philosophic tradition, its insistence on the development of the powers that are latent in man and are in jeopardy of being atrophied by modern dependence on machinery, may yet serve humanity by correcting the stress laid by other schools of thought upon the material to the neglect of the spiritual.

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Sir Charles Eliot's *Hinduism and Buddhism* (1921) is a fine presentment of facts based on personal knowledge and a critical investigation of the texts. Such works as *The Crown of Hinduism* by J. N. Farquhar (1913), *The Chamars* by G. W. Briggs (1920), and *The Village Gods of Southern India* (1921) by the Rt. Rev. Henry Whitehead, D.D., may also be consulted.

See also articles: ARYA SAMAJ; BRAHMANISM; BRAHMA SAMAJ; CASTE; DADU PANTHIS; KABIR PANTHIS; MADHVAS; MENDICANT ORDERS (INDIAN); NIMAVATS; RADHAVALLABHIS; RAMANUYAS; RAMATS; VAISHNAVITES; VALLABHACHARS.

HINDU KUSH, a range of mountains in Central Asia. Throughout 500 m. of its length, from the Pamir region to the Koh-i-Baba, west of Kabul, it forms the water-divide between the Kabul and the Oxus basins, and, for the first 200 m. is the southern boundary of Afghanistan. Probably it branches from the head of the Taghdumbash Pamir, where it unites with the Sarikol stretching northwards, and the impressive mountain barrier of Muztagh, the northern base of which separates China from Kanjut. The Wakhjir pass, crossing the head of the Taghdumbash Pamir into the river Hunza, almost marks the trijunction of the three great chains. As the Hindu Kush strikes westwards, after first rounding the head of an Oxus tributary (the Ab-i-Panja), it closely overlooks the trough of that glacier-fed stream under its northern spurs, its crest at the nearest point being separated from the river by a distance of about 10 m. As the river is here the northern boundary of Afghanistan, and the crest of the Hindu Kush the southern boundary, this distance represents the width of the Afghan kingdom at that point.

Physiography.—For the first 100 m. the Hindu Kush is a comparatively wide flat-backed range with small lakes on the crest, and possessing no considerable peaks. It is crossed by many passes, varying in height from 12,500 ft. to 17,500 ft., the lowest and the easiest being the group about Baroghil. As the Hindu Kush gradually recedes from the Ab-i-Panja and turns south-westwards it gains in altitude, and prominent peaks rise to more than 24,000 ft. above sea-level. The main central water-divide is not the line of highest peaks, which line is farther south, where Tirach Mir dominates Chitral from a southern spur. For some 40 or 50 m. of this south-westerly bend, the crest is intersected by many passes, of which the most important is the Durah group (including the Minjan and the Mandal), which rise to about 15,000 ft., and which are practicable links between the Oxus and Chitral basins.

From the Durah to the Khawak group of passes (11,000 and 12,000 ft. in altitude), the water-divide overlooks Kafiristan and Badakshan. Here, its exact position uncertain, it lies amidst a wild, inaccessible region of snow-bound crests, and is nowhere less than 15,000 ft. above sea-level. The Khawak, at the head of the Panjshir river, leading straight from Badakshan to Charikar and the city of Kabul, is now an excellent kafila route, and is available for traffic throughout the year. From the Khawak to the head of the Ghorband (a river which meets the Panjshir near Charikar), the Hindu Kush is intersected by passes at intervals, *e.g.*, the Kaoshan (the "Hindu Kush" pass *par excellence*), 14,340 ft.; the Chahardar (13,900 ft.), on the Afghanistan high road to Turkistan; and the Shibar (9,800 ft.). Here is the southern extremity of the Hindu Kush, for here commences the Koh-i-Baba system into which the Hindu Kush is merged.

The general structure of the Hindu Kush south of the Khawak, no less than such evidence as at present exists to the north, points to similar conditions of uplift and subsequent denudation as in the western Himalaya and the whole of the trans-Indus borderland. The uplift was later than the Himalayas and was marked by the overthrusting of Cretaceous limestones upon Recent shales and clays as on the Baluch frontier. The Hindu Kush is, in fact, but the face of a great plateau-land lying north of it, just as the Himalaya forms the southern face of the table-land of Tibet, and its general physiography, exhibiting long, narrow, lateral valleys and transverse lines of "antecedent" drainage, is similar. There are few passes across the southern section of the Hindu Kush which have not to surmount a succession of crests or ridges as they cross from Afghan Turkistan to Afghanistan. The exceptions are notable, and have played an important part in the military history of Asia. From a little ice-bound lake called Gaz Kul, which lies on the crest of the Hindu Kush near the Taghdumbash Pamir, two very important river systems (those of Chitral and Hunza) are believed to originate. The lake really lies on the watershed and is probably a glacial relic. Its contribution to either stream appears to depend on the blocking of ice masses towards one or other end. It marks the commencement of the water-divide which separates the Gilgit basin from that of the Yashkun, and subsequently divides the drainage of Swat, and Bajour from that of the Chitral (or Kunar). The Yashkun-Chitral-Kunar river is the longest affluent of the Kabul, and it is in many respects a more important river than the Kabul. It is closely flanked on its left bank by this main water-divide. It is this range, crowned by peaks of 22,000 ft. and of an average height of 10,000 ft. throughout its length of 250 m., that is the real barrier of the north—not the Hindu Kush itself. Across it are glacial passes (Darkot) which lead to the foot of the Baroghil. Those passes (the Kilik and Mintaka, both above 15,000 ft.) from the Pamir, which lead into the gorges of the upper affluents of the Hunza, east of Darkot, belong rather to the Muztagh system. Other passes are the Shandur (12,250 ft.), between Gilgit and Mastuj; the Lowarai (10,450 ft.), between the Panjkora and Chitral valleys; and farther south certain lower crossings which formed part of the great highway between Kabul and India.

Facing Chitral, on the right bank of the river, and extending for 70 m., is the lofty snow-clad spur of the Hindu Kush known as Shawal, across which one or two difficult passes lead into the Bashgol valley of Kafiristan. This spur carries the boundary of Afghanistan. South of Arnawai the Kunar valley becomes a part of Afghanistan (*see* KUNAR). The value of Chitral as an outpost of British India may be best gauged by its geographical position. The Durah pass leads into the Chitral valley from the Oxus, as also the Mandal pass, a few miles south, is the connecting link between the Oxus and the Bashgol valley of Kafiristan; and the Bashgol valley leads directly to the Chitral valley at Arnawai, about 50 m. below Chitral. Nor must we overlook the connection between north and south afforded by the long narrow valley of the Chitral (or Yashkun) itself, leading up to the Baroghil pass This route was once made use of by the Chinese for purposes of pilgrimage, if not for invasion. Access to Chitral from the north is therefore but a matter of practicable tracks, or passes, in two or three directions, and the measure of practicability under any given conditions can best be reckoned from Chitral itself.

Historical.—Hindu Kush is the Caucasus of Alexander's historians. It is also included in the Paropamisus, though the latter term embraces more, Caucasus being apparently used only when the alpine barrier is in question. It was no doubt regarded (and perhaps not altogether untruly) as a part of a great alpine zone believed to traverse Asia from west to east, whether called Taurus, Caucasus or Imaus. Arrian himself applies Caucasus distinctly to the Himalaya also. The application of the name Tanais to the Syr seems to indicate a real confusion with Colchian Caucasus. Alexander, after building an Alexandria at its foot (probably at Hupian near Charikar), crossed into Bactria, first reaching Drapsaca, or Adrapsa. This has been interpreted as Anderab, in which case he probably crossed the Khawak pass, but the identity is uncertain. The ancient Zend name is, according to Rawlinson, Paresina, the essential part of Paropamisus; this accounts for the great Asiatic *Parnassus* of Aristotle, and the *Pho-lo-sin-a* of Hsüan Tsang.

The Hindu Kush, formidable as it seems, and often as it has been the limit between petty states, has hardly ever been the boundary of a considerable power. Greeks, White Huns, Samanidae of Bukhara, Ghaznevides, Mongols, Timur and Timuridae, down to Saddozais and Barakzais, have ruled both sides of this great alpine chain. (*See* also AFGHANISTAN; INDIA.)

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HINDUR or **NALAGARH,** hill state, Punjab, India. Pop. (1921) 46,868; area, 256 sq.m.; estimated revenue, £20,000. The country was overrun by the Gurkhas for some years before 1815, when they were driven out by the British, and the raja was confirmed in possession of the territory.

HINDUS: *see* CASTE; INDIA: *Ethnology;* HINDUISM.

HINES, JOHN LEONARD (1868–), American soldier, was born at White Sulphur Springs, W.Va., on May 21, 1868. After graduating from the U.S. Military academy in 1891 he was stationed for five years at Fort Omaha, Neb. He served as acting quartermaster in Cuba during the Spanish-American War, and afterwards in the Philippines, 1900–01, 1903–05, 1911–12. He was assistant chief quartermaster 1908–09 in the department of Missouri and 1910–11 in Japan. In 1916–17 he served as adjutant of the punitive expedition into Mexico, and in June 1917 was sent to France as assistant adjutant-general of the American Expeditionary Forces. In May 1918, he was appointed to the command of the 1st Brigade of Infantry, 1st Division, A E F. which he commanded during the Cantigny operations and in the Montdidier and Aisne-Marne defensives. In August he was transferred to the 4th Division, which he commanded at the Battle of St. Mihiel and in the earlier stages of the Meuse-Argonne offensive. He was appointed commander of the III. Army Corps Oct. 11, 1918 with a temporary commission as major-general He was made a major-general of the Regular Army on March 5, 1921, and in Dec. 1922, became deputy chief of staff. Upon the retirement of Gen. John J. Pershing on Sept. 18, 1924, Maj -gen Hines succeeded as chief of staff.

HINES, WALKER DOWNER (1870–), American lawyer, was born at Russellville, Ky., Feb. 2, 1870. He was educated at Ogden college and the University of Virginia. From 1893 to 1904 he was with the Louisville and Nashville railroad in the legal department and, after 1901, as first vice-president. He practised law in Louisville, Ky., 1904–06 and in New York city 1906–16. In 1906 he became general counsel for the Atchison, Topeka and Santa Fe Railroad, later becoming chairman of the board of directors. In Feb. 1918, after the U.S. Government had assumed control of the railways as a war measure, he was appointed assistant director-general, and in January of the following year director-general. In May 1920 he was designated by President Wilson as arbitrator in the distribution of German, Austrian and Hungarian inland shipping under the peace treaties. In 1925 he made an investigation and report of navigation on the Rhine and Danube for the League of Nations. He wrote *The War History of the American Railroads* (1928).

HINGANGHAT, a town of British India in the Wardha district of the Central Provinces, 21 miles S.W. of Wardha, on the railway to Chanda. Pop. (1921) 17,200. It has given its name to one of the best known indigenous cotton staples in India. It is a flourishing place with two cotton mills and several presses and ginning factories. The new town is well laid out with broad streets and there are many prosperous Marwari traders.

HINGE, a movable joint, *e.g.*, of a door or window (M.E. *hengen*, to hang); any device joining two parts together, but allowing them to move upon each other (*see* JOINERY). Figuratively, the word is used of a turning point or crisis on which something depends.

In modern industrial nations the manufacture of hinges of steel or brass has become a trade of large dimensions. The better sort of brass hinges are cast, but there is a big production of machine-made cheap articles.

HINGHAM, a town of Plymouth county, Mass., U.S.A., on Massachusetts bay, 12m. S.E. of Boston; served by the New York, New Haven and Hartford railroad. The area is 30 sq.m., and the population in 1925 was 6,158. It is primarily a residential town and a summer resort. It has some manufactures and is the seat of a United States arsenal and of Derby academy, founded in 1784 by Sarah Derby. The Old Meeting house was built in 1681. There were settlers here as early as 1633, some of whom were natives of Hingham in England; and in 1635 the common land called Barecove became the town of Hingham

HINNY, a hybrid between a horse and an ass in which the latter is the female parent. (*See* MULE.)

HINRICHS, HERMANN FRIEDRICH WILHELM (1794–1861), German Hegelian philosopher, studied theology at Strassburg, and philosophy at Heidelberg under Hegel (*q.v.*), who wrote a preface to his *Religion im innern Verhältniss zur Wissenschaft* (Heidelberg, 1822) directed against Schleiermacher. He became a *Privatdozent* in 1819, and held professorships at Breslau (1822) and Halle (1824).

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HINSCHIUS, PAUL (1835–1898), German jurist, was the son of Franz Sales August Hinschius (1807–77), and was born in Berlin on Dec. 25, 1835. His father was not only a scientific jurist, but also a lawyer in large practice in Berlin. After working under his father, Hinschius in 1852 began to study jurisprudence at Heidelberg and Berlin, the teacher who had most influence upon him being Aemilius Ludwig Richter (1808–64), to whom he afterwards ascribed the great revival of the study of ecclesiastical law in Germany. In 1855 Hinschius took the degree of *doctor utriusque iuris*, and in 1859 was admitted to the juridical faculty of Berlin. He lectured at Halle, Berlin and Kiel universities, and in 1870–71 represented Kiel in the Prussian Upper House (1870–71). In 1872 he was appointed professor ordinarius of ecclesiastical law at Berlin. He took part in the conferences of the ministry of ecclesiastical affairs, which issued in the famous "Falk laws." In connection with the developments of the *Kulturkampf* which resulted from the "Falk laws," he wrote several important treatises. He sat in the Reichstag as a National Liberal from 1872 to 1878, and again in 1881 and 1882, and from 1889 onwards he represented the University of Berlin in the Prussian Upper House. He died on Dec. 13, 1898.

The two great works by which Hinschius established his fame are the *Decretales Pseudo-Isidorianae et capitula Angilramni* (2 parts, Leipzig, 1863) and *Das Kirchenrecht der Katholiken und Protestanten in Deutschland*, vols. i.–vi. (1869–77). The first of these, for which during 1860 and 1861 he had gathered materials in Italy, Spain, France, England, Scotland, Ireland, Holland and Belgium, was the first critical edition of the False Decretals. The *Kirchenrecht* is an exhaustive historical and analytical study of the Roman Catholic hierarchy and its government of the church.

See the articles *s.v.* by E. Seckel in Herzog-Hauck, *Realencyklopädie* (3rd ed., 1900), and by Ulrich Steitz in the *Allgemeine deutsche Biographie*, vol. 50 (Leipzig, 1905).

HINSDALE, a residential village of Du Page county, Ill., U.S.A., on the Burlington (railway) Route, 17m. W.S.W. of Chicago. The population in 1920 was 4,042, and was estimated locally at 7,500 in 1928. Since 1908 it has had a commission-manager form of government.

HINTERLAND, the region lying behind a littoral country dependent for trade or commerce upon it. As a political term the word first came into prominence during 1883–85, when Germany insisted on her right to exercise jurisdiction in the territory behind those parts of the African coast that she had occupied. The "doc-

trine of the hinterland" was that the possessor of the littoral was entitled to as much of the back country as geographically, economically or politically was dependent upon the coast lands, a doctrine which, in the space of ten years, led to the partition of Africa between various European Powers.

HINTZE, PAUL VON (1864–), German admiral and diplomatist, was born at Schwedt-on-the-Oder on Feb. 13, 1864. He entered the navy, and became (1908) military plenipotentiary at the Russian court, where he was said to enjoy the Tsar's confidence. From 1911–14 he was ambassador in Mexico, but was recalled at the end of 1914, was sent to Peking, and accomplished the journey in spite of the vigilance of the Allies. Transferred to Christiania (Oslo) in 1915 he again succeeded in eluding the blockade. From July 9 to Oct. 3, 1918 he was State secretary at the foreign office in succession to Kühlmann, representing it at German headquarters in the months preceding the armistice in 1918. Tirpitz expressed the opinion in his *Erinnerungen* (1919) that war with Russia might have been averted in 1914 if the emperor had sent Hintze on a special mission to the Tsar.

HIP. (1) (From O.E. *hype*, a word common in various forms to many Teutonic languages; *cf.* Dutch, *heup*, and Ger., *Hüfte*), the projecting part of the body formed by the top of the thigh-bone and the side of the pelvis, in quadrupeds generally known as the haunch (*see* JOINTS AND LIGAMENTS) (2) (O E. *héope*, from same root as M H. Ger *hiefe*, a thorn-bush), the fruit of the dog-rose (*Rosa canina*); "hips" are usually spoken of with "haws," the fruit of the hawthorn.

HIPPARCHUS (*fl* 146–126 B.C.), Greek astronomer, was born at Nicaea in Bithynia early in the 2nd century B.C. He observed in the island of Rhodes probably from 161, and made the capital discovery of the precession of the equinoxes in 130. (*See* ASTRONOMY, *History*.) Hipparchus founded trigonometry, invented the method of fixing terrestrial positions by circles of latitude and longitude, and catalogued more than 1,000 stars. None of his many works has survived except a Commentary on the *Phaenomena* of Aratus and Eudoxus, published by P. Victorius at Florence in 1567, and included by D Petavius in his *Uranologium* (Paris, 1630) A new edition was published by Carolus Manitius (Leipzig, 1894)

See J. A. Schmidt, *Variorum philosophicorum decas* (Jena, 1691); J. F Montulca, *Histoire des mathématiques* (1758); J. B. J. Delambre, *Histoire de l'astronomie ancienne* (1817), R. Grant, *History of Physical Astronomy* (1852); G. Cornewall Lewis, *Astronomy of the Ancients* (1862); M. Marie, *Histoire des sciences* (12 vols., 1883–88); R. Wolf, *Geschichte der Astronomie* (1890–93); A Berry, *History of Astronomy* (1891); P. Tannery, *Recherches sur l'histoire de l'astronomie ancienne* (1893); F. Boll, *Sphaera* (Leipzig, 1903).

HIPPARION, one of the extinct horses which spread from North America over Europe and Asia during the lower Pliocene. *Hipparion* (or *Hippotherium*) was not directly ancestral to the modern horse (*Equus*), but probably represents a lateral offshoot derived from *Merychippus*. It is the most abundant fossil in the so-called Hipparion fauna. (*See* EQUIDAE.)

HIPPASOS OF METAPONTUM, Pythagorean philosopher, was one of the earliest disciples of Pythagoras. Nothing is known of his life. Diogenes Laërtius says that he left no writings, but other authorities ascribe to him a μυστικὸς λόγος directed against the Pythagoreans. According to Aristotle (*Met.*, i 3), he held the Heraclitean fire-doctrine, whereas the Pythagoreans maintained that number is the first principle. He seems to have regarded the soul as composed of igneous matter, and so approximates the Pythagorean doctrine of the central fire to the theories of Heraclitus. In spite of this divergence, Hippasos is always regarded as a Pythagorean.

See Diogenes, viii. 84; Diels, *Fragmente der Vorsokratiker*, vol. i. (4th ed., 1922); also PYTHAGORAS.

HIPPEASTRUM, in botany, a genus of the family Amaryllidaceae, containing about 75 species of bulbous plants, natives of tropical and sub-tropical South America. The various forms in cultivation are generally known as Amaryllis. The handsome funnel-shaped flowers are borne in a cluster of two to many, at the end of a short hollow scape. The species and the numerous hybrids which have been obtained artificially show a great variety in size and colour of the flower, including the richest deep crimson and blood-red, white, and striped, mottled or blended colours. They are of easy culture, and free-blooming habit. Like other bulbs they are increased by offsets, which should be carefully removed when the plants are at rest, and should be allowed to attain a fair size before removal.

HIPPED ROOF, in architecture, a roof which starts on all sides on the same level at the eaves and slopes up towards a ridge or point in the centre. Hipped roofs were apparently common in the domestic work of the Mediterranean countries from the time of Greece, and are still the most common form for informal buildings throughout the near east and in Italy, southern France and Spain. With the coming of the Renaissance into northern Europe the hipped roof tended to supersede the gable, owing to the emphasis on the horizontal line of the cornice. Thus most of the Renaissance *châteaux* of France and many of the earlier Georgian manors of England have hipped roofs. A remarkable development of hipped roof design was made by the Chinese, particularly in the north, where many of the great temple and palace halls have widely projecting and gently curved hipped roofs in which the hips (the intersections of the slopes) and the ridges are richly decorated with moulded tiles and terminated by fantastic dragons or grotesque beasts.

HIPPEL, THEODOR GOTTLIEB VON (1741–1796), German satirical and humorous writer, was born on Jan. 31, 1741, at Gerdauen, East Prussia, the son of a schoolmaster. In 1770 he was appointed chief burgomaster in Königsberg, and in 1786 president of the town. He died at Königsberg on April 23, 1796. *Lebensläufe nach aufsteigender Linie* (1778–81) is an autobiography, in which persons well known to him are introduced, together with a mass of heterogeneous reflections on life and philosophy. *Kreuz- und Querzüge des Ritters A bis Z* (1793–94) is a satire levelled against the follies of the age—ancestral pride and the thirst for orders, decoration and the like. Hippel has some resemblance to Jean Paul Richter in his constant digressions and in the interweaving of scientific matter in his narrative. Like Richter he was strongly influenced by Laurence Sterne.

In 1827–38 a collected edition of Hippel's works in 14 vols., was issued at Berlin. *Über die Ehe* has been edited by E. Brenning (Leipzig, 1872), and the *Lebensläufe nach aufsteigender Linie* has in a modernized edition by A von Öttingen (1878), gone through several editions. *See* J. Czerny, *Sterne, Hippel und Jean Paul* (Berlin, 1904).

HIPPIAS OF ELIS, Greek sophist, was born about the middle of the 5th century B.C. At Athens he made the acquaintance of Socrates, and seems to have lectured on politics, mathematics, music and astronomy. He boasted that he was more popular than Protagoras, and could deliver an extempore address on any subject to the assembly at Olympia. Plato's dialogues, the *Hippias major* and *minor*, contain an exposé of his methods, exaggerated no doubt, but written with full knowledge of the man. His aim was not to give knowledge, but to provide his pupils with the weapons of argument, to make them fertile in discussion on all subjects alike. Hippias did a real service to Greek literature by insisting on the meaning of words, the value of rhythm and literary style. He is credited with an excellent work on Homer, collections of Greek and foreign literature, and archaeological treatises, but only the barest notes remain.

See Diels, *Fragmente der Vorsokratiker*, vol. 2 (4th ed., 1922); and Überweg, *Grund. der Gesch. der Phil.*, pt. 1 (1926).

HIPPIUS, ZINAIDA (1869–), Russian poet and prose writer, was born on Nov. 8, 1869 at Belev, in the Tula province. She married Dmitry Mereshkovsky (*q.v.*) in 1889 and went to live in St. Petersburg (Leningrad). Later she settled in Paris. Hippius was one of the leading poets of the Russian symbolist movement of the 'nineties and her poetry bears the usual character of the movement: the cult of beauty, mysticism and individualism. The influence of Nietzsche's philosophy is also apparent as in the famous line "I love myself as I love God," which became the slogan of the Russian "decadents." Her later poetry shows the influence of the neo-Christian theories of Mereshkovsky but at the same time reveals deep individual and emotional power. Her prose works were much inferior to her poetry, but under the pseudonym of "Anton Krainy" she was known as a trenchant

literary critic. Among her works are *Revolution and Violence* (French trans., 1907); *The Green Ring* (Eng trans. by S. S. Koteliansky, 1920); *My Journal under the Terror* (French trans., 1921).

HIPPO, Greek philosopher and natural scientist of the Ionian or physical school, was probably a contemporary of Archelaus and lived chiefly in Athens Aristotle thought him unworthy of the name of philosopher. Hippo held that the principle of all things is moisture (*τὸ ὑγρόν*); that fire develops from water, and from fire the material universe. His denial of all existence save that of things known through the senses led to his being classed among the "Atheists." The gods are merely men canonized by popular tradition. It is said that he composed his own epitaph, wherein he claims for himself a place in this company.

See Diels, *Fragmente der Vorsokratiker,* vol. i. (4th ed., 1922).

HIPPOCRAS. An old medicinal drink or cordial, made of wine mixed with spices—such as cinnamon, ginger, and sugar—and strained through woollen cloths. The early spelling usual in English was *ipocras* or *ypocras*. The word is an adaptation of the M.Lat. *Vinum Hippocraticum*, or wine of Hippocrates, so called, not because it was supposed to be a receipt of the physician, but from an apothecary's name for a strainer or sieve. "Hippocrates' sleeve" (*see* W. W. Skeat, *Chaucer,* note to the *Merchant's Tale*).

HIPPOCRATES AND THE HIPPOCRATIC COLLECTION. The attitude of scholars towards Hippocrates and the Hippocratic problem has altered greatly during the last quarter of a century. Serious investigators now agree that we know next to nothing of the man and that few, if any, of the works to which his name is attached can be by him.

According to Soranus (*q.v.*) Hippocrates, the "Father of Medicine" was born on the island of Cos off the coast of Asia Minor at a date corresponding to 460 B.C. He is spoken of, both by Soranus and by Plato as a member of the sect, family, guild or society known as the Asclepiadae (*i.e.* sons of Asclepios). Unfortunately we know nothing of the rights, duties or functions of these Asclepiadae, though highly conjectural statements about them have become current. It is said that Hippocrates was descended from Asclepios on his father's side and from Herades on his mother's. Since Asclepios is an historical figure—being mentioned as a physician in the *Iliad*—the former is at least possible. It is said that Hippocrates prosecuted his early medical studies in the famous temple of Asclepios at Cos, but neither the results of the excavations on that island nor the description by Herondas (born *c.* 300 B.C.) of the conduct of the place suggest any affinity with the spirit of the *Hippocratic* collection. We shall, therefore, not occupy space with the mass of Hippocratic legend, centring round Cos and spreading also to other sites. It is said, and it is likely, that Hippocrates travelled widely. He is stated to have taught and practised in Thrace, Thessaly, Delos, Athens and elsewhere. He is said to have died at Larissa, at an age given variously, the extremes being 85 and 110. His "floruit" may be safely placed about 400 B.C. Biographies of him were written by Soranus of Ephesus in the second century A.D., by Suidas the lexicographer in the eleventh, and by Tzetzes the historian in the twelfth centuries. None of them contain much concerning him.

The character and abilities of Hippocrates as a physician have been held in almost universal veneration by medical men in the ages which have followed. Nevertheless, early references to him are very scanty. He is mentioned twice by Plato with respect (in the dialogues *Protagoras* and *Phaedrus*). When we reflect that Plato was his younger contemporary, it is surprising that he does not mention Hippocrates more often, especially in the *Timaeus* which deals with physiological subjects. There are some passages in the Platonic dialogues which have been influenced by works now included in the *Hippocratic Collection.* Aristotle mentions the name of Hippocrates once only (in his *Politics*) but a number of parallels can be discovered between works of the Hippocratic collection and those of Aristotle. These are most frequent in Aristotle's *Historia Animalium.* On the other hand, Hippocrates has had very few detractors. Among them were Andreas of Carystus, who practised in Egypt at the end of the third century B.C., and Asclepiades of Bithynia, who practised in Rome in the first century B.C. The works of neither Andreas nor of Asclepiades have survived. We shall make no attempt to entertain the reader by inventing a life of Hippocrates, but pass straight to the so called *Hippocratic Collection.*

THE HIPPOCRATIC COLLECTION

Early in the history of the Alexandrian medical school—probably not long after 300 B.C.—there began to circulate a group of medical works that has since become known as the *Hippocratic Collection.* The name of Hippocrates was already at that date held in high veneration, and into this collection was thrown everything that could, by any device, be passed off as of Hippocratic origin. The genuineness of some of these works was suspected from a very early date. Ancient scholars applied themselves to their critical study. Notable among these students was Galen (*q.v.*) who lived six hundred years after Hippocrates and wrote commentaries on a number of works of the *Collection.* But dubious in its origin as was the *Collection,* it had not remained intact even between the time when first put together and the time of Galen. On the contrary, during that interval it had suffered considerable alteration—both by accretion and loss—to say nothing of confusion and error due to the mistakes, dishonesty, haste and ignorance of booksellers, scribes and editors. Further, the deterioration continued after Galen. Our earliest manuscript of the *Collection* is of the ninth century A.D.; our earliest manuscript of a translation is of the seventh century, and is a Latin version of the obviously spurious *Dynamidia;* while the earliest documents of any part of the *Collection* are papyrus fragments, of the third or fourth century, of the no less spurious *Epistolae.* Thus the *Hippocratic Collection* provides an ideal battle ground for textual criticism and for the discussion of genuineness. The literature on it is vast. Here, we shall give only conclusions.

The works which make up the *Hippocratic Collection* are variously numbered and divided, and can be regarded, according to taste, as between about 70 and about 100. Where and when were they written? Of later works, some of the more recent, dating from the time of the Empire, were probably mostly written in Rome and may be as late as the third century A.D. The main interest of the *Collection* is, however, concentrated on the earlier works. Of these the very earliest were composed in the 5th century B.C. and came from the shores of Asia Minor, one or two possibly from Sicily. In Asia Minor two schools of Medicine were early organized. The older was associated with the peninsula of Cnidus. The younger has always been associated with the opposite island of Cos, though it would be safer to link it with Coan physicians rather than with Coan soil, for reasons which we have given above. It is with the Coan school that the name of Hippocrates will be for ever linked. The Coan and the Cnidan schools represent divergent views and their differences cleft the medical world of the fifth and fourth centuries B.C. There is indeed evidence of further sub-division of medical opinion even at this early period. Later medical writers, in the sect-ridden days of the Empire, looked back to the Hippocratic time as to a golden age which basked in the uninterrupted sunshine of a pure and undisputed doctrine. Modern historians have not been slow to follow and to see in the Hippocratic writers clear-eyed observers, unmoved in their pursuit of truth by any preconceived view of its nature, uncorrupted by the jargon of the schools, naked heroes of science facing the world as it is and not as it may be thought to be. A very small body of works there is to which such a conception is particularly applicable—and perhaps these only because we do not possess them in the complete form. For most of them the cold and piteous light of investigation dispels the radiant vision. The men of that time were well-nigh as riven into sects and driven by doctrines as those of a later age.

But Hippocrates was, by all tradition, above and beyond the noisy warfare of the Schools. He it was, as Celsus (1st century A.D.) tells us, "who first separated medicine from philosophy." That is, in the language of the present day, he observed and inferred without allowing his judgment to be biased by preconceived ideas. Now there is a small group of treatises in the *Collection* of which this can fairly be said. Is this the residuum of works of

which perhaps the famous tracts known as the first and third books of the *Epidemics* are the foremost examples by the "father of medicine" himself? We may say so, if we will, but in doing so we have no test of authenticity save excellence. If we examine even these "authentic" works closely we shall find them by no means as free from preconceived ideas as many have considered. Scientific thinkers of the fifth century B.C. were indeed much like those of the twentieth century A.D., for all their work was conditioned and controlled by their past.

Among the more striking literary characteristics of the *Hippocratic Collection* is the so-called "aphoristic style," in which conclusions of wide general import are compressed into very short and easily remembered sentences. Several of the works of the Collection adopt this method, the best known being the admirable treatise which bears the title *Aphorisms* and opens with the most famous sentence of the whole Collection, "Art is long and Life is short." As a rule common style is an argument for common authorship, but in the case of aphorisms imitation is so easy that confidence as to authorship is almost impossible. (*See* MEDICINE, HISTORY OF.) Nearly every treatise in the *Collection* requires separate and individual discussion from the point of view of style, authorship, philosophical associations, language, sources, doctrines and interpretation. The works of the *Collection* can no more be treated in common than can the books of the Old Testament, which cover a comparable area of time. We may, however, make one general negative statement. The works of the *Collection* contain nothing of superstition They are sometimes wearisomely sophistic; they are frequently ludicrously wrong; they often advance absurd hypotheses; they are not seldom obscure. But the attitude of their authors to the supernatural is the same throughout and none swerves in his loyalty to the idea of natural law. There is a work on *The Sacred Disease* (*i.e.* Epilepsy) which puts the point for us:

"As for this disease called divine, surely it too has its nature and causes whence it originates, just like other diseases, and is curable by means comparable to their cure. It arises—like other diseases—from things which enter and quit the body, such as cold, the sun, and the winds, things which are ever changing and never at rest. Such things are divine or not—as you will, for the distinction matters not—and there is no need to make such division anywhere in nature, for all are alike divine or all are alike human. All have their antecedent causes which can be found by those who seek them." (Slightly paraphrased.)

The Sacred Disease was written about 400 B.C. and another work in the *Collection*, the *Airs, Waters and Places* is perhaps by the same author, but there are not many instances in the collection in which several works can be safely ascribed to one hand.

A famous section of the *Collection* is the so-called *Hippocratic Oath*, which sets the tone of that ethical character which characterises nearly all—though not quite all—of the writings which bear the name of Hippocrates. We regard the *Oath* in its present form as of the third century A.D. It is perhaps the latest work in the *Collection*. By its very lateness, however, it illustrates the width and depth of the ethical influences exerted by this great Collection. (For the *Hippocratic Oath see* MEDICINE, HISTORY OF).

There are several surgical treatises in the *Collection*, of which the earliest, *On Wounds of the Head*, dates from the early part of the fourth century B.C. It has affinities with certain Egyptian papyri and part of it may be of Egyptian origin. It awakens in us a peculiarly vivid interest when we find it describing the operation of trephining almost as practised to-day. Nor can our attention fail to be arrested by the startling modernness of the little lecture notebook *Concerning Things in the Surgery*, when we read such a category as this:—

"Operative requisites in the surgery; the patient, the operator, assistants, instruments, the light, where and how placed; the patient's person and apparatus. The operator, whether seated or standing, should be placed conveniently to the part being operated upon, and to the light. Each of the two kinds of light, ordinary and artificial, may be used in two ways, direct or oblique."

Or again, such details as:—

"The nails (of the operator) neither to exceed nor come short of the finger tips. Practice using the finger ends. Practice all the operations with each hand and with both together, your object being to attain ability, grace, speed, painlessness, elegance, and readiness."

"Let those who look after the patient present the part for operation as you want it, and hold fast the rest of the body so as to be all steady, keeping silence and obeying their superior.

Surely we are here in an up-to-date operating theatre, and the Greeks are the most modern of peoples.

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(C. SI.)

HIPPOCRATIC OATH, still taken at some universities by graduates in medicine, whereby they undertake not to divulge anything which comes to them in a professional capacity which it is not proper for them to divulge. (*See* PRIVILEGE.)

HIPPOCRENE (Gr ἡ Ἵππου κρήνη), "the fountain of the horse," the spring on Mt. Helicon, in Boeotia, which like the other spring there, Aganippe, was sacred to the Muses and Apollo, and hence taken as the source of poetic inspiration. The spring, surrounded by an ancient wall, is now known as *Kryopegadi* or the cold spring. According to the legend, it was produced by the stamping of the hoof of Bellerophon's horse Pegasus. The same story accounts for the Hippocrene in Troezen and the spring Peirene at Corinth.

HIPPODAMUS, of Miletus, a Greek architect of the 5th century B.C. who introduced a system of town planning, in series of broad straight streets, cutting each other at right angles. He planned the harbour-town Peiraeeus at Athens for Pericles about 446 B.C. and was architect to the Athenian colony which founded Thurii in Italy about 445 B.C. He superintended the building of the new city of Rhodes in 408 B.C. His plan consisted of series of broad, straight streets, cutting one another at right angles.

See C. F. Hermann, *De Hippodamo Milesio* (Marburg, 1841).

HIPPODROME, a Greek building for horse and chariot races, corresponding to the Roman *circus*. It was usually placed on a hill slope, so that the excavated material from one side could serve for an embankment for the other. One end was semi-circular and the other square. The seats ran continuously around the semi-circle and the two long sides, in rising tiers, and down the centre was a division. Owing to the fact that as many as ten chariots raced at a time, a width of about 400 ft. was necessary. The usual length varied from 600 to 700 feet. Many remains of the hippodrome at Constantinople exist, and are now (1928) being carefully investigated. In this case much of the area was supported on tiers of great vaults instead of the more usual embankment. On the centre division, between an Egyptian obelisk and a memorial column, was placed the famous bronze serpent tripod from the oracle at Delphi. These three monuments still exist in place. Begun by Severus in 203, and completed by Con-

stantine in 330, it was both the largest and the most splendid hippodrome of the ancient world Among its decorations were the four Greek bronze horses that now stand on the façade of St. Mark's at Venice.

HIPPOLYTUS (d. *c.* 230), a writer of the early Church, whose personality was enveloped in mystery before the discovery in 1851 of the *Philosophumena* (*see* below). Assuming the authenticity of this work, and correlating it with tradition, we get a tolerably clear picture. Hippolytus was born in the second half of the 2nd century, probably in Rome. He was learned and eloquent and under Bishop Zephyrinus (199–217) was presbyter of the church at Rome. He accused Zephyrinus's successor, Calixtus I. (*q.v.*), of favouring the Christological heresies of the Monarchians, and of subverting discipline by receiving back into the Church those guilty of gross offences. The result was a schism, and for some ten years Hippolytus stood as bishop at the head of a separate church. During the persecution under Maximinus the Thracian, Hippolytus and Pontius, who was then bishop, were transported in 235 to Sardinia, where it would seem that both of them died, the former having been reconciled with the Church.

Hippolytus's voluminous writings, some of which are listed in Eusebius, *Hist. Eccl.* vi. and in Jerome, *De Viris Ill.* lxi., exist chiefly in fragments. They embrace the spheres of exegesis, apologetics and polemic, chronography and ecclesiastical law. Of his exegetical works the best preserved are the *Commentary on the Prophet Daniel* and the *Commentary on the Song of Songs*, both distinguished by sobriety and sense of proportion. Of his polemical treatises the chief is the *Refutation of all Heresies*, or *Philosophumena*. Bk. i. was for a long time printed among the works of Origen; bks iv.–x. were found in 1842 by the Greek Minoides Mynas, without the name of the author, in a ms. at Mount Athos, but it is now accepted as a work of Hippolytus; books ii. and iii. are lost. The work has been much overrated, the exposition of the Gnostic system in particular being untrustworthy. Of the dogmatic works, that on *Christ and Antichrist* which survives in a complete state, gives a vivid account of the events of the beginning of the 3rd century. The chronicle of the world, from the creation to 234, formed a basis for many chronographical works both in the East and West. In the great compilations of ecclesiastical law which arose in the East since the 4th century (*see* APOSTOLIC CONSTITUTIONS) much material was taken from Hippolytus.

BIBLIOGRAPHY.—The edition by J. A. Fabricius (2 vols., Hamburg, 1716–18, reprinted in Gallandi, *Bibliotheca veterum patrum* (vol. ii., 1766), and Migne, *patrol. graeca*, x.) is out of date. The *Commentaries on Daniel* and on the *Song of Songs*, the treatise on *Antichrist*, and the *Lesser Exegetical* and *Homiletic Works* were edited by N. Bonwetsch and H. Achelis in 1897. The *Chronicle* has been published by A. Bauer (Leipzig, 1905) and the *Refutation* by Miller (Oxford, 1851), Duncker and Schneidewin (Göttingen, 1859) and Cruice (Paris, 1860). The *Philosophumena* has been translated by F. Legge (1921).

See Bunsen, *Hippolytus and his Age* (1852, 2nd ed., 1854); Döllinger, *Hippolytus und Kallistus* (Regensb. 1853; Eng. transl., 1876); G. Ficker, *Studien zur Hippolytfrage* (Leipzig, 1893); H. Achelis, *Hippolytstudien* (Leipzig, 1897); K. J. Neumann, *Hippolytus von Rom in seiner Stellung zu Staat und Welt*, part i. (Leipzig, 1902); Adhémar d'Alès, *La Théologie de Saint Hippolyte* (1906).

HIPPOLYTUS, in Greek legend, son of Theseus and Hippolyte, queen of the Amazons (or of her sister Antiope), a famous hunter and charioteer and favourite of Artemis. His stepmother Phaedra became enamoured of him, but, finding her advances rejected, she hanged herself, leaving a letter in which she accused Hippolytus of an attempt upon her virtue. Theseus, to whom his father Poseidon had given three wishes, then prayed for the destruction of Hippolytus and banished him. While Hippolytus was driving along the shore at Troezen (the scene of the *Hippolytus* of Euripides), a sea-monster sent by Poseidon frightened his horses; Hippolytus was thrown out of the chariot, and was dragged along, entangled in the reins, until he died. According to a tradition of Epidaurus, Asclepius restored him to life at the request of Artemis; later, he was represented as having been removed to Aricia (*see* VIRBIUS). At Troezen he had a cult, and girls used to dedicate a lock of hair to him before marriage (Eurip. Hipp. 1423; Paus. ii., 32, 1); a local cult-legend said he was not dead, but turned into the constellation Auriga (Paus. *ibid.*). Well-known classical parallels to the main theme are Bellerophon and Antea (or Stheneboea) and Peleus and Astydamia. The story was the subject of two plays by Euripides (the later of which is extant), and a tragedy by Seneca. Trace of it has survived in the legendary death of the apocryphal martyr Hippolytus, a Roman officer who was torn to pieces by wild horses as a convert to Christianity.

See Roscher's *Lexikon*, art. HIPPOLYTUS; L. R. Farnell, *Greek Hero-Cults* (1921).

HIPPOLYTUS, THE CANONS OF. This book stands at the head of a series of Church Orders, which contain instructions in regard to the choice and ordination of Christian ministers, and regulations for baptism, the Eucharist, fasts and other observances. We possess the *Canons of Hippolytus* only in an Arabic version, itself made from a Coptic version of the original Greek. It was only in 1870 that it was edited by Haneberg, who added a Latin translation, and so made it generally accessible. In 1900 a German translation was made by H. Riedel, based on fresh mss. These showed that the book, as hitherto edited, had been thrown into disorder by the displacement of two pages near the end; they also removed other difficulties upon which the theory of interpolation had been based

Contents of the Canons.—The book is attributed to "Hippolytus, the chief of the bishops of Rome," and is divided into thirty-eight canons, to which short headings are prefixed. This division is certainly not original, but it is convenient for purposes of reference. Canon 1 is prefatory; it contains a brief confession of faith in the Trinity, and especially in the Word, the Son of God; and it speaks of the expulsion of heretics from the Church. Canons 2–5 give regulations for the selection and ordination of bishops, presbyters and deacons. The bishop is chosen by the whole congregation: "one of the bishops and presbyters" is to lay hands upon him and say a prayer which follows (3): he is at once to proceed with "the offering," taking up the eucharistic service at the point where the *sursum corda* comes in. A presbyter (4) is to be ordained with the same prayer as a bishop, "with the exception of the word bishop"; but he is given no power of ordination (this appears to be inconsistent with c. 2) The duties of a deacon are described, and the prayer of his ordination follows (5). Canons 6–9 deal with various classes in the Church One who has suffered punishment for the faith (6) is to be counted a presbyter without ordination: "his confession is his ordination" Readers and sub-deacons (7) are given the Gospel, but are not ordained by laying-on of hands. A claim to ordination on the ground of gifts of healing (8) is to be admitted, if the facts are clear and the healing is from God. Widows are not ordained (9): "ordination is for men only." Canons 10–15 describe conditions for the admission of converts. Certain occupations are incompatible with Christian life: only under compulsion may a Christian be a soldier Canons 16–18 deal chiefly with regulations concerning women.

Canon 19 is a long one dealing with catechumens, preparation for baptism, administration of that sacrament, and of the eucharist for the newly baptized. The candidate is twice anointed: first, with the oil of exorcism, after he has said, with his face westward, "I renounce thee, O devil, and all thy following"; and, again, immediately after the baptism. As he stands in the water, he declares his faith in response to an interrogatory creed; and after each of the three clauses he is immersed. After the second anointing the bishop gives thanks "for that Thou hast made them worthy that they should be born again, and hast poured out Thy Holy Ghost upon them, so that they may belong, each one of them, to the body of the Church": he signs them with the cross on their foreheads, and kisses them. The eucharist then proceeds: "the bishop gives them of the body of Christ and says, This is the body of Christ, and they answer Amen": and similarly for the cup. Milk and honey are then given to them as being "born a second time as little children." A warning is added against eating anything before communicating. Canons 20–22 deal with fast-days, daily services in church, and the fast of the passover-week. Canon 23 seems as if it closed the series, speaking, as it does, of "our brethren the bishops" who in their cities have made

regulations "according to the commands of our fathers the apostles": "let none of our successors alter them; because it saith that the teaching is greater than the sea, and hath no end." We pass on, however, to regulations about the sick (24) who are to be visited by the bishop, "because it is a great thing for the sick that the high-priest should visit them (for the shadow of Peter healed the sick)."

Canons 25–27 deal again with prayers and church-services. The "seven hours" are specified, with reasons for their observance (25): attendance at sermons is urged (26), "for the Lord is in the place where his lordship is proclaimed" (comp. *Didachè* 4, part of the *Two Ways*). When there are no prayers in church, reading at home is enjoined (27): "let the sun each morning see the book upon thy knees" (comp. Ath. *Ad virg.*, § 12, "Let the sun when he ariseth see the book in thy hands"). Prayer must be preceded by the washing of the hands. "No believer must take food before communicating, especially on fast-days": only believers may communicate (28). The sacred elements must be guarded, "lest anything fall into the cup, and it be a sin unto death for the presbyters." No crumb must be dropped, "lest an evil spirit get possession of it." Canons 30–35 contain various rules, and specially deal with suppers for the poor (i.e., *agapae*) and memorial feasts. Then we have a prayer for the offering of first-fruits (36); a direction that ministers shall wear fair garments at "the mysteries" (37); and a command to watch during the night of the resurrection (38). The last canon hereupon passes into a general exhortation to right living, which forms a sixth part of the whole book. In Riedel's translation we read this for the first time as a connected whole. It falls into two parts, and describes, first, the true life of ordinary Christians, warning them against an empty profession, and laying down many precepts of morality; and then it addresses itself to the "ascete" who "wishes to belong to the rank of the angels," and who lives a life of solitude and poverty. He is encouraged by an exposition, on somewhat strange lines, of the temptations of our Lord, and is specially warned against spiritual pride and contempt of other men. The book closes with an appeal for love and mutual service, based on the parables in St. Matthew xxv.

Authenticity of Authorship.—The Puritan severity of the canons well accords with the temper of the writer to whom the Arabic title attributes them; and it is to be noted that the exhortation at the close contains a quotation from 2 Peter actually attributed to the apostle, and Hippolytus is perhaps the earliest author who can with certainty be said to have used this epistle. But the general style of Hippolytus, which is simple, straightforward and strong, is in marked contrast with that of the closing passage of the canons; moreover, his mind, as presented to us in his extant writings, appears to be a much larger one than that of the writer of these canons; it is as difficult to think of Hippolytus as it would be to think of Origen in such a connection. How, then, are we to account for the attribution? There is evidence to show that Hippolytus was highly reverenced throughout the East: his writings, which were in Greek, were known, but his history was entirely unknown. He was supposed to be "a pupil (γνώριμος) of apostles" (Palladius, 4th century), and the Arabic title calls him "chief of the bishops of Rome," *i.e.*, archbishop of Rome. A whole group of books on Church Orders bears the name of Clement of Rome; and the attribution of our canons to Hippolytus may be only an example of the same tendency.

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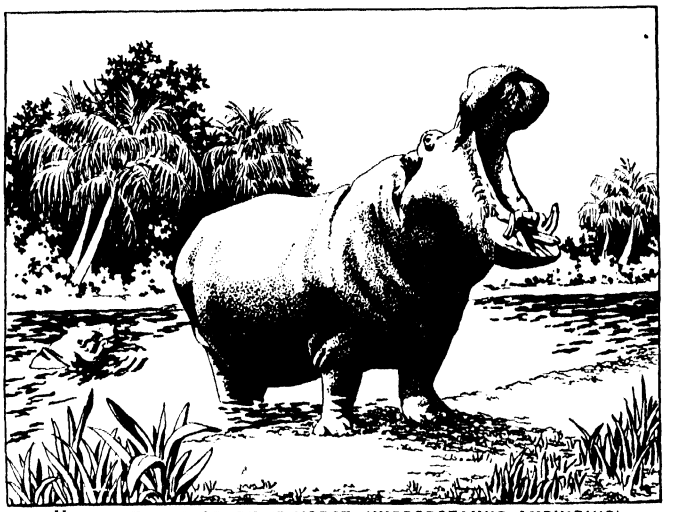
HIPPONAX, of Ephesus, Greek iambic poet. Expelled from Ephesus in 540 B.C. by the tyrant Athenagoras, he took refuge in Clazomenae, where he spent the rest of his life in poverty. He was caricatured by the Chian sculptors Bupalus and Athenis, upon whom he revenged himself by a series of satires. His coarseness, his rude vocabulary, and his numerous allusions to local matters prevented his becoming a favourite in Attica. He was considered the inventor of parody and of a peculiar metre, the *scazon* or *choliambus*, which substitutes a spondee for the final iambus of an iambic senarius.

Fragments in Bergk, *Poëtae lyrici Graeci; see* also B. J. Peltzer, *De parodica Graecorum poësi* (1855), containing an account of Hipponax and the fragments.

HIPPOPOTAMUS, the largest living non-ruminating even-toed mammal (*see* ARTIODACTYLA). The common hippopotamus (*H. amphibius*) inhabits the large rivers of Africa, though its range has now become much restricted. It is the type of the



HIPPOPOTAMUS OR RIVER-HORSE (HIPPOPOTAMUS AMPHIBIUS)
An inhabitant of Africa and one of the largest living mammals, it usually reaches a length of 14 ft., and weighs between 3 and 4 tons

family *Hippopotomidae*, whose nearest relatives are the pigs.

In form the hippopotamus is huge and unwieldy, reaching a length of 14ft., a height of 3ft.10in. at the shoulder, and a weight of at least 3 tons. The ears are small but flexible, the body thick, the legs short. The eyes and nostrils protrude so as to be out of water when the animal is floating; the gape is enormous and the upper lip thick and bulging. Both canines and incisors are of continuous growth and very large. The skin, which is 2in. thick in places, is almost destitute of hair. Hippopotami live in herds of 20 to 40 on the banks and in the beds of rivers, feeding mainly at night and on aquatic plants growing in the water, but they also come on shore to feed, frequently doing immense damage to crops. Of a mild and inoffensive disposition, the hippopotamus can exhibit great ferocity when wounded or defending its young; its immense strength and agility, despite its unwieldy bulk, render it a formidable antagonist. As among elephants, old bulls may become "rogues" and will attack all and sundry without provocation.

The only other living species is the pygmy hippopotamus (*H. liberiensis*) inhabiting the rivers of West Africa. In the Pleistocene epoch, a hippopotamus inseparable from *H. amphibius*, inhabited the greater part of Europe, while dwarf species were natives of Crete, Malta, and Sicily, India, Burma, and northern Africa. More recently, one species, *H. lemerlei*, lived in Madagascar.

HIPPURIC ACID, found in the urine of horses (whence the Gr. derivation) and other herbivorae. It is excreted when certain aromatic compounds, such as benzoic acid and toluene, are taken internally. It is one of the amino-acids, being benzoylaminoacetic acid, $C_6H_5CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, or benzoyl glycine. It crystallizes in rhombic prisms which are readily soluble in hot water, melt at 187° C and decompose at about 240° C. It is formed by heating benzoic anhydride with glycine, and by heating benzamide with monochloroacetic acid. It is readily hydrolysed by hot caustic alkalis to benzoic acid and glycine.

HIRA, capital of old Arabian kingdom of Lakhmid dynasty, 4 m. S.E. of modern Najaf in 'Iraq, founded 2nd century B.C. Practically subordinate to the Sasanian empire, this kingdom, comprising the Euphrates valley and upper part of the Persian gulf, constituted a buffer State towards Arabia. After the battle

of Qadisiya (637) and, the founding of Kufa by the conquering Arabs, Hira rapidly fell into decay, and its ruins do not suggest that it was ever of any architectural merit.

HIRADO, an island belonging to Japan, 19½ m. long and 6 m. wide, lying off the west coast of the province of Hizen, Kyushu, in 33° 15′ N. and 129° 25′ E. It is celebrated as the site of the original Dutch factory—often erroneously written Firando—and as the place where one of the finest blue-and-white porcelains of Japan (*Hiradoyaki*) was produced in the 17th and 18th centuries. The kilns are still active.

HIRE PURCHASE: *see* INSTALMENT SELLING.

HIRE-PURCHASE-AGREEMENT: *see* INSTALMENT PURCHASE; INSTALMENT SELLING.

HIRING, in law, a contract by which one man grants the use of a thing to another in return for a certain price. It corresponds to the *locatio-conductio* of Roman law. That contract was either a letting of a thing (*locatio-conductio rei*) or of labour (*locatio operarum*). The distinguishing feature of the contract was the price. In modern English law the term can scarcely be said to be used in a strictly technical sense. The contracts which the Roman law grouped together under the head of *locatio-conductio*—such as those of landlord and tenant, master and servant, etc.—are not in English law treated as cases of hiring but as independent varieties of contract, but hiring is generally applied to contracts in which the services of a man or the use of a thing are engaged for a short time.

Hiring Fairs or *Statute Fairs*, still held in Wales, and some parts of England, were formerly an annual fixture in every important country town. The men and maids seeking work stood in rows, the males together and the females together, while masters and mistresses walked down the lines and selected those who suited them. Originally these hiring-fairs were always held on Martinmas day (Nov. 11). Now they are held on different dates in different towns, usually in October or November. In Cumberland the men seeking work stood with straws in their mouths. In Lincolnshire the bargain between employer and employed was closed by the giving of the "fasten-penny," the earnest money, usually a shilling, which "fastened" the contract for a twelvemonth. Some few days after the statute fair it was customary to hold a second called a mop fair or runaway mop. "Mop" meant in Old English a tuft or tassel, and the fair was so called, it is suggested, in allusion to tufts or badges worn by those seeking employment. Thus the carter wore whipcord on his hat, the cowherd, a tuft of cow's hair, and so on.

See FAIRS; LABOUR LEGISLATION; MASTER AND SERVANT; WAKE.

HIROHITO (1901–), Emperor of Japan, was born on April 29, 1901, son of Emperor Taisho. While Crown Prince Hirohito visited Europe in 1921, and in that year the Emperor Taisho retired from the direction of public affairs on the ground of ill-health, leaving the government to Hirohito as prince regent. He married Princess Nogako on Jan. 26, 1924, and has one daughter (b. 1925). For the events of his regency, *see* JAPAN: *History*. He had thus been effectively the ruler of Japan for five years when he succeeded to the throne on Dec. 25, 1926. The new reign was officially designated the period of Showa (Light and Peace), and in the rescript issued by the new emperor on ascending the throne stress was laid on harmony at home and peace abroad.

HIROSAKI, a town of North Japan, 22 m. S.W. of Aomori by rail. Pop. *c.* 40,000. The fine isolated cone of Iwakisan, a mountain of pilgrimage, rises to the west. Hirosaki is noted for its distinctive green lacquer-ware.

HIROSHIGE (1797–1858), Japanese artist, was one of the principal members of that branch of the *Ukiyo-ye* or Popular School of Painting in Japan, a school which chiefly made colour-prints. His family name was Andō Tokitarō; that under which he is known having been, in accordance with Japanese practice, adopted by him in recognition of the fact that he was a pupil of Toyohiro. The earliest reference to him is in the account given by an inhabitant of the Lu-chu islands of a visit to Japan; where a sketch of a procession drawn with great skill by Hiroshige at the age of ten years only is mentioned as one of the remarkable sights seen. At the age of fifteen he applied unsuccessfully to be admitted to the studio of the elder Toyokuni, but was eventually received by Toyohiro. On the death of the latter in 1828, he began to practise on his own account, but finding small encouragement at Yedo (Tōkyō) he removed to Kiōto, where he published a set of landscapes. He soon returned to Yedo, where his work soon became popular, and was imitated by other artists. He died in that city on the 6th day of the 9th month of the year, Ansei 5th, at the age of sixty-two, and was buried at Asakusa. One of his pupils, Hironobu, received from him the name of Hiroshige II. and another, Ando Tokubei, that of Hiroshige III. All three were closely associated with the work signed with the name of the master. Hiroshige II. some time after the year 1863 fell into disgrace and was compelled to leave Yedo for Nagasaki, where he died; Hiroshige III. then called himself Hiroshige II. He died in 1896. The earlier prints by these artists, whose work can hardly be separated, are of extraordinary merit. They applied the process of colour block printing to the purposes of depicting landscape, with a breadth, skill and suitability of convention that has been equalled only by Hokusai in Japan, and by no European. Most of their subjects were derived from the neighbourhood of Yedo, or were scenes on the old high road—the Tokaidō—that ran from that city to Kiōto. The two elder of the name were competent painters, and pictures and drawings by them are occasionally to be met with.

See E. F. Strange, "Japanese Colour-prints" (*Victoria and Albert Museum Handbook*, 1904), and *Hiroshige* (1925). (E. F. S.)

HIROSHIMA, a city seaport and district of central Japan. Pop. (1925), 195,731. It is very beautifully situated on a small plain surrounded by hills, the bay being studded with islands. It is one of the most important commercial centres on the inland sea. The government has an area of about 3,000 sq.m., with a population of about 1,500,000. Hiroshima is famous all over Japan owing to its association with the neighbouring islet of Itaku-Shima, "Island of Light," which is dedicated to the goddess Bentin and regarded as one of the three wonders of Japan. The chief temple dates from the year 587.

HIRPINI, from an Oscan or Sabine stem *hirpo-*, "wolf." An inland Samnite tribe in the south of Italy, whose territory was bounded by that of the Lucani on the south, the Campani on the south-west, the Appuli (Apuli) and Frentani on the east and north-east. On the north we find them, politically speaking, identified with the Pentri and Caracēni, and with them constituting the Samnite alliance in the wars of the 4th century B.C. (*See* SAMNITES.) On the final defeat of the Samnites by Sulla in 83 B.C., they received the Roman franchise. Of their Oscan speech, besides the evidence of their place-names, only a few fragments survive.

See R. S. Conway, *The Italic Dialects* (1897), pp. 170 ff.; and for *hirpo-*, *ib.* p. 200.

HIRSAU (formerly *Hirschau*), a village of Germany, in Württemberg, on the Nagold-Pforzheim railway, 2 m. N. of Calw. Pop. 1,219. Hirsau has some small manufactures, but it owes its origin and historical interest to its former Benedictine monastery, *Monasterium Hirsaugiense*, at one period one of the most famous in Europe. Of its ruins only the chapel with the library hall are still in good preservation. It was founded about 830 by the Count of Calw, and its first occupants (838) were a colony of 15 monks from Fulda. Under the counts of Calw, it became an important seat of learning, but towards the end of the 10th century the pestilence, the rapacity of its patrons and the immorality of its inmates caused it to decay. After it had been in ruins for 60 years it was rebuilt in 1059, and under Abbot Wilhelm von Hirsau (1069–91), it more than regained its former splendour. By his *Constitutiones Hirsaugienses*, a new religious order, the Ordo Hirsaugiensis, was formed, the rule of which was afterwards adopted at Blaubeuren, Erfurt, Schaffhausen and many other abbeys. The friend and correspondent of Pope Gregory VII., and of Anselm of Canterbury, Abbot Wilhelm took active part in controversies, and also wrote *De musica et tonis*, as well as the *Philosophicarum et astronomicarum institutionum libri iii.* Hirsau declined about the end of the 12th century and, after

the Reformation it was secularized in 1558; in 1692 it was laid in ruins by the French. The *Chronicon Hirsaugiense*, or, as in the later edition it is called, *Annales Hirsaugienses* of Abbot Trithemius (Basel, 1559; St. Gall, 1690), though largely legendary, is an important source of information on the early history of Germany. The *Codex Hirsaugiensis* was edited by A. F. Gfrörer and printed at Stuttgart in 1843.

HIRSCH, MAURICE DE, Baron Hirsch auf Gereuth, in the baronage of Bavaria (1831–1896), German capitalist and philanthropist, was born at Munich on Dec. 9, 1831, the grandson of Baron Jakob von Hirsch, who founded the family fortune. He attended school at Brussels, but when 17 went into business. In 1855 he became associated with the banking house of Bischoffsheim & Goldschmidt, of Brussels, London and Paris. He amassed a fortune, which he increased by purchasing and working railway concessions in Austria, Turkey and the Balkans, and by speculations in sugar and copper. While living in splendour, he devoted much time to schemes for the relief of his persecuted Hebrew co-religionists, and took a deep interest in the educational work of the Alliance Israélite Universelle, on two occasions presenting the society with a million francs. For some years he regularly paid the deficits of the Alliance, amounting to several thousand pounds a year. In 1889 he capitalized his donations and presented the society with securities producing an annual income of £16,000.

On the 40th anniversary of Emperor Francis Joseph's accession to the Austrian throne Hirsch gave £500,000 for the establishment of schools in Galicia and the Bukowina. His greatest charitable enterprise was in connection with the persecution of the Jews in Russia (*see* ANTI-SEMITISM). He gave £10,000 for the repatriation of the refugees in 1882 and offered the Russian Government £2,000,000 for the endowment of a system of secular education in the Jewish pale of settlement. The Russian Government, while willing to accept, declined to allow any foreigner to be concerned in its administration. Thereupon Baron de Hirsch devoted the money to a colonization scheme which should enable persecuted Jews to establish themselves in agricultural colonies outside Russia. He founded the Jewish Colonization Association as an English society, with a capital of £2,000,000, and in 1892 presented to it a further £7,000,000 On the death of his wife in 1899 the capital was increased to £11,000,000, of which £1,250,000 went to the Treasury in death duties This fund, which is probably the greatest charitable trust in the world, is now managed by delegates of Jewish societies, chiefly the Anglo-Jewish Association of London and the Alliance Israélite Universelle of Paris, among whom the shares in the association have been divided The association, which is prohibited from working for profit, possesses large colonies in South America, Canada and Asia Minor, and deals with the whole problem of Jewish persecution, including emigration and distributing agencies, technical schools, co-operative factories, savings and loan banks and model dwellings in the congested Russian jewries.

Baron de Hirsch also founded in 1891 a trust in the United States for the benefit of Jewish immigrants, which he endowed with £493,000. His minor charities were on a princely scale. While in London he distributed over £100,000 among the local hospitals. In this manner he disposed of the whole gross proceeds derived from his successes on the English turf. He raced, as he said himself, "for the London hospitals," and in 1892, when his filly, La Flêche, won the Oaks, St. Leger and One Thousand Guineas, his donations from this source amounted to £40,000. Baron de Hirsch married Clara, daughter of Senator Bischoffsheim of Brussels (b. 1833), by whom he had a son and daughter, both of whom predeceased him. He died at Ogyalla, near Komorn, in Hungary, April 21, 1896.

For details of Baron de Hirsch's chief charities *see* the annual reports of the Alliance Israélite Universelle and of the "Administration Centrale" of the Jewish Colonization Association.

HIRSCH, SAMSON RAPHAEL (1808–1888), Jewish theologian, was born in Hamburg on June 20, 1808, and died at Frankfort-on-the-Main on Dec. 31, 1888. He studied at Mannheim and at Bonn university, and was chief rabbi of Oldenburg from 1830–41, when he was transferred to Aurich and Osnabrück. In 1846 he was called to Moravia, but five years later, became rabbi of a reformed section of Jews at Frankfort-on-the-Main. Hirsch opposed the reform tendency of Geiger (*q.v.*), and presented Jewish orthodoxy in a new light. His philosophical conception of tradition, associated as it was with conservatism in ritual practice, created what is often known as the Frankfort "Neo-Orthodoxy." His famous *Nineteen Letters* (1836, Eng trs. 1899) was followed by *Horeb,* and commentaries on the Pentateuch and Psalms. Three volumes of his essays were published (1902–8).

For his philosophy *see* S. A. Hirsch, *A Book of Essays* (1905).

HIRSCHBERG, town in the Prussian province of Silesia, at the confluence of the Bober and Zacken, 1,120 ft above the sea-level, 48 m. S.E of Görlitz Pop. (1925) 28,619 Hirschberg existed in the 11th century, and obtained town rights in 1108 from Duke Boleslaus of Poland. It withstood a siege by the Hussites in 1427, and an attack of the imperial troops in 1640 The foundation of its prosperity was laid in the 16th century by the introduction of the manufacture of linen and veils. It possesses an Evangelical church, the church of the Holy Cross, one of the six *Gnaden Kirchen* for the Silesian Protestants stipulated for in the agreement at Altranstädt between Charles XII. of Sweden and the emperor Joseph I in 1707, and a Roman Catholic church, of the 14th century. It cards and spins wool, and makes linen and cotton fabrics, yarn, artificial flowers, paper, cement, porcelain, machinery, gloves, cellulose and cider. There is also a trade in wine and leather.

Hirschberg is also the name of a town of Thuringia on the Saale with manufactures of leather and knives Pop 2,800

HIRSON, a town of northern France in the department of Aisne, 35 m. by rail N E of Laon, on the Oise. Pop (1926) 10,858. It occupies an important strategic position near the intersection of several railway lines, and near the Belgian frontier. For its defence there are a permanent fort and two batteries, near the railway junction. The town carries on the manufacture of glass bottles, tiles, iron and tin goods

HIRTIUS, AULUS (*c.* 90–43 B.C.), Roman historian and statesman He was with Julius Caesar as legate in Gaul, but after the civil war broke out in 49 he seems to have remained in Rome to protect Caesar's interests He was also a personal friend of Cicero He was nominated with C Vibius Pansa by Caesar for the consulship of 43; and after the dictator's assassination in March 44, he and his colleague supported the senatorial party against M Antonius, with whom Hirtius had at first sided. The consuls set out for Mutina, where Antonius was besieging Decimus Brutus On April 15 Pansa was attacked by Antonius at Forum Gallorum, about 8m. from Mutina, and killed. Hirtius, however, compelled Antonius to retire on Mutina, where another battle took place on April 25 (or 27) in which Hirtius was slain. Of the continuations of Caesar's *Commentaries*—the eighth book of the Gallic war, the history of the Alexandrian, African and Spanish wars—the first is generally allowed to be by Hirtius; the Alexandrian war is perhaps by him (or Oppius); the last two are supposed to have been written at his request, by persons who had taken part in the events described, with a view to subsequent revision and incorporation in his proposed work on military commanders. The language of Hirtius is good, but his style is monotonous and lacks vigour.

Hirtius and the other continuators of Caesar are discussed in M. Schanz, *Geschichte der romischen Literatur,* i; also R. Schneider, *Bellum Africanum* (1905). For the history of the period *see* ANTONIUS; Cicero's *Letters* (ed. Tyrrell and Purser); G. Boissier, *Cicero and his Friends* (Eng. trans., 1897).

HIRUDINEA, a class of the Annelida (*q.v.*), comprising the leeches (*q.v.*).

HIRUNDINIDAE: *see* SWALLOW, MARTIN.

HISHÂM IBN AL-KALBÎ (Abū-l Mundhir Hishām ibn Maḥommed ibn us-Sā'ib ul-Kalb) (d. *c.* 819), Arabic historian, was born in Kufa but spent much of his life in Baghdad. Like his father, he collected information about the genealogies and history of the ancient Arabs. According to the *Fihrist* (*see* NADĪM) he wrote 140 works, most of which are lost. His account of the genealogies of the Arabs is continually quoted in the *Kitāb ul-Aghāni.*

Large extracts from another of his works, the *Kitāb ul-Asnām*, are contained in the *Khizānat ul-Adab* (iii. 242–246) and in the geography of Yāqūt (*q.v.*). These latter have been translated by J. Wellhausen in *Reste des arabischen Heidentums* (2nd ed., 1897). (G. W. T.; X.)

HISPELLUM (mod. Spello, *q.v.*), an ancient town of Umbria, Italy, 3 m. N. of Fulginiae, on the road between it and Perusia, 1,030 ft. above sea-level. Augustus founded a colony there (*Colonia Iulia Hispellum*) and extended its territory to the springs of the Clitumnus. It received the name of Flavia Constans by a rescript of the emperor Constantine, a copy of which on a marble tablet is still preserved at Spello. The gate by which the town is entered is ancient and has three portrait statues above it; a ruined amphitheatre and two other gates and a part of the city wall, built of rectangular blocks of local limestone, may still be seen; one of these gates, the Porta Venere, has two dodecagonal towers resembling those of the ancient Augusta Taurinorum (Turin) and is probably, like them, of the Augustan period.

(T. A.)

HISSAR. (1) A town in the Tajik A.S.S.R. of Asiatic Russia in lat. 38° 30′ N., long. 68° 39′ E., at a strategic point at the head of the defile carved out by the Kafirnigan river, a tributary of the Amu-Darya. It is the ancient capital of a once independent region where principalities rose and fell, finally incorporated with the former emirate of Bukhara. The town was at one time famous for its damascene swords and silk goods. Before the revolution it was the winter residence of the Beg of Hissar; in summer fever, malaria and mosquitoes drive the inhabitants to the hills. The moist and oppressive heat leads to an abundance of reeds, and Hissar at present is little more than a collection of reed thatched huts. (2) The Hissar Mountains 6,500 to 9,800 ft. also in the Tajik A.S.S.R. form the snow-capped southern arm of the bifurcation in long. 67° 45′ E. of the Alai Range, a western extension of the Tian-Shan. The Turkistan Range forms its northern arm, and a long spur, the Zarafshan Range branches off west of the Pakshif Pass, from which point the Hissar Range turns off in a slightly south-west direction, with two deep curves on its northern slopes, and numerous spurs thrusting into the plain on the south. The valleys here are well wooded on their lower slopes, with clumps of poplar, ash, birch, willow, maple, juniper, pear, hawthorn and walnut interspersed with currant bushes and shrubs. From these southern slopes the Surkhan and Kafirnigan flow into the Amu-Darya. In the narrow parallel valley between the Turkistan Range and the Zarafshan Range the glacier-fed Zarafshan river flows westward, while between the Zarafshan Range and the Hissar Range, its tributary, the Yagnob, flows parallel to it.

See W. R. Rickmers, *The Duab of Turkestan*, with bibliography (1913).

HISSAR, a town and district of British India, in the Umbella division of the Punjab. The town is situated on the Western Jumna canal, 102 m. W.N.W. of Delhi. Pop. (1921) 21,415. It was founded in 1356 by the emperor Feroz Shah, who constructed a canal to supply it with water; but this fell into decay during the 18th century, owing to the constant inroads of marauders. Hissar was almost completely depopulated during the famine of 1783, but was afterwards occupied by the famous Irish adventurer George Thomas, who built a fort and collected inhabitants. It is now chiefly known for its cattle-farm supported by the Government.

The District comprises an area of 5,213 sq m. It forms the western border district of the great Bikanir desert, and consists for the most part of sandy plains dotted with shrub and brushwood, and broken by undulations towards the south, which rise into hills of rock like islands out of a sea of sand. The Ghaggar is its only river, and its supply is uncertain. The Western Jumna canal crosses the district from east to west, irrigating many villages. Hissar produces a breed of large milk-white oxen, which are in great request. Before recent extensions of irrigation the district was often subject to famine. Its population in 1921 was 816,810. The climate is very dry, hot westerly winds blowing from the middle of March till July. Cotton weaving, ginning and pressing are carried on. The chief trading centres are Bhiwani, Hansi, Hissar and Sirsa.

Early in the mutiny of 1857 Hissar was wholly lost for a time to British rule, and all Europeans were either murdered or compelled to fly. The Bhattis rose under their hereditary chiefs, and the majority of the Mahommedan population followed their example. Before Delhi had been recovered, however, the rebels were utterly routed.

HISTAMINE: *see* Anaphylaxis.

HISTIAEUS (d. 494 B.C.), tyrant of Miletus under the Persian king Darius, son of Hystaspes. According to Herodotus he rendered service to Darius while he was in Scythia by persuading his fellow-despots not to destroy the bridge over the Danube by which the Persians must return. In reward for this he was given some rich territory near Amphipolis. Darius became alarmed at his influence in Ionia and invited him to Susa, whence he would not let him return. Aristagoras, his son-in-law, meanwhile ruled Miletus in his place. Finding his position in danger, Aristagoras meditated revolt and was finally induced to attempt to raise Ionia against Persia, according to Herodotus, by a message tattooed on the head of a slave. The revolt assumed a formidable character and Histiaeus persuaded Darius that he alone could quell it. He was allowed to leave Susa, but on his arrival at the coast found himself suspected by the satrap, and was driven to establish himself (Herodotus says as a pirate) at Byzantium. Eventually he was captured by the Persian Harpagus and crucified by Artaphernes at Sardis in 494 B.C. His head was embalmed and sent to Darius, who gave it honourable burial.

HISTOLOGY, the science or study of the tissues, is that branch of biology which deals with the appearance and nature of the structural elements of living organisms, whether animal or vegetable. The term was introduced by A. F. J. K. Mayer in 1819; when used alone, it is understood to refer to animal tissues, otherwise the term "vegetable histology" is usually employed. As such study is largely with the microscope, histology has come in the English-speaking countries to be almost synonymous with "microscopic anatomy." In Germany, Holland and other countries, however, emphasis is still laid on the nature of the tissue under consideration (including origin, development and characteristics), so that textbooks are commonly entitled: "Textbook of Histology and Microscopic Anatomy." Thus in the microscopic study of an organ such as the lung, the form, position, etc., of alveoli, vestibules, capillaries and so on is strictly speaking a matter of microscopic anatomy, whereas consideration of the component tissue—epithelium, endothelium, collagen, muscle fibres and so on—is a matter of histology. As the function of the various tissues may properly be considered under the wider use of the term histology, its study in some medical schools is more closely linked with physiology than with anatomy.

History.—As the history of the subject will be taken up under other headings, it will not be discussed here (*see* Hooke; Grew; Swammerdam; Leeuwenhoek; Malpighi; Bichat; Schleiden and Schwann; Virchow).

Histological Methods.—The ideal of histological technique should be to prepare tissues with a minimum deviation from the condition in the living state and yet with a differentiation permitting a maximum recognition and study of the various component elements. Needless to say neither of these desiderata has yet been attained—new methods are frequently being invented and there is still widespread difference of opinion as to the best methods to be used in attaining a desired purpose.

Fresh Material.—Preparations may be scraped or teased (with two mounted needles) either dry on a slide, or in an indifferent fluid, such as physiological salt solution. Though not in much demand today, this method is useful, with the addition of caustic potash, for, *e.g.*, the demonstration of fungi. Maceration with appropriate fluids will in rare cases give the best demonstration of the structures being studied, as in the scroll-like structure of heart muscles or the vascular supply of an organ. Very thin sections of fresh tissues, formerly done with a hand razor or crude instrument, can be prepared with modern instruments on frozen tissue with almost the same accuracy and perfection as with hardened embedded material. With the greater speed avail-

able, this method is therefore considered by some to be preferable to the use of fixed tissues in pathology, both because quicker diagnosis of the diseased tissue is possible and also because less distortion has occurred. In skilful hands, such sections can be cut, stained and ready for examination within a very few minutes, though in some pathological laboratories preliminary partial fixation in heated formalin for a few hours is considered preferable. In some surgical clinics this method is employed while the operation is still in progress as a routine in doubtful cases of malignant disease; in others it is felt that tissues, doubtful to the surgeon on gross examination, deserve the more thorough examination that fixation permits.

Fixed Tissues.—For proper examination with the modern microscope (magnifying up to 1,500 diameters) tissues must be cut so thin that after appropriate staining they can be accurately examined by transmitted light and without the confusion of several superposed layers of cells. The vast majority of histological materials are prepared for microscopic examination by preliminary "fixation," hardening, sectioning, staining and mounting, processes which altogether require from 2 to 10 days, depending on which of the innumerable methods is used. The purpose of the fixing fluid (formalin, Zenker's, Orth's, Bouin's, Müller's, etc., etc.) is to penetrate and kill the tissues quickly, so that the various tissue elements, and especially the cell nuclei, are preserved as lifelike and undegenerated as possible. If, for instance, the natural process of "mitosis" (important in tumour diagnosis) may be completed in twenty minutes, the need for quick fixation becomes at once apparent.

As hardening fluids, formalin and alcohol are preferred and both can be subsequently used indefinitely as preservatives, though, especially with the latter, distortion by shrinkage occurs.

To get sufficiently even and thin (*e.g.*, one thousandth of a millimeter) sections with the microtome (introduced by Purkinje and His), the tissue must by gradual transitions be imbedded in paraffin wax or celloidin, the former having the advantage that "ribbons" of serial sections can be more easily obtained. The paraffin sections, fastened with egg albumin to glass slides and rid of their impregnated paraffin, may be stained and counterstained in the greatest variety of ways, depending on the microchemical result to be obtained. (*See* EHRLICH.) Then after further transitions through alcoholic and oily fluids, the preparations are permanently mounted beneath a coverslip in a reagent such as balsam or damar, which harden with a refraction index similar to that of the microscope lenses, and thus minimize distortion. The celloidin technique, used especially in the examination of the nervous system, is similar and simpler yet more time-consuming.

Smears or Spreads.—The cellular contents of the blood and various body fluids may be spread in thin films, and like sections of body tissues, be examined either fresh, stained or unstained, or after fixation with a great variety of stains, designed to bring out diverse properties or pathological changes. (*See* hematological treatises such as Ferrata's "Emopatie" or any textbook of clinical microscopy or pathology.)

Vital Stains.—In recent years, methods of intra-, supra- and post-vital staining have developed a considerable technique for the study of living cells and tissues. Here dyes are used which enter but do not kill the cell. They usually select certain parts of the cell (nuclei, granules, vacuoles, mitochondria, etc.) and the cell only becomes diffusely stained after it has died. Such dyes may be injected in the living organism and the cells which have selected the stain studied, or may be applied to cells withdrawn from the body but still alive. Such procedures are comparatively free from the objection that death of the tissue may introduce artefacts in the form of the cell or tissue and also have the advantage of permitting the study of the differentiated components under varying experimental living conditions. It must be recognized, however, that even such stains are toxic to a greater or less degree, so that the cells being studied are to a corresponding degree abnormal.

Tissue Cultures.—The cell being the important unit of animal tissue, methods are constantly being sought by histologists to study it under relatively normal conditions. The discovery by Ross Harrison in 1907 that nerve cells would survive, function and reproduce in suitable media outside the body ("tissue culture" or "tissue growth in vitro") has been applied to practically every cell in the body. It has proved to be of such wide application that a special journal has for several years been devoted to the subject. By this method Carrel has kept fibroblasts from mice alive and healthy for over 15 years, far beyond the natural term of life of the animal, suggesting the potential immortality of animal tissue. Though this method can subject cells to microscopic examination while still alive, they exist under conditions that are far from normal. Carrel's rather complicated technique reduces this disadvantage to a minimum.

Examination of Living Tissues Under Normal Conditions.—The classic studies of Cohnheim of the phenomena of inflammation in the living mesentery or tongue of the frog at once come to mind; but greatly improved methods have recently become available. The Clarks' method of studying the living tadpole's tail permits microscopic examinations, indefinitely repeated, over weeks, whereby normal growth or reaction to various tests or injuries can be studied in a way hitherto impossible. Repeated examination of the same living cell or vessel *ad libitum* without extraneous damage is bound to furnish information of fundamental value. Very recently Sandison has applied the same principle to a window inserted in a rabbit's ear, so that mammalian tissue is now also subject to examination under these favorable conditions, even with the oil immersion lens.

The Tissues.—Tissues are composed of *cells* (*see* CYTOLOGY) and *intercellular substances*, the latter in most cases formed from the cells and aiding in their support. In epithelial tissues there is a meagre "cement substance" the origin and nature of which is but poorly understood. In connective tissue, the intercellular substances (collagenous fibres, elastic fibres and reticulum) constitute the bulk of the material and the same is true of the cartilage matrix and the calcareous substance of bone. Intercellular elements exist in the three types of muscle but much remains to be learned of their status. In the nervous system, the glia fibres of the supporting neuroglia bear the same relation to the glia cells as the fibres of connective tissue to their parent cells.

The elementary tissues of the body may be more or less arbitrarily subdivided into: 1, epithelial (of various types and including such modifications as hair, nails, tooth enamel, glands, etc.); 2, nervous tissue; 3, connective tissue (including fibrous and elastic tissue, fat tendon, bone, cartilage, dentine); 4, muscular tissue (voluntary, involuntary and cardiac). The vascular system (including lymphoid tissue) is sometimes considered an elementary tissue as a matter of convenience, though, more strictly speaking, it is a combination of elements of the other tissues mentioned. The blood is also sometimes spoken of as a tissue, though, more strictly speaking, its cellular elements are mobile, functioning cast-offs from various fixed sources.

These elementary tissues are derived from the three primary blastodermic layers of the embryo (with trifling exceptions) as follows: 1 from ectoderm and entoderm; 2 from ectoderm; and 3 and 4 from the mesoderm.

Epithelial tissue serves chiefly as a protective covering and for secretion and excretion. According to shape, epithelial cells are called: flat or squamous (covering skin, adjacent mucous membranes, alveoli of the lungs, some kidney tubules, etc.); or columnar (lining the respiratory and digestive tract, the ducts of glands, uterus and oviducts, forming the secreting cells of glands); pyramidal, etc. They may occur in single layers or stratified and various modified forms are found, such as "ciliated" (uterus, bronchi, etc.), "goblet" (upper respiratory tract, stomach, colon), "transitional" (parts of urinary system) and greatly modified for special uses (as in the retina, ear, taste buds). The single-layered flat cells lining the vascular system and the large enclosed body spaces (pleura, etc.) are called endothelial cells (or endothelial and mesothelial respectively).

Connective tissue is found in such forms as the embryonal jelly of the umbilical cord, mucous, reticular, loose fibro-elastic or areolar, dense fibrous, elastic tissue, cartilage and bone. (For details, *see* appropriate sections.) It contains a variety of cells

such as fibroblasts, lymphocytes, plasma cells, macrophages (clasmatocytes), giant cells, eosinophiles, mast cells, etc.

Muscle tissue (*i.e.*, a form of protoplasm in which the property of contractility predominates) is of three main types: 1. smooth or involuntary; 2. striated or voluntary; 3. cardiac. Some striped muscle, such as oesophagus and diaphragm, is only partly voluntary. Smooth muscle, consisting of elongated pointed cells with central oval nuclei, mitochondria, granules, etc., is found in the following systems; alimentary, respiratory, genito-urinary, vascular, and in glandular ducts, the capsules of the spleen and lymph nodes, the skin and some eye muscles. Voluntary muscle, distinguished by definite longitudinal and cross striae, a complex system of lines and cross discs, and a peripheral nucleus, is of obvious distribution through the body. Cardiac muscle (structurally intermediate between the other two) forms a close meshwork with complete loss of the original cell boundaries, and centrally placed nuclei. Myofibrils pass beyond the "intercalated discs," structures the nature of which is still in doubt.

Nervous tissue, receiving, originating and conducting nerve impulses, is made up of the neuron (or nerve cell in its broadest sense) and the supporting neuroglia, previously mentioned. While details may be found under the heading NERVOUS SYSTEM, a few examples of the many kinds of nerve cells may be given. The giant pyramidal cell of Betz in the cerebral cortex, the lesser ganglion cells of wide distribution (unipolar, bipolar and multipolar), the characteristic Purkinje cells of the cerebellum, the various types of Golgi cells, the ependymal cells and long and short rayed astrocytes of the glial tissue (to say nothing of these cells in various stages of immaturity found in tumour tissue), will indicate the great variation of structure to be found, though unfortunately there is still a tremendous lack of correlation with function. While tigroid bodies, axone, dendrites, medullated sheath, neurolemma and terminal arborizations are common properties of most nerve cells, their infinite variety adds still further to the complexity of this subject. (*See* EPITHELIAL, ENDOTHELIAL AND GLANDULAR TISSUES; NERVOUS SYSTEM; CONNECTIVE TISSUE; CYTOLOGY.)

Organs are formed from combinations of the various units of these tissues, sometimes of two units, usually of several. The separate subjects are to be found further described under appropriate headings.

Morbid Histology.—The microscopic study of the structural changes produced in the tissues by disease is a subject of great importance. (*See* PATHOLOGY.) It will suffice here to say that the microscopic study of tissues removed at autopsy not only serves to confirm the gross anatomical diagnosis or to give the necessary information where a gross diagnosis was impossible, but also gives an accurate picture of the condition at time of death of all the organs examined. An evaluation of the morbid process is thus constructed, which would otherwise be impossible. Morbid histology also performs a great practical service in the examination and diagnosis of "biopsy" material, *i.e.*, tissue removed from the living body (*e.g.*, in suspected neoplasms) in order to make a diagnosis. While this method is not infallible, and its value is vastly different in the hands of skilled and unskilled pathologists, it has proved to be the only scientific method of diagnosing diseased tissue of doubtful nature. The method is also of prognostic value in determining, according to more or less arbitrarily adopted standards, the "degree of malignancy" of the neoplasm under consideration.

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HISTORICAL ARTICLES. Under this head we give a general guide to the arrangement of these articles in the *Encyclopædia Britannica*.

ANCIENT HISTORY

In addition to the guide here given, *see* ARCHAEOLOGICAL ARTICLES, COMPARATIVE RELIGION (articles on), LITERATURE (classical), PHILOSOPHY (articles on) and the article MEDITERRANEAN.

Non-classical History.—For this *see* the articles BABYLONIA AND ASSYRIA, MESOPOTAMIA, BABYLONIAN LAW, EGYPT, PHOENICIA, PALESTINE, PERSIA; and smaller articles such as PERSIS, MEDIA, PARTHIA, ELAM and EDESSA. *See* also AEGEAN CIVILIZATION, CNOSSUS, CRETE and MYCENAE; ETRUSCANS and HITTITES; SCYTHIA; and the ancient history sections of such articles as GERMANY, IRELAND or WALES.

Greek History.—The main account of Greek history will be found under GREECE, *History*. But this should be supplemented by reference to the special articles on constitutional and State questions, of which the chief are ARCHON, AREOPAGUS, BOULE, CONSTITUTION OF ATHENS, ECCLESIA, ORACLE, STRATEGUS, GREEK LAW. There are also articles on the most important towns, leagues, etc., such as ACHAEAN LEAGUE, AEGINA, ATHENS, BYZANTIUM, CORINTH, DELIAN LEAGUE, SICILY, SPARTA, SYRACUSE, THEBES, and tribes such as AMAZONS, ACHAEANS, DORIANS, IONIANS and PELASGIANS.

HERODOTUS, ARISTOPHANES, DEMOSTHENES, THUCYDIDES, and all other ancient Greeks of importance have their biographies, which should be consulted; the history of the latest period of Greece should be also studied under the headings HELLENISM, MACEDONIAN EMPIRE and such biographies as that of ALEXANDER.

Roman History.—In Roman history the chief article is to be found under ROME. Under ITALY will be found pre-Roman history. All figures in Roman history or legend of any importance have biographical articles, from ROMULUS to ROMULUS AUGUSTULUS. The organization of the Roman State is systematically explored under the heads AERARIUM, CENSOR, COMITIA, CONSUL, EQUITES, MUNICIPIUM, PATRICIANS, PRAEFECT, PRAETOR, PROVINCE, QUAESTOR, SENATE, TRIBUNE, etc. There are other minor headings and the articles AGRARIAN LAWS and ROMAN LAW should be consulted.

The chief tribes of the Roman world have each a separate article. We may mention HELVETII, HUNS, MESSAPII and VOLSCI. Every province, etc., of the republic or empire has a separate article, in particular, AFRICA (ROMAN), BITHYNIA, BRITAIN (ROMAN), CAPPADOCIA, CILICIA, DACIA, GALATIA, GAUL, ILLYRIA, LIMES GERMANICUS, LYCIA, LYDIA, MAURETANIA, PALMYRA, PANNONIA, PHRYGIA, PONTUS, SPAIN, SYRIA, THRACE; *see* also CARTHAGE.

Military History.—The military history of the ancient world is dealt with in articles which, on the one hand, cover the outstanding military organizations and, on the other, the chief campaigns and battles. In the first class come the articles MACEDONIAN ARMY and ROMAN ARMY. The second class enables the reader not merely to study the course of the great conflicts but to trace the evolution of warfare and its methods. Beginning with the GRAECO-PERSIAN WARS, the thread passes through the PELOPONNESIAN WAR, then through such illustrative battles as CUNAXA, LEUCTRA, MANTINEA, and on by Alexander's battles, GRANICUS, ISSUS, GAUGAMELA and HYDASPES, as well as the biographical article on ALEXANDER. DIADOCHI, WARS OF THE, shows the decline of his system, and the next stage is reached with the PUNIC WARS (*see* also HANNIBAL and SCIPIO). TRASIMENUS and CANNAE show Hannibal's art, as CARTAGENA, ILIPA and ZAMA show Scipio's. Thereafter come Caesar's battles and sieges, among them ALESIA, ILERDA, PHARSALUS and THAPSUS, and as CARRHAE reveals a weakness in the Roman legionary organization, so ADRIANOPLE marks its fall from military supremacy.

MEDIAEVAL HISTORY

In addition to the guide here given reference should also be made to articles under the various biographical articles and to the headings connected with Archaeology, Church History, Economics, Law and Literature.

For Europe *see* DARK AGES; MIDDLE AGES; EUROPE. For articles on subjects concerning Europe generally, *see* also:—COM-

MUNE; CRUSADES; FEUDALISM; GOTHS; GUILDS; LOMBARDS; PAPACY; ROMAN EMPIRE, LATER; SERFDOM; VANDALS; VIKINGS; VILLAGE COMMUNITIES; VILLEINAGE. For histories of individual countries and peoples of Mediaeval Europe, *see* articles under names of countries except England, which is under ENGLISH HISTORY.

For England, in addition to ENGLISH HISTORY, *see* such articles as ANGLO-SAXONS; BRITAIN; DANELAW; EAST ANGLIA; ESSEX; HWICCE; JUTES; KENT; NORTHUMBRIA; SUSSEX; STRATHCLYDE; WESSEX, etc. And also articles on constitutional problems and particular subjects, for example: BAYEUX TAPESTRY; CHURL; CLARENDON, CONSTITUTIONS OF; DOMESDAY BOOK; FRANKPLEDGE; FYRD; HIDE; JUSTICIAR; LOLLARDS; MAGNA CARTA; NORTHAMPTON, ASSIZE OF; OXFORD, PROVISIONS OF; PIPE ROLLS; PURVEYANCE; RAPE; SCUTAGE; TALLAGE; TRINODA NECESSITAS; WAPENTAKE; WITAN; VASSAL.

In addition to article FRANCE, *see* articles on chief divisions of Mediaeval France, *e.g.*, ARTOIS; BRITTANY. *See* also ANTRUSTION; CAGOTS; DAUPHIN; JACQUERIE, THE; CHATELAIN; PARLEMENT; PRAGUERIE; FRENCH LAW AND INSTITUTIONS; FRANKS; MAYOR OF THE PALACE; MEROVINGIANS; MISSI DOMINICI.

In addition to article GERMANY, *see* articles on:—EMPIRE; AULIC COUNCIL; DIET; FEHMIC COURTS; IMPERIAL CHAMBER; DIET; GOLDEN BULL; HANSEATIC LEAGUE; HUSSITES; SWABIAN LEAGUE; and articles on the principal divisions of GERMANY.

In addition to the article ITALY, *see* CAROCCIO; GUELPHS and GHIBELLINES; LOMBARD LEAGUE; PODESTA; RAVENNA, EXARCHATE OF; ROME; PAPACY; VENICE; DODGE; SICILY; VESPERS, SICILIAN.

In addition to articles SPAIN and PORTUGAL, *see* articles on the mediaeval divisions of Spain.

For Flanders (*q.v.*) *see* also BRABANT; FRISIANS; GELDERLAND; HAINAULT; HOLLAND, COUNTY OF, JOYEUSE ENTREE; NETHERLANDS.

For the Scandinavian countries, in addition to DENMARK, NORWAY, SWEDEN, *see* articles VIKINGS; VINLAND.

For the NEAR EAST, *see* AUSTRIA-HUNGARY; BULGARIA; CUMANS; PETCHENEGS; PERSIA; SLAVS; VLACHS; GREECE; TURKEY; ISLAM; ISLAMIC LAW; ISLAMIC INSTITUTIONS.

For the Jews, *see* BOSTENAI, EXILARCH, GHETTO, JEWS, RITUAL, MURDER.

The development of the methods and means of warfare in Mediaeval history is covered in the historical parts of such general articles as ARMY; CAVALRY; FORTIFICATION AND SIEGECRAFT; GUN; INFANTRY; MILITIA; and TACTICS. For special light on certain periods and on certain military organizations which markedly influenced the course of mediaeval history *see* MOHAMMEDAN CAMPAIGNS, MONGOL CAMPAIGNS, HUNDRED YEARS' WAR, SWISS WARS, etc. The thread of evolution is also traced through the separate narrations of the more famous battles of each period, such as DARAS, TRICAMERON, TAGINAE and MANZIKORT, COURTRAI, ACRE, ARSAF and BOUVINES, MURAT, BOUCOMTO and TAGLIACOZZO, BANNOCKBURN, DUPPLIN, HALIDON HILL, CRECY, POITIERS and AGINCOURT, RAVENNA and MARIGNANO. More isolated but immortal incidents, for example the battles of Chalons, Tours and Hastings, and the siege of Constantinople, 1453, have also individual treatment.

MODERN HISTORY

The history of the various countries will be found under their respective names with the following exceptions: the history of England is under the title ENGLISH HISTORY; the history of Ireland is to be found under IRELAND until the date 1921, but afterwards under IRELAND, NORTHERN, and IRISH FREE STATE; the post-war history of "Iraq" is given under that title: for earlier history *see* MESOPOTAMIA. There is also a comprehensive article under the title of each continent. There are separate articles on all the British colonies and dominions as well as a long general article BRITISH EMPIRE. The article SOUTH AFRICA, UNION OF, contains the complete history of the territory embraced by the Union; but there are also separate articles on its component parts, *e.g.*, CAPE COLONY, NATAL, TRANSVAAL, etc. The officially recognized names Nyasaland and French Equatorial Africa, are used in this edition in place of the older names British Central Africa and French Congo.

The events of the World War and its consequent problems are dealt with in such articles as SERBIA and DIMITRIEVIC, which discuss the Serajevo murder; WORLD WAR; EUROPE; PARIS, CONFERENCE OF; VERSAILLES, TREATY OF; LEAGUE OF NATIONS; FOURTEEN POINTS; SECURITY; DISARMAMENT; REPARATIONS AND THE DAWES PLAN; MINORITIES; SAAR TERRITORY; RUHR; SANCTIONS AND GUARANTEES; LOCARNO; WAR GUILT, etc.

A great number of articles deal with questions of government and administration, *e.g.*, CABINET; PRIVY COUNCIL; PRIME MINISTER; STAR CHAMBER; GOVERNMENT; GOVERNMENT DEPARTMENTS; MINISTRY; SPEAKER; ELECTORAL SYSTEMS; PAYMENT OF MEMBERS; WOMEN'S SUFFRAGE.

Most important treaties, political documents, and congresses have entries of their own, *e.g.*, BERLIN, CONGRESS AND TREATY OF; BILL OF RIGHTS; EDICT OF NANTES, etc. Political parties, etc., are dealt with under such headings as COMMUNISM; SOCIALISM; CHARTISM; FASCISM; MAFIA; CARBONARI; CONSERVATIVE PARTY; LIBERAL PARTY; LABOUR PARTY; and under the titles of the principal parties of the French Revolution. Movements of historic importance have special articles of their own, *e.g.*, REFORMATION; RENAISSANCE; FRENCH REVOLUTION; REFORM MOVEMENT; EASTERN QUESTION; SCHLESWIG-HOLSTEIN QUESTION; PAN-GERMANISM; PAN-SLAVISM; CHURCH AND STATE. The Czech National Movement in Bohemia, Moravia, Silesia, and Slovakia, is included in the article BOHEMIA. There are also various articles on special subjects related to history such as DIPLOMACY; RECORD; DIPLOMATIC; TRADE ROUTES.

The history of the Church will be found under PAPACY; CHURCH HISTORY; ROMAN CATHOLIC CHURCH; INQUISITION, etc., and under the separate headings of denominations, *e.g.*, UNITARIANISM; BAPTISTS, etc., where the rise and development of each movement is traced. In some isolated articles, *e.g.*, MONGOLS, a sketch of history is given as an essential indication of the influence of such peoples on surrounding nations. The Mohammedan religious world is treated in the article ISLAM, the history of Mohammedan Law is found under ISLAMIC LAW and the articles ISLAMIC INSTITUTIONS and CALIPHATE, give an indication of Mohammedan influence on Europe. The religious history of Further Asia is treated under BUDDHISM; BRAHMANISM; SHINTOISM; TAOISM; HINDUISM; etc., and the individual biographical articles, *e.g.*, CONFUCIUS; BUDDHA, etc.

All the principal historical characters have their own biographical articles. There are also certain general family articles, *e.g.*, BOURBONS; HABSBURGS; HOHENZOLLERNS; ROMANOFFS.

The great wars of modern history are all fully described and arranged in articles under their own headings—THIRTY YEARS' WAR; GREAT REBELLION; DUTCH WARS; GRAND ALLIANCE; SPANISH SUCCESSION; AUSTRIAN SUCCESSION; SEVEN YEARS' WAR; AMERICAN REVOLUTION; FRENCH REVOLUTIONARY WARS; NAPOLEONIC CAMPAIGNS; PENINSULAR WAR; WATERLOO CAMPAIGN; ITALIAN WARS 1848–1870; CRIMEAN WAR; AMERICAN CIVIL WAR; SEVEN WEEKS' WAR, 1866; FRANCO-GERMAN WAR; RUSSO-TURKISH WAR; RUSSO-JAPANESE WAR; BALKAN WARS, and finally the WORLD WAR. The military history of Great Britain's overseas expansion and defense of her territories may be traced in such articles as QUEBEC; SIKH WARS; BURMESE WARS; INDIAN MUTINY; EGYPT AND SUDAN CAMPAIGN; and SOUTH AFRICAN WAR. The chief battles of all these wars have special articles, and these rise in scale as we approach the determinating military events of recent history. Thus ATLANTA, BULL RIVER, FREDERICKSBURG, GETTYSBURG, the SEVEN DAYS and VICKSBURG, in the American Civil War have extensive treatment, as also such particular phases as the PETERSBURG, SHENANDOAH VALLEY, and WILDERNESS campaigns. Similarly with WORTH, METZ and SEDAN in 1870. The events of the World War have been brought into historical perspective, the main battles of the Western, Eastern and Italian fronts, in particular MARNE, YPRES, SOMME, VERDUN, CAPORETTO, CAMBRAI, ST. QUENTIN, AMIENS, HINDENBURG LINE, and MEUSE-ARGONNE, having separate articles, in

which fresh light is shed on their origin and course, and their conduct is examined with frank and impartial regard for historical truth which documentary and personal evidence has made possible and the lapse of time has made suitable. The course of events in subsidiary theatres is described in such articles as CAUCASUS; DARDANELLES; PALESTINE; MESOPOTAMIA; SALONIKA; SERBIAN, and EAST AFRICAN campaigns.

For more detailed information on the development of the instruments and methods of warfare during modern history, the reader should consult such articles as AIR COMBAT; AIR WARFARE; AMMUNITION; ARMY; ARTILLERY; BRIDGING; CAMOUFLAGE; CHEMICAL WARFARE; CONSCRIPTION; CROSS-COUNTRY TRANSPORT; FORTIFICATION AND SIEGECRAFT; GUERRILLA WARFARE; INFANTRY; MEDICAL SERVICE; MOTOR TRANSPORT; MOUNTAIN WARFARE; ORDNANCE; SMALL ARMS; SIGNALLING; SMOKE IN WARFARE; STAFF; STRATEGY; SUPPLY AND TRANSPORT; TACTICS; TANKS and WAR.

HISTORICAL METHOD. This term is used in a variety of meanings which have not much in common. Sometimes it denotes the whole complex of methods employed in historical investigations, a subject being said to be treated by the historical method when an historical account is given of it. Sometimes a subject is said to be treated by the historical method when all that is given is a chronological survey of the different views that have been entertained about it. By an ambiguity not altogether unnatural the term "historical method" is also used instead of "evolutionary method" or "genetic method" or even "comparative method," although the story of the development of a natural species, etc., has not the chronological character of a "history" in the strict sense. Perhaps a vague reminiscence of the older use of the term "history" is partly responsible for the loose employment of the term "historical method." Originally "history" meant any kind of descriptive account of a thing, and this use still survives in the expression "natural history," to say nothing of the titles of various classics of science from Aristotle's "History of Animals" to Bacon's and Boyle's "histories" of all sorts of non-historical subjects. J. S. Mill, again, used the term "historical method" in quite another and peculiar sense, applying it to that form of the combined method of deduction and induction (or the Deductive-Inductive Method) in which the facts are first investigated inductively, and the result then confirmed by deductive reasoning from the nature of the case and in the light of truths already accepted. *See* SCIENTIFIC METHOD; A. Wolf, *Essentials of Scientific Method* (1928); J. S. Mill, *A System of Logic* (1890, etc.).

HISTORY. The word "history" is used in two senses. It may mean either the record of events or events themselves. Originally limited to inquiry and statement, it was only in comparatively modern times that the meaning of the word was extended to include the phenomena which form or might form their subject. It was perhaps by a somewhat careless transference of ideas that this extension was brought about. Now indeed it is the commoner meaning. We speak of the "history of England" without reference to any literary narrative. We term kings and statesmen the "makers of history," and sometimes say that the historian only records the history which they make. History in this connection is obviously not the record, but the thing to be recorded.

History in the wider sense is all that has happened, not merely all the phenomena of human life, but those of the natural world as well. It includes everything that undergoes change; and as modern science has shown that there is nothing absolutely static, therefore the whole universe, and every part of it, has its history. This idea of universal activity has in a sense made physics itself a branch of history. It is the same with the other sciences—especially the biological division, where the doctrine of evolution has induced an attitude of mind which is distinctly historical.

But the tendency to look at things historically is not merely the attitude of men of science. Our outlook upon life differs in just this particular from that of preceding ages. We recognize the unstable nature of our whole social fabric, and are therefore more and more capable of transforming it. In short, the historical spirit of the age has invaded every field. The world-picture presented in the *Encyclopædia Britannica* is that of a dynamic universe, of phenomena in process of ceaseless change. Owing to this insistent change all things which happen, or seem to happen, are history in the broader sense of the word. The *Encyclopædia Britannica* itself is a history of them in the stricter sense—the description and record of this universal process. This narrower meaning is the subject of the rest of this article.

The earliest prose origins of history are the inscriptions. Their inadequacy is evident from two standpoints. Their permanence depends not upon their importance, but upon the durability of the substance on which they are inscribed. Sealed to all but those who know how to read them, they lie forgotten for centuries while oral tradition flourishes—being within the reach of every man. Next to the inscriptions (sometimes identical with them) are the early chronicles frequently preserved in temples. These were of various kinds: simple religious annals, votive tablets recording miracles accomplished at a shrine, lists of priests and priestesses, accounts of benefactions, of prodigies and portents. In some cases, as in Rome, the pontiffs kept a kind of register, not merely of religious history, but of important political events as well. Down to the time of the Gracchi (131 B.C.) the Pontifex Maximus inscribed the year's events upon annual tablets of wood which were preserved in the Regia, the official residence of the pontiff in the Forum. These pontifical "annals" thus came to be a sort of civic history.

The first historians were the logographi of Ionian cities; men who carried their inquiry (*historiē*) beyond both written record and oral tradition to a study of the world around them. Their "saying" (*logos*) was gathered mostly from contemporaries, and upon the basis of a widened experience they became critics of their traditions. They were the forerunners of the "father of history," Herodotus (*q.v.*). It is easy for the student now to show the inadequacy of his sources, yet the work of Herodotus remains a scientific achievement as remarkable for its approximation to truth as for the vastness of its scope. It was his chief glory to have joined to this scientific spirit an artistic sense which enabled him to cast the material into the truest literary form. In Thucydides a higher art than that of Herodotus was combined with a higher science. He scorned the story-teller "who seeks to please the ear rather than to speak the truth," and yet his rhetoric is the culmination of Greek historical prose. He withdrew from vulgar applause, conscious that his narrative would be considered "disappointing to the ear," yet he recast the materials out of which he constructed it in order to lift that narrative into the realm of pure literature. Speeches, letters and documents are re-worded to be in tone with the rest of the story. It was his art, in fact, which really created the Peloponnesian war out of its separate parts. And yet this art was merely the language of a scientist. The "laborious task" of which he speaks is that of consulting all possible evidence and weighing conflicting accounts. It is this which makes his rhetoric worth while, "an everlasting possession, not a prize competition which is heard and forgotten."

From the sublimity of Thucydides and Xenophon's straightforward story, history passed with Theopompus and Ephorus into the field of rhetoric. A revival of the scientific instinct of investigation is discernible in Timaeus the Sicilian, at the end of the 4th century; but his attack upon his predecessors was the text of a more crushing attack upon himself by Polybius, who declares him lacking in critical insight and biased by passion. Polybius' comments upon Timaeus reach the dignity of a treatise upon history. He protests against its use for controversial pamphlets which distort the truth. "Directly a man assumes the moral attitude of an historian he ought to forget all considerations, such as love of one's friends, hatred of one's enemies. . . . He must sometimes praise enemies and blame friends. For, as a living creature is rendered useless if deprived of its eyes, so, if you take truth from History, what is left but an improfitable tale" (bk. xii. 14). These are the words of a Ranke. Unfortunately Polybius, like most modern scientific historians, was no artist. His style is the very opposite to that of Isocrates and the rhetoricians. It is often only clear in the light of inscriptions, so closely does it keep to the sources. The style found no imitator; history passed from Greece

to Rome in the guise of rhetoric. In Dionysius of Halicarnassus the rhetoric was combined with an extensive study of the sources; but the influence of the Greek rhetoricians upon Roman prose was deplorable from the standpoint of science. Cicero, although he said that the duty of the historian is to conceal nothing true, to say nothing false, would in practice have written the kind of history that Polybius denounced. History for him is the mine from which to draw argument in oratory and example in education. It is not the subject of a scientific curiosity.

History-writing in Rome (except for the Greek writers resident there) was until the first half of the 1st century B.C. in the form of annals. Then came rhetorical ornamentation—and the Ciceronian era. The first Roman historian who rose to the conception of a science and art combined was Sallust, the student of Thucydides. The Augustan age produced in Livy a great popular historian and natural artist and a trained rhetorician (in the speeches). From Livy to Tacitus the gulf is greater than from Herodotus to Thucydides. Tacitus is at least a consummate artist. His style ranges from the brilliancy of his youth to the sternness and sombre gravity of age, passing almost to poetic expression in its epigrammatic terseness. Yet in spite of his searching study of authorities, his keen judgment of men, and his perception of underlying principles of moral law, his view was warped by the heat of faction, which glows beneath his external objectivity. After him Roman history-writing speedily degenerated. Suetonius' *Lives of the Caesars* is but a superior kind of journalism. But his gossip of the court became the model for historians, whose works, now lost, furnish the main source for the *Historia Augusta*. The importance to us of this uncritical collection of biographies is sufficient comment on the decline of history-writing in the latter empire. Finally, from the 4th century the epitomes of Eutropius and Festus served to satisfy the lessening curiosity in the past and became the handbooks for the middle ages. The single figure of Ammianus Marcellinus stands out of this age like a belated disciple of Tacitus. But the world was changing from antique to Christian ideals just as he was writing, and with him we leave this outline of ancient history.

THE CHRISTIAN ERA

Early Christian History.—The 4th and 5th centuries saw a great revolution in the history of history. The story of the pagan past slipped out of mind, and in its place was set, by the genius of Eusebius, the story of the world force which had superseded it, Christianity, and of that small fraction of antiquity from which it sprang—the Jews. Christianity from the first had forced thinking men to reconstruct their philosophy of history, but it was only after the Church's triumph that its point of view became dominant in historiography. Three centuries more passed before the pagan models were quite lost to sight. But from the 7th century to the 17th (from Isidore of Seville and the English Bede for a thousand years) mankind was to look back along the line of Jewish priests and kings to the Creation. Egypt was of interest only as it came into Israelite history, Babylon and Nineveh were to illustrate the judgments of Yahweh, Tyre and Sidon to reflect the glory of Solomon.

Christian history begins with the triumph of the Church. With Eusebius of Caesarea the apologetic pamphlets of the age of persecutions gave way to a calm review of three centuries of Christian progress. Eusebius' biography of Constantine shows what distortion of fact the father of church history permitted himself, but the ecclesiastical history was fortunately written for those who wanted to know what really happened, and remains to-day an invaluable repository of Christian antiquities. With the continuations of Socrates, Sozomen, and Theodoret, and the Latin manual which Cassiodorus had woven from them (the *Historia tripartita*), it formed the body of church history during all the middle ages. An even greater influence, however, was exercised by Eusebius' *Chronica*. Through Jerome's translation and additions, the scheme of this world's chronology became the basis for all mediaeval world chronicles. It settled until our own day the succession of years from the Creation to the birth of Christ, fitting the Old Testament story into that of ancient history. Henceforth the Jewish past (that one path back to the beginning of the world) was marked out by the absolute laws of mathematics and revelation.

From the first, Christianity had a philosophy of history. Its earliest apologists sought to show how the world had followed a divine plan in its long preparation for the life of Christ. From this central fact of all history, mankind should continue through war and suffering until the divine plan was completed at the judgment day. This idea received its classic statement in St. Augustine's *City of God*. The terrestrial city, whose eternity had been the theme of pagan history, had just fallen before Alaric's Goths. Augustine's explanation of its fall passes in review not only the calamities of Roman history (combined with a pathetic perception of its greatness) but carries the survey back to the origin of evil at the Creation. The Roman Empire (the last general form of the earthly city) must at last yield to the heavenly. This is the main thread of Augustine's philosophy of history. The historical demonstration of its truth was left by Augustine for his disciple, Paulus Orosius (*q.v.*), whose *Seven Books of Histories against the Pagans*, written as a supplement to the *City of God*, was the first attempt at a Christian "World History."

The commonest form of mediaeval historical writing was the chronicle. Utterly lacking in perspective and dominated by the idea of the miraculous, they are for the most part a record of the trivial or the marvellous. Individual historians sometimes recount the story of their own times with sober judgment, but seldom know how to test their sources when dealing with the past. Contradictions are often copied down without the writer noticing them, and since the middle ages forged and falsified so many documents (monasteries, towns, and corporations gaining privileges or titles of possession by the bold use of them) the narrative of mediaeval writers cannot be relied upon unless we can verify it by collateral evidence. Some historians, like Otto of Freising, Guibert of Nogent, or Bernard Gui, would have been scientific if they had had our appliances for comparison. But even men like Roger Bacon, who deplored the inaccuracy of texts, had worked out no general method to apply in their restoration. Toward the close of the middle ages the vernacular literatures were adorned with Villani's and Froissart's chronicles. But the merit of both lies in their journalistic qualities of contemporary narrative. Neither was a history in the truest sense.

The Renaissance marked the first great gain in the historic sense, in the efforts of the humanists to realize the spirit of the antique world. They did not altogether succeed; antiquity to them meant largely Plato and Cicero. Their interests were literary, and the un-Ciceronian centuries were generally ignored. Those in which the foundations of modern Europe were laid, which produced parliaments, cathedrals, cities, Dante and Chaucer, were grouped alike on one dismal level and at a later date christened the middle ages. History became the servant to literature, an adjunct to the classics. But if the literary side of humanism has been a barrier to the progress of scientific history, the discovery and elucidation of texts first made that progress possible. Laurentius Valla's brilliant attack on the "Donation of Constantine" (1440) and Ulrich von Hutten's rehabilitation of Henry IV. from monkish tales mark the rise of the new science. For a while it remained but a phase of humanism. It was north of the Alps that it parted company with the grammarians. Classical antiquity was an Italian past, the German scholars turned back to the sources of their national history. Aeneas Sylvius Piccolomini (Pius II.) had discovered Otto of Freising and Jordanes. Maximilian I. encouraged the search for manuscripts, and Vienna became a great humanistic centre. Conrad Celtes left his *Germania illustrata* unfinished, but he had found the works of Hroswitha. Conrad Peutinger gathered all sorts of Chronicles in his room in Vienna, publishing among them those of Gregory of Tours. This national movement of the 15th century was not paralleled in France or England, where the classical humanities reigned. The Reformation meanwhile gave another turn to the work of German scholars.

Influence of the Reformation.—The Reformation, with its heated controversies, seems a strange starting-point for science,

yet it, even more than the Renaissance, brought out scientific methods of historical investigation. It not only sobered the humanist tendency to sacrifice truth for aesthetic effect, it called for the documents of the Church and subjected them to the most hostile criticism. Luther himself challenged them. Then in the *Magdeburg Centuries* (1559–74) Protestantism tried to make good its attack on the mediaeval church by a great collection of sources accompanied with much destructive criticism. This gigantic work is the first monument of modern historical research. The reply of Cardinal Baronius (*Annales ecclesiastici*, 1588–1697) was a still greater collection, drawn from archives which till then had not been used for scientific history.

The movement back to the sources in Germany until the Thirty Years' War was a notable one. Collections were made by Simon Schard (1535–73), Johannes Pistorius (1576–1608), Marquard Freher (1565–1614), Melchior Goldast (1576–1635), and others. After the war Leibnitz began a new epoch, both by his philosophy, with its law of continuity in phenomena, and by his systematic attempt to collect sources through an association (1670). His plan to have documents printed as they were, instead of "correcting" them, was a notable advance. But from Leibnitz until the 19th century German national historiography made little progress—although church historians like Mosheim and Neander stand out among the greatest historians of all time.

France had not paralleled the activity of Maximilian's Renaissance historians. The father of modern French history, or at least of historical research, was André Duchesne (1584–1640), whose splendid collections of sources are still in use. Jean Bodin wrote the first treatise on scientific history (*Methodus ad facilem historiarum cognitionem*, 1566), but he did not apply his own principles of criticism; and it was left for the Benedictine monks of the Congregation of St. Maur to establish definitely the new science. The place of this school in the history of history is absolutely without a parallel. When Luc d'Achery turned from exegetics to patristics and the lives of the saints, as a sort of Christian humanist, he led the way to that vast work of collection and comparison of texts which developed through Mabillon, Montfauçon, Ruinart, Martène, Bouquet, and their associates, into the indispensable implements of modern historians. Here, as in the Reformation, controversy called out the richest product. Jean Mabillon's treatise, *De re diplomatica* (1681), was due to the criticisms of that group of Belgian Jesuits whose *Acta Sanctorum quotquot toto orbe coluntur* (1643, etc., *see* BOLLANDISTS) was destined to grow into the greatest repository of legend and biography the world has seen. In reply to D. Papebroch's criticisms of the chronicle of St. Denis, Mabillon prepared this manual for the testing of mediaeval documents. Its canons are the basis, indeed, almost the whole, of the science of diplomatic (*q.v.*), the touchstone of truth for mediaeval research. Henceforth even the mediocre scholar had a body of technical rules by which to sort out the vast mass of apocrypha in mediaeval documentary sources. Scientific history depends upon implements. Without manuals, dictionaries, and easy access to texts, we should go as far astray as any mediaeval chronicler. The France of the Maurists supplied the most essential of these instruments. The great "glossary" of Du Cange is still in enlarged editions the indispensable encyclopaedia of the middle ages. Chronology and palaeography were placed on a new footing by Dom Bernard de Montfauçon's *Palaeographia graeca* (1708), the monumental *Art de vérifier les dates* (3rd ed., 1818–31, in 38 vols.) and the *Nouveau Traité de diplomatique* (1750–65) of Dom Tassin and Dom Toustain. The collections of texts which the Maurists published are too many and too vast to be enumerated here (*see* C. Langlois, *Manuel de bibliographie historique*, pp. 293 *seq.* Dom Bouquet's *Historiens de la Gaule et de la France*—the national repertory for French historians—is but one of a dozen tasks of similar magnitude. During the 18th century this deep under-work of scientific history continued to advance, though for the most part unseen by the brilliant writers whose untrustworthy generalities passed for history in the salons of the old régime. Interrupted by the Revolution, it revived in the 19th century, and the roll of honour of the French École des Chartes has almost rivalled that of St. Germain-des-Prés.

The father of critical history in Italy was L. A. Muratori (1672–1750), the Italian counterpart of Leibnitz. His vast collection of sources (*Rerum Italicarum scriptores*), prepared amid every discouragement, remains to-day the national monument of Italian history; and it is but one of his collections. His output is perhaps the greatest of any isolated worker in the whole history of historiography. The same haste, but much less care, marked the work of J. D. Mansi (d. 1769), the compiler of the fullest collection of the Councils. Spain, stifled by the Inquisition, produced no national collection of sources during the 17th and 18th centuries, although Nicolas Antonio (d. 1684) produced a national literary history of the first rank.

England in the 16th century kept pace with Continental historiography. Henry VIII.'s chaplain, John Leland, is the father of English antiquaries. Three of the most precious collections of mediaeval manuscripts still in existence were then begun by Thomas Bodley (the Bodleian, Oxford), Archbishop Matthew Parker (Corpus Christi, Cambridge), and Robert Cotton (the Cottonian collection, British Museum). In Elizabeth's reign a serious effort was made to arrange the national records, but until the end of the 18th century they were scattered in not less than 15 repositories. In the 17th and 18th centuries English scholarship was enriched by such monuments of research as William Dugdale's *Monasticon*, Thomas Madox's *History of the Exchequer*, Wilkins's *Concilia*, and Thomas Rymer's *Foedera*. But these works, important as they were, gave but little idea of the wealth of historical sources which the 10th century was to reveal in England.

MODERN PRACTICE

History as a Science.—In the 19th century the science of history underwent a revolution. The machinery of research was perfected. Workers or groups of workers grew into national or international associations, producing from archives collections of material to be worked up into the artistic form of history. These faithful workers (devoting their lives to the cataloguing of archives and libraries, to the publication of material, and then to the gigantic task of indexing what they have produced) have made it possible for the student to master in a few hours in his library sources of history which baffled the long years of research of a Martène or Rymer.

Every science which deals with human phenomena is in a way an implement in this great factory system, in which the past is welded together again. But the real auxiliary sciences to history are those which deal with those traces of the past that still exist, the science of language (philology), of writing (palaeography), of documents (diplomatic), of seals (sphragistics), of coins (numismatics), of weights and measures, and archaeology in the widest sense of the word. These sciences underlie the whole development of scientific history. Dictionaries and manuals are the instruments of this industrial revolution. Without them the literary remains of the race would still be as useless as Egyptian inscriptions to the fellaheen. Archaeology itself remained but a minor branch of art until the machinery was perfected which enabled it to classify and interpret the remains of the "prehistoric" age.

This is the most remarkable chapter in the whole history of history—the recovery of that past which had already been lost when our literary history began. The old "providential" scheme of history disintegrates before a new interest in the "gentile" nations to whose high culture Hebrew sources bore unwilling testimony. Biblical criticism is a part of the historic process. The Jewish texts, once the infallible basis of history, are now tested by the libraries of Babylon, from which they were partly drawn, and Hebrew history sinks into its proper place in the wide horizon of antiquity. The finding of the Rosetta stone left us no longer dependent upon Greek, Latin, or Hebrew sources, and now 50 centuries of Egyptian history lie before us. The scientific historian of antiquity works on the hills of Crete, rather than in the quiet of a library with the classics spread out before him. There he can reconstruct the splendour of that Minoan age to

which Homeric poems look back, as the Germanic epics looked back to Rome or Verona. His discoveries, co-ordinated and arranged in vast *corpora inscriptionum,* stand now alongside Herodotus or Livy, furnishing a basis for their criticism.

The immense increase in available sources, archaeological and literary, has remade historical criticism. Ranke's application of the principles of "higher criticism" to works written since the invention of printing (*Kritik neuerer Geschichtsschreiber*) was an epoch-making challenge of narrative sources. Now they are everywhere checked by contemporary evidence, and a clearer sense of what constitutes a primary source has discredited much of what had been currently accepted as true. This is true not only of ancient history, where last year's book may be a thousand years out of date, but of the whole field. Hardly an "old master" remains an authoritative book of reference. Old landmarks drop out of sight—*e.g.,* the fall of the Western Empire in 476, the coming of the Greeks to Italy in 1450, dates which once enclosed the middle ages. The perspective changes—the Renaissance grows less and the middle ages more; the Protestant Revolution becomes a complex of economics and politics and religion; the French Revolution a vast social reform in which the Terror was an incident. The result has been a complete transformation of history since the middle of the 19th century.

Theories of History.—The Augustinian scheme of world history received its last classic statement in Bossuet's *Histoire universelle.* Voltaire's reply to it in the 18th century (*Essai sur les moeurs*) attacked its limitations on the basis of deism, and its miraculous procedure on that of science. But while there are foreshadowings of the evolutionary theory in this work, neither the *philosophe* historians nor Hume nor Gibbon arrived at a constructive principle in history which could take the place of the Providence they rejected. Religion, though false, might be a real historic force. History became the tragic spectacle of a game of dupes—the real movers being priests, kings, or warriors. The pawns slowly acquired reason, and then were able to regulate the moves themselves. But all this failed to give a satisfactory explanation of the laws which determine the direction of this evolution. Giovanni Battista Vico (1668-1744) was the first to ask why there is no science of human history. But his lonely life and unrecognized labours leave him apart from the main movement, until his works were discovered again in the 19th century. The first half of the century (apart from the scientific activity of Pertz, Guizot, etc.) was largely dominated by the Romanticists, with their exaggeration of the individual. Carlyle's "great man theory of history" is logically connected with the age of Scott. It was a philosophy of history which lent itself to magnificent dramatic creations; but it explained nothing. Carlyle stands to Bossuet as the saga to the myth. Hegel got no closer to realities. His idealistic scheme of history, which makes religion the keynote of progress, and describes the function of each (Judaism to typify duty, Confucianism order, Mohammedanism justice, Buddhism patience, and Christianity love) does not account for the facts of the history enacted by the devotees. It characterizes, not the real process of evolution, but an ideal which history has not realized. Besides, it does not face the question how far religion itself is a product or a cause, or both combined.

In the middle of the century two men sought to incorporate in their philosophy the physical basis which Hegel had ignored in his spiritism—recognizing that life is conditioned by an environment and not an abstraction for metaphysics. H. T. Buckle, in his *History of Civilization in England* (1857), was the first to work out the influences of the material world upon history, developing through a wealth of illustration the importance of food, soil, and the general aspect of nature upon the formation of society. Buckle did not, as is generally believed, make these three factors dominate all history. He distinctly stated that "the advance of European civilization is characterized by a diminishing influence of physical laws and an increasing influence of mental laws," and "the measure of civilization is the triumph of mind over external agents." Yet his challenge, not only to the theologian, but also to those "historians whose indolence of thought" or "natural incapacity" prevented them from attempting more than the annalistic record of events, called out a storm of protest from almost every side. Meanwhile the economists had themselves taken up the problem, and it was from them that the historians of to-day have learned it. Ten years before Buckle published his history, Karl Marx had already formulated the "materialist conception of history" Accepting with reservation Feuerbach's attack on the Hegelian "absolute idea," based on materialistic grounds (*Der Mensche ist, was er isst*), Marx was led to the conclusion that the evolution of society is conditioned by the economic circumstances of its existence. From this he went on to socialism, which bases its militant philosophy upon this interpretation of history. But the truth or falseness of Socialism does not affect the theory of history. In 1845 Marx wrote of the Young-Hegelians that to separate history from natural science and industry was like separating the soul from the body, and "finding the birthplace of history, not in the gross material production on earth, but in the misty cloud formation of heaven" (*Die heilige Familie,* p. 238). In his *Misère de la philosophie* (1847) he lays down the principle that social relationships largely depend upon modes of production, and therefore the principles, ideas, and categories which are thus evolved are no more eternal than the relations they express, but are historical and transitory products. In the famous *Manifesto of the Communist Party* (1848) the theory was applied to show how the industrial revolution had replaced feudal with modern conditions. But it had little vogue, except among Socialists, until the third volume of *Das Kapital* was published in 1894, when its importance was borne in upon Continental scholars. Since then the controversy has been almost as heated as in the days of the Reformation. It is an exaggeration of the theory which makes it an explanation of all human life, but the whole science of dynamic sociology rests upon the postulate of Marx.

The content of history always reflects the interests of the age in which it is written. Modern historians began with politics; but as the complex nature of society became more evident in the age of democracy they gradually realized that no one branch of history is more than a single glimpse at a vast complex of phenomena, most of which lie for ever beyond our ken.

This expansion of interest has intensified specialization. Each historian chooses his own epoch or century and his own subject, and spends his life mastering such traces of it as he can find. His work there enables him to judge of the methods of his fellows, but his own remains restricted by the very wealth of material which has been accumulated on the single subject before him. Thus the great enterprises of to-day are co-operative—the *Cambridge Modern History,* Lavisse and Rambaud's *Histoire générale,* Lavisse's *Histoire de France,* Hunt and Poole's *Political History of England,* and Oncken's *Allgemeine Geschichte in Einzeldarstellungen.* But even these vast sets cover but the merest fraction of their subjects. This limitation of the professed historian is made up for by the growingly historical treatment of all the sciences and arts. Indeed, for a definition of that limitless subject which includes all the phenomena that stand the stress of change, one might adapt a famous epitaph—*si historiam requiris, circumspice.*

BIBLIOGRAPHY.—For the general treatment of the problems of the historian, *see* Ernst Bernheim, *Lehrbuch der historischen Methode und der Geschichtsphilosophie* (6th ed., 1914); C. V. Langlois, *Manuel de bibliographie historique* (2nd ed., 1901-04), and James T. Shotwell, *Introduction to the History of History* (1922). For recent trend *see* J. H. Robinson, *The New History* (1912); for more exhaustive treatment and bibliographies *see* Harry E. Barnes, *The New History and the Social Studies* (1925) and his article "History" in the *Encyclopaedia Americana.*

For ancient history in general an old but important manual is that of C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895). For mediaeval historiography such works as W. Wattenbach's *Deutschlands Geschichtsquellen im Mittelalter* (6th ed., 1893-94) or A. Molinier's *Les sources de l'histoire de France* (1901-06), are adequate in their respective fields. No similar survey exists of English mediaeval historians. For the modern field E. Fueter's *Geschichte der neueren Historiographie* (1911; Fr. ed., 1914) covers the ground from Machiavelli to about 1870, while such works as G. P. Gooch's *History and Historians in the Nineteenth Century* (1913), or A. Guilland's *Modern Germany and Her Historians* (1915; Fr. ed., 1900), deal with important topics. For French history the series *Les sources*

de l'histoire de France, referred to above, is continued in the modern field by H. Hauser, and E. Bourgeois (1906–24).

For a philosophical survey *see* R. Flint's *History of the Philosophy of History, Historical Philosophy in France and French Belgium and Switzerland* (1894), which is preceded by a short general sketch. *See* also B. Croce's *Theory and History of Historiography* (trans., 1921), and F. J. Teggart, *The Theory of History* (1925). For more specific references *see* various historical articles. The output of historical literature is enormous, and the only way to follow it critically is by the aid of the great historical reviews, especially the *English Historical Review,* the *American Historical Review, La Revue historique,* and the most comprehensive and authoritative survey of all historical literature in the *Jahresberichte der Geschichtswissenschaft,* which has become an international undertaking in connection with the International Congress of Historical Sciences. (J. T. S.)

HIT, a town in 'Iraq on the right (western) bank of the Euphrates, on which it forms the limit of navigation, in 34° N. and 43° E., about 70 m. north-west of Baghdad. The town is of great antiquity and was the chief source of bitumen which was used in ancient times for binding the courses of brick buildings. There are bitter springs and lakes and abundant surface indications of oil, which has oozed from the surface here since time immemorial. Boats daubed with bitumen are still made here. The importance of the region to-day lies in its potential oil-supplies, to utilize which however improved communications would be necessary, and a pipe line westwards has been suggested. The region is desolate in the extreme, although the town itself has a little fringing girdle of palm trees.

HITCHCOCK, EDWARD (1793–1864), American geologist and educator, was born at Deerfield, Mass., on May 24, 1793. After graduating from Yale Theological seminary in 1820 he became pastor of a Congregational church at Conway, Mass. An interest in science led him at the same time to pursue a course in chemistry and geology at Yale under the elder Silliman and also to undertake a scientific survey of the western counties of Massachusetts. In 1825 he became the first professor of natural history at Amherst college and until 1845 was the sole instructor in all scientific subjects at that institution. In 1845 he became the third president of the college, and from then until his death in 1864 was professor of geology and natural theology. As president his energetic efforts contributed greatly to the early success of the school.

In 1830 he was appointed State geologist of Massachusetts and conducted the first government geological survey of the State. A resurvey was also made by him from 1837 to 1841 when his final report was published. In 1836 he was appointed geologist of New York, but ill health prevented him from conducting any of the field work. In 1857 he was appointed State geologist of Vermont, and the results of his geological survey of that State were published in 1862. He made the first detailed study of the fossil footprints from Triassic sandstones of the Connecticut valley, and convinced eminent geologists that they were those of prehistoric birds, lizards, insects, etc. He also was active in the study of the drift phenomena and was one of the first in this country to support Agassiz in attributing it to the action of ice, though he could not believe glaciers wholly responsible. He died at Amherst on Feb. 27, 1864.

His son, CHARLES HENRY HITCHCOCK (1836–1919), aided him in the Vermont geological survey and became professor of geology at Dartmouth college. In 1911 he published *Hawaii and its Volcanoes.*

A bibliography of the books, pamphlets, periodicals and newspaper articles of Edward Hitchcock totalling several hundred titles is found in his book *Reminiscences of Amherst* (1863), which is largely autobiographical. Among his principal works were: *Geology of the Connecticut Valley* (1823); *Catalogue of Animals and Plants of Massachusetts* (1835); *Elementary Geology* (1840; 31st ed., 1860); *Fossil Footmarks in the United States* (1848); *Outline of the Geology of the Globe* (1853); *Illustrations of Surface Geology* (1856); *Ichnology of New England* (1858).

See also J. P. Lesley, "Biographical Notice of Edward Hitchcock," National Academy of Science, *Biographical Memoirs,* I. (1877), and W. J. Youmans, *Pioneers of Science in America* (1896).

HITCHCOCK, GILBERT MONELL (1859–), American politician, was born at Omaha, Neb., on Sept. 18, 1859. He was educated at Omaha and Baden-Baden (Germany), and the law school of the University of Michigan. He was admitted to the bar in 1881 and practised law in Omaha for four years. In 1885 he founded the Omaha *Evening World,* and four years later bought the Omaha *Morning Herald,* combining the two papers into *The World-Herald.* He was representative in Congress 1903–05 and 1907–11. He was elected United States Senator as a Democrat for the terms 1911–17 and 1917–23. After the sinking of the "Lusitania" in 1915, he believed that action on the part of America should be limited to a demand for reparation. In 1917, however, he supported the resolution for a declaration of war against Germany, and in 1918 became chairman of the Senate committee on foreign relations. When President Wilson submitted to the Senate the Treaty of Versailles, Senator Hitchcock led the administration forces by virtue of his office, giving strong support to the League of Nations.

HITCHIN, a market town in Hertfordshire, England, on the small river Hiz, 32 m. N. from London by the L.N.E.R. Pop. of urban district (1921) 13,525. It is the junction of the main line with the Cambridge branch, and with a branch to Bedford. The church of St. Mary is Perpendicular, with a fine porch and a painting of the Adoration of the Magi, attributed to Rubens. Hitchin priory is a mansion on the site of a Carmelite foundation of the early 14th century. A Gilbertine nunnery, founded later in the same century, stood adjacent to the church, and portions of the buildings appear in an existing block of almshouses. The grammar school (1632) was reconstituted in 1889 for boys and girls. Hide curing, and the cultivation and distillation of lavender and peppermint are carried on.

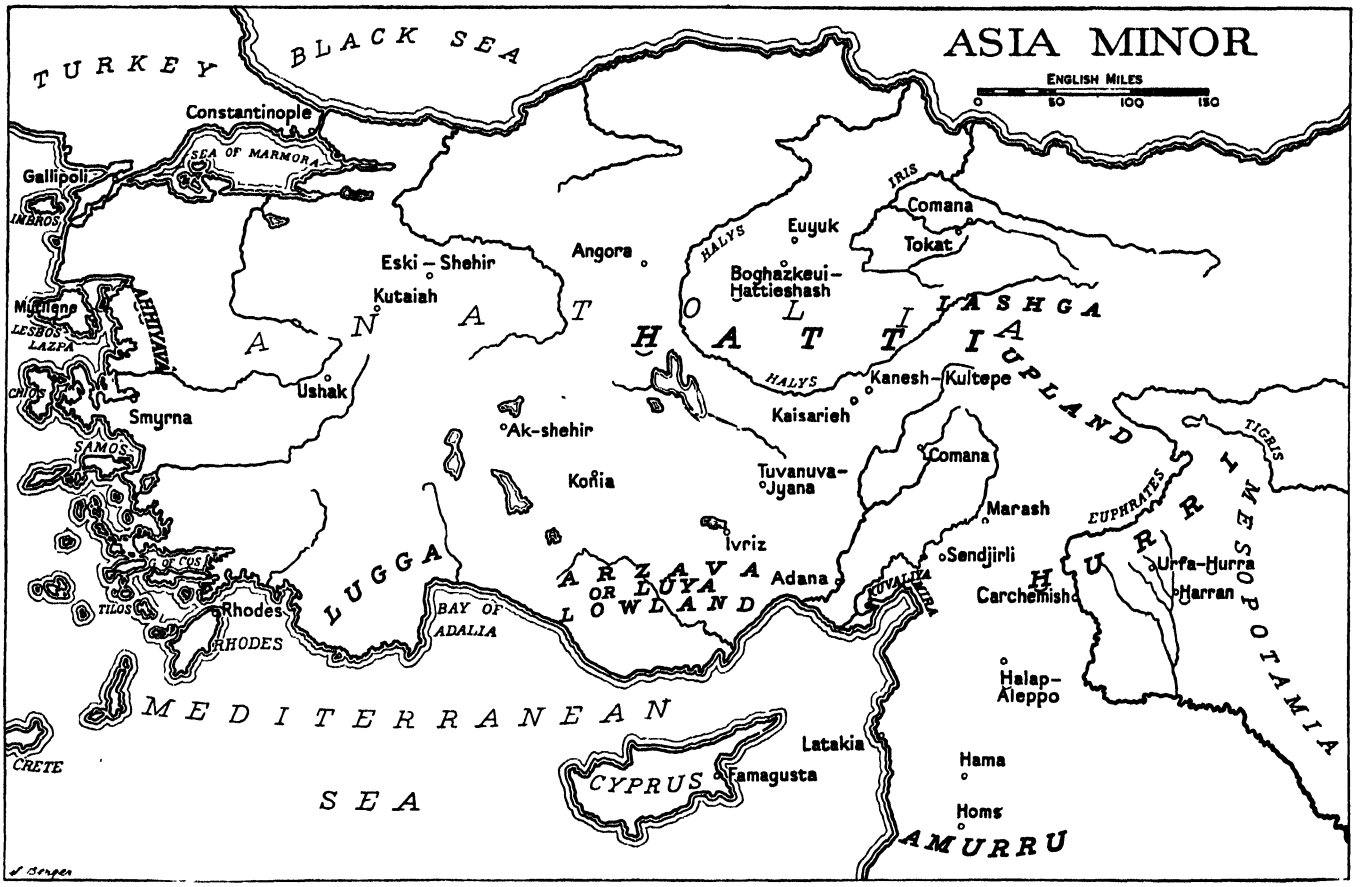
HITLER, ADOLF (1889–), Bavarian politician (Austrian by birth), was born at Braunau, Upper Austria on April 20, 1889. He was an architect's draughtsman by profession. He was a leader of the reaction in Bavaria, and founded, in 1919, the nationalist socialist workers' party, formed to oppose the social democrats, in reliance on a military organization known as the Hitler volunteers. On Nov. 8, 1923, he organized the revolt in Munich known as the Hitler *putsch.* The revolt was quashed on the next day, and Hitler was condemned, in April 1924, to five years' detention in a fortress. He was, however, released, in December, and in February of the next year re-organized the nationalist socialist labour party which then seceded from the *Deutschvölkische Freiheitsbewegung.* The party was represented in the Reichstag by Dr. Frick and Ludendorff, but Hitler himself found no seat there. He became the editor of the *Völkische Beobachter* (Munich).

HITTITE LAW: *see* BABYLONIAN LAW.

HITTITES, THE. This ancient Oriental people ruled over a great part of Asia Minor and Syria between the years 2000 and 1200 before the birth of Christ, and imposed their own high degree of civilization upon those regions. Rivals of the old Egyptians and Assyro-Babylonians, in comparison with both these nations, the Hittites rank third in importance among the peoples of the ancient East. Modern research has proved that the ruling people of the Hittite kingdom spoke a language which is related to modern European languages.

THE HITTITE PROBLEM AND ITS SOLUTION

The Old Testament, Egyptian and Assyro-Babylonian Knowledge of the Hittites.—The Hittite race, "the sons of Heth" (Hebr. *Ḥittîm, Benê Ḥêth*) was known to the writers of the Old Testament. In Gen. x. 15. Heth was a son of Canaan; in Gen. xxiii. "the sons of Heth" abode in Hebron, where Abraham traded with them for a grave for his wife Sarah; in Num. xiii. 29, the Hittites occupied the mountains of Canaan; in Gen. xxvi. 34, Esau married the Hittite women, Judith and Basemath. Also Uriah, whose wife David had appropriated (II Sam. xi.), is called a Hittite. In I Kings ix. 20, the Hittites, in conjunction with the Amorites, Hivites etc. were an important element in the population of Canaan. Yet according to the testimony of the Old Testament, Syria was the real home of the Hittites. In Joshua I. 4, the land of the Hittites reached to the Euphrates. In North Palestine, in the time of Solomon, the powerful kings of the Hittites ruled as sovereigns over separate Hittite states, besides



CHIEF HITTITE TOWNS, AND NEIGHBOURING DISTRICTS

the "kings of Arameans" (I Kings x. 29). From there King Solomon obviously brought his Hittite women (I Kings, xi. 1).

In confirmation and amplification of these Old Testament accounts, Egyptian evidence shows that in the time of the 18th to the 20th dynasties, between the years 1500–1190 B.C., a powerful northern kingdom *Kheta* sought perpetually to obtain political influence over Syria and therefore often fought with Egypt. Already the Pharaoh Thutmosis III. (1501–1447), who had conquered Syria as far as the Upper Euphrates, received presents from the prince of Kheta. Under the succeeding rulers of the 18th dynasty the Hittites established themselves in Syria. Bitter struggles took place between them and, especially, the Pharaohs of the 19th dynasty, Seti I. (*c.* 1313–1292) and Ramses II. (*c.* 1292–1225). About the year 1288 B.C. a great battle took place between the two hostile powers near Kadesh on the Orontes; after further combats, about the year 1272 Ramses II. established an alliance with the Hittite king Khattushilish III. and married, about the year 1259, one of his daughters; on this occasion the Hittite king visited Egypt in person. About the year 1190, the Hittite kingdom succumbed to the attacks of the so-called "sea nations."

The Cuneiform inscriptions also know a powerful kingdom and people *Khatti* who gave much trouble to the Babylonians, Assyrians and Egyptians during the II. and I. millenniums B.C. According to a Babylonian chronicle, about the year 1758 B.C. the *Khatti* people overwhelmed Akkad-Babylonia under the rule of King Samsuditana, and made an end of the Khammurabi dynasty. The increasing influence of the Khatti kingdom in Syria about 1400 B.C. is shown by the Amarna inscriptions. After the destruction of the Hittite empire in the 12th century B.C. the name Khatti is applied especially, according to the evidence of the inscriptions of the Assyrian kings, after Tiglath Pileser (*cir.* 1110 B.C.), to the kingdom of Carchemish on the upper Euphrates, but it also denotes the whole of Syria. Sargon II., it is true, made an end of the Khatti kingdom of Carchemish in 717 B.C., yet the New-Babylonian king, Nebuchadnezer II. (604–562), still used the name Khatti for Syria.

Hittite Monuments and Hieroglyphic Inscriptions.—The quoted information pointed to Syria and probably also to the adjoining regions of Asia Minor as the home of the Hittites. When during the 19th century, monuments of unusual style and inscriptions written in an unknown hieroglyphic script, were found in Syria and Commagene, as for example, at Hamah on the Orontes, at Aleppo, at Jerablus on the Euphrates, at Marash and Malatia, further in Cappadocia, as at Boghazkeui and Euyuk, as well as in the Taurus mountains, at Bor, Ivriz and Bulgarmaden, and finally also in western Asia Minor, at Sipylos near Magnesia, it was very natural to attribute them to the Hittites. The native monuments, together with the Egyptian reliefs representing Hittites, showed the physical characteristics of the Hittite race; in particular, the great curved nose and backward sloping forehead, which proved beyond any dispute that the Hittites were not Semites or Indo-Europeans. The hieroglyphic writing of the Hittites has nothing to do with the Egyptian hieroglyphic script. It is a pictographic script; but the original meaning of many of the signs is still obscure. In the course of time many signs developed a cursive form. The inscriptions are written *boustrophedon;* after a line written from right to left (or the reverse) there follows one from left to right (or the reverse), so that the figures and heads always face towards the beginning of the line. So far about 200 of the signs of this writing are known. In regard to the age of this writing, the Hittite Archives of Boghazkeui, for example a clay bulla bearing the seal of King Shuppiluliumash (about 1385 B.C.), the legend being written both in cuneiform and in hieroglyphics, proves that the latter was used as early as the 14th cent. B.C. Indeed this script may be much older, as is shown by its use in the very old Hittite sanctuary Yasili Kaya, not far from the chief Hittite city Khattushash-Boghazkeui. The invention of this writing may, therefore, be placed in the first half of the second millennium B.C. This script was employed by the Hittites on their rock and stone monuments especially, and upon seals made of stone and metal. It is their monumental writing; for their daily needs and especially for library and archive purposes, as the

archives of Boghazkeui show, they used cuneiform writing and clay tablets.

Much ingenuity has been employed in deciphering the Hittite hieroglyphics. Systems of deciphering were published by F. E. Peiser, A. H. Sayce, P. Jensen, A. Gleye, R. C. Thompson, A. E. Cowley and C. Frank, yet none of them was accepted by the scientific world It seems that from all these systems only the interpretation of very few signs will prove true. The task is, in fact, very difficult, since bilingual inscriptions are still too few; those that have been discovered so far give but little help in decipherment owing to their brevity, obscurity or damaged condition. They are these: the silver seal of a king Tarkutimme-Tarkondemos of Metan (?), the seal cylinder of one Indilimma, which is, possibly, not bilingual, and the seal impressions of the Kings Shuppiluliumash and Arnuvantash IV.

The Hittite Royal Archives of Boghazkeui.—The discoveries of the 19th century failed to solve the very important problem of the affinities of the language of the Hittite people. A firm position was first reached, when in the course of his epoch-making excavations, 145 km. east of Angora, Hugo Winckler, the Berlin Assyriologist, found in the ruins of Boghazkeui a great mass of Hittite clay tablets inscribed with cuneiform characters. Winckler dug there in 1906–07 and in 1911–12, and found about 10,000 broken and whole cuneiform tablets which belonged to the archives of the kings of Khatti, and proved that the capital of the Hittite empire had been at Boghazkeui. Only a relatively small number of the clay tablets discovered in Boghazkeui are written in Babylonian cuneiform script and in Babylonian language. These are state treaties which the Khatti kingdom concluded with other ancient oriental states, and diplomatic letters of the Hittite kings. Babylonian, as the Tell-el-Amarna letters have shown, was the language of eastern diplomats, the ancient oriental French, in the second millennium B.C. The greatest number of the Boghazkeui clay tablets are written, it is true, in Babylonian cuneiform writing, but in the Hittite language. A closer examination of these Hittite documents soon showed the identity of the Hittite language with that of Aezawa (probably Cilicia Tracheia, Isauria and Southeast Lycaonia), which was already known through two letters from the cuneiform collection of Tell-el-Amarna in Egypt. (For the contents of the Hittite archives of Boghazkeui, now for the most part in the museum at Constantinople, some being in Berlin, *see* below.)

The Decipherment of Hittite.—After the premature death of Hugo Winckler in 1913, the German Oriental Society, under whose aegis the excavations at Boghazkeui had been carried out, entrusted the publication of the Hittite archives to a group of Assyriologists, one of whom, Professor Frederic Hrozný, of the Czech University at Prague (but then at the University of Vienna), succeeded in solving the riddle of the Hittite language, in writing the first Hittite grammar and establishing the Indo-European character of the structure of this language. About the same time E. F. Weidner declared the Hittite to be undoubtedly a Caucasian language. Hrozný's decipherment was founded upon the unilingual clay tablets of Boghazkeui: these inscriptions had to be interpreted only on their own content. For this task sentences containing proper names afforded valuable help, as well as those in which Sumero-Babylonian ideograms (word signs) occurred. The Sumero-Babylonian cuneiform writing (*see* CUNEIFORM) in which the Boghazkeui texts are written was indeed originally a picture-writing, from which later on a syllabic script was developed; but even in the later, more phonetic stage the cuneiform signs were used sometimes as word-signs (for example, the cuneiform sign  , originally the picture of a fish  , as the sign for the word "fish"). Even the Hittites employed these so-called ideograms in their cuneiform script so that these signs in a Hittite text were intelligible even without knowledge of the Hittite language. Moreover the Hittites also occasionally employed phonetically written Babylonian words as ideograms. Thus, in the middle of an unintelligible Hittite text the Babylonian word *a-bu*, "father" is found: this Babylonian word was naturally read by the Hittites (as we now know) *attash*, but, by its Babylonian form, known to us, it helped us eventually, even without knowledge of the Hittite reading, to penetrate at least in some degree into the sense of the Hittite sentence. A help was derived also from the method of combination which, progressing from the known to the unknown, by means of analogy, parallelism, resemblance of words, etc., endeavours to elucidate the unknown words. In this way, later on, Hittite sentences could be treated which were written phonetically in Hittite.

Hittite—an Indo-European Language.—Hrozný, in the course of his researches, succeeded in identifying most forms of the Hittite language. On the basis of the structure of the language thus established he built his thesis that Hittite is an Indo-European language. He got this idea at first when he established that Hittite has a present participle, which in Nom. Sing. Masc. ends in *-anza*, in other cases in the Masc. in *-ant-* and *-and-*, thus resembling the Indo-European participle in *-nt-* (Lat. *ferens, ferentis*, Gr. *φέρων, φέροντος*). The idea of a relationship between Hittite and Indo-European languages soon took a stronger hold when, having established a complete paradigm of the Hittite participle in *-ant-*, as of other Hittite nouns, he discovered that almost all the case-endings have more or less precise counterparts in Indo-European languages. Thus the Hittite participle *khûmanza* "all" is declined:

	Masc.-Fem.	Neuter
Singular:		
Nom.	*khûmanza* (compare Lat. *ferens*)	*khûman* (compare *φέρον*)
Gen.	*khûmandash* (compare *ferentis*, *φέροντος*)	
Dat.-Loc.	*khûmanti/-i* (compare *ferenti*, *φέροντι*)	
Accus.	*khûmandan* (compare *ferentem*, *χρόνον*)	*khûman* (compare *φέρον*)
Abl.	*khûmandaz(a)*[1]	
Instr.	*khûmantel* (compare osk. Abl. *praesentid*?)[1]	
Plural:		
Nom.	*khûmanteš* (compare *ferentes*, *φέροντες*)	*khûmanda* (compare *φέροντα*)
Gen.	*khûmandâsh*[2]	
Dat.-Loc.	*khûmandâsh*[2]	
Accus.	*khûmandush* (compare *lupos*, *λύκους*)	*khûmanda* (compare *φέροντα*)

The Hittite word for "Father" *attash* for example is declined in the same way:

Sing.: Nom. *attash*, Gen. *attash*, Dat.-Loc. *atti*, Acc. *attan*, Abl. *attaza*, Instr. not yet found would be *attil*;
Plural: Nom. *attêsh*, Gen. and Dat.-Loc. *attâsh*, Accus. *attush*.

Very important was the discovery of a declension which is especially characteristic of Indo-European languages. It is the declension of the Hittite word *vâdar* "water" whose meaning Hrozný succeeded in establishing with the help of the sentence: *nu NINDA-an ezzatteni vâdar-ma ekutteni*. In this sentence the meaning of the Sumero-Babylonian ideogram *NINDA* "bread" was all that was known. The following Hittite ending *-an* has been established as the termination of the Acc. Sing. from examples in other places. In one sentence speaking of bread also the word for "to eat" might possibly (though not necessarily) be expected, and as this meaning fitted for the Hittite root *ezza-* everywhere, Hrozný identified the Hittite *ezza-* and also *ad-* (*adanzi* "they eat") with the Latin *edo*, old High German *ezzan* "to eat," etc. Other passages showed him that *-teni* is the ending of the second Pers.

[1]The ablative (not the locative as was originally assumed by Hrozný) in *-az* (*a*) is perhaps of the same origin as the Hittite instrum. in *-et, -it*. Compare *kallarit uddanaz* (*Keilschriftt. aus Bogh.* IV. 7, 60) "from the disastrous thing," *sharkhuvantazshet* "from its belly" (Code Hittite par. 90), *KAP-laz-tet* "from thy left side" (KBo. 2482 II. 6) etc. Both the Hittite endings *-az(a)* and *-et, -it* are derived from the Indo-European ablative ending *-ōd, -ēd;* before the particle *-a* (from *-e*) the *d* is changed into *z* in Hittite. Thus two forms arise, *-az(a)* and *-et, -it*, which differ also in use: the first, as a rule, is used as the ending of the ablative, the second, chiefly as that of the instrumental.

[2]The origin of the ending *-âsh* is still obscure.

Pl. Pres.: *ezzateni* means consequently: "you eat, you will eat." As the sentence: *vâdarma ekutteni* was clearly in parallelism with the first one (*NINDA-an ezzatteni*), it seemed possible to see in *vâdar*, which is parallel with "bread," also a simple victual. A meaning as "water" was here very convenient and also other passages confirmed this interpretation. A surprising comparison with the English *water*, old Saxon *watar* "water," etc., offered itself and proved true. Then *ekutteni* that is parallel to *ezzatteni* "you will eat" must signify: "you will drink"; and for the Hittite root *eku-*, *aku-* "to drink" and the cognate Hittite word *akuvanna* "drinking, drink" offered itself as a comparison with the Latin *aqua* "water." The Hittite sentence above this runs when translated: "Now you will eat bread, further you will drink water."

Astonishing as was the discovery of a word for "water" similar to the English one in an ancient oriental language of the middle of the second millennium B.C. the discovery soon after of the declension of this Hittite word was still more so: Sing. Nom. *vâdar*, Gen. *vedenash*, Dat.-Loc. *vedeni*, Accus. *vâdar*, Abl. *vedenaz*, Instr. *vedenit;* Plural Nom. and Accus. *vidâr*. The Gen. Sing. of *vâdar* is not, as we might expect, *vadarash*, but *vedenash*, with an alteration in the suffix (*n* for the *r*, used in the Nominative). The same very remarkable declension shows however also the quoted Indo-European word for "water" (Old Saxon *watar*, etc.): Gr. Nom. ὕδωρ, Gen. ὕδατος from ὕδν-τος. (*Cf.* Lat. *femur*, Gen. *feminis*.)

The Hittite pronouns, as established by Prof. Hrozný, also bear marked resemblance to Indo-European forms as shown in the following list in which the Hittite forms are set in italics at the beginning of each line or paragraph:

uga, ug "I", compare Lat. *ego*.
ammug, ammuga "to me, me," compare Gr. ἐμέγε.
ammêl "of me, my," which is similarly related, is connected through the Genitive ending *-êl* with the languages of Asia Minor and with Etruscan.
zig, ziga "thou," compare Gr. σύγε or better perhaps according to Marstrander, the Accus. σέγε.
tug, tuga "to thee, thee," compare Goth. *thuk*.
tuêl "of thee, thy" with the Genitive ending *-êl*, is also connected.
vêsh "we," compare Goth. *weis*.
anzâsh "us," compare old High German *uns*.
anzel "our," compare Goth. *unsara*.
shumêsh, shumâsh "you," compare Gr. ὑμεῖς.
-mu "to me, me," *-ta, -du* "to thee, thee," compare Gr. μοί, μέ, τοί, etc.
-mish "my," *-tish* "thy," compare Lat. *meus, tuus*.
enish, annish (compare *uni*) "that," compare old High German *ënor* "that," old Slav. *onŭ*.
kâsh "this," compare Oscan *e-kas* "these" (fem.)
shash "this," compare Sanskrit *sá*.
kuish "who, which," *cf.* Lat. *quis*.
kuit neuter "what, which," *cf.* Lat. *quid*.
kuvabi "where, whither," *cf.* Lat. *ubi, ne-cubi*.
kuish kuish "whoever," neuter *kuit kuit*, *cf.* Lat. *quisquis, quidquid*.
kuishki, neuter *kuitki*, "somebody, something," *cf.* Lat. *quisque, quidque*.
kuvatka, "something, perhaps," *cf.* Lat. *quodque*.
kuvabikki "somewhere," *cf.* Lat. *ubique*, etc.

On the other hand, the Hittite pronoun *apâsh* "that" is connected with the languages of Asia Minor (*see* ASIANIC LANGUAGES); *cf.* Lycian *ebe* "this," Lydian *bis* "he."

Hrozný likewise proved that also the Hittite verb is essentially Indo-European. The present tense of the Hittite verb *jami* "I make" runs:

	Hittite	Sanskrit	Greek
Sing. 1.	*jami* "I make"	*yâmi* "I go"	τίθημι
2.	*jashi*	*yâsi*	τίθης
3.	*jazi*	*yâti*	τίθησι, τίθητι (Dor.)
Plur. 1.	*javeni* (*javani, jauni*)	*yâmaḥ*, *cf.* 1. pers. dual *yâvaḥ*	τίθεμεν
2.	*jatteni* (*jattani*)	*yâtha, yâthana*	τίθετε
3.	*janzi*	*yânti*	τιθέασι, τίθεντι (Dor.)

(The forms enclosed in brackets are found, but from another verb—not yet from *jami*.)

The Hittite verb *dâkhkhe* "I take" for example presents a somewhat different paradigm for the present tense:

Sing. 1. *dâkhkhe, dâkhkhi* "I take" (comp. Lat. *fero*? The Hittite *kh* or *h* is, perhaps, as elsewhere frequently, secondary).
2. *datti* (comp. 2. Pers. pret. *dâtta*).
3. *dâi* (comp. οἶδε?).
Plur. 1. (*dâveni*), *dâvvani*.
2. *datteni*, (*dattani*).
3. *dânzi*.

The Imperative Pres. Active runs:

	Hittite	Sanskrit
Sing. 1.	*jallu* (KUB xiv. 27, 10); also (*jallut, jallit*)? Comp. *eshlut, eshlit* I will do.	
2.	*ja* "make"	*yâhi* "go"
3.	*jaddu*	*yâtu*
Plur. 2.	*jatten*	*yâta, yâtana*
3.	*jandu*	*yântu*.

Comp. for *jal-* old ecclesiastical Slav. Part. Pret. Act. 11. *neslŭ*, umbr. Fut. ex. *apelust*, Armenian Part. Pres. *berol*? *-u* is an Imperative ending, which is found also in Indo-Iranian.

The *-t* in *eshlut, eshlit* is perhaps of medial origin; *see* below especially the Preterite of the Hittite Medio-passive.

The Preterite Active runs:

Sing. 1.	*janun* "I made" (comp. ἔφερον)	*dâkhkhun* "I took" (Hittite *kh* is perhaps secondary); *tabarkha* "I reigned" (comp. οἶδα?).
2.	*jat* (comp. *dâtta* 2. Pers. sing. and *jat* 3. p. sing.)	*dâtta* (comp. οἶσθα), *dâsh* (from *dâsh+ sh*?).
3.	*jat* (comp. Sanskrit *ádhāt*)	*dâtta* (? Comp. *jat* 3. pers. and *dâtta* 2. Pers. sing. ?) *dâsh* (from *dâsh+t*?).
Plur. 1.	*javen*	*dâven*
2.	*jatten*	(*datten*)
3.	*jêr* (comp. Lat. *fuēre*).	*dâir*; also *dalugnula* "they have made long" (comp. for ex. Czech *nesli*?).

Very important is the proof of the existence of a Hittite Medio-passive form which frequently has an *-r* ending as exhibiting resemblance to the Latin verbal forms such as *amatur, amantur* and similar forms in Italo-Celtic and Tocharish. Besides *-r*, a medial *-ti, -t* is found as ending in the Hittite Medio-passive in other forms, especially in the Preterite; the forms with *-ti* are in the old Hittite more frequent than those with *-t*.

The present of the Hittite medial verb *jakhkhari*, "I go" runs:

Sing. 1. *jakhkhari* (comp. Lat. *feror*? Hittite *kh* is secondary?), (*jakhakhari*) "I go." *See* also Kuryłowicz in *Symbola grammatica in honor. Rozwadowski*, p. 95 104.
2. (*jatta* old Hittite), *jattati* (comp. οἶσθα and 3. Pers. sing. *jatta*?) Also *eštari* "thou sittest down," *v.* Götze, *Madduwattaš*, p. 104, n. 12.
3. *jatta* (comp. φέρεται, ἐφέρετο), *jattari, jattâri* (comp. Lat. *amatur*), also *esha, eshari*, "he sits down" (comp. Umbrian *ferar*).
Plur. 1. (*javashta, javashtat, javashtati*) (comp. Act. *javeni*, [*javani,*] the pronoun *vêsh* "we" and 1. Pers. dual Sansk. *svás*?)
2. *jadduma* (*jatumari* old Hittite) (comp. Sanskrit *abharadhvam*, old Avestic *mązdazdûm*).
3. *janta*, (comp. φέρονται, ἐφέροντο), *jantari* (comp. Lat. *amantur*).

The medio-passive imperative of Hittite, whose endings for the most part show the imperative ending *-u*, already known to us, runs:

Sing. 1. (*jakhkharu, jakhakharu*) "I will go."
2. *jakhkhut*, (*jakhkhuti*) (stem with a secondary *kh+-u* of the Imperative *+-t, -ti* of the medium?)
3. *jattaru*, also *esharu*.
Plur. 2. *jaddumat*, (*jaddumati*) (comp. 2. Pers. Plur. Pres. and Preterite.)
3. *jantaru*.

The Preterite of the Hittite medio-passive runs:

Sing. 1. (*jakhati*), *jakhkhat, jakhkhakhat* "I went" (comp. 1. pers. Sing. present).
2. (*jattati, jattat*) (comp. 2nd pers. sing. Pres. and 3rd sing. Pret.), also *ḫtshat* (comp. *ḫtshat, eshat* 3rd Sing.?) "thou becamest," besides *ḫtshtat*.

3. (*jatta?*), (*jattati*), *jattat* (comp. 3. Sing. pres.), also *eshati*, *eshat* (=3rd Sing. pres. *esha*+medial *-li*, *-t?*), "he sat down," besides *eshtat*.

Plur. 1. (*javashtati*), (comp. 1. Plur. Pres.)

2. (*jadumat*), *kîshdumat*, "you became" (comp. 2. Plur. Pres.)

3. (*jantati*), *jantat* (comp. 3. Plur. Pres.).

(Both Friedrich and Götze have been successful in the interpretation of some medio-passive forms of Hittite. However the paradigms cited above are given on the basis of independent researches of Hrozný with the only exception of the forms *javashta* and *javashtat*[*i*], whose identification must be referred to Friedrich. Hrozný found also the form of the 1. Pers. sing. Imp. Act. independently of Friedrich.)

Among others, Hittite had also verb stems in *-shk-*, as for example *dashkishi*, "thou takest" (to the simple stem *dâ-* "to take"), as also verb stems in *-nu*, as for example *arnumi* "I send for," to the simple stem *ar-* "come"; comp. Lat. *posco*, Greek ὄρνυμι, etc.

That all this correspondence of Hittite with Indo-European languages shows that in its construction Hittite is an Indo-European tongue, is the substance of Hrozný's decipherment of the Hittite language: of his preliminary report *Die Losung des hethitischen Problems*—"The solution of the Hittite Problem" in the Transactions of the German Oriental Society (*Mitteilungen der deutschen Orientgesellschaft*), No. 56 (1915) and especially of his Hittite grammar *Die Sprache der Hethiter, ihr Bau und ihre Zugehörigkeit zum indogermanischen Sprachstamm*—"The Language of the Hittites, its structure and its membership of the Indo-Germanic stock" (Leipzig, 1916–17). Within the Indo-European group of languages the Hittite, which treats the gutturals like the West Indo-European languages, the so-called Kentum group (*see* INDO-EUROPEAN LANGUAGES), appears to be related chiefly in respect of its medio-passive endings, such as *-tari*, with the Italo-Celtic languages and Tocharish. (In 1902 Knudtzon published the view that the Arzava language which, as we now know, is identical with Hittite, is an Indo-European language. But his opinion met with such severe and universal opposition from the Indo-European philologists that he withdrew it.)

Foreign Influences.—In the Hittite language, the remains of which date from the second millennium B.C., and which therefore is one of the oldest Indo-European languages, there can be observed a strange extensive simplification and attrition of the language, in spite of the survival of certain ancient features. Further at the present time only a small proportion of the Hittite vocabulary can be traced to Indo-European roots. This, it is true, is perhaps in some extent due to the fact that the cuneiform script invented by the Sumerians is poorly adapted for rendering an Indo-European language. For this reason it is very difficult to set up a complete system of Hittite phonology. In Hittite words such as *khameshkhanza* "spring," *antukhshash*, *antuvakhkhash* "man," *idâlush* "evil," *karmalashai* "remains crippled," etc., are very numerous, for which a clearly defined Indo-European etymology is—at least at the present time—wanting. All these strange facts are best explained by the supposition that Hittite was largely influenced by other, non-Indo-European, languages. We find in Hittite words, borrowed from Assyro-Babylonian as, for example, the verb *khabalashaizi* "he smashes," which is borrowed from the Assyro-Babylonian verb *khabâlu* "to destroy." The Hittite word for house *pir* has its origin perhaps in the old Egyptian word *per* "house," which is found also in the word Pharaoh, properly "great house, palace." For the far greatest number of such non-Indo-European words Hittite is however most probably indebted to the indigenous languages of Asia Minor, with which it was in close association for about 1,000 years. It is even possible that Hittite derives a not unimportant part of its foreign words from non-Indo-European tribes with whom the nation was in contact when it occupied its earliest Indo-European home. As the Hittites belong to the oldest Indo-European peoples, those who first left their earliest Indo-European home in the north, it must be supposed that they belonged to the borderland tribes of the earliest Indo-European home and, therefore, had already there come into contact with foreign peoples. Later, probably in the second half of the third millennium B.C., when the Hittites, as a conquering apparently not very numerous people, forced their way over the Caucasus, or (less probably) across the Bosporus, into Asia Minor, and overthrew the native inhabitants, also, the languages of the latter exercised considerable influence on the language of the Indo-European conquerors. At the same time the Hittites came into contact with the Assyro-Babylonian colonies in Asia Minor, from whom they took over cuneiform writing, many religious and cultural goods, and, naturally, many words of their language.

Hrozný's Decipherment and the Experts.—Relying chiefly on these foreign influences in Hittite, the philological experts (*e.g.*, Bartholomae, Bork) in the beginning opposed and refused to accept both Hrozný's decipherment and his theory of the Indo-European character of Hittite. They even sometimes doubted the accuracy of his readings which were held to be tendencious. Hrozný himself provided a measure of support to these unfavourable criticisms since, while working out the Indo-European affinity of this language, he sometimes overshot the mark in his first public announcement. Scepticism as to Hrozný's decipherment was carried very far especially in England. But further investigations of Hittite material which achieved notable success, especially in Germany, demonstrated the futility of this criticism and thus obtained a complete victory for Hrozný's position. The first to maintain Hrozný's theory were the Assyriologist Holma (1916), the Indo-Germanist, Marstrander (1919) and the Assyriologist, Forrer (1919). Also the Indo-Germanist, F. Sommer, who learned cuneiform writing on account of Hittite, and thus convinced himself of the exactness of Hrozný's readings, "after long doubt" declared (1920) Hittite "to be by its flexional structure an Indo-Germanic language," and in 1921 the Indo-Germanists, Herbig and Debrunner joined him. The Indo-Germanic (Indo-European) theory won a very warm adherent in the Hittitologist J. Friedrich of Leipzig, an expert in Assyriology and Indo-Germanic learning Also the assent of both the eminent Indo-Germanists, P. Kretschmer and H. Pedersen (1925–26) to the theory of the Indo-European character of Hittite is very important. Thus in 1924 Friedrich was able to assert that almost all serious students adhere to the theory that Hittite is a newly discovered Indo-Germanic language (Ebert, *Reallexikon der Vorgeschichte, s.v.* "Altkleinasiatische Sprachen").

OTHER HITTITE LANGUAGES

Khattish.—Not only the mixed character of the Hittite language, but also the physical characters of the "Hittite" race, its hyperbrachycephalous skull, the large hooked nose and sloping forehead, suggested the hypothesis that here an Indo-European nation is mingled with a non-Indo-European race. At the turn of the year 1919–20 this conjecture was confirmed by the independent and surprising discovery of Hrozný and Forrer that in the State archives of the Hittite kings had been preserved remains of one language which is totally different from the Indo-European Hittite and which these documents call *khattili*, that is, *khattish*. According to a collection of instructions an employe shall come out from the Palace and call "khattish" the word *tâkhaja*, whereby the word *tâkhaja* is said to be the "khattish" word for shaver. Also according to another text the doorkeeper calls the employes of the Palace by their "khattish" designations, and this same text gives also the Indo-European-Hittite versions of these titles. Sometimes the rituals composed in the Indo-European Hittite comprise litanies, prayers, exorcisms, etc., "in the Khattish language," "in the language of the town Khatti" (*khattili*); songs also were very frequently sung by the singers in the Khattish language during religious services. Khattish appears to have played an important rôle, especially in the religion of the Khatti land. The Khattish litanies were left sometimes without translation into the Indo-European-Hittite language, but they sometimes appear there also translated into Indo-European Hittite; in the latter case we have to do with true Khattish-Hittite bilingual texts. The population of the Khatti country therefore, in regard to physical and linguistic characteristics, was mixed and not pure, as was also the case in ancient Babylonia, with its Sumerian and Baby-

lonian peoples, and Sumerian used as the ecclesiastical language. We must assume that when the Indo-European Hittites invaded Asia Minor they found there an older population which they subdued, but were in return strongly influenced by them, both in blood and language. The long-nosed type already mentioned, and called "Hittite," also "Armenoid," especially described by the anthropologist von Luschan—so far as Eastern Asia Minor is concerned—goes indeed back to these original inhabitants of Eastern Asia Minor called "khattish" by the Boghazkeui texts. The same type is found also in Syro-Palestine, Mesopotamia, Armenia and Persia. In consequence of mixtures of peoples this large nosed race now speaks (as in antiquity) widely different languages, Indo-European languages, such as Armenian and Persian, and Semitic Hebrew (in antiquity the Semitic Assyrian also). (The so-called "Jewish" type belongs also to this ancient race.) According to the Hittite Boghazkeui texts, to the Khattish race element in the Hittite empire belonged especially, though not exclusively, the lower class of the towns, the minor officials and the craftsmen in temple and palace, a great part of the priesthood and probably also a part of the country people.

The Khattish (by Forrer called proto-khattish) language differs fundamentally from all others of the Khatti kingdom in its construction. It employs almost exclusively prefixes in its inflections and not suffixes; for example, the word *binu,* child, forms its plural *lê-binu.* Knowledge of this language with its astonishing abundance of curious prefixes, which is known to us only through texts of slight extent, is still in its infancy. It is as yet uncertain whether we should regard it, with Forrer, as related to the north-east Caucasian tongues, which also make use of prefixes. (Bleichsteiner [*Ber. d. Forsch.-Inst. f. Osten u. Orient,* 3, p. 102 and foll.] believes, on the contrary, that some analogies between Khattish and West Caucasian languages can be established. This also is uncertain.)

Contact between Indo-European Hittite and Khattish can also be established in the words borrowed from the latter tongue. As characteristic of Khattish we may mention the Khatti words *kâtte* "king," *nimkhutun* probably "woman" (Bo. 2039), *vindukḳaram* "cup-bearer," in which the Minor Asiatic word *vin* "wine," occurs, *shakhtarîl* (with the suffix *l*) "exorcist," *khantipshuvâ* "cook," and deal with the following Khattish fragment: *imâkhashâil ugga varvû shugga varvashkhap ziptipâil kâtti kurkuvenna bidush kâbarvun vashkhavûn liggarân varûshemu kurkubenna,* etc.

It proves therefore that the Hittites themselves designated as the speech of the capital city, and probably also that of the country Khatti—K h a t t i s h—the non-Indo-European language just described, that of the original inhabitants of their country. This language should therefore be called "Hittite," because the name "Hittite" goes back to the name Khatti through the Old Testament Heth. So far a name for the Indo-European Hittite, for the official language of the Hittite state, has not been discovered in the Boghazkeui texts; once only is the Hittite state language called *nâshili* which, however, according to Hrozný's interpretation, means no more than "our (language)"—comp. Lat. *nos* "us." In the Hittite religious services, according to the Hittite ritual texts, sometimes Khattish, sometimes Khurrish (*see* below), sometimes Lûish (*see* below) singers took part, sometimes also singers from the city *Kanesh, Kanish,* in Asia Minor. Because these last singers probably used the Indo-European state language, Forrer would call this language the "Kanish language." But nothing else supports the supposition that the Indo-European Hittites called themselves "Kaneshites"; further so far, the expression *Kaneshili*="in Kaneshite (language)" never occurs. We must therefore continue the make-shift of designating the non-Indo-European speech as "Khattish" and the Indo-European, as hitherto, as "Hittite."

Lûish.—Another very important language of the Khatti kingdom is Lûish which Hrozný has also shown to be essentially Indo-European. Forrer, who falsely calls this language "Lûvish," regarded it at first as a Finno-ugrian language, but adopted later Hrozný's view that it, too, must be considered as Indo-European. Of this opinion are also, for example, Friedrich, Kretschmer, Ungnad and others. Lûish is closely related to Hittite as is demonstrated by the following passage, written in Lûish and Hittite:

Hittite: *Marduk . Innaravantash. .eshkhanuvanta kuêsh veshshanti Lûlakhijashshan*

Lûish: *Shantąsh ..Annarummenzi . ashkhanuvanta kuinzi vashantari Lûlakhinzashtar*

English: *Shantash* (and) the *Innaravantash*-deities who put on mantles and the *Lûlakhi*-deities

Hittite: *khuprush kuêsh ishkhijantish*

Lûish: *khupparaza kuinzi khishkhijanti*

English: who have tied on their pilgrim bottles(?).

Sentences such as *kuinzi vashantari* (medio-passive; comp. *amantur*) = Hitt. *kuêsh veshshanta* leave no doubt as to the Indo-European character of Lûish and its relationship to Hittite. Certainly in this example (and still more perhaps in others) Lûish appears to have been already more thoroughly transformed through the autochthonous languages of Asia Minor than Hittite. Unfortunately, Lûish passages in the Boghazkeui texts occur but so seldom that a thorough investigation of this language is beset with difficulties.

The name Lûish (Hittite *Lûili*) is derived from that of the country *Lûya,* which was also called *Arzava* and which may be possibly sought in West Cilicia, Isauria and South Lycaonia. Besides for Lûya itself the Lûish language is also attested for the capital Hittite city *Khatti* or *Kattushash* and for the State of Kizvatna, commonly identified with Pontus on the Black sea. Götze and Smith look for it on the Gulf of Issos, though with meagre justification. Thus, in the second millennium B.C., the Lûites were dispersed, though probably unequally, throughout the whole of Eastern Asia Minor, but because of their name, we must certainly seek the centre of their distribution in Lûya-Arzava, therefore southerly from the Khatti country. They are the Indo-Europeans who made the furthest advance into the South of Asia Minor in the second millennium B.C. They must—as the earliest Indo-European wave—have reached Asia Minor earlier than the Indo-European Hittites (about 3000 B.C.?). The language of this vanguard of the later Hittites was destroyed to a greater degree by the influence of the autochthonous tongues of Asia Minor than was the case with that of the true Hittites. On the contrary these Indo-European languages have also influenced the autochthonous tongues of Asia Minor, as is shown by the Indo-European elements in Lycian, Lydian, Etruscan, etc. Lûish appears to have been spoken in the Khatti kingdom—so far indeed as they did not use Khattish—by the peasants; their language was accounted barbaric by the Hittites. (It is also interesting that the employees, priests and workmen of the royal palace in Khatti-Khattushash were Khattish, its fire-men however Lûish.)

Khurrish.—Besides the Hittite, Khattish and Lûish, still another language has been revealed by the inscriptions at Boghazkeui—Khurrish (Hittite *khurlili*), which is thus named after a people, empire and, apparently, also a city *Khurri.* The country *Khurri* (which properly means "hollows, caverns"), must be looked for in North Mesopotamia and the bordering Armenian mountains. The name both of this country and its people was formerly read as Kharri which, graphically, was also possible. The Mitanni country, the later Mygdonia on the rivers Djaghdjagh and Khabur in North Mesopotamia, formed one part of the Khurri country. Because the Aryan deities Mitra, Varuna, Indra and Nāsatya are named in the political treaties of Mitanni, Winckler associated the name Kharri with that of the Aryans. However, Hrozný has shown that the character *khar, khur* in the name *Khar-ri* can only be read *khur,* and this name itself therefore only *Khur-ri;* this is proved by the place-name *Bàd-Khu-u-ur-lu-ush-sha* (in the inscription Bo. 434), that is "The fortress of the *Khurri* people," where only the reading with *u* is possible. (Compare also the proper name *Ḫu-u-ur-lu-u* [*i.e.,* "the Khurrite"] in the inscription *Transact. of the Amer. Phil. Assoc.* 58, p. 24, 2. Hrozný regards the North Mesopotamian town Urfa, Gr. Orrhoë, Edessa, as the centre of the empire of *Khurri.* The name of this town and country in Aramaic is *Urhôi,* אורהי, in Arabic *ar-Ruhâ'u;* compare also the Arabes Orrhoei or Orroei of Pliny [n.h. V. 85, VI. 25, 117, 129]. In the letter of Tushratta

composed in Mittanish the Khurri country is called *Khurvûkhe* or *Khurrûkhe*, *i.e.*, the Khurrish. To a *Hurrûhe*, which may have been spoken with a weak *h*, can easily be traced *Urhôi*, *Orrhoë* [country *Orrhoëne*, later changed into *Osroëne*]; comp. *Khabur*, Gr. *Khaboras* and also *Aborras*. In Assyrian Urfa seems to be called *Khurra* [in an inscription of Adadnarâri I.]. As the name probably means "cavern[s]," it is perhaps possible to suppose that *Khurra-Urfa* received this name on account of the numerous caverns in the Nimrûd Dâgh of the surrounding country.)

As Hrozný has shown, the Khurrish language is not related to Aryan tongues, but to the entirely non-Aryan and non-Indo-European speech of Mitanni, which is represented by a long letter of the king Tushratta of Mitanni from Tell el-Amarna. The two languages are probably distinguished only by very slight dialectical differences. When, in Khurri-Mitanni the nom. sing. ends in *-sh* (as well as in *-l*), and the accus. in *-n*, the influence of the Aryan speech of the *Khurri-Mitanni* country (*see* below), can be perceived in it and, in some degree perhaps also that of Hittite. The genitive endings *-ve* and *-kke*, and the plural ending *-nz* are, on the contrary, native to the language. When a genitive is dependent on a substantive, it receives also the ending of that substantive: *iêni-na Shamûkhakki-nz*, "the gods of the city *Shamûkha*." This phenomenon occurs also in some Caucasian languages, especially in Old Georgian and Calchurish (Bork). But no definite conclusion can be based as yet upon this isolated phenomenon. Wholly non-Indo-European also is the Khurrish-Mitannish verb which Messerschmidt, Bork, Forrer and Ungnad have studied carefully. In any case Khurrish and Khattish are not related. The following are chosen as examples of Khurrish-Mitannish words: *shena*, brother; *askte*, wife; *tivi*, word; *katiu*, I will proclaim (Ungnad). The following specimen of the language may be quoted: *Teshubbutte shilallukki shâla abkijâve annân mirzi ammânmân irâne annân gaggari*, etc.

Khurrish litanies and prayers occur in the Hittite rituals but, unfortunately, without Hittite translations, and Khurrish singers (singers of the city Khurri) also sang in the religious services. This is the case especially in the eastern Khatti provinces, in Kizvatna and in the city Shamûkha, situated somewhere in Commagene or Melitene. But also in Shamûkha were found Hittites and Khatti.

A mixed population of Hittite, Khatti and Khurri was distributed throughout Syria, while in Khurri (Orrhoëne and South Armenia) and Mitanni (Mygdonia) the Khurrish-Mitannish were the preponderating race. Occasionally Khurri is synonymous with Syria generally. The country *Khâru*, more exactly *Khôr* of the Egyptian inscriptions, as also the Old Testament people, the Khorites (until now usually considered to be "dwellers in the caverns") who, according to Gen. xiv. 6, Deut. ii. 12 and 22, inhabited the land of Edom before the Edomites, is identical with this *Khurri*. The Khurri-Khorites also belong, like the Khatti, to the large-nosed Armenoid race which has influenced, physically, the later Semitic (Assyrian, Hebrew, etc.) and Indo-European (Armenian) population of these countries. Not a little literature must have been written in Khurrish, as the fragments of the Gilgamesh epic and also other poetical texts in the same tongue, found in Boghazkeui, testify. Ungnad suggests the name Subarian for Mitannish (and Khurrish), derived from the geographical term Subartu used for the countries lying north and north-west of Babylonia.

In the Boghazkeui inscriptions a language of the country *Palâ* (*palâumnili*) is mentioned occasionally. This must be sought, perhaps, somewhere in Syria (?). Unfortunately, no sure records of this language have, so far, come to light. Two insignificant fragments, published by Forrer, if really written in Palâ, suggest perhaps a Lûish-Khattish mixed language.

If, as suggested above, Hittite, Khattish, Lûish and Khurrish were spoken in the Hittite area, and if the cuneiform writing was used for all these languages, it is very likely to suppose, that in the monumental writing of the Hittites, that is in the Hittite hieroglyphs, also several languages—presumably Hittite, Khattish and Khurrish—occur. If so, the decipherment of this script becomes still more difficult, since the language in which any given inscription is written must first be determined.

Aryans (Earliest Indians) in Syria and Mesopotamia.—The Boghazkeui inscriptions show that, besides the Hittites and the Lûish, there was also in the second millennium B.C. another Indo-European people within the Hittite area: an Aryan conquering people which formed the governing class in the kingdoms of Khurri and Mitanni and—probably in consequence of a former expansion of the Khurri kingdom in Syria-Palestine—not seldom supplied Syrian and Palestinian cities with their Dynasties. In the treaty of the Hittite king Shuppiluliumash (*cir.* 1380 B.C.) with the king of Mitanni, Mattivaza, among the gods of Mitanni, also the gods *Mitrashshil* (Mitra gods), *Arunashshil* (Aruna gods), *Indara* and *Nashattijanna* are invoked as witnesses of the oath, which are surely identical with the Indian gods *Mitra*, *Varuna*, *Indra* and *Nâsatya*. In the Boghazkeui archives four tablets (originally there were still more) have also been discovered of a manual written in Hittite on the management of horses and chariot races of which a certain Kikkuli from Mitanni was the author, and in which expressions used in chariot racing in Indian language occur: *aikavartanna* "in one turning," *teravartanna* "in three turnings," *panzavartanna* "in five turnings," *shattavartanna* "in seven turnings," etc. (comp. old Indian *ēka-ḥ*, one, *tráy-aḥ*, three, *pañca*, five, *saptá*, seven, *vártanam*, the turning). In addition the inscriptions mention a class of military nobility, the so-called *mariannu* who play an important rôle in Syria and Khurri-Mitanni, and whose name is derived from the old Indian *márya*="young man, hero." Finally, in the inscriptions of Tell el-Amarna and Boghazkeui, names of Palestinian, Syrian and Mesopotamian kings and princes, of Aryan character, are preserved as, for example, the names of the kings of Khurri and Mitanni, *Artatama* (probably old Indian *Rta-tama*, "the most pious"), *Tushratta*, *Mattivaza*, the name of the Palestinian prince *Shubandu* (old-Indian *su-bandhu*= "who has good kinsmen"), and others.

It is to be supposed, that in the course of their wandering to India the earliest Indians, or, at least, a part of them, touched Mesopotamia and Syria, where the Khurri-Mitanni kingdom was their centre, in the second and even the third millennium B.C. At the present time, Kretschmer pleads for a longer sojourn of all Indians in Near Asia particularly on the ground of his hypothesis that the Indians borrowed the deities *Varuna* and *Indra* from the Hittites; *cf.* the Hittite *arunash*, sea, and the Hittite god *Inar*, *Inarash*. (That the Hittites had a god of the sea *Arunash*, whose name was in the cuneiform writing written with the determinative for gods, is now shown—[which could not have been known to Prof. Kretschmer]—by the text *Keilschr.-Urk. aus Bogh.* XX., 1, 32 and 2, 5, and also by Bo. 3206, II. 16.) On the other hand the Hittite god *Aknish* or *Agnish*, discovered by Hrozný (*Rev. d'assyr.* 1921) may perhaps have been derived from the old Indian god of fire *Agni*. Iranians also may have taken part in this immigration of Aryan stock in the Near Asia. Forrer's proposal to name the Aryan language of Khurri-Mitanni as Mandaean is impossible, for even if the name "Manda-people, Manda-warriors" of the paragraph 54 of the Hittite Codex of Laws really denoted the Aryans of Khurri-Mitanni, the Assyrian-Babylonian collective expression *Ummân-Manda* "troops of peoples" for the hostile, mostly—as it is to be supposed—Indo-European north peoples obviously could not be employed to designate the speech only of one of these peoples. It is also doubtful if the name of the country Mitanni (also Metan?) has anything to do with the Medes. On the other hand it is sure that the horse which appears in Near Asia somewhere about 2000 B.C., was there introduced by the Aryans now in question.

HISTORY OF THE HITTITES

The earliest information concerning Asia Minor relates to the first half of the third millennium B.C. Eastern Asia Minor was already inhabited by the non-Indo-European Khatti. The rich natural resources of the country attracted the Sumero-Babylonians and Assyrians, who founded colonies and kingdoms there. About 2635 B.C. the powerful ruler, Sargon of Akkad, undertook a campaign against the city *Purushkhanda*, in Asia Minor, governed by a king with the Accadian name *Nûr-Dagan*. According to text

of uncertain historical value the most powerful of the successors of Sargon of Akkad, King Narâmsin (25th century B.C.), fought a victorious battle against a coalition of 17 kings which included *Pamba*, king of Khatti (now Boghazkeui), *Zipani*, king of Kanesh (now Kara Euyuk and Kultepe near Caesarea), and *Khuvâruvash*, king of Amurru in Southern Syria. It is not certain whether it is permitted to infer from the name *Khuvâruvash*, of wholly Hittite character, that the invasion of Asia Minor, even of Syria, by the first Indo-Europeans, the Lûites (in part also the true Hittites?) took place as early as the first centuries of the third millennium B.C. Narâmsin had also to defend his empire against the attack of the *Ummân-Manda* "troops of peoples" which came from the North, and in which then, as later, are to be seen in the first line Indo-European, Aryan peoples. One of these peoples may have been the later Aryans of Khurri-Mitanni.

Further light on the most ancient history of Asia Minor is thrown by the old Assyrian (also called Cappadocian), cuneiform tablets of Kultepe-Kanesh, which date from the 21st century and which were discovered partly by the secret diggings of natives, and partly by the official excavations of Hrozný in 1925. The original stock of the population is Khatti; the native prince of Purushkhanda? (or Khatti) is called *Labarsha*, in an inscription found by Hrozný's expedition. This name is Khattish (*cf.* the later Khatti-Hittite royal name and kingly title *Labarna-Tabarna.*) Meanwhile the Assyrian empire had become very powerful; Eastern Asia Minor was subject to it. In the cities resided rich Assyrian merchants who were organized in *gâru's* "Bazaars" and carried on a flourishing trade in the products of Asia Minor. The Indo-European Hittites had already invaded this territory as is shown by distinctly Indo-European names, such as *Inar* (*cf.* ἀνήρ "man"), also *Inarava, Khalkiashu* (*cf.* Indo-Eur.-Hittite *khalkish* "corn") and others. While the political centre of the Khatti was the city Khatti and the first Indo-Europeans, the Lûites, were concentrated in the South, in Arzava-Lûya, it may be that the Indo-European Hittites, at first (probably however after 2000 B.C.), had settled mainly around the cities Kanesh and Kushar. Inscriptions do not state that the city Kanesh was once also a political centre of the Indo-European Hittites. Probably the invasion of the Indo-European Hittites in the 20th century B.C. made an end of the Assyrian rule in Cappadocia. Eastern Asia Minor was subdivided again, as for example in the time of the kings of Akkad, into a number of small mutually hostile states, over which the Indo-European conquering people, called by us Hittites, now attempt to rule. One of the important rulers, of this time, the great king *Anittash*, of *Kushshur*, about the beginning of the 19th century B.C. vanquished *Pijushtish*, then king of the town Khatti (himself, possibly, also a Hittite), then the king of *Nêshash*, the king of the city *Zalpuva* (*Zalpa*), situated apparently somewhere in the coastal region (or upon an island? *cf.* Bo. 2736, Rev. 4), and rulers of *Purushkhanda* and *Shalativara.*

Some generations later, about 1800 B.C., there ruled in Kushshar the great conqueror *Tlabarnash*, whose name is written *Tabarnash* or *Labarnash*, and who extended his kingdom as far as to the sea. His successes are so great that his name and that of his wife, *Tlabarnash* and *Tavannannash*, were used as titles of honour by the later Hittite kings and queens. The kingdom, thus greatly enlarged, later on undertook military expeditions beyond Asia Minor. In Mesopotamia, Syria and South Armenia, in the first half of the second millennium B.C., the effect of the invasion of the East Indo-European peoples—of the Aryans of Khurri-Mitanni—becomes more evident. A series of Aryan-Khurrish states arose here: among which the most notable are *Khanigalbat* (= *Khurri-Mitanni*) in Mesopotamia and the great kingdom *Khalap* (now Aleppo) in Syria. The great king *Khattushilish I.*, a son of *Tlabarnash*, who lived in Kushshar, but apparently also in *Khattushash-Boghazkeui* fought against Khalap successfully. His successor Murshîlish I. who transferred the seat of the Hittite Dynasty to Khattushash, succeeded about the year 1758 B.C. in vanquishing not only Khalap and the Khurri, but even Babylon itself, and overthrew the Khammurabi dynasty in Babylonia. During the remainder of the 18th and the 17th–15th centuries B.C. the Hittites were engaged in internal disorders and external campaigns, especially against the Khurri. From the Syrian Khurri, who were strongly mingled with Khatti, Hittite and Semite elements, went out the people, known as the Hyksos, who took possession of Egypt about 1685 B.C. (The Hyksos names are probably partly of Semitic and partly of Syrian-Asianic origin. Only the name of the Hyksos king, *Khender* or *Khendel*, may be here mentioned, which is of linguistic interest as recalling the name of the Hittite king *Khantilish*, the successor of Murshîlish I.) The great king *Telepinush* attempted, about 1600 B.C., to reorganize the shattered kingdom. The Hittite rulers of the 15th century B.C. may still be reckoned as belonging to the Old Empire, though the forerunners of the New one. *Tudkhalijash II.* succeeded in reuniting the kingdom and breaking the power of the confederate kingdoms of Khanigalbat (Khurri-Mitanni) and Khalap; but still some time after this, *Khattushilish II.* fought successfully against Khalap and Mitanni.

The New Empire which begins about 1385 B.C. with the brilliant Hittite king *Shuppiluliumash*, son of *Tudkhalijash III.*, embraced the last two centuries of the Hittite kingdom. During this time the Khatti kingdom exercised the most profound influence on the destiny of the Near East. It may certainly be considered as, for some time, the first military and political power of the East at that epoch. The united Hittite kingdom sought to extend its sphere of influence in all directions, by means of wars, alliances and treaties with vassals, as well as by dynastic marriages. A powerful confederation of States came into existence, which, however, composed of very dissimilar elements, could not be of long duration. The resurrection of the Indo-European Hittite empire was facilitated by the decay of the Khurri kingdom, ruled over by an Aryan dominant class which took place in the 14th century B.C. The Khurri kingdom, Khanigalbat dissolved into two enemy states, Khurri and Mitanni (with the capital *Vashshuggani*), which we may seek perhaps in Râs el-Ain in North Mesopotamia; *cf.* Opitz in *Zeitsohr f. Assyr.* 1927, 299 *et seq.*), against which Shuppiluliumash was able to fight. The king *Tushratta* ruled in Mitanni at this time. Shuppiluliumash established his power almost over the whole of Syria, where he successfully checked the Egyptian influence. His armies advanced thence as far as the territory of Lebanon. He also subdued the people of Gashga between the Euphrates and the Halys, and by means of alliances and marriages, bound Khajasha on the Upper Euphrates and Arzava in southern Asia Minor to the Hittite empire, with which Kizvatna-Pontos was also very closely allied. After the death of the Pharaoh *Bibkhuruiash* (= Tutankhamen?) his widow sought to marry one of the sons of Shuppiluliumash, but the Hittite prince was murdered by Egyptians on his way to Egypt. The political and military activities of the Hittite kingdom were conducted on the same lines with many vicissitudes, in the reign of the successors of Shuppiluliumash which however can not be described here in detail. His son and second successor *Murshilish II.* (about 1340 B.C.) belongs to the most enterprising and warlike rulers not only of the Hittite kingdom, but even of the ancient East as a whole. This great king also took special interest in Western Asia Minor, where he came into touch with the Greeks as Forrer was the first to point out, though his views as Friedrich specially has shown, are in many instances untenable. The city and the country *Akhkhiyavâ*, which now appear in the Hittite inscriptions and which are there named together with *Lazpash*, perhaps = Lesbos, can be probably connected with Gr. Ἀχαιρᾶ and the Achaeans (*q.v.*), which are for the rest mentioned in an inscription of Pharaoh Menneptah (*c.* 1240 B.C.). It is, however, impossible (with Forrer) to seek this *Akhkhiyavâ* in Greece. It is probably a country situated on the coast of Western Asia Minor near the island Lesbos. Further both on linguistic and real grounds, it is not possible to identify *Tavagalavash*, who at the time of Murshîlish was perhaps the king of *Akhkhiyavâ*, and who wished to become a vassal of the Hittites, with the mythical king Eteokles (Ἐτεοκλέης) of Orchomenos in Boeotia. To identify *Antaravash*, mentioned in an oracle text, which names also *Akhkhiyavâ* and *Lazpash*, with *Andreus*, the father of Eteokles of Orchomenos, is also very risky. Again, Forrer has failed to prove that the king *Attarishshijash* of *Akhkhiyâ* (probably = Akhkhi-

yavâ), an opponent of the Hittite king *Tudkhaliyash IV.* (*cir.* 1240 B.C.) is the same as *Atreus,* king of Mycenae and father of Agamemnon. Forrer's opinion that the Hittite word *ajavalash* means Aeolian and that Troy might be recognized in Hittite inscriptions in the name *Taruisha,* which Forrer reads *Troisa,* which however should be read *Tarvisha,* is also erroneous.

At the present time we may reasonably admit only the existence of an Achaian state in Asia Minor, represented by *Akhkhiyavâ* and *Lazpa* (probably not to be identified with *Zalpa* which, too, possibly, was situated on an island), and await further information from the future. (Kretschmer [*Glotta* 12] compares the king *Alakshandush* [*cir.* 1300 B.C.] of Vilusha-Elaiussa with the Homeric Alexandros-Paris.) On the relations between the Hittites and the Greeks, *see* also below the chapter on the Hittite myths.

Other powerful Hittite rulers of this age were the sons of *Murshîlish II., Muvattallish* (*Muttallish*) about 1300 B.C., who vanquished at Kadesh the Egyptian Pharaoh Rameses II. (*see* above), and *Khattushilish III.,* who concluded an alliance with the same Pharaoh about the year 1272 B.C. (*See* also above.) *Tudkhalijash IV.* (*cir.* 1240 B.C.), son of Khattushilish III., apparently still extended his kingdom westwards by successful wars. But already about the year 1190 B.C. under his second successor *Tudkhalijash V.,* the Hittite kingdom fell under the attack of the so-called sea peoples and that of the Indo-European Thracians, Phrygians and Armenians, who followed in their train and forced their way into Asia Minor. Shortly before this the Mitanni kingdom was conquered by the Assyrians. Subsequently small Hittite-Khurrish states arose in Syria, such as Carchemish and Kunulua. Yet these too were gradually overthrown by the Assyrians; Carchemish itself fell under the attack of Sargon II. in 717 B.C.

HITTITE CIVILIZATION

Generalities. Law.—The cuneiform inscriptions of Boghazkeui show that Hittite civilization had reached a high level. In this civilization the cuneiform script and many other elements were borrowed from Babylon, yet the invention of a native hieroglyphic script, the rich and original Hittite cuneiform literature, the art monuments and other manifestations of Hittite culture, all prove that in spite of all borrowings, due to their comparatively late entry into the civilization of Asia, the Hittites are in no way inferior to the Babylonians and Egyptians.

In the state archives of Boghazkeui, there was found a series of so-called vocabularies, a kind of lexicon, with Sumerian in the first column, Babylonish in the second and Hittite in the third; for example: Sumerian *gú* = Babylonian *rêshu* "head" = Hittite *khalanta* (*cf.* Latin *calva,* Armenian *xalam* "skull"). If we add Khattish, Lûish and Khurrish to these three languages, we perceive that there were writers and scholars in the Hittite kingdom, who were masters of six languages.

The historical literature of the Hittites is rich and varied. There exist extremely important State treaties of the great Hittite kings with their vassals, and other powers abroad, diplomatic correspondence; annals of the Hittite kings, their proclamations, which treat the problems of politics and administration (for instance: the succession of the throne, disputes between individual cities, etc.), deeds of royal gifts and so on.

The strict military and political organization of the new Hittite kingdom is clearly portrayed in these documents. The same picture of an administration, ordered and regulated to the smallest details, is presented to us by the preserved prescriptions for different palace and temple employes. A well organized kingdom must also have its code of laws. The Hittite code (published by Hrozný) in two parts, containing about 200 paragraphs, gives us a deep insight into Hittite justice. In regard to punishment it is much milder than that of Khammurabi, Assyria or the Israelites. Mutilations and the death penalty were only seldom imposed in the Hittite kingdom; the Hittite code was very indulgent to certain sexual crimes which throws a not very favourable light on the sexual morality of this nation. A longer section of the Hittite code of laws, regulating prices in the Hittite kingdom is in the economic regard very important. Partly from this, partly from other texts, we learn that the Hittites, like other nations of the ancient East, cultivated especially barley, *Triticum dicoccum* (a kind of spelt) and wheat; that they brewed beer from barley malt after the manner of the Babylonians, and that wine also played an important part among them. The whole economic position of the Hittite kingdom was founded on agriculture and the raising of cattle; beekeeping was zealously cultivated. Silver pieces, which were weighed according to the Babylonian system (*manû,* etc.) were used as circulating medium. In the domain of material civilization, the Babylonians were in many things the teachers of the Hittites who arrived in Asia much later than they.

The Hittite Pantheon.—The numerous religious texts in the archives of Boghazkeui familiarize us with the religion of the Hittites. The Hittite Pantheon, which is known also to us from the State treaties, where all possible gods, "a thousand gods" are summoned as witnesses and in support of the treaty, and which may be here assembled for the first time in its principal divinities, is very mixed. Sumerian-Babylonian, Assyrian, Khurrish, Indo-European-Hittite, Lûish and Indian elements are here bewilderingly blended together. The Weather god and the Sun goddess are the chief divinities. We do not know the names they bore in the proper Khatti territory; in the Khurrish-Mitannish country they were called *Teshup* and *Khepit* (*Khepa*). The weather gods of *Nerig* and *Zippalanda* are the sons of the weather god of *Khattushash* and the sun goddess of the city Arinna (= Euyuk [?]); this is also the case with the god of the fields, *Telepinush,* to whom can be traced back the hero *Telephos,* specially honoured in Mysia and Lycia; the goddess *Mezzullash* is daughter to this divine pair, the goddess *Zentukhîsh* or *Zindukhijash* is the grandchild. The exact position of the goddess *Lelvanish* in this family circle is uncertain. (By this analysis of the Hittite Pantheon the chief Hittite gods on the rock reliefs at Yasili-Kaya can now be successfully identified. From left to right they are: the Storm-god, Sun-goddess, *Telepinush, Mezzullash* and *Zentukhîsh* [or *Lelvanish* ?]. The hieroglyphs which accompany the names of these gods can be now adequately interpreted). The wife of *Telepinush* is called *Khatepinush.* The sacred bulls of the weather god of Khattushash are called *Sherish* and *Khurrish.* Of secondary origin in this circle is the goddess *Khepit.* The very important god of male virtues, *Inar* or *Inarash,* is certainly of Indo-European origin (of period Skt. NARA, Gr. ἀνήρ, "man"); according to a conjecture of Kretschmer he was borrowed by the early Indians (*cf. Indara-Indra*) from the Hittites. The Hittite god *Indra, Indara,* may be found—as may here be established for the first time—also in the Egyptian Rameses treaty in the form *'ntrtj* which, according to Lexa, is probably the Egyptian word for "goddess," Coptic NTWPE. Apparently the Egyptians simply identified the name of the god *Indara,* which was unknown to them, with this Egyptian word. Possibly all the divinities of this kind are comprehended in the name *Innaravantash* (probably Plur.; Sing. *innaravanza,* Keilschr.-Urk. aus Bogh. 17, Nr. 20, 11.3), Lûish *Annarummenzi.* For the other Hittite deities, who are also adored by the Indians *Arunash* "Sea" (*cf.* Ind. *Varuna*) and *Agnish* (*cf.* Ind. *Agni*) *see* also above. Besides the "Great Sea" which also plays an important part in the Hittite myths, the Hittites worshipped also the Heavens, the Earth, mountains, rivers, wells, winds and clouds. A deity of field fruits is apparently *Khalkish,* sometimes named with Telepinush and probably of Indo-European origin. Another god who bears probably an Indo-European name, is *Vashdulashshish* whose name is derived from the Hittite *vashdul*="transgression, sin." (*Cf.* Lat. *vasto.*)

Another Hittite divinity is the father of the gods, *Kumarpish,* who may have been borrowed from the Khurrish *Kumarve,* and who plays also an important part in the Hittite mythology. He is sometimes identified with the Babylonian Earth god *Enlil,* but is also worshipped beside him. His messenger is called *Mukishanush* (of Babylonian origin?). Related to the god *Inarash* are probably the gods *Âlash* (who must not be confounded with the goddess *Alâsh*), *Zitkharijash,* whose cult arose in the city *Zitkhara, Karzish, Khapantalijash* or *Khapatalijash,* and perhaps also the god *Pirinkir* or *Pirikar.* According to a text the god *Inarash* was worshipped under no less than 112 forms. Others are the





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BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

HITTITE RELIEFS AND HIEROGLYPHIC INSCRIPTIONS FROM CARCHEMISH

1. Hittite-Khurri sculpture of a warrior, one figure on a series of reliefs discovered at Carchemish, the modern Jerablus, on the west bank of the Euphrates. From recent excavations it has been determined that Carchemish, probably the most important site of Hittite dominion, existed as a city at least as early as 2000 B.C.
2. Two men killing a lion. Another relief on basalt found at Carchemish. Head dress, beard and hair, as well as the turned-up toes, are characteristic of Hittite sculpture
3. Hittite inscription, found on a monument at Carchemish. The hieroglyphic writing of the Hittites is a pictographic script. The original meaning of many of the signs is still obscure, only about 200 being known. The invention of this writing is placed in the first half of the second millennium, B.C. The script was employed by the Hittites on their rock and stone monuments especially, and upon seals made of stone and metal
4. Hittite-Khurri sculpture of bird-headed demons

deities *Birvash* (comp. the Syrian deity *Biruva*, Rawl. III. 66, Rev. I. 19), *Mâlijash*, "the mother" *Kamrushepash* or *Kammarushepash*, who appears in Hittite myths, and the goddess (or god?) *Ashkashepash*. The goddesses *Nenattash* or *Ninattash* and *Kulittash* may be regarded as connected to a certain degree with the goddesses *Ishtar* and *Ishkhara; Ninattash* is probably borrowed from the Sumerian-Babylonian goddess *Nina*, while again, *Kulittash* can be traced back to the Sumerian-Babylonian goddess *Gula*, the "great lady doctor"; instead of *Kulittash*, also *Gulittash* may be read. (Comp. the Syrian goddesses *Ninitum* and *Kulittum*, Rawl. III. 66, Rev. I, 27. 28.) Of great importance are the Hittite tutelar deities of the house and of the grave, *Kulshêsh* or *Kulashshêsh* and *MAH-nêsh*. From the first name are probably derived the names of the Etruscan deities *Culśanś*, who was the protector of the gates, and of *Culśu*, the goddess of the nether world. (For the relations of the Etruscans to the Hittites *see* Hrozný in *Zeitschrift für Assyriologie*, 1928.) To the Hittite tutelar deities belong also *Zukkish* (or *Zunkish*) and *Anzilish*. The following deities may also be named here: *Khullash, Jarrish, Zappanash* (*Zampanash, Zapnash*), *Khashammilish* or *Khashmilish, Khîlashshish, Târavash, Jajash, Pentarukhshish, Nârash* (originally a Babylonian river god?), *Namsharash* or *Napsharash* (of Sumerian-Babylonian origin? Comp. the Sumerian-Babylonian primeval gods *Ninshar, Enmeshara, Ninmeshara?*), *Minkish* or *Munkish, Ammu(n)kish, Tukhushish* or *Tushshish* (related to the Hittite word *antukhshish*, "man"?), *Ammezadush, Alalush* (of Sumerian-Babylonian origin), and *Apantum* (originally Babylonian??).

Other aboriginal Sumerian-Babylonian divinities in the Hittite Pantheon are: the Heaven god *Anush* and his wife *Antum*, the Earth god *Enlil* and his wife *Ninlil*, the Sea god *Êa* and his wife *Damkina* and his son *Marduk*, the Moon god *Sin* and his wife *Ningal, Nikkal*, the god of the underworld *Nergal* and his wife *Ereshkigal* or *Allatum*, the goddesses *Ishtar* and *Ishkhara*, the war god *Zababa*, and others. Many of the Babylonian divinities were included in the Hittite Pantheon only because the Hittite priests diligently studied the religious literature of the Babylonians: their existence in the realm of the Hittite gods, is therefore somewhat theoretical. On the other hand not a few of the Babylonian names of divinities in Hittite inscriptions may in reality be only ideograms, expressing the names of Hittite native gods. The influence of Babylonia upon the religion of the Hittites, though certainly great, may therefore have been much less than seems to be the case, on the first glance, on the basis of the graphical impression of the names of deities.

Among the numerous local Hittite gods whose names are of interest, the following may be mentioned: *Khantidashshush* of the city *Khurma, Katakhkhash*, also *Khatakhkhash* or *Khataggash* of *Ankuva*, the goddess *Shartijash*, the "queen" (Babylonian in origin; but *cf.* also Hittite *shardijash* "helper"?) of *Katapa, Mammash* or *Ammammash* of *Takhurpa, Khallarash* of *Dunna, Gazbâja* (Babylonian in origin?) and *Khuvashshannash* of *Khûbishna, Tapishuva* of *Ishkhupitta, Bîlat* or *Bêlti* (Babylonian) and *Kunijavannish* of *Lânda* (cf. *Laranda*), *Zashkhabûnâsh* or *Zakhabunash* or *Zakhbunash* of *Kashtama, Khâshigashnavanza* (comp. the name of the city *Khashshikkashanavanta*) and *Mullijarash* of *Lavvazantija* (cf. *Lauzados*), the goddesses *Alâsh* of *Karakhna, Zûlimash* of *Shugazzija, Tashimish* of *Likhshina, Lushitish* of *Nenashsha, Shakhkhashsharash* of *Tuvanuva* (=Tyana), *Shuvanzipash* of *Shuvanzana, Navatijalash* of *Zarvisha, Vashkhalijash* of *Kharziuna, Zanduza* of *Shallapa, Ammamash of Khakhana, Katakhkhash* of *Tavinija, Karmakhish* of *Kalimuna, Karunash* of *Kariuna, Tamishshijash* of *Tabikka* (*cf.* the modern Dâbik in Syria), *Bishanukhish* of *Kumanni* (Comana) and *Apârash* of *Shamûkha* in the so-called "Upper Land."

Notice also these names of Hittite gods: *Kharishtashshish, Kattishkhapish* (Khattish), *Tashimmet* (Khattish? or comp. Babylonian *Tashmêtu?*), *Vašezzel* (Khattish), *Valizilish* or *Valizalish* (Khattish), *Teteshkhapish* (Khattish), *Shullinkattish* (Khattish), *Âpish, Aduntarish, Zulkish, Irbitigash, Karmakhilish, Zilibûrish, Negmish, Menkishurish, Zibarvâ* or *Zabarvâ* (in *Palâ*) etc.

The worship of the gods *Shantash* (cf. *Sandon*) and *Tarkhunza* (cf. *Tarku*) was characteristic of *Lûya-Arzava* especially; for *Annarumenzi*. In Arzava was also the deity *Ulilijashshish*, in the apparently Lûish city *Ishtanuva* or *Ashtanuva* among other divinities also *Shuvashunash, Vandush, Jashallashshish* or *Vashalla* worshipped. *Teshup* and *Khepit* (*Khepa*) were worshipped in Khurri-Mitanni. For the Aryan gods of these countries and for *Kumarve* see above. Among the other gods of these countries were the goddess *Shaushgash*, further *Shimegi, Êasharri* (Babylonian), *Shâlush* (Babylonian), *Lellûrish*, etc. The Pantheon of Shamûkha is also closely related. Hittite-Khattish, Lûish, Khurrish and Babylonian elements are mingled in the Pantheon of Kizvatna.

Hittite Mythology.—Among the numerous, though mostly badly preserved Hittite mythological texts, the first to be mentioned may be that of the disappearance of the offended god of vegetation *Telepinush*, who brings bad growth, sterility and famine in his train, and of his reappearance, which produces a new fruitfulness. The connection of this myth with the ancient oriental myths of Tammuz, Adonis, Attis, etc. is plainly evident. It is interesting, that the gods have *Telepinush* sought among others also by an eagle and even a bee. Another myth relates to the struggle between the weather god and the serpent *Illujankash*, and still another relates to the sea (?) serpent *Khedammush* (Sumerian-Babylonian? *cf. Khedimme-azag*, the daughter of the Ocean, resp. Êas) and the goddess *Ishtar*. Another myth, though not completely preserved, is that of the goddess *Ashertush*, identical with the west-Semitic goddess *Ashirtu-Ashera*, who attempts to seduce the weather god. On his refusal *Ashertush* contrives that the refusal should appear to be on her side; evidently a parallel to the Old Testament story of Potiphar's wife! The storm-god then betakes himself to *Elkunirshash*, husband of *Ashertush*, and relates what has happened. Another badly preserved myth is that related of *Gurpa-Aranzakhush*, probably king of a city *Ailanuva*, situated, evidently in Asia Minor, who married *Tatizulish*, the daughter of King *Impa-akrush* of *Accad* in Babylonia, and who resides at the court at *Accad*, and is there sought for by the river-god *Aranzakhash*, the personification of the water from the weather god's head. This myth may be a feeble reflection of some historical event. Another myth relates the story of a rich man, *Abbush* (is the name Babylonian?), who lives in the *Lulluvaja* country in the city of *Shudul*, situated on the sea-shore, to whom nothing is wanting (Heth. *vakkari; cf.* Lat. *vaco!*) but a son and a daughter. In his trouble he seeks the help of the sun-goddess. *Abbush*, apparently, then has two sons, one good and one bad, who later on divide the paternal inheritance and separate; but this text also is very incompletely preserved.

In Hittite countries the Babylonian myth of *Gilgamesh* was much in favour. Fragments of the *Gilgamesh* Epos have been discovered in Boghazkeui, written in Babylonian, Hittite and Khurrish. There existed also indigenous adaptations of this grateful material, inasmuch as *Khuvavaish-Khumbaba* of the *Gilgamesh* Epos, who dwells in the cedar wood, appears to have belonged originally to Khurri-Syria. Not less than 15 (possibly still more) tablets in Khurrish existed of the "Songs of *Keshshesh*," *i.e.*, of *Gilgamesh* (called in Khurrish also *Galgamishul*). The myth of *Gilgamesh* was related and songs of this hero were sung over the whole of Asia Minor. The Greeks of Asia Minor also were certainly familiar with the *Gilgamesh* epic, traces of which may be found in the Odyssey. It is not impossible that the name of Odysseus or Olysseus, Lat. Ulixes (as Gemser suggests in the Archiv f. Orientforschung III. 184) may be traced back to the Hittite name *Ullush* (from the Babylonian *Ullû, i.e.*, "carried away, distant") of the hero of the deluge story who dwelt apparently in the city *Idlash* (at the mouth of the rivers?). Khattish has a *tl*-sound, which is sometimes represented by *t*, at others by *l* (*see* above, the king's name *Tlabarnash*).

Religious Worship, Exorcisms, Omens.—We can learn much concerning the Hittite forms of worship, sacrifices, religious festivals, etc., from the archives of Boghazkeui. Rituals for various temple feasts and other occasions of the public and private

life, which request the intervention of the priest, recorded by priests and priestesses who are named by their names, have been preserved. Purifications, sacrifices, prayers and oaths are the chief features of Hittite worship, whereby many connections with and borrowings from Babylonia can be established. Illnesses and epidemics, famines, evil demons, domestic quarrels, etc., are banished from believers by the exorcists and sacrificial priests. Before every considerable undertaking the future and the will of the gods were ascertained by consulting them; the liver of the sacrificial animals was examined; the flight of birds was observed, a prophetess was questioned, etc. Here the influence of Babylon is unmistakable. Clay models of livers used in hepatoscopy have been discovered in Boghazkeui, bearing Hittite or Babylonian inscriptions. The will of the gods was also revealed to men by appearances in the heavens, and all kinds of unusual occurrences on earth. All these signs and omens were interpreted by competent priests. The manuals used by these priests in the interpretation of omens are mostly of Babylonian origin. The Babylonian influence and origin are disclosed by the astronomical-astrological inscriptions of the Hittites, and by their medical treatises, written in both Hittite and Babylonian, which have been discovered at Boghazkeui. Here it may be remarked that also deeds of landed property and clay tablet catalogues have been found in Boghazkeui.

Hittite Art.—It is certain that, like the script documents, the artistic monuments, generally attributed to the Hittites, which have been discovered in the country between Smyrna and Tell Halaf on Khabur in Mesopotamia, are the work of not one, but of the several peoples described above. In the West the monuments are essentially Khatti-Hittite, in the East, Khurri-Mitanni; in Syria both spheres met and later on also Aramaic influence can be stated there. In the first centuries of the first millennium B.C. Assyrian influence was felt in the East, while late Assyrian art was not a little influenced by the Hittite-Khurrish. That this Hittite-Khurrish art in its beginning was dependent to a wide extent on Sumerian-Babylonian art, is obvious. Egyptian influence was added in the second millennium B.C. But in spite of all these external influences, Hittite-Khurrish art has its independent nature, which is of value for the history of art. Hittite-Khurrish artistic remains can never be confused with those of either Egypt or Babylonia. If Hittite-Khurrish monuments give a more naïve and awkward impression than the Egyptian or Babylonian, this can be explained chiefly by the relatively short duration of Hittite-Khurrish civilization, which rendered impossible the attainment of a higher perfection. Hittite art motifs are also found in Greek art.

The application of whole series of reliefs to gates, accesses and bases of palace walls, as well as the use of wooden columns on stone bases are characteristic of Hittite-Khurrite building and architecture.

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HITTORF, JOHANN WILHELM (1824–1914), German physicist, was born at Bonn, on March 27, 1824. He studied at Bonn and Berlin, and became *privatdozent* in the academy of Münster. When this institution became the university of Münster, Hittorf became professor of physics and chemistry; in 1879 the physics and chemistry departments were separated, and he became director of the physical laboratories. Hittorf retained this post until 1889 when he had to resign because of ill-health. After a rest his health improved, and he continued his research work. He died at Münster on Nov. 28, 1914.

Hittorf's early investigations were on the allotropy of selenium and phosphorus. His most important work on the migration of ions during electrolysis appeared in the *Annalen der Physik* between 1853 and 1859. He investigated the changes in concentration in the electrolyte and from this worked out the "transport numbers" for the migrating ions. Hittorf was associated with his teacher Plücker in a series of investigations on the spectra of gases and vapours. He made a number of investigations on the passage of electricity through gases, he discovered a number of properties of cathode rays and observed the Crookes' dark space. Other investigations were on the passivity of metals.

His monograph, *Ueber die Wanderung der Ionen während der Elektrolyse*, was republished by Ostwald in 1903-04.

See obituary notices by Arrhenius in *Zeitschrift für Electrochemie*, 21 (1915) and by Heydweiller in *Physikalische Zeitschrift* 15 (1915).

HITTORFF, JACQUES IGNACE (1792–1867), French architect and archaeologist, was born at Cologne on Aug. 20, 1792, and died in Paris on March 25, 1867. After apprenticeship to a mason in Cologne, he went in 1810 to Paris to study at the Academy of Fine Arts under Bélanger, the Government architect, whom Hittorff succeeded in his post in 1818. Thereafter he designed many important buildings, both public and private, in Paris and the south of France. His principal work is the basilica of St. Vincent de Paul (1830–44). His books are: *Architecture antique de la Sicile* (1826–30 and 1866–67); *Architecture Moderne de la Sicile* (1826–35); *Architecture polychrome chez les grecs* (1830); *Restitution du temple d'Empédocle à Sélinunte* (1851).

See T. L. Donaldson, "J. I. Hittorff," *R.I.B.A. Journal* (London, April, 1867).

HITZACKER, a town in the Prussian province of Hanover at the influx of the Jeetze into the Elbe, 33 m. E.S.E. of Lüneburg by the railway to Wittenberge. Pop. (1925) 823. It has an old castle and other mediaeval remains. There are chalybeate springs in the town. The famous library, originally founded here by Augustus, duke of Brunswick (d. 1666) was removed to Wolfenbüttel in 1643.

HITZIG, FERDINAND (1807–75), German biblical critic, was born on June 23, 1807, at Hauingen, Baden, and studied theology at Heidelberg, Halle and Göttingen. Returning to Heidelberg he became *Privatdozent* in theology in 1829, and in 1831 published his *Begriff der Kritik am Alten Testamente praktisch erörtert*, in which he explained the critical principles of the grammatico-historical school, and his *Des Propheten Jonas Orakel über Moab*, an exposition of chapters 15 and 16 of Isaiah attributed by him to the prophet Jonah mentioned in 2 Kings xiv. 25. In 1833 he went to Zürich as professor of theology, and in 1861 to Heidelberg, where he died on June 22, 1875. As a Hebrew philologist Hitzig holds high rank; and as a constructive critic he is remarkable for acuteness and sagacity. As a historian, a number of his speculations have been considered fanciful.

His chief works include commentaries on Isaiah (1833), on the Psalms (1835, 2nd ed., 1863–65); on the minor prophets (1838, 3rd ed., 1863); on Jeremiah (1841, 2nd ed., 1866); archaeological monographs, the *Gesch. des Volkes Israel* (1869), *Zur Kritik paulinischer Briefe* (1870) and *Sprache u. Sprachen Assyriens* (1871). *See* Herzog-Hauck's *Realencyklopädie*.

HIUNG-NU, HIONG-NU, HEUNG-NU, a people who about the end of the 3rd century B.C. formed, according to Chinese records, a powerful empire from the Great Wall of China to the Caspian. A theory which seems plausible is that which assumes them to have been a heterogeneous collection of Mongol, Tungus, Turki and perhaps even Finnish hordes under a Mongol military caste, though the Mongolo-Tungus element probably predominated. Towards the close of the 1st century of the Christian era the Hiung-nu empire broke up. Their subsequent history is obscure. De Guiques suggests that they were the ancestors of the Huns, and many ethnologists hold that the Hiung-nu were the ancestors of the modern Turks.

See *Journal Anthropological Institute* for 1874; Sir H. H. Howorth, *History of the Mongols* (1876–80); 6th Congress of Orientalists, Leyden, 1883 (*Actes*, part iv. pp. 177–195); de Guiques, *Histoire générale des Huns, des Turcs, des Mongoles, et des autres Tartares occidentaux* (1756–58); F. Hirth, *The Ancient History of China* (1911).

HJORRING, an ancient town of Denmark, in the northern insular part of the peninsula of Jutland. Pop. (1925) 11,093. It lies 7 m. inland from Jammer Bay, a stretch of coast notoriously dangerous to shipping. The church of St. Catherine dates from 1300, St. Hans from 1600 and St. Olai from 1200. Great fires have destroyed many beautiful buildings. The principal industries include textiles and engineering, the making of bricks, tiles and tobacco.

HKAMTI LÔNG (called Kantigyi by the Burmese, and Bor Hkampti by the peoples on the Assam side), a collection of seven Shan states subordinate to Burma. It lies between 27° and 28° N. and 97° and 98° E., and is bordered by the Mishmi country on the north, by the Patkai range on the west, by the Hukawng valley on the south and east, and indeed all round by various Chingpaw or Kachin communities. The country was visited by T. T. Cooper, the Chinese traveller and political agent at Bhamo, where he was murdered; by General Woodthorpe and Colonel Macgregor in 1884, by Mr. Errol Grey in the following year, and by Prince Henry of Orleans in 1895. For long the hill-girt plain lay outside British administered districts but the need for protecting the Shan community and of checking the irruption of the Kachins or Chingpaw resulted in the setting up of a British district (Putao) with its administrative centre at Putao or Fort Hertz—over 100 miles by mule track from railhead at Myitkyina. In the census of 1921 the district is given a nominal area of 200 square miles and a population of 7,673. The Putao district was later absorbed into the Myitkyina district of which it now forms part From its northern situation, winters are colder than in most parts of Burma and the rainfall is heavy, evergreen dipterocarp forests surrounding the Hkamti plain itself. Hkamti was no doubt the northernmost province of the Shan kingdom, founded at Mogaung by Sam Lông-hpa, the brother of the ruler of Kambawsa, when that empire had reached its greatest extension.

HLOTHHERE, king of Kent, succeeded his brother Ecgbert in 673, and appears for a time to have reigned jointly with his nephew Eadric, son of Ecgbert, as a code of laws still extant was issued under both names. Neither is mentioned in the account of the invasion of Aethelred in 676. In 685 Eadric, who seems to have quarrelled with Hlothhere, went into exile and led the South Saxons against him. Hlothhere was defeated and died of his wounds.

See Bede, *Hist. Eccl.* (Plummer), iv. 5, 17, 26, v. 24; *Saxon Chronicle* (Earle and Plummer), s.a. 685; Schmid, *Gesetze*, pp. 10, *sqq.*; Thorpe, *Ancient Laws*, i. 26, *sqq.*

HOADLY, BENJAMIN (1676–1761), an English bishop, who was born at Westerham, Kent, on the 14th of November, 1676. In 1691 he entered Catharine Hall, Cambridge, where he graduated M.A. and was for two years tutor, after which he held from 1701 to 1711 the lectureship of St. Mildred in the Poultry, and along with it from 1704 the rectory of St. Peter-le-Poor, London. His first important appearance as a controversialist was against Edmund Calamy "the younger" in reference to conformity (1703–1707), and after this he came into conflict with Francis Atterbury, first on the interpretation of certain texts and then on the whole Anglican doctrine of non-resistance. His principal treatises advocating civil and religious liberty were the *Measures of Submission to the Civil Magistrate* and *The Origin and Institution of Civil Government discussed*. In 1710 he was presented by a private patron to the rectory of Streatham in Surrey. In 1715 he was appointed chaplain to the king, and the same year he obtained the bishopric of Bangor. He held the see for six years, but never visited the diocese. In 1716, in reply to George Hickes (*q.v.*), he published a *Preservative against the Principles and Practices of Nonjurors in Church and State*, and in the following year preached before the king his famous sermon on the text, "My Kingdom is not of this world," in which he maintained that Christ had not delegated his powers to any ecclesiastical authorities. The sermon was immediately published by royal command. The bishops at once resolved to proceed against him in convocation. The king therefore prorogued the assembly, a step which had vital consequences on the history of the Church of England, since from that period Convocation ceased to transact business of a more than formal nature.

As Convocation was thus debarred from taking action against Hoadly, the dispute took the form of a war of pamphlets known as the Bangorian Controversy, in which the main issues of the dispute were concealed almost beyond the possibility of discovery. But however vague and uncertain might be the meaning of Hoadly in regard to some of the questions around which he aroused discussion, he was explicit in denying the power of the Church over the conscience, and its right to determine the conditions of grace. His own most important contribution to the controversy was his *Reply to Representation of Convocation*. William Law was his ablest opponent; others were Andrew Snape, provost of Eton, and Thomas Sherlock, dean of Chichester. In July 1717 as many as seventy-four "Bangorian" tracts appeared. Hoadly, being not unskilled in the art of flattery, was translated

in 1721 to the see of Hereford, in 1723 to Salisbury and in 1734 to Winchester. He died at his palace at Chelsea on April 17, 1761. His controversial writings are vigorous if prolix and his theological essays have little merit.

The works of Benjamin Hoadly were collected and published by his son John in 3 vols. (1773). To the first volume was prefixed the article "Hoadly" from the supplement to the *Biographia Britannica*. *See* also L. Stephen, *English Thought in the 18th Century*.

HOAR, SAMUEL (1778–1856), American lawyer, was born in Lincoln (Mass.), on May 18, 1778. He graduated at Harvard in 1802, was admitted to the Massachusetts bar in 1805, and began practice at Concord. His success was immediate, and for half a century he was one of the leading lawyers of Massachusetts. He was in early life a Federalist, later an ardent Whig. He was a member of the State Senate in 1825, 1832, and 1833 and of the U.S. House of Representatives in 1835–37, during which time he made a notable speech in favour of the constitutional right of Congress to abolish slavery in the District of Columbia.

In November 1844 he went to Charleston (S.C.) to test in the courts of South Carolina the constitutionality of the State law which provided that "it shall not be lawful for any free negro, or person of colour, to come into this State on board any vessel, as a cook, steward, or mariner, or in any other employment," and that such free negroes should be seized and locked up until the vessels on which they had come were ready for sea, when they should be returned to such vessels. His visit aroused great excitement; he was threatened with personal injury; the State legislature passed resolutions calling for his expulsion, and he was compelled to leave early in December. In 1848 he was prominent in the Free Soil movement and assisted in the organization of the Republican Party. In 1850 he served in the Massachusetts house of representatives. He died at Concord (Mass.), on Nov. 2, 1856.

See a memoir by his son, G. F. Hoar, in *Memorial Biographies of the New England Historic Genealogical Society*, vol. iii. (1883); the estimate by R. W. Emerson in *Lectures and Biographical Sketches* (1903); and "Samuel Hoar's Expulsion from Charleston," *Old South Leaflets*, vol. vi. No. 140.

His son, EBENEZER ROCKWOOD HOAR (1816–1895), was born at Concord (Mass.), on Feb. 21, 1816. He graduated at Harvard in 1835 and at the Harvard Law school in 1839, and was admitted to the Massachusetts bar in 1840. From 1849 to 1855 he was a judge of the Massachusetts court of common pleas, from 1859 to 1869 a judge of the State supreme court, and in 1869–70 as attorney-general in the cabinet of President Grant, fought unmerited "machine" appointments to offices in the civil service until, at the pressure of the "machine," Grant asked for his resignation. In 1871 he was a member of the joint high commission which drew up the Treaty of Washington. In 1872 he was a presidential elector on the Republican ticket, and in 1873–75 was a representative in Congress. He died at Concord on Jan. 31, 1895.

Another son, GEORGE FRISBIE HOAR (1826–1904), was born in Concord (Mass.), on Aug. 29, 1826. He graduated at Harvard in 1846 and at the Harvard Law school in 1849. He settled in the practice of law in Worcester (Mass.), and became a partner of Emory Washburn (1800–77). In 1852 he was elected as a Free Soiler to the Massachusetts house of representatives, and subsequently thereto became the leader of his party. He was active in the organization of the Republican Party in Massachusetts and in 1857 was elected to the State Senate. During 1856–57 he worked for the Free State cause in Kansas. He was a member of the U.S. House of Representatives, 1869–77. A defender of the Freedman's Bureau, he took a leading part in later reconstruction legislation and in the investigation of the Crédit Mobilier scandal, and in 1876 was one of the House managers of the impeachment of Gen. W. W. Belknap, Grant's secretary for war.

In 1877 he was a member of the electoral commission which settled the disputed Hayes-Tilden election. From 1877 until his death he was a leader of the Republican Party in the U.S. Senate. From 1882 until his death he sat on the important judiciary committee, of which he was chairman in 1891–93 and in 1895–1904.

His most important piece of legislation was the Presidential Succession Act of 1886. He was a delegate to every Republican national convention from 1876 to 1904 and presided over that at Chicago in 1880. He was a Conservative, and although he did not leave his party he disagreed with its policy in regard to the Philippines and spoke and voted against the ratification of the Spanish Treaty. He died at Worcester (Mass.), on Sept. 30, 1904. A memorial statue has been erected there.

See his *Recollections of Seventy Years* (1903).

HOAR-FROST is formed and deposited when the water vapour in the atmosphere is solidified without passing through the liquid state. (*See* FROST.)

HOATZIN, a tropical South American bird, *Opisthocomus hoatzin*, remarkable for the keel, only developed on the posterior part of the sternum; for a very capacious crop resembling a gizzard, and for the claws on the young birds' wings.

Appearing about the size of a small pheasant, though actually much smaller, the hoatzin has a strong, curiously denticulated beak; prominent eyelashes set in a bare space round the eye; a long pendant crest of yellow feathers; and an olive body above, varied with white; below it is dull bay. The wings are short, the tail long and tipped with yellow. The legs are short, the claws long. It lives in bands, feeding on leaves and fruits. On account of its strong smell, it is called the "stink-bird" in British Guiana. The nest is built of sticks in some tree and contains three or four yellowish-white eggs, blotched with red. The young have well-developed claws on the first and second fingers of the wing, with which they can climb; they can also swim.

See H. W. Bates, *Naturalist on the River Amazon;* C. W. Beebe, *Naturalist in Guiana*.

HOBART, GARRET AUGUSTUS (1844–1899), vice-president of the United States 1897–99, was born at Long Branch, N.J., on June 3, 1844. He graduated at Rutgers College in 1863, was admitted to the bar in 1860, practised law at Paterson, N.J., and rose to prominence in the State. He was long conspicuous in the State republican organization, was chairman of the N J. State republican committee from 1880–90, became a member in 1884 of the Republican National Committee, and was the delegate-at-large from New Jersey to five successive Republican national nominating conventions. He served in the N.J. Assembly in 1873–74, and in the N.J. Senate in 1877–82, and was speaker of the Assembly in 1874 and president of the Senate in 1881 and 1882. He was also prominent and successful in business and accumulated a large fortune. He accepted the nomination as vice-president in 1896, on the ticket with President McKinley, and was elected; but while still in office he died at Paterson, N.J., on Nov. 21, 1899.

See the *Life* (1910) by David Magie.

HOBART PASHA, AUGUSTUS CHARLES HOBART-HAMPDEN (1822–1886), English naval captain and Turkish admiral, 3rd son of the 6th duke of Buckinghamshire, was born in Leicestershire on April 1, 1822. He entered the navy in 1835, and served with distinction until 1862, when he retired with the rank of post-captain. His first engagement was against slave-traders off Brazil in 1835. During the American Civil War, he took command of a blockade-runner. He ran the blockade eighteen times, conveying war material to Charleston and returning with a cargo of cotton. In 1867 Hobart entered the Turkish service, and was immediately nominated to the command of the fleet, with the rank of "Bahrie Limassi" (rear-admiral). He helped to suppress the insurrection in Crete, and was rewarded by the Sultan with the title of Pasha (1869). In 1874 Hobart, whose name had, on representations made by Greece, been removed from the British Navy List, was reinstated; his restoration did not, however, last long, for on the outbreak of the Russo-Turkish war he again entered Turkish service. In command of the Turkish squadron he completely dominated the Black Sea, blockading the ports of South Russia and the mouths of the Danube, and paralysing the action of the Russian fleet. In 1881 he was appointed Mushir, or marshal, being the first Christian to hold that office. He died at Milan on June 19, 1886.

See his *Sketches of My Life* (1886), which must, however, be used with caution, since it contains many proved inaccuracies.

HOBART, the capital of Tasmania, in the county of Buckingham, on the southern coast of the island. Pop. (1925), including

suburbs, 58,740. It occupies a site of great beauty, standing on a series of low hills at the foot of Mount Wellington (4,166 ft.) which is snow-clad for many months in the year. The town faces Sullivan's Cove, a bay opening into the estuary of the river Derwent, and is nearly square in form and is well planned. It is the seat of the Anglican bishop of Tasmania, and of the Roman Catholic archbishop of Hobart. The public buildings include Houses of Parliament, to which an excellent library is attached; the town hall, built of brown and white Tasmanian freestone in Italian style; the museum and national art gallery. Government House is the residence of the governor of Tasmania. The botanical gardens adjoin. Among the parks are the Queen's Domain (700 ac.) and Franklin Square, named after the famous explorer and former governor. The University of Tasmania, established in 1890, and opened in 1893, has its headquarters at Hobart. The harbour is easy of access, well sheltered and deep, with wharf accommodation for vessels of the largest tonnage. It is a port of call for several intercolonial lines from Sydney and Melbourne, and for lines from London to New Zealand. The exports consist mainly of fruit, hops, grain, timber, minerals and wool; while manufactured goods, tea, sugar, tin and coal are imported. The industries comprise saw-milling, iron-founding, flour-milling, tanning and the manufacture of woollen goods. Hobart is the centre of a large fruit-growing district. The city was founded in 1804 and takes its name from Lord Hobart, then secretary of state for the colonies. It was created a municipality in 1853, and a city in 1857; and in 1881 its name was changed from Hobart Town to the present form. The chief suburbs are Newton, Sandy Bay, Wellington, Risdon, Glenorchy, Bellerive and Beltana.

HOBBEMA, MEYNDERT (1638–1709), Dutch landscape painter, was born at Amsterdam in 1638 and lived there all his life. He was a friend, and probably the pupil, of Jacob van Ruisdael. The two artists made sketching tours together and often painted the same views. Thus Ruisdael's "Water Mill" at Amsterdam, and Hobbema's "Water Mill" in the Widener collection; Ruisdael's "Ruins of the Castle of Breberode" in the Northbrook collection, and Hobbema's on the same subject in the Wallace and Frick collections. These were painted during 1661–63. In Oct. 1668, Ruisdael was a witness to the marriage between Hobbema and the cook of the Burgomaster of Amsterdam. This marriage marked the end of Hobbema's artistic career, for through the position and influence of his wife he received a municipal appointment. He had henceforth to gauge the casks, in which wine was imported into Holland, and estimate their contents in the Amsterdam measure; and he had no more time for painting. He was, however, not able to amass a fortune, for when his wife died in 1704 she was buried as a pauper, and Hobbema himself was buried in December 1709 in the pauper section of the Westerkerk cemetery at Amsterdam.

Hobbema's artistic activity was confined to his youth. Unlike Ruisdael, who liked to paint the sea, the mountain torrent and rocky landscape, Hobbema's favourite motive is the countryside, more or less thickly studded with trees, with houses, churches and ruined castles. A peaceful stream with a water-mill enlivens the landscape. His pictures are rich in attractive details. His masterpiece is "The Avenue, Middelharnis," in the National Gallery, London. It is signed and dated 16–9. The mutilated third figure, according to Hofstede de Groot, was 6 and not 8 as suggested in the catalogue. But external evidence such as the height of the trees, which were planted in 1664, and the beacon at the harbour entrance, which was introduced in 1682 according to local records, seem to favour the allocation of the picture to a later date, although on stylistic evidence it seems improbable that anyone who had abandoned painting at the age of 30 should at the age of 50 be capable of producing such a masterpiece. Hobbema's other masterpieces were painted between 1663–69. Among them are "a wooded landscape with two cows," in the collection of O. Beit, London. The cows are painted by Adrian van de Velder. A similar landscape is in the Morgan collection, New York. "The Mill" is in the Louvre, and there are various examples in the Wallace collection and in the National Gallery. He is represented in most European galleries and in many private collections. There are from 180 to 200 works by the master extant.

See Hofstede de Groot, *Catalogue of Dutch Painters* (1912).

HOBBES, THOMAS (1588–1679), English philosopher, second son of Thomas Hobbes, vicar of Westport and Charlton, Wilts, was born, prematurely, at Westport, now part of Malmesbury, on April 5, 1588. His premature birth was due to his mother's fright at the reports of the Armada, and Hobbes attributed his own timorous disposition to the circumstances of his birth. His father caused a scandal by engaging in a brawl at the church-door, and disappeared, leaving the three children to be brought up by his brother, a well-to-do glover in Malmesbury. Thomas Hobbes went, at four years of age, to the church school at Westport, then to a private school kept by Robert Latimer, and at 15 to Magdalen hall, Oxford. He took little interest in the scholastic philosophy taught there, and devoted his leisure to books of travel and the study of maps and charts.

On graduating (Feb. 5, 1608) he became private tutor to William Cavendish (1591?–1628), afterwards 2nd earl of Devonshire, and began the connection with the Cavendishes which lasted, with interruptions during the Civil War, until the end of his life. He was a little older than his pupil, was his companion in sport, and in 1610 made a tour in Europe with him. On his travels he found a general revolt against scholasticism, and devoted himself to a closer study of the classics, beginning, after his return to England, the translation of Thucydides, which he published in 1629. The publication was inspired by the troubles of the time, for Hobbes thought the history of the Athenian Commonwealth offered many pertinent lessons for his fellow-citizens.

After his patron's death, Hobbes remained for a short time in the Cavendish household, without being employed, but in 1629 went abroad again, as travelling companion to the son of Sir Gervase Clinton. In 1631 he was called home from Paris to teach the young earl of Devonshire, William Cavendish (1617–84), son of his late patron. He took his pupil to France and Italy in 1634. This third stay abroad is important for Hobbes's intellectual development. He was already known in intellectual circles in Paris, and now became a regular habitué of the group which gathered round the monk-philosopher, Mersenne, the friend of Descartes. In 1636 he met at Florence Galileo, for whom he always retained the profoundest admiration. At some time between his first and second visits abroad, he had for a short time acted as amanuensis to Bacon. He was later to make the acquaintance of Descartes and of Gassendi. He had, therefore, immediate contact with the great leaders of the revolt against scholasticism. But he does not seem to have been influenced by Bacon, whose inductive method he opposed, and with Descartes his relations were, as will be seen later, unfortunate.

His philosophic awakening is described by Aubrey (*Lives*, p. 604) as being due to picking up a copy of *Euclid* and opening it at the 47th proposition of the first book. "By God," he exclaimed, "this is impossible." But he read the proof and "fell in love with geometry." He himself describes, in his Latin verse autobiography, how he was in company with learned men in Paris when the question was asked, "What is sense?" On thinking over the subject it occurred to him that if material things and all their parts were always at rest or in uniform motion there could be no distinction of anything and consequently no perception, and he concluded that the cause of all things must be sought in diversity of motion. He therefore was driven to geometry to examine the modes of motion. This awakening to physical science may be placed in his second journey on the Continent between 1629 and 1631; on his third journey the new interest became an overpowering passion, and he was able to discuss his ideas with Mersenne's circle in Paris and with Galileo in Florence. He now determined to embody his doctrines in a threefold treatise: *De Corpore*, to show that physical phenomena were explicable in terms of motion; *De homine*, to show what specific bodily motions were involved in the phenomena of sensation and knowledge; and *De cive*, discussing social relations and the proper regulation of society.

The orderly treatment of these subjects was interrupted first

by the Civil War and then by the many controversies in which he was engaged. The three treatises were eventually written, but they did not cover the intended ground.

He returned home in 1637 to find king and parliament in the thick of the constitutional struggle. He set to work to prove that certain prerogatives disputed by the parliament were inseparably annexed to the sovereignty, which the parliament did not then deny to the king. By 1640 he had ready a treatise on *The Elements of Law, Natural and Politique*, in two parts, *Human Nature* and *De corpore politico* which were published separately ten years later. In this book his characteristic political doctrine is already crystallized. He maintained that under the social compact implicit in the constitution of the State it is the people, in virtue of the implicit contract, who rule; by that contract every man's natural right was transferred to the monarch. But in his view sovereignty was derived from the people, and he fell foul of both parties, the believers in the divine right of kings and the opponents of the monarchy. He thought the State should be as strong as possible, and that absolute obedience was required of the subject. Necessarily Hobbes made many modifications and explanations which cannot be given here.

The treatise was privately circulated, and when the strife became acute in 1640 and Laud and Strafford were sent to the Tower, Hobbes, who was naturally timid, thought he was a marked man, and fled to Paris. Probably his fears were exaggerated. In any case the next 11 years were spent in exile, chiefly in Paris, where he was soon in contact with later fugitives from England. He rejoined the Mersenne circle, and Mersenne showed him the *Meditations* of Descartes. Hobbes put in writing certain objections to the *Meditations* and later to the *Dioptrique* without disclosing the identity of authorship of the two documents. Descartes then refused correspondence with him. In 1642 he completed his *De cive*, in which he laid down more explicitly than in the treatise of 1840 the doctrine that peace required that the Church should be completely subordinated to the State. Hobbes's pronounced Erastianism was due to experience of the evil results of sectarian controversy in England and France. He feared anarchy above all else. The *De cive* was privately circulated, and was not printed until 1647. He now began the preparation of his great work, *The Leviathan; or the Matter, Form and Power of a Commonwealth, Ecclesiastical and Civil*, a comprehensive statement of his doctrine of sovereignty. The State might be regarded as a great artificial man or monster, with a life traceable from its generation through human reason under pressure of human needs to its dissolution through civil strife. He was concerned not so much with the power of the sovereign as with the power of the State and its claim on men's allegiance. Incidentally it must wield all sanctions, supernatural as well as natural, against the pretensions of any clergy, Catholic, Anglican or Presbyterian, to the exercise of an *imperium in emperio*.

Hobbes represented the reaction against the Renaissance and the Reformation. Freedom of conscience had brought anarchy; men must submit to the ruling of the State so that peace and order might be restored. By the time the *Leviathan* appeared (1651), Charles I. was dead and the Commonwealth established. In the "Review and Conclusion" at the end of the book he had sought to define the circumstances under which submission to a new sovereign becomes legitimate. For this he was later on, freely accused of time-serving. He was, in fact, following out the logic of his original position. So little was he conscious of any disloyalty that he presented a ms. copy, "engrossed in vellum in a marvellous fair hand" (probably the copy in the British Museum, Egerton, mss. 1910) to Charles II. on his return to Paris after the battle of Worcester. Charles had been his pupil in mathematics in 1646–48, but now he was denied audience. The exiled prince's political and clerical advisers were appalled by the *Leviathan*, though Charles himself bore no malice against his former tutor. Barred from the English exile's court, he was suspected by the French authorities for his attack on the papacy. He fled at the end of 1651, in the middle of a severe winter, to England. His patron, the duke of Devonshire, had submitted in 1646 to the parliament. Hobbes also made his submission to the Commonwealth and was allowed to live quietly in London. He had received a small pension from the earl of Devonshire, and Harvey had left him a small legacy. His house was in Fetter lane, and he took pains to find a church where he could receive the Sacrament according to Anglican rites. His conformity was probably due to his loyalty to the monarchy. His personal view on religion was that we can form no idea of God. It lay with the State, now that the time of miracles was past, to decide religious questions. Religion is not philosophy, but law. Not reasoning, but obedience was demanded.

Hobbes was now 63 years of age, but was to retain his vigour for another quarter of a century. He worked at his *De corpore*, but his difficulty in meeting the objections to his solutions of mathematical problems delayed its publication until 1655. *De homine* appeared in 1658, but instead of being the comprehensive treatise on psychology which he had originally meditated, it was a mere makeshift; it included some unpublished work on optics. Meanwhile he was involved in a controversy with Bramhall, bishop of Londonderry, on free-will. He replied to the bishop's *Defence of the True Liberty of Human Actions* by *Questions concerning Liberty, Necessity and Chance* (1656), in which he gave a clear exposition and defence of the *psychological* doctrine of determinism. The bishop replied in a treatise with an appendix entitled "The Catching of Leviathan the Great Whale." Hobbes took no notice at the time, but ten years later he replied to the charge of atheism of which he says he now heard for the first time.

It is unfortunate that Hobbes was drawn away from his philosophical and political studies to make excursions into mathematics, in which he had had no training. He was more sensitive to attacks on his solutions of mathematical conundrums, like squaring the circle, than on his political and philosophical positions. He had made enemies at Oxford by attacking in the *Leviathan* the university system as being founded originally for the support of the papal against the civil authority, and as still working social mischief by adherence to the old learning. Oxford was therefore quick to avail itself of the opportunities for criticism offered by *De corpore* (1655) and its English translation *Concerning Body* (1656). Hobbes was involved in a long quarrel with Seth Ward, Savilian professor of astronomy, and John Wallis, author of the great treatise, *Arithmetica infinitorum*. In this long controversy Hobbes was decidedly worsted. He replied to the attacks on him in *Six Lessons to the Professors of Mathematics, one of Geometry, the other of Astronomy, in the University of Oxford* (*English Works*, vol. vii.) in 1656. After more rough thrusts on both sides, Hobbes determined to remain silent; but after his *De homine* (1658) was through the press, he again prepared for the fray.

In the spring of 1660, he made an onslaught on the new-fangled methods of mathematical analysis in five dialogues entitled *Examinatio et emendatio mathematicae hodiernae qualis explicatur in libris Johannis Wallisii*, with a sixth dialogue so-called, consisting entirely of 70 or more propositions on the circle and cycloid. In the *Dialogus physicus, sive De natura aëris* (*Latin works*, iv. 233–296) he fulminated in 1661 against Boyle and other friends of Wallis who were now forming themselves into a society (incorporated as the Royal Society in 1662) for experimental research, to the exclusion of himself personally, and in direct contravention of the method of physical enquiry enjoined in the *De corpore*. Wallis retorted in the scathing satire *Hobbius heautontimorumenos* (1662). He had apparently been stung to fury by a wanton allusion in Hobbes's latest dialogue to a passage of his former life (his deciphering for the parliament of the king's papers taken at Naseby). Professing to be roused by the attack on his friend Boyle, when he had scorned to lift a finger in defence of himself against the earlier dialogues, he tore them all to shreds with an art of which no general description can give an idea. He roundly charged Hobbes, quite unjustly, with having written *Leviathan* in support of Oliver's title, and deserting his royal master in distress. Hobbes's answer to these charges took the form of a letter about himself in the third person addressed to Wallis in 1662, under the title of *Considerations upon the Reputation, Loyalty, Manners and Religion of Thomas Hobbes*

(*English works*, iv. 409–440). In this piece, which is of great biographical value, he told his own and Wallis's "little stories during the time of the late rebellion" so effectively that Wallis, like a wise man, attempted no reply. Thus ended the second bout.

After a time Hobbes began a third period of controversial activity, which did not end, on his side, till his 90th year. *De principiis ratiocinatione geometrarum* (1666) (*Latin works*, iv. 385–484), was designed to show that there was no less uncertainty and error in the works of the geometers than in those of physical or ethical writers. *Quadratura circuli, Cubatio sphaerae, Duplicatio cubi* (1669) gave Hobbes's solution of these famous problems; and, in spite of Wallis's refutations he worked them up again in later publications. In 1674, at the age of 86, he published his *Principia et problemata aliquot geometrica, ante desperata nunc breviter explicata et demonstrata* (*Latin works*, v. 150–214), containing in the chapters dealing with questions of principle not a few striking observations, which ought not to be overlooked in the study of his philosophy. His last piece of all, *Decameron physiologicum* (*English works*, vii. 69–180), in 1678, was a new set of dialogues on physical questions.

All these controversial writings on mathematics and physics represent but one-half of his activity after the age of 70; though, as regards the other half, it is not possible, for a reason that will be seen, to say as definitely in what order the works belonging to the period were produced From the time of the Restoration he acquired a new prominence. Two or three days after Charles's arrival in London, Hobbes drew in the street the notice of his former pupil, and was at once received into favour. The king relished his wit (he used to say, "Here comes the bear to be baited"), and did not like the old man the less because his presence at court scandalized the bishops or the prim virtue of Chancellor Hyde. He even bestowed on Hobbes a pension (not always paid) of £100, and had his portrait hung in the royal closet. But "Hobbism" was freely regarded as equivalent to freethinking and even to atheism, for Hobbes's attack on the Church was regarded as subversive of all religion. His enemies were many and powerful. His eagerness to defend himself against Wallis's imputation of disloyalty, and his apologetic dedication of the *Problemata physica* to the king, are evidence of the hostility with which he was being pressed by the Church party as early as 1662; but it was not till 1666 that he felt himself seriously in danger. In that year the House of Commons embodied the general superstitious fear arising from the calamities of the Plague and the Great Fire in a bill against atheism and profanity. On Oct. 17 it was ordered that the committee to which the bill was referred "should be empowered to receive information touching such books as tend to atheism, blasphemy and profaneness, or against the essence and attributes of God, and in particular the book published in the name of one White, and the book of Hobbes called the *Leviathan*, and to report the matter with their opinion to the House." (The *De medio animarum statu* of Thomas White, a heterodox Catholic priest, who contested the immortality of the soul. White [d. 1676] and Hobbes were friends). Hobbes, then verging upon 80, burnt such of his papers as he thought might compromise him, and set himself to enquire into the actual state of the law of heresy. The results of his investigation appeared in three short dialogues added (in place of the old "Review and Conclusion," for which the day had passed) as an appendix to his Latin translation of *Leviathan* (*Latin works*, iii.). In this appendix, as in the posthumous tract, *An Historical Narration concerning Heresy and the Punishment thereof* (1680, *English works*, iv. 385–408), he maintained that, since the High Court of Commission had been put down, there remained no court of heresy at all to which he was amenable, and that even when it stood nothing was to be declared heresy but what was at variance with the Nicene Creed, as he maintained that the doctrine of *Leviathan* was not.

After the parliamentary scare Hobbes could never afterwards get permission to print anything on ethical subjects. His Latin works (in 2 vols.) appeared at Amsterdam in 1668, because he could not obtain the censor's license for its publication at London, Oxford or Cambridge. Other writings were not made public till after his death—the king apparently having made it the price of his protection that no fresh provocation should be offered to the popular sentiment. The most important of the works, written about 1670, and thus kept back, is the spirited dialogue *Behemoth: the History of the Causes of Civil Wars of England and of the Counsels and Artifices by which they were carried on from the year 1640 to the year 1660.* (*English works*, vi 161–418. Though *Behemoth* was kept back at the king's express desire, it saw the light, without Hobbes's leave, in 1679 before his death.) To the same period probably belongs the unfinished *Dialogue between a Philosopher and a Student of the Common Laws of England* (*English works*, vi. 1–160), a trenchant criticism of the constitutional theory of English government as upheld by Coke. The two thousand and odd Latin elegiac verses in which he gave his view of ecclesiastical encroachment on the civil power may also date from this period; they were first published, nine years after his death, under the title *Historia ecclesiastica* (*Latin works*, v. 341–408).

For some time Hobbes was not allowed to utter a word of protest, whatever might be the occasion that his enemies took to triumph over him. But no Englishman of that day stood in the same repute abroad, and foreigners, noble or learned, who came to England, never forgot to pay their respects to the old man, whose vigour and freshness of intellect no progress of the years seemed able to quench. Among these was the grand-duke of Tuscany (Ferdinand II.), who took away some works and a portrait to adorn the Medicean library.

The autobiography in Latin verse, with its playful humour, occasional pathos and sublime self-complacency, was thrown off at the age of 84. In 1673, he sent forth a translation of four books of the *Odyssey* (ix.–xii.) in rugged but not seldom happily turned English rhymes; and, when he found this *Voyage of Ulysses* eagerly received, he had ready by 1675 a complete translation of both *Iliad* and *Odyssey* (*English works*, x.), prefaced by a lively dissertation "Concerning Virtues of an Heroic Poem," showing his unabated interest in questions of literary style. Even as late as Aug. 1679 he was promising his publisher "somewhat to print in English." He died at Hardwick Hall on Dec. 4 of that year, and was buried in the neighbouring church of Ault Hucknall.

Hobbes was tall and erect in figure. He shaved his beard to avoid the appearance of a venerable philosopher. He used to say that he had been drunk about a hundred times, but he lived a temperate life; after he was 70 he drank no wine and ate no meat. His favourite exercise was tennis, which he played regularly. Socially he was genial and courteous, though in argument he occasionally lost his temper. As a friend he was generous and loyal. Intellectually bold in the extreme, he was timid in ordinary life, and is said to have had a horror of ghosts. He read little, and often boasted that he would have known as little as other men if he had read as much. He appears to have had an illegitimate daughter, for whom he made generous provision. In the National Portrait Gallery there is a portrait of him by J. M. Wright, and two others are in the possession of the Royal Society.

HIS PLACE IN PHILOSOPHY

It cannot be allowed that Hobbes falls into any regular succession from Bacon; neither can it be said that he handed on the torch to Locke. He was the one English thinker of the first rank in the long period of two generations separating Locke from Bacon, but there is no true relation of succession among the three. It would be difficult even to prove any affinity among them beyond the disposition to take sense as a prime factor in subjective experience: their common interest in physical science was shared equally by rationalist thinkers of the Cartesian school, and was indeed begotten of the time. Backwards, Hobbes's relations are rather with Galileo and other enquirers who, from the beginning of the 17th century, occupied themselves with the physical world in the manner that has come later to be distinguished by the name of science in opposition to philosophy.

But even more than in external nature, Hobbes was interested in the phenomena of social life as displayed in an age of political revolution. While he was unable, by reason of imperfect training and too tardy development, with all his pains, to make any original

contribution to physical science or to mathematics, and was easily worsted by Wallis in mathematical controversy, he attempted a task which no other adherent of the new "mechanical philosophy" conceived—nothing less than such a universal construction of human knowledge as would bring society and man (at once the matter and maker of society) within the same principles of scientific explanation as were found applicable to the world of Nature. The attempt was premature, but it is Hobbes's distinction to have conceived it, and he must be classed with those philosophers who have sought to order the whole domain of human knowledge. Upon every subject that came within his system, except mathematics and physics, his thoughts have been productive of thought. As the first storm of opposition died down, thinkers of real weight, beginning with Cumberland and Cudworth, were moved by their aversion to his analysis of the moral nature of man to probe anew the question of the natural springs and the rational grounds of human action; and thus it may be said that Hobbes gave the first impulse to the whole English movement of ethical speculation. In politics the revulsion from his particular conclusions did not prevent the more clear-sighted of his opponents from recognizing the force of his supreme demonstration of the practical irresponsibility of the sovereign power, wherever seated, in the State; and, when in a later age the foundations of a positive theory of legislation were laid in England, the school of Bentham—James Mill, Grote, Molesworth—brought again into general notice the writings of the great publicist of the 17th century, who, however he might, by the force of temperament, himself prefer the rule of one, based his whole political system upon a rational regard to the common weal. Finally, the psychology of Hobbes, though too undeveloped to attract Locke, when essaying the scientific analysis of knowledge, came in course of time (chiefly through James Mill) to be connected with the theory of associationism developed from within the school of Locke, in different ways, by Hartley and Hume; nor is it surprising that the later associationists, finding their principle more distinctly formulated in the earlier thinker, should sometimes have been betrayed into affiliating themselves to Hobbes rather than to Locke. For his ethical theories *see* ETHICS. Höffding (*Hist. of Mod. Phil.*, i., p. 264) summed up Hobbes's contribution to philosophical thought as follows: "Hobbes is an acute and energetic thinker. He instituted the best thought-out attempt of modern times to make our knowledge of natural science the foundation of all our knowledge of existence. The system he constructed is the most profound materialistic system of modern times. Moreover, Hobbes's works, which are distinguished by their powerful and clear exposition, contain many interesting observations on logic and psychology. He may be called the founder of English psychology, that is, of the English school of philosophy. It was his ethical and political views, however, which exerted the greatest influence on his contemporaries. His sturdy, although one-sided, naturalism, challenged men's opinions and brought them into a state of flux. In the sphere of mental science he effected a breach with scholasticism similar to that instituted by Copernicus in astronomy, Galileo in physics, and Harvey in physiology. Hobbes, with justifiable pride, ranges himself alongside of these men as the founder of sociology: this science (as he remarks in the preface to the *De corpore*), is no older than his own *De cive*. The naturalistic basis which he gave to ethics and politics originated a movement which has been strikingly compared to that inaugurated by Darwin in the 19th century."

BIBLIOGRAPHY.—Sufficient information is given in the *Vitae Hobbianae auctarium* (*Latin works*, i. p. 65 *seq.*) concerning the early editions of Hobbes's separate works and the works of his opponents to the end of the 17th century. In the 18th century, after Clarke's *Boyle Lectures* of 1704–05, the opposition was less express. In 1750 *The Moral and Political Works* were collected, with life, etc., by Dr. Campbell, in a folio edition. In 1812 the *Human Nature* and the *Liberty and Necessity* (with supplementary extracts from the *Questions* of 1656) were edited by Philip Mallet, and in 1839–45 by Molesworth. *The Elements of Law* was printed by F. Tönnies from the oldest ms. in 1888. There are numerous reprints of the *Leviathan*. Of translations may be mentioned *Les Élémens philosophiques du citoyen* (1649) and *Le Corps politique* (1652), both by S. de Sorbière, conjoined with *Le Traité de la nature humaine*, by d'Holbach, in 1787, under the general title *Les Oeuvres philosophiques et politiques de Thomas Hobbes;* a translation of the first section, "Computatio sive logica," of the *De corpore*, included by Destutt de Tracy with his *Élémens d'idéologie* (1804); a translation of *Leviathan* into Dutch in 1678, and another (anonymous) into German (Halle, 1794, 2 vols.); a translation of the *De cive* by J. H. v. Kirchmann (Leipzig, 1873). Important later editions are those of Ferdinand Tönnies, *Behemoth* (1889), on which *see* Croom Robertson's *Philosophical Remains* (1894), p. 451; *Elements of Law* (1889).

Three accounts of Hobbes's life were first published together in 1681, two years after his death, by R. B. (Richard Blackbourne, a friend of Hobbes's admirer, John Aubrey), and reprinted, with complimentary verses by Cowley and others, at the beginning of Sir W. Molesworth's collection of the Latin Works: (1) *T. H. Malmesb. vita* (pp. 13–21), written by Hobbes himself, or (as also reported) by T. Rymer, at his dictation; (2) *Vitae Hobbinae auctarium* (pp. 22–80), turned into Latin from Aubrey's English; (3) *T. H. Malmesb. vita carmine expressa* (pp. 81–99), written by Hobbes at the age of 84 (first published by itself in 1680). The *Life of Mr. T. H. of Malmesburie*, printed among the *Lives of Eminent Men* in 1813, from Aubrey's papers in the Bodleian, etc. (vol. ii. pt. ii. pp. 593–637), contains some interesting particulars not found in the *Auctarium*. All that is of any importance for Hobbes's life is contained in G. Croom Robertson's *Hobbes* (1886) in Blackwood's Philosophical Classics, and Sir Leslie Stephen's *Hobbes* (1904) in the "English Men of Letters" series, both of which cover his philosophy. *See* also F. Tönnies, *Hobbes Leben und Lehre* (1896), *Hobbes-Analekten* (1904); G. Zart, *Einfluss der englischen Philosophie seit Bacon auf die deutsche Philosophie des 18ten Jahrh.* (1881); G. Brandt, *Thomas Hobbes: Grundlinien seiner Philosophie* (1895); G. Lyon *La Philos. de Hobbes* (1893); J. M. Robertson, *Pioneer Humanists* (1907); J. Rickaby, *Free Will and Four English Philosophers* (1906); J. Watson, *Hedonistic Theories* (1895); W. Graham, *English Political Philosophy from Hobbes to Maine* (1899); W. J. H. Campion, *Outlines of Lectures on Political Science* (1895); M. Frischeisen-Köhler, *Zur Erkenntnislehre und Metaphysik des Thomas Hobbes* (1914); H. Höffding, *Hist. of Modern Philosophy*, vol. i. (1900). Full bibliography in Übesweg, *Grundriss der Gesch. der Phil.*, bd. iii. (1914).

HOBHOUSE, ARTHUR HOBHOUSE, 1ST BARON (1819–1904), English judge, fourth son of Henry Hobhouse, permanent under-secretary of State in the Home Office, was born at Hadspen, Somerset, on Nov. 10, 1819. Educated at Eton and Balliol, he was called to the bar at Lincoln's Inn in 1845, and rapidly acquired a large practice as a conveyancer and equity draftsman; he became Q.C. in 1862, and practised in the Rolls Court, retiring in 1866. He was an active member of the charity commission and urged the appropriation of pious bequests to educational and other purposes. In 1872 he began a five years' term of service as legal member of the council of the governor-general of India, his services being acknowledged by a K.C.S.I.; and in 1881 he was appointed a member of the judicial committee of the privy council, on which he served for 20 years. He was made a peer in 1885, and consistently served the Liberal party in the House of Lords. He died on Dec. 6, 1904, leaving no heir to the barony.

His papers read before the Social Science Association on the subject of property were collected in 1880 under the title of *The Dead Hand*.

HOBHOUSE, LEONARD TRELAWNEY (1864–), British sociologist, was educated at Oxford; he became fellow of Merton college in 1887, and of Corpus Christi in 1890. He served for five years on the staff of *The Manchester Guardian*. An active Liberal, he was secretary of the Free-Trade Union in 1903–05 and published several political works, notably *The Labour Movement* (1893; 2nd ed., 1898) and *Democracy and Reaction* (1904), showing strong sympathy with collectivism, which he maintained to be not inconsistent with Liberalism. In 1907 he was appointed Martin White professor of sociology in the university of London, and next year became editor of *The Sociological Review*. Thenceforth, except for a few war publications, he devoted his energies to writing and lecturing on ethical, psychological and sociological subjects. His principal works are *The Theory of Knowledge* (3rd ed., 1921); *Mind in Evolution* (2nd ed., 1915); *Morals in Evolution* (2 vol., 3rd ed., 1915); *Development and Purpose* (1913); and *Principles of Sociology* in four separate sections (1918–24); the social application of ethical principles; in collaboration with G. C. Wheeler and M. Ginsberg, *The Material Culture and Social Institutions of the Simpler Peoples* (1915); and with J. L. Hammond, *Lord Hobhouse; a Memoir* (1905).

HOBOKEN, town of Belgium on the right bank of the Scheldt about 4 m. above Antwerp. It is an important industrial centre and has the ship-building yard of the Cockerill firm of Seraing.

Many wealthy Antwerp merchants have villas here, and it is the headquarters of several of the leading rowing clubs on the Scheldt. Pop. (1925) 27,790.

HOBOKEN, a city of Hudson county, N.J., U.S.A., on the Hudson river, adjoining Jersey City on the south, opposite the lower part of New York city, with which it is connected by the Hudson River tunnels, four ferries, and (through Jersey City) the Vehicular tunnel. It is served by the Hudson and Manhattan and the Lackawanna railways, and for freight also by the Erie, the Lehigh Valley, the Pennsylvania, the West Shore and the Hoboken Manufacturers railways and steamship lines. The population was 68,166 in 1920 (34·5% foreign-born white, over half from Italy and Germany). The city has a restricted area of 1·3 sq.m. Its water-front of 1·3 m. is lined with piers, including those of the United States line, the North German Lloyd, Lamport and Holt, the Munson, the Scandinavian American and the Holland-American lines and other steamship companies. Much of the surface has been filled in, to raise it above the level of high tide. Castle Point, rising 100 ft. above the river near the centre of the shoreline, is occupied by Hudson park, formerly the residence and private estate of the founder of the city, John Stevens (1749–1838), and the Stevens Institute of Technology (opened 1871), endowed by his son, Edwin A. Stevens (1795–1868). The city has numerous and varied manufacturing industries, with an output in 1925 valued at $59,536,561. The assessed valuation of property for 1926 was $100,089,371. Bank deposits on June 30, 1925, amounted to $159,221,734.

Hobocan was an Indian word, meaning tobacco-pipe. The site of the city was bought by the Dutch West India company in 1635 for $1,040, and was occupied by 1640 by a Dutch farm, which was laid waste by the Indians in 1643. In 1658 the land was deeded by the Indians to Peter Stuyvesant. In 1711 Samuel Bayard, a New York merchant, acquired title to it and built his summer residence on Castle Point. The property was confiscated in 1780 by the state of New Jersey from his descendant, a loyalist, and in 1784 it was bought (for $90,000) by John Stevens, the inventor. He laid it out as a town in 1804, and for the next 35 years its Elysian Fields were a famous pleasure resort of New York city. Hoboken was incorporated as a town in 1849 and as a city in 1855. In 1860 the population was 9,662. In the next decade, and again in the 20 years 1870–90, it more than doubled, and in 1910 it reached 70,324. The city has a commission form of government.

HOBSON'S CHOICE, *i.e.*, "this or nothing," an expression that arose from the refusal of the Cambridge-London carrier, Thomas Hobson (1544–1630), when letting his horses on hire, to allow any animal to leave the stable out of its turn. Among other bequests made by Hobson, and commemorated by Milton, was a conduit for the Cambridge market-place. See *Spectator,* No. 509, Oct. 14, 1712.

HOBY, SIR THOMAS (1530–1566), English diplomatist and translator, son of William Hoby of Leominster, was born in 1530. He entered St. John's college, Cambridge, in 1545, but in 1547 he went to Strassburg, where he was the guest of Martin Bucer, whose *Gratulation . . . unto the Church of Englande for the restitution of Christes Religion* he translated into English. He then proceeded to Italy, visiting Padua and Venice, Florence and Siena, and in May 1550 he had settled at Rome, when he was summoned by his half-brother, Sir Philip Hoby (1505–58), then ambassador at the emperor's court, to Augsburg. The brothers returned to England at the end of the year, and Thomas attached himself to the service of the marquis of Northampton, whom he accompanied to France on an embassy to arrange a marriage between Edward VI. and the princess Elizabeth. Shortly after he returned to England he started once more for Paris, and in 1552 he was engaged on his translation of *The Courtyer of Count Baldessar Castilio,* printed in 1561. The *Cortegiano* of Baldassare Castiglione, which Dr. Johnson called "the best book that ever was written upon good breeding," exercised an immense influence on the standards of manners throughout Europe, and was the recognized authority for the education of a nobleman. Thomas Hoby married in 1558 Elizabeth, the learned daughter of Sir Anthony Cook, who wrote a Latin epitaph on her husband. He was knighted in 1566 by Elizabeth, and was sent to France as English ambassador. He died on July 13 in the same year in Paris, and was buried in Bisham Church. The authority for Thomas Hoby's biography is a ms., "Booke of the Travaile and lief of me Thomas Hoby, with diverse things worth the noting." This was edited for the Royal Historical Society by Edgar Powell in 1902. Hoby's translation of *The Courtyer* was edited (1900) by Prof. Walter Raleigh for the "Tudor Translations" series. *See* also Sir Walter Raleigh, *Some Authors* (1923).

HOCHE, LAZARE (1768–1797), French general, was born near Versailles on June 24, 1768. He enlisted in the *Gardes françaises* and soon obtained promotion. When the *Gardes françaises* were broken up in 1789 he served in various line regiments up to the time of his receiving a commission in 1792. He served with credit in the operations of 1792–1793 on the northern frontier of France. When Dumouriez deserted to the Austrians, Hoche, with le Veneur and others, fell under suspicion of treason; but after being kept under arrest for some months he took part in the defence of Dunkirk, and in the same year (1793) he was promoted successively *chef de brigade,* general of brigade, and general of division. During his command in Lorraine he was defeated by the Prussians at Kaiserslautern (Nov. 28, 30, 1793), but the Committee of Public Safety valued his services enough to leave him in command; in December, after he had stormed the lines of Fröschweiler the Army of the Rhine was also put under him, and he pursued his success, sweeping the enemy before him to the middle Rhine in four days. Before the following campaign opened, he married Anne Adelaïde Dechaux at Thionville (March 11, 1794). Ten days later he was suddenly arrested, on charges of treason preferred by Pichegru, the displaced commander of the Army of the Rhine. Hoche escaped execution, though imprisoned in Paris until the fall of Robespierre. On Aug. 21, 1794 he was appointed to command against the Vendéans and made the peace of Jaunaye (Feb. 15, 1795) when the war was renewed by the royalists. Hoche inflicted a crushing blow on the royalist cause by capturing de Sombreuil's expedition at Quiberon and Penthièvre (July 16–21, 1795). Before the summer of 1796 he had pacified the whole of the west, which had for more than three years been the scene of a pitiless civil war. In December 1796 he was appointed to organize the invasion of Ireland, but the expedition was driven back by bad weather. Hoche was at once transferred to the Rhine frontier, where he defeated the Austrians at Neuwied (April), though operations were soon afterwards brought to an end by the Preliminaries of Leoben. Later in 1797 he was minister of war for a short period, but, finding himself the dupe of Barras and technically guilty of violating the constitution, he returned to his command on the Rhine frontier. But his health grew rapidly worse, and he died probably of consumption at Wetzlar on Sept. 19, 1797. He was buried by the side of his friend Marceau in a fort on the Rhine, and was mourned throughout France.

See Desprez, *Lazare Hoche d'après sa correspondance* (1858; new ed., 1880); Bergounioux, *Essai sur la vie de Lazare Hoche* (1852); É. de Bonnechose, *Lazare Hoche* (1867); H. Martin, *Hoche et Bonaparte* (1875); Dutemple, *Vie politique et militaire du général Hoche* (1879); Escaude, *Hoche en Irlande* (1888); Cunéo d'Ornano, *Hoche* (1892); A. Chuquet, *Hoche et la lutte pour l'Alsace* (a volume of this author's series on the campaigns of the Revolution, 1893); E. Charavaray, *Le Général Hoche* (1893); A. Duruy, *Hoche et Marceau* (1885).

HOCHHEIM, a town in the Prussian province of Hesse-Nassau, situated on the Main, 3 m. above its influx into the Rhine and on the railway from Wiesbaden to Frankfort-on-Main. Pop. (1925) 4,704. Hochheim is mentioned in the chronicles as early as the 7th century. It was the scene of a victory gained here in 1813 by the Austrians over the French. It trades in wine (*see* Hock).

HÖCHST, town of Germany, in the Prussian province of Hesse-Nassau on the Main, 6 m. by rail W. of Frankfort-on-Main. Pop. (1925) 31,439. Höchst belonged formerly to the electors of Mainz who had a palace here; this was destroyed in 1634 with the exception of one fine tower which still remains. It has large dye-works and manufactures of machinery, armour, chemicals, furniture and leather. Brewing is carried on and there is a con-

siderable river trade. The Roman Catholic church of St. Justinus is a fine basilica originally built in the 9th century.

Höchst is also the name of a small town in Hesse. This has some manufactures, and was formerly the seat of a Benedictine monastery.

HÖCHSTÄDT, a town of Bavaria, Germany, in the district of Swabia, on the left bank of the Danube, 34 m. N.E. of Ulm by rail. Pop. (1925) 2,156. It has a castle flanked by walls and towers and some small industries, including malting and brewing. Here Frederick of Hohenstaufen, vicegerent of the Empire for Henry IV., was defeated by Hermann of Luxemburg, in 1081; it came into Bavarian possession in 1266, in 1703 the Imperialists were routed here by Marshal Villars in command of the French; and in August 1704 Marlborough and Prince Eugene defeated the French and Bavarians, this battle being usually known as that of Blenheim.

There is another small town in Bavaria named Höchstadt. Pop. (1925) 2,108. This is on the river Aisch, not far from Bamberg, to which bishopric it belonged from 1157 to 1802, when it was ceded to Bavaria.

HOCK. From a very early date, certainly not later than the 11th century, the German traders from the hanseatic cities, who had a "hanse" or headquarters in London, brought to England some of the wines of the Rhine. In all official documents relating to the importation and taxation of wine in England from the earliest times until the end of the 17th century all wines from Germany are named "Rhenish wines," but they were known to the public under the name of hock as early as the 16th century. Although no actual evidence has as yet come to light to place beyond dispute the origin of the name hock, it was probably first used to designate the wines from Hochheim, a village surrounded by vineyards, situated upon the right bank of the river Main, close to where it flows into the Rhine. The name hock, short for Hochheim, being a name easy to pronounce and to remember, would quite naturally be used by most people in place of so many long and difficult names of German vineyards; so in time hock was used to designate all wines which were shipped to England from the Rhine, whether red or white. As a matter of fact, the output of red Rhine wines is so small, and the demand for them is so much greater in Germany than the supply, that they are hardly ever exported and the name "hock" is, in practice, restricted to the white wines of the Rhine.

Rhinegau.—The finest hocks are those from the Rhinegau vineyards, which are situated upon the right bank of the Rhine from Rüdesheim, opposite Bingen, to the hills of Rauenthal. It is within that comparatively small area that are to be found the most famous Rhinegau vineyards: *Rüdesheim, Geisenheim, Winkel, Mittelheim, Oestrich, Johannisberg, Volrads.* A little farther east are the no less celebrated hills of *Steinberg,* whilst nearer the Rhine are the famous growths of *Hattenheim, Marcobrunn, Erbach* and *Eltville.*

Rhinehesse.—Upon the opposite bank of the Rhine, in Hesse, from Bingen to Mayence and from Mayence to Worms, there are far more extensive vineyards than those of the Rhinegau, but they do not produce wines of the same high degree of excellence: the best wines of Hesse are those of *Nierstein* and *Oppenheim,* from vineyards situated a few miles south of Mayence, and those of *Liebfraumilch* grown near Worms, close to the southern boundary of Hesse.

Palatinate.—Hocks which are quite distinctive in character, possessing more breed and bouquet than the Hesse wines, and more sweetness than those of the Rhinegau, are made in the Palatinate, the best being those of *Deidesheim, Forst, Durkheim, Wackenheim* and *Ruppertsberg.*

In Franconia, in quite another part of Bavaria, farther east and north, we find the *Stein* wines, which are very characteristic and in good years are also very fine.

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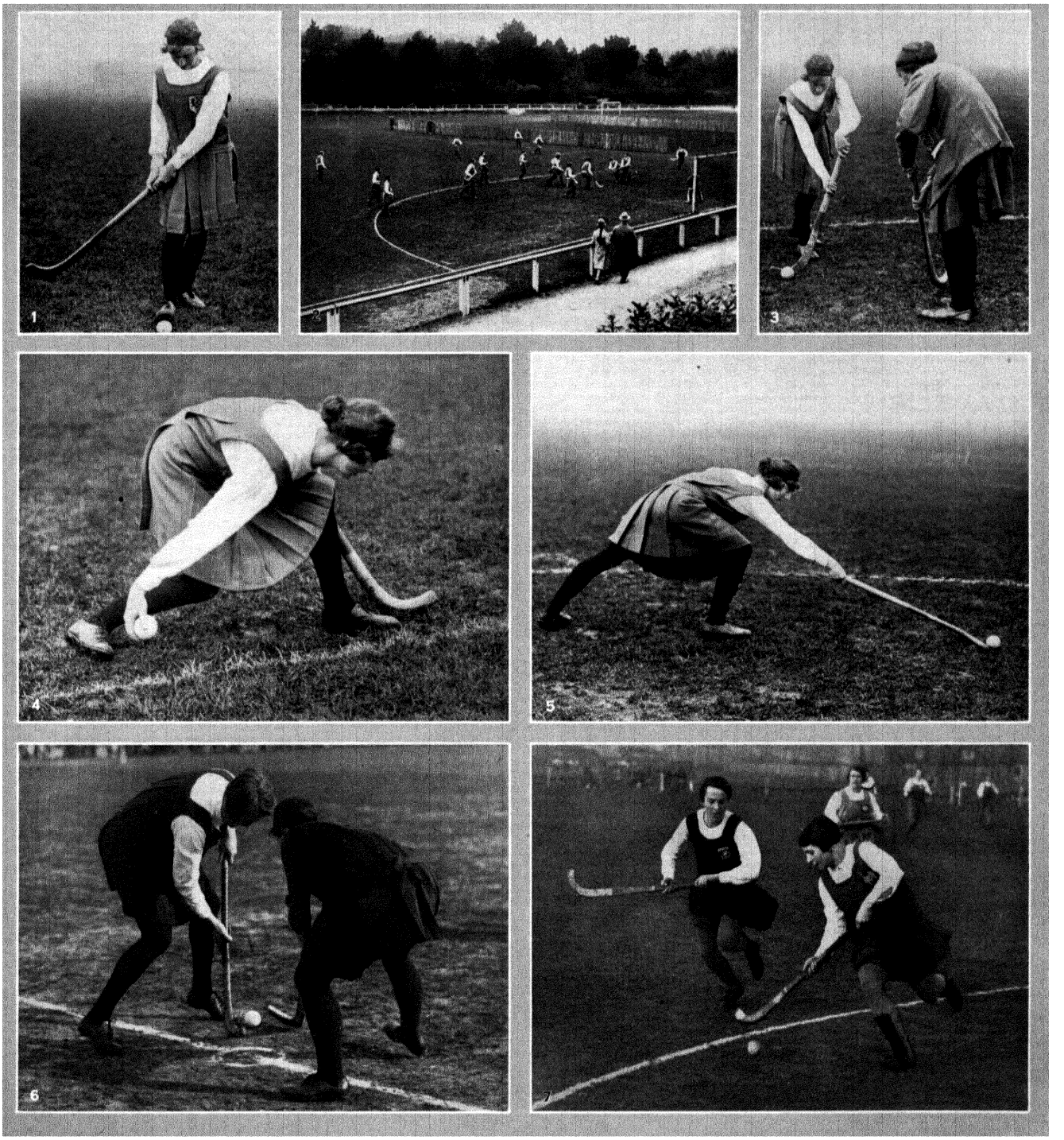
HÖCKERT, JOHAN FREDRIK (1826–1866), Swedish painter, was born at Jonköping on Aug. 26, 1826. He studied in Munich and in Paris, where he came under the influence of Delacroix's Romanticism, and afterwards went from place to place, working in Spain, Tunis and Naples. The experience thus gained gave him an unusually broad outlook, and on his return he upset all the traditions of the Swedish-Düsseldorf school by painting for the sake of art and not for the anecdote or historical incident which provided the subject. His great merit lies in the fact that he was first among his countrymen to adopt this attitude. Both his "Divine Service in Lapland" and "Interior of a Lapland Hut" were exhibited in Paris and afterwards found their way to the museums at Lille and Stockholm respectively. His last important work, "The Burning of the Castle of Stockholm" (1866) is an example of his vivid colouring (Museum of Stockholm). All three pictures are admirably composed.

See T. Chasrel, "Études sur la Musée de Lille," in *L'Art,* vol. iv. p. 261 (1877); R. Muther, *The History of Modern Painting* (authorized Eng. ed., 2 vols. 1907; rev. ed., enlarged, 4 vols., 1907).

HOCKEY, a game played with a ball by two opposing sides, using hooked or bent sticks with which each side attempts to drive it into the other's goal.

A crude form of a stick-game was played by the ancient Persians, from whom it was acquired by the Greeks, who in turn passed it on to the Romans. A discovery made at Athens in 1922 gives reason to believe that a form of stick-game came from the East. This was a bas-relief found in the wall built by Themistocles (514–449 B.C.), which depicts six youths taking part in a game resembling hockey, and shows what is termed a "bully" in the modern game, but with the hooked sticks pointing downward instead of upward. Traces of a sort of stick-game have also been found in America, as played by the Aztec Indians, and there is evidence to show that probably most, if not all, of the Indian tribes in America have played a rough sort of stick-game for some thousand years. But neither these, nor the "London Balle Playe" mentioned by Fitzstephen in 1175, seem to have born more than a general resemblance to modern hockey.

Modern Hockey.—About 1875 a game resembling modern hockey began to be played. No goal could be scored if hit from a distance of more than 15yd. from the nearest goal post, but players did not for a time realize the need of a definite marked out circle. A landmark in the progress of the game was the formation of the famous Wimbledon Club in 1883. The members at first used a string ball and light ash sticks. A few more clubs soon came into being in the London area and the game spread to the Midlands, west and north of England. The real birthday of modern hockey was however Jan. 18, 1886, the date of the formation of the Hockey Association and of the adoption of the striking circle. The following year the first county match was played; this was Surrey v. Middlesex, and out of this match there arose the question of a county qualification. It was decided by the Hockey Association that actual residence should be the sole qualification, but later this rule was amended, the Division being empowered to make their own rules in regard to this matter. By 1890 the Hockey Association had 26 southern clubs affiliated to it, and in addition the recently formed Northern Counties Hockey Association. It was in this year that the first divisional match was played, the North meeting the South in Jan. 1890 at Queen's Club, London, when the South won by 6 goals to nil. At this time there was trouble over the vexed question of "cup ties," and an application for affiliation by the Northamptonshire Hockey Association was granted by the Hockey Association only on the express understanding that they abolished all cups or prize competitions. That has always been the parent body's policy. Consequently hockey is one of the few games into which no trace of professionalism has entered. The Midland Counties Divisional Association came into being in 1894 and a year later the first international match was played between England and Ireland, resulting in a win for the former by 5 goals to nil. About this time the West started an association of its own, and the first of its series of matches with the Midlands was played, though it was not until several years later that the other divisions arranged fixtures with the West.



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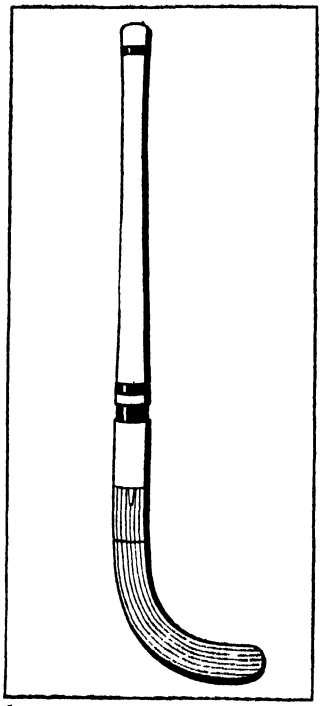
WOMEN'S FIELD HOCKEY

1. Player on a Surrey ladies' hockey team, showing one method of fielding the ball with the foot. Player holds stick uplifted to hit ball
2. Southern Counties' Women's Tournament at Bournemouth, Hants. View of Surrey first team versus Oxfordshire. Surrey attacking opponents' goal
3. The Push Pass. Right hand is well below the left to give leverage
4. Correct position at start of the "Roll In." Ball is held in the right hand, ready for forward swing. Stick used to brace body
5. The "Job," stroke used when the ball is too far away to hit. The arm is stretched out to its full extent, with the back of the stick laid on the ground, face uppermost. A series of quick thrusts at the ball will keep the player in touch with it until she is near enough for a hit
6. International Ladies' Hockey Match, score England 5 versus Wales 1, at Merton Abbey, Surrey. Action shows *"bully off"* at goal line
7. Southern Counties' Women's Hockey Association match: South versus Midlands at Merton Abbey. A fine run down field by Midland forward, showing ball inside goal line

The Welsh Hockey Association was formed in 1897, England meeting Wales in the spring of 1898 and winning by 7 goals to nil. Ireland had, however, started international matches with Wales three years previous to this. About 1900 the need was realized of having an international committee to frame and amend the rules of the game, and the governing bodies of Ireland and Wales were each asked to send two representatives to meet three from the Hockey Association. Later this body was called the International Hockey Board, its membership being increased by two on the formation of the Scottish Hockey Association in 1902.



A HOCKEY STICK, SHOWING BLADE, MADE OF ASH, AND HANDLE OF CANE, WHICH MAY BE WITH OR WITHOUT RUBBER INSERTIONS

The organization of the game was now nearing completion, and it was brought a step nearer on the formation of the Eastern Counties Hockey Association and the Army Hockey Association. The Royal Navy soon followed the leaders. The growth of the game in England may be gauged by the fact that whereas on the formation of the Hockey Association in 1886 there was a mere handful of clubs, the number had in 1926 increased to over 1,000, many of them having a large membership. Hockey has not, however, flourished to the same extent in Wales or Scotland, although it is very popular in Ireland. Over a period of 32 years (excluding the years 1915 to 1919) England has played 73 matches against Ireland, Scotland and Wales, winning 63, losing 5, and drawing 5. This pre-eminence is due partly to the far larger numbers of players at her command, and partly to the fact that an increasing number of the public schools devote a term to hockey, and that there is a great number of players at the universities of Oxford and Cambridge.

The Game Throughout the World.—Although hockey is not played to anything like the same extent as football among the nations of Europe, yet since the beginning of the 20th century the game has become more popular. In parts of France inter-regional matches are held. International matches between England and France were begun in 1907. In 1913 England also played Germany, winning easily. Other hockey-playing countries are Belgium, Denmark, Holland, Spain, Austria and Switzerland, and these arrange to have international contests as opportunity offers. From time to time the Hockey Association sends out teams abroad, and during the Christmas and Easter holidays several English teams go on tour. In Australia and New Zealand the game is making headway, and the Hockey Association of the latter country has twice invited the Hockey Association to send over a team to tour there, but this invitation it has unfortunately been impossible to accept. In South Africa, a federation was formed in 1925 and gradual progress is being made. But in no country in the world is hockey so extensively played as in India. It is computed that there are about 3,000 teams, and recently an All-India Federation was formed to include the 24 provinces. Japan is a newcomer to hockey and has formed an association including some 50 clubs. The Japanese army and navy have also included the game in their athletic curriculum and there are several Service teams. Throughout the world, wherever the game is played, the Hockey Association is looked upon as the parent body.

The Game.—The game is played by two teams of eleven players on a rectangular ground, 100yd. long, and not more than 60yd. nor less than 55yd. wide, marked with white lines, the longer boundary lines are the side lines, the others the goal lines. Inside the ground, at a distance of 7yd. and running parallel with the side lines, a dotted line is marked, called the 7yd. line. In front of each goal there is drawn a white line, 4yd. long, parallel to and 15yd. from the goal-line. This line is continued each way to meet the goal-line by quarter circles having the goal posts as centres. The space thus enclosed is called the striking-circle. For a goal to be scored the ball must pass over the goal-line between the goal posts, and whilst within the striking-circle must have been hit by or glanced off the stick of an attacker. The ball is an ordinary cricket ball painted white. A hockey stick has a flat face on the left side of the head and is rounded on the right, and the ball may only be struck with the flat side. The diameter must not exceed 2in. nor the weight 28 oz. The curved head of the stick is made of ash and the handle of pieces of cane with thin strips of rubber let in. At the start of the game two players (one from each side) "bully" the ball in the centre of the ground. To "bully" the ball each player taps first the ground on his own side of the ball and then his opponent's stick three times alternately, after which one of these two players must strike the ball before it is in general play. Each side then endeavours, by means of striking, passing and dribbling, to drive the ball into its opponent's goal. The ball may be caught (but not held) or stopped by any part of the body, but may not be picked up, carried, thrown, kicked or knocked on, except with the stick. Each goal-keeper is, however, allowed to kick the ball in his own striking-circle. Hooking of sticks is permissible within striking distance of the ball. A player must not obstruct by interposing himself between an opponent and the ball. Penalties for infringing rules are of three classes: "free hits," "penalty-corners" and "penalty bullies." If the ball is hit over the goal line (not between the goal posts) by one of the attacking team from any part of the field or unintentionally by one of the defending team, from outside the 25yd. line, it is brought out 25yd. in a direction at right angles to the goal-line where it crossed the line, and there "bullied." But if the ball is unintentionally hit over the goal-line from within the 25yd. line by one of the defenders, the attacking side is given a "corner," or if, in the opinion of the umpire, the ball has intentionally been hit over the goal-line, a "penalty-corner" is awarded. A "corner" is a free hit taken within 3yd. of a corner flag and a "penalty-corner" from any point on the goal-line, at a distance of not less than 10yd. from the nearer goal post. In each case the defending team must be behind their own goal-lines. In no case can a goal be scored direct from a free hit. When the ball passes over the side line, it is rolled in from the point where it crossed the side line by one of the team opposed to the player who last touched the ball. It may be rolled (not thrown) in any direction, but all players must stand outside the 7yd. line until the ball shall have left the hand of the roller-in. When striking the ball players are not allowed to raise the stick above the shoulder, and intentional undercutting of the ball is disallowed.

From small beginnings, hockey has become a popular game at not a few of the public schools, at the universities and with the middle classes. To be an adept the essentials are a good eye, strong wrists, footwork, pace and ball control. Hockey suffers if played on a rough and uneven ground, as then accurate stick-work is very difficult, and the game is slowed up by reason of foot or hand being used to stop the ball; speed, which is one of the principal charms of the game, thus cannot be attained. ICE HOCKEY is the subject of a separate article under that title.

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HOCKING, SILAS KITTO (1850–), English novelist, was born at St. Stephens, Cornwall, on March 24, 1850, and educated at the local grammar school. He was ordained a Free Church minister in 1870 but resigned his pastorate in 1896. Both he and his younger brother JOSEPH HOCKING (b. Nov. 7, 1860), who had a similar upbringing for the Nonconformist ministry,

became prolific writers of widely read novels with a distinct religious note. Among those of Silas Hocking were *Alec Green* (1878); *Who Shall Judge?* (1910); *His Own Accuser* (1917), and *Watchers in the Dawn* (1920). Among those of Joseph Hocking were *Jabez Easterbrook* (1891); *Zillah* (1892); *The Scarlet Woman* (1899); *Tommy and the Maid of Athens* (1917), and *The Pomp of Yesterday* (1918).

HOCK-TIDE, an ancient general holiday in England, celebrated on the second Monday and Tuesday after Easter Sunday. Hock-Tuesday was an important term day, rents being then payable, for with Michaelmas it divided the rural year into its winter and summer halves. No trace of the word is found in Old English, and "hock-day" appears first in the 12th century. The characteristic pastime of hock-tide was called binding. On Monday the women, on Tuesday the men, stopped all passers of the opposite sex and bound them with ropes till they bought their release with a small payment, or a rope was stretched across the highroads and the passers were obliged to pay toll. The money thus collected seems to have gone towards parish expenses. Many entries are found in parish registers under "Hocktyde money." The hock-tide celebration became obsolete in the beginning of the 18th century. At Coventry a play called *"The Old Coventry Play of Hock Tuesday"* was suppressed at the Reformation.

HOCUS, a shortened form of "hocus pocus," used in the 17th century in the sense of "to play a trick on any one," to "hoax," which is generally taken to be a derivative. "Hocus pocus" appears to have been a mock Latin expression first used as the name of a juggler or conjurer.

HODDEN, a coarse kind of cloth made of undyed wool, formerly much worn by the peasantry of Scotland. It was usually made on small hand-looms by the peasants themselves. Grey hodden was made by mixing black and white fleeces together in the proportion of one to 12 when weaving.

HODDESDON, an urban district of Hertfordshire, England, near the river Lea, 17 m. N. from London by the L.N.E. railway. Pop. (1921) 5,409. Hoddesdon was a famous coaching station on the Old North Road; and the Bull posting-house is mentioned in Matthew Prior's "Down Hall." The Lea has been a favourite resort of anglers from the time of Izaak Walton, in whose book Hoddesdon is specifically named. The church of St. Augustine, Broxbourne, is a fine example of Perpendicular work, and contains an altar tomb with enamelled brasses of 1473. Hoddesdon probably covers the site of a Romano-British village.

HODEIDA (HODEDA, HADEDA), a town in Arabia situated on the Red Sea coast 14° 48′ N. and 42° 57′ E. It lies on a beach of muddy sand exposed to the southerly and westerly winds. Steamers anchor more than a mile from shore, and merchandise is carried by means of native boats. But Hodeida has become the chief centre of the maritime trade of Yemen and is known as the "Key to San'a." The population is estimated at 35,000 and is cosmopolitan in character. Services are maintained with Aden, and with Suez, Massaua and the other Red Sea ports. Coffee and dates are the principal exports. After the war of 1914–18 Hodeida came under the influence of the Idrisi Seyyid Ali b. Mohammed.

HODGENVILLE, a town of central Kentucky, U.S.A., on Federal highway 68 and the Illinois Central railroad, 5om. S. of Louisville; the county seat of Larue county. The population was 1,100 in 1920. Three miles south-west of the town, in a log cabin on the Big South Fork of Nolin's Creek, Abraham Lincoln was born on Feb. 12, 1809. The cabin is now enclosed in a memorial hall, and is kept as a national shrine.

HODGES, FRANK (1887–), British politician, was born at Woolaston, Gloucestershire. At the age of 14 he entered the Vivian Colliery at Abertillery, South Wales. In 1912 he was elected a miners' agent and six years later secretary of the Miners' Federation of Great Britain. He became a civil lord of the Admiralty in the Labour ministry of 1924. He lost his seat at the election of that year; and in 1925 was made general secretary of the International Miners' Federation. He resigned in 1927, and then became a member of the Central Electricity Board.

See his *My Adventures as a Labour Leader* (1925).

HODGKIN, THOMAS (1831–1913), British historian, son of John Hodgkin (1800–1875), barrister, was born in London, on July 29, 1831, and died on March 2, 1913. Having been educated as a member of the Society of Friends and taken the degree of B.A. at London university, he became a partner in the banking house of Hodgkin, Barnett & Co., Newcastle-on-Tyne, a firm afterwards amalgamated with Lloyds Bank. Hodgkin devoted a good deal of time to historical study, and became a leading authority on the history of the early middle ages.

His chief works are, *Italy and her Invaders* (1880–99); *The Dynasty of Theodosius* (1889); *Theodoric the Goth* (1891); and an introduction to the *Letters* of Cassiodorus (1886). He also wrote a *Life of Charles the Great* (1897); *Life of George Fox* (1896); the opening volume of Longman's *Political History of England* (1906); and a few religious books from a Quaker standpoint. *See* L. Creighton, *Life and Letters of Thomas Hodgkin* (1917).

HODGSON, BRIAN HOUGHTON (1800–1894), English administrator, ethnologist and naturalist, was born at Lower Beech, Cheshire, on Feb. 1, 1800. In 1816 he obtained an East Indian writership, went out to India in 1818 and in 1820 was appointed assistant to the resident at Katmandu. In 1833 he became resident in Nepal, and succeeded in concluding a satisfactory treaty in 1839 with the court to which he was accredited; but in 1842 his imperious policy towards the native Government was upset by the interference of Lord Ellenborough. Hodgson disobeyed the latter's instructions; he was continued in office for a time, but was recalled in 1843. He died at Aiderley Grange in the Cotswold hills, on May 23, 1894.

Hodgson did much to throw light on Buddhism as it exists in Nepal. He presented his collection of Sanskrit manuscripts to the East India Office. He also became the greatest authority on the flora of the Himalayas. He wrote 184 philological and ethnological, and 127 scientific papers, and some pamphlets on native education. His principal work, *Illustrations of the Literature and Religion of Buddhists* (1841) was republished with other writings in 1872–80.

See his *Life* by Sir W. W. Hunter (1896).

HODGSON, SHADWORTH HOLLOWAY (1832–1912), English philosopher, was born at Boston, Lincs., on Dec. 25, 1832, and educated at Rugby and Corpus Christi college, Oxford. He devoted himself from 1858 onwards to the study of philosophy, and helped to found in 1880 the Aristotelian Society of London, of which he was the first president (1880–94). He died on June 13, 1912, in London. Besides numerous contributions to *Mind,* Hodgson published *Time and Space* (1865); *The Philosophy of Reflection* (1878) and *The Metaphysic of Experience* (1898), an exposition of his philosophy.

HODLER, FERDINAND (1853–1918), Swiss painter, was born at Gurzelen in the canton of Berne on March 14, 1853. He received his early education in drawing from Ferd. Sommer-Collier, a Swiss landscape painter at Thun, but his artistic career began at Geneva in 1872, where he worked under Barthelémy Menn, at the same time studying at the university. In 1874 he won the Calame prize for a landscape. After various journeys, notably in Spain, which explains the Spanish influence in much of his earlier work, he settled down in Geneva where, with a few intervals, he remained until his death. Among his most important pictures are the "Cortège des lutteurs" (1887), "La Nuit" (1891), "Las de vivre" (1892), "L'Elu" (1894), "Eurythmie" (1895), "L'Emotion," "La Vérité" (1905), "Le Jour," "L'Amour" (1908). He also executed numerous portraits, landscapes, water colours and lithographs. He died on May 20, 1918. He was a protagonist of the expressionist movement. The best display of his work is in the Kunsthaus at Zürich. *See* E. Bender, *Die Kunst Ferdinand Hodlers* (1920).

HÓDMEZŐ-VÁSÁRHELY, a Hungarian town in the county of Csongrád. Lying near the right bank of the Tisza and protected from normal floods by a large dike, the town is on the edge of a very fertile alluvial plain and is essentially the centre of extensive agriculture and stock-rearing, being particularly noted for grapes and melons and the fine breeds of horned cattle and horses. Much of the surrounding plain (383 sq.m.) is owned by the municipality. Pop. (1920), 60,922.

HODOGRAPH. If from any point *O* a vector *OP* be drawn representing at any instant in magnitude and direction the velocity of a particle *P'*, which is moving in any manner whatever, the locus of *P* is the hodograph of the path of *P'*. (*Cf.* the definition of radial curve under CURVES, SPECIAL.) A fundamental property of this curve is that the velocity of any point *P* of the hodograph is equal to the acceleration of the corresponding point *P'*; also that the direction of motion of *P* is that of the direction of acceleration of *P'*. The hodograph of the orbit of a planet or a comet, considered as in a Newtonian field, is always a circle, whatever may be the form and dimensions of the orbit. The pole *O* is inside, on, or outside the circle, according as the orbit is an ellipse, a parabola or a hyperbola. The idea of the hodograph originated with Möbius (1843) and, independently, with Sir William Rowan Hamilton (1846) to whom the name and certain original developments of the theory are due. If a particle describes a logarithmic spiral about the pole as a centre of force, the hodograph is also a logarithmic spiral; the same result holds true for sinusoidal spirals (Schouten). If a particle starts from rest at the vertex of a perfectly smooth inverted cycloid and oscillates under the action of gravity, the hodograph of the motion is a circle through the pole, described with constant velocity. An important improvement in nautical charts by A. Smith (*Proc. Roy. Soc.*, vol. xv., 1867) introduced a curve which has been called a tidal hodograph (Thomson and Tait).

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HODSON, WILLIAM STEPHEN RAIKES (1821–1858), known as "Hodson of Hodson's Horse," British leader of light cavalry during the Indian Mutiny, son of a clergyman, was born on March 19, 1821 at Maisemore Court, near Gloucester. He was educated at Rugby and Cambridge, and became a cadet in the Indian army at twenty-three. Joining the 2nd Bengal Grenadiers he went through the first Sikh War, and was present at the battles of Moodkee, Ferozeshah and Sobraon. In one of his letters home at this period he calls the campaign a "tissue of mismanagement, blunders, errors, ignorance and arrogance" and outspoken criticism such as this brought him many bitter enemies throughout his career.

In 1847, through the influence of Sir Henry Lawrence, he was appointed adjutant of the corps of Guides, and in 1852 was promoted to the command of the Guides with the civil charge of Yusafzai. In 1855 he was charged with having arbitrarily imprisoned a Pathan chief named Khadar Khan, on suspicion of being concerned in the murder of Colonel Mackeson. The man was acquitted, and Dalhousie removed Hodson from his civil functions and remanded him to his regiment. He was also accused of malversation in the funds of his regiment. He was tried by a court of inquiry, who found that his system of accounts was "calculated to screen peculation and fraud." A later inquiry carried out by Major Reynell Taylor, found Hodson's accounts to be "an honest and correct record . . . irregularly kept." This particular charge may be declared "not proven." Other irregularities in money matters were from time to time charged against him.

Hodson's career seemed ruined when the Indian Mutiny broke out. At the outset of the campaign he made his name by riding with despatches from General Anson at Karnal to Meerut and back again, a distance of 152 m. in all, in seventy-two hours, through a country swarming with the rebel cavalry. He was then empowered to raise a regiment of 2,000 irregular horse, famous as Hodson's Horse, and was placed at the head of the Intelligence Department. In his double rôle of cavalry leader and intelligence officer, Hodson played a large part in the reduction of Delhi and consequently in saving India.

Hodson had the defects of his qualities. During the siege of Delhi a native, said to be an enemy of Bisharat Ali, to whom Hodson owed money, informed Hodson that Bisharat had turned rebel and had just reached Khurkhouda, a village near Delhi. Hodson thereupon took out a body of his sowars, attacked the village, and shot Bisharat Ali and several of his relatives. Again, after the fall of Delhi, Hodson obtained from General Wilson permission to ride out with fifty horsemen to Humayun's tomb, 6 m. out of Delhi, and bring in Bahadur Shah, the last of the Moguls. This he did with safety in the face of a large and threatening crowd. Next day with 100 horsemen he went out to the same tomb and obtained the unconditional surrender of the three princes, who had been left behind on the previous occasion. A crowd of 6,000 persons gathered, and Hodson ordered them to disarm, which they proceeded to do. He sent the princes on with an escort of ten men, while with the remaining ninety he collected the arms of the crowd. On galloping after the princes he found the crowd once more threatening an attack; and fearing that he would be unable to bring his prisoners into Delhi he shot them with his own hand. This is the most bitterly criticized action in his career. Furthermore he gave the king a safe conduct, which was afterwards seen by Sir Donald Stewart, before he left the palace. He was freely accused of looting at the time, but the charge is difficult to reconcile with the fact that he died a poor man, his effects being sold for £170. Hodson was killed on March 11, 1858 in the attack on the Begum Kotee at Lucknow.

The controversy relating to Hodson's moral character is very complicated and unpleasant. Upon Hodson's side *see* Rev. G. Hodson, *Hodson of Hodson's Horse* (1883), and L. J. Trotter, *A Leader of Light Horse* (1901); against him, R. Bosworth Smith, *Life of Lord Lawrence*, appendix to the 6th edition of 1885; T. R. E. Holmes, *History of the Indian Mutiny, appendix* N to the 5th edition of 1898, and *Four famous Soldiers* by the same author, 1889; and General Sir Crawford Chamberlain, *Remarks on Captain Trotter's Biography of Major W. S. R. Hodson* (1901).

HOE, RICHARD MARCH (1812–1886), American inventor, was born in New York city on Sept. 12, 1812. He was the son of Robert Hoe (1784–1833), an English-born American mechanic, who with his brothers-in-law, Peter and Mathew Smith, established in New York city a manufactory of printing presses, and used steam to run his machinery. Richard became head of Robert Hoe and Company on his father's death. He had considerable inventive genius and set himself to secure greater speed for printing presses. He discarded the old flat-bed model and placed the type on a revolving cylinder, a model later developed into the Hoe rotary or "lightning" press, patented in 1846, and further improved under the name of the Hoe web perfecting press (*see* PRINTING). He died in Florence, Italy, on June 7, 1886.

See *A Short History of the Printing Press* (1902) by his nephew Robert Hoe (1839–1909).

HOE: *see* CULTIVATING MACHINERY.

HOE CULTURE: *see* AGRICULTURE, PRIMITIVE.

HOEFNAGEL, JORIS (1542–1600), Dutch painter, designer and traveller, the son of a diamond merchant, was born at Antwerp. He was a pupil of Jan Bol. He travelled abroad often in the company of the famous geographer Abraham Ortelius, studying and making drawings of countries, the people, their costumes and customs. He visited France, Spain, England and Italy. He was afterwards patronized by the elector of Bavaria at Munich, where he stayed eight years, and by the Emperor Rudolph II. at Prague. He is famous for his miniature work, especially on a missal in the Imperial library at Vienna; he painted animals and plants to illustrate works on natural history; and his illustrations (especially for Braun's *Civitates orbis terrarum*, 1572), give him a place among early topographical draughtsmen.

HOETZSCH, OTTO (1876–), German historian, was born at Leipzig on Nov. 14, 1876, and was educated at the Thomas gymnasium of that city and the University of Munich. He became, in 1913, professor of history at Berlin, and in 1920 a member of the *Reichstag*. Hoetzsch made a special study of east European politics, and edited, from 1910 onwards, the *Zeitschrift für Osteuropäische Geschichte*. His works include *Russland* (1913; 2nd ed., 1917), and *Der Krieg und die grosse Politik* (3 vols., 1917–18).

HOF, town of Germany, in the province of Upper Franconia, situated on the Saale, on the north-eastern spurs of the Fichtelgebirge, 103 m. S.W. of Leipzig. Pop. (1925) 41,377. Hof, originally called Regnitzhof, built about 1080, was sold by the dukes of Meran in 1373 to the burgraves of Nuremberg. Cloth manufacture introduced in the 15th century, and the manufacture of veils begun in the 16th century, greatly helped it, but it has suffered severely in various wars. In 1810 it was incorporated with Bavaria. In 1823 the greater part of the town was destroyed by fire. It has a town hall of 1563, and a hospital founded in 1262. It is the seat of woollen and cotton spinning, and the manufacture of cotton and half-woollen fabrics. It has also dye-works, flourmills, sawmills, breweries, ironworks, and manufactures of machinery, iron and tin wares, chemicals and sugar. In the neighbourhood there are large marble quarries and extensive iron mines.

HOFER, ANDREAS (1767–1810), Tirolese patriot, was born on Nov. 22, 1767, at St. Leonhard, in the Passeier valley. There his father kept the inn "am Sand," which Hofer inherited, whence the popular nickname of "Sandwirth." In the wars against the French (1796–1805) he took part, first as a sharp-shooter and afterwards as a captain of militia. By the Treaty of Pressburg (1805) Tirol was transferred from Austria to Bavaria and Hofer soon became a leader of the agitation against Bavarian rule. In 1808 with others he visited Vienna at the invitation of the Archduke John to concert a rising in 1809. Hofer defeated the Bavarians heavily, enabling the Austrians to re-occupy Innsbruck temporarily, and a month later won two further victories on the Iselberg, drove back the Bavarians, who had advanced again, and entered Innsbruck in triumph. An autograph letter of the emperor Francis assured him that no peace would be concluded by which Tirol would again be separated from Austria, and Hofer, believing his work accomplished, returned home.

By the armistice of Znaim, however (July 12), Austria unconditionally surrendered Tirol and Vorarlberg. French and Bavarian troops, numbering 40,000, again invaded the country, which rose once more. Hofer (on whose head a price had been placed), placed himself at the head of the movement. After defeating the French on the Iselberg, Hofer again entered Innsbruck which he saved from sack. Hofer was now elected *Oberkommandant* of Tirol and for two months ruled the country in the emperor's name. He preserved the habits of a peasant, and his administration, while shrewd, was marked chiefly by a pious solicitude for details of faith and morals. On Sept. 29 Hofer received from the emperor a chain and medal of honour, which encouraged him in the belief that Austria did not intend again to desert him; but the Treaty of Schönbrunn (Oct. 14) again ceded Tirol to Bavaria. The French re-entered the country, and, an amnesty having been stipulated in the treaty, Hofer and his companions submitted to France, though not to Bavaria. On Nov. 12, however, deceived by false reports of Austrian victories, Hofer attempted to renew the revolt. The regular forces proved too strong and Hofer had to take refuge, but his hiding-place was betrayed and on Jan. 27, 1810, he was captured by Italian troops and sent to Mantua, where he was shot. This brutal act which inflamed popular sentiment against France, was attributed to Napoleon's direct orders. Napoleon, however, denied this. The most ignominious part was certainly played by the Austrian emperor Francis, who used Hofer and sacrificed him cynically. In 1823 Hofer's remains were removed from Mantua to a Franciscan church in Innsbruck.

See *Leben und Thaten des ehemaligen Tyroler Insurgenten-Chefs Andr. Hofer* (1810); Hormayr, *Geschichte Andr. Hofer's Sandwirths auf Passeyr* (Leipzig, 1845); Weldinger, *Andreas Hofer und seine Kampfgenossen* (3rd ed. Leipzig, 1861); Stampfer, *Sandwirth Andreas Hofer* (Freiburg, 1874); Schmolze, *Andreas Hofer und seine Kampfgenossen* (Innsbruck, 1900); I. Caracciolo, *Andrea Hofer nella Insurrezione anti-bavarese del 1809* (Bologna, 1928). His history has supplied the materials for tragedies to B. Auerbach and Immermann, and for numerous popular ballads (*see* Franke, *Andreas Hofer im Liede*, Innsbruck, 1884).

HÖFFDING, HARALD (1843–), Danish philosopher, was born and educated in Copenhagen where he became a professor in 1883. For Höffding the chief problems of philosophy are (*a*) the problem of knowledge (the logical problem); (*b*) the problem of existence (the cosmological problem); (*c*) the problem of the estimation of worth (the ethico-religious question); (*d*) the problem of consciousness (the psychological problem), and these stand out in his best known works, the *Hist. of Modern Philosophy* (Eng. trans., 2 vols., 1900); *The Problems of a Philosopher* (Eng. trans., 1905), and *Philosophy of Religion* (Eng. trans., 1906). Höffding himself is averse to metaphysics. In psychology he is an associationist claiming that synthesis belongs to the nature of consciousness, and stressing the primacy of the will. His ethics, which is evolutional and teleological, is based on religion, the essence of which he regards as the reaction of mind to the sense of value.

Höffding's other writings, which also exhibit his extensive knowledge of philosophy and science, include: *Den engelske Filosofi i vor Tid* (1874); *Etik* (1876); *Psychologi i Omrids paa Grundlag of Erfaring* (ed. 1892); *Charles Darwin* (1889); *Kontinuiteten i Kants filosofiske Udviklingsgang* (1893); *Det psykologiske Grundlag for logiske Domme* (1899); *Rousseau und seine Philosophie* (1901); *Mindre Arbejder* (1899); *Danske Filosofer* (1909); *Bergson's Filosofie* (1914); *Modern Philosophers* (1915); *Oplevelse og Tydning* (1918), *Spinoza's Ethica* (1918) and *Erkenntnistheorie u. Lebensauffassung* (1926); *Udvalgte Skrifter* (Copenhagen, vii. bd. 1902 foll.).

See E. Rindom, *H. Höffding* (Copenhagen, 1913); G. Schott, *H. Höffding als Religionsphilozoph* (Munich, 1913).

HOFFMAN, MALVINA (1887–), American sculptor, was born in New York city on June 15, 1887. She studied sculpture in New York with Herbert Adams and Gutzon Borglum, and in Paris with Auguste Rodin. After obtaining recognition in Paris, where she was awarded a first prize at the Salon in 1911 for "Russian Dancers," she settled in New York. Her memorial group, "The Sacrifice," presented to Harvard university by Mrs. Robert Bacon, but placed temporarily in the cathedral of St. John the Divine, New York city, is considered the finest of her works. Three portraits by her of Paderewski, when exhibited in New York in 1920, attracted great admiration. Other works are "John Muir" in the American Museum of Natural History, New York city; "Modern Crusader" in the Metropolitan Museum of Art, New York city; "Bacchanale Russe" in the Luxembourg Musée, Paris, and "Gervase Elwes" in Queen's Hall, London. One of her latest commissions was a heroic size stone group over the entrance of Bush House, Strand, London. She was married to S. B. Grimson on June 6, 1924, in New York city.

HOFFMANN, AUGUST HEINRICH (1798–1874), known as HOFFMANN VON FALLERSLEBEN, German poet, philologist and historian of literature, was born at Fallersleben, Lüneburg, Hanover, on April 2, 1798, the son of the mayor of the town. Educated at the universities of Göttingen and Bonn, he was custodian of the university library at Breslau (1823–38), extraordinary professor of German language and literature at Breslau (1830), and ordinary professor (1835). He was deprived of his chair by the Prussian authorities in 1842 in consequence of his *Unpolitische Lieder* (1840–41). He then became a naturalized citizen of Mecklenburg, and after the revolution of 1848 was enabled to return to Prussia. In 1860 he was appointed librarian to the Duke of Ratibor at the castle of Corvey, where he died on Jan. 19, 1874. Fallersleben was among the earliest and most effective of the political poets who prepared the way for the revolutionary movement of 1848. He composed melodies for many of his songs, which were sung all over Germany. Among the best known is *Deutschland, Deutschland über Alles*, written at Heligoland (Aug. 26, 1841).

The best of his poems is his *Gedichte* (1827; 9th ed., Berlin, 1887); but there is great merit also in his *Alemannische Lieder* (1826; 5th ed., 1843), *Soldatenlieder* (1851), *Soldatenleben* (1852), *Rheinleben* (1865), and in his *Fünfzig Kinderlieder, Fünfzig neue Kinderlieder*, and *Alte und neue Kinderlieder*. As a student of ancient Teutonic literature Hoffmann ranks among the most persevering and cultivated of German scholars. *Die deutsche Philologie im Grundriss* (1836) was at the time of its publication a valuable contribution to philological research, and his *Geschichte des deutschen Kirchenliedes bis auf Luther* (1832; 3rd ed., 1861),

Unsere volkstümlichen Lieder (3rd ed., 1869) and *Die deutschen Gesellschaftslieder des 16. und 17. Jahrh.* (2nd ed., 1860) are all important works.

BIBLIOGRAPHY.—In 1868–70 Hoffmann published an autobiography, *Mein Leben: Aufzeichnungen und Erinnerungen* (an abbreviated ed. in 2 vols., 1894); his *Gesammelte Werke* were edited by H. Gerstenberg in 8 vols. (1891–94); his *Ausgewählte Werke* by H. Benzmann (1905, 4 vols.). *See* also *Briefe von Hoffmann von Fallersleben und Moritz Haupt an Ferdinand Wolf* (1874); J. M. Wagner, *Hoffmann von Fallersleben, 1818–1868* (1869–70); Berneisen, *Hoffmann von Fallersleben als Vorkämpfer deutscher Kultur in Belgien und Holland* (1915).

HOFFMANN, ERNST THEODOR WILHELM (1776–1822), German romance-writer, who was also a composer, theatrical manager, lawyer and many other things in the course of his diversified career, was born at Königsberg on Jan. 24, 1776. For the name Wilhelm he himself substituted Amadeus in homage to Mozart. His parents lived unhappily together, and when the child was only three they separated. He was brought up by an uncle, who had neither understanding nor sympathy for his dreamy and wayward temperament. He studied law at Königsberg, and began to practise in the town in 1795. He then removed to Glogau, in 1798 to Berlin, and in 1800 received an official legal appointment (*assessor*) at Posen, which he lost, however, through having offended the authorities by his caricatures. He was sent to a little country town, Plozk, into virtual banishment. There he spent his leisure in musical composition, which was, throughout his life, his chief delight. In 1804 he received an appointment at Warsaw, where, through Zacharias Werner, he became acquainted with the work of Novalis, Tieck, Wackenroder and other romanticists. He was happy in Warsaw, where he wrote the music of Brentano's *Lustige Musikanten* and Werner's *Kreuz an der Ostsee;* also an opera *Liebe und Eifersucht,* based on Calderon's drama *La Banda y la Flor.* The French invasion (1806) put an end to this peaceful existence, and Hoffmann lived an uncertain and troubled life until 1814. He was for a short time musical director of a theatre at Bamberg, then at Dresden, and wrote the sketches in the *Allgemeine musikalische Zeitung,* ultimately collected, with others, in the *Phantasiestücke in Callots Manier* (4 vols., 1814).

In 1814 he resumed his legal profession in Berlin, and two years later he was appointed councillor of the court of appeal (*Kammergericht*). Hoffmann had the reputation of being an excellent jurist and a conscientious official; he had leisure for literary pursuits and belonged to the circle of Romantic poets and novelists who gathered round Fouqué, Chamisso and his old friend Hitzig. He had a great musical success with his opera *Undine* (1816), to libretto by Fouqué, and, under the name of "Johannes Kreisler, Kapellmeister," he wrote the excellent musical criticisms on J. S. Bach—at that time almost forgotten—on Beethoven and others, which inspired Schumann's *Kreisleriana.* To his Berlin period belong the great series of tales which have placed Hoffmann in the short list of great story-tellers of the strange and grotesque. Unfortunately, the habits of intemperance which, in earlier years, had thrown a shadow over his life, grew on him, and his health was speedily undermined by the nights he spent in the wine-house. He died of locomotor ataxy on July 24, 1822.

The *Phantasiestücke,* with a preface by Jean Paul, were followed by the gruesome novel—to some extent inspired by Lewis's *Monk—Die Elixiere des Teufels* (1816), and the even more gruesome stories which make up the *Nachtstücke* (2 vols., 1817). The full range of Hoffmann's powers is first clearly displayed in the collection of stories (4 vols., 1819–21) *Die Serapionsbrüder,* this being the name of a small club of Hoffmann's more intimate literary friends. *Die Serapionsbrüder* includes not merely stories in which Hoffmann's love for the mysterious and the supernatural is to be seen, but novels in which he draws on his own early reminiscences (*Rat Krespel, Fermate*), finely outlined pictures of old German life (*Der Artushof, Meister Martin der Küfner und seine Gesellen*), and vivid and picturesque incidents from Italian and French history (*Doge und Dogaressa,* the story of Marino Faliero, and *Das Fräulein von Scuderi*). The last-mentioned story is usually regarded as Hoffmann's masterpiece. *Klein Zaches, genannt Zinnober* (1819) and *Lebensansichten des Katers Murr, nebst fragmentarischer Biographie des Kapellmeisters Johannes Kreisler* (1821–22), are good examples of his powers as a humorist.

Hoffmann is one of the master novelists of the Romantic movement in Germany. He combined with a humour that reminds us of Jean Paul the same warm sympathy for the artist's standpoint towards life shown by early Romantic leaders like Tieck and Wackenroder; but he was superior to all in the almost clairvoyant powers of his imagination. His work abounds in grotesque and gruesome scenes; but the gruesome was only one outlet for Hoffmann's genius, and even here the secret of his power lay, not in his choice of subjects, but in the wonderfully vivid and realistic presentation of them. Every line he wrote leaves the impression behind that it expresses something felt or experienced; every scene, vision or character he described seems to have been real and living to him. It is this realism, in the best sense of the word, that made him the great artist he was, and gave him so extraordinary a power over his contemporaries. His influence in France and in England was, in fact, as great as in his own country.

With respect to his work as a composer, his *Undine* still holds the stage in Germany as a minor classic of its period, though he will probably be longest remembered by musicians in having provided the inspiration and the book for Offenbach's *Les Contes d'Hoffmann* ("Tales of Hoffmann"), based on three of his fantastic stories.

The first collected edition of Hoffmann's works appeared in 10 vols. (Ausgewahlte Schriften, 1827–28); to these his widow added 5 vols. in 1839 (including the 3rd ed. of J. E. Hitzig's *Aus Hoffmanns Leben und Nachlass,* 1823). There are good modern editions by E. Grisebach (15 vols., 1900), W. Harich (15 vols., 1925), and others. There are many editions of selections, as well as cheap reprints of the more popular series. His writings on musical subjects were edited by Istel (1907) and his musical compositions by Becking (2 vols., 1923). All Hoffmann's important works—except *Klein Zaches* and *Kater Murr* have been translated into English; *The Devil's Elixir* (1824), *The Golden Pot,* by Carlyle (in *German Romance,* 1827); *The Serapion Brethren,* by A. Ewing (1886–92), etc. In France Hoffmann was even more popular than in England; *cf.* G. Thurau, *Hoffmanns Erzahlungen in Frankreich* (1896). An edition of his *Oeuvres complètes* appeared in 12 vols. in Paris (1830). For bibliographies *see* Goedeke, *Grundriss zur Geschichte der deutschen Dichtung,* 2nd ed., vol. viii., pp. 468 *seq.* (1905), and G. Salomon, *E. T. A. Hoffmann, Bibliographie* (Weimar, 1924). *See* also G. Ellinger, *E. T. A. Hoffmann* (1894); O. Klinke, *Hoffmanns Leben und Werke vom Standpunkte eines Irrenarztes* (1903); W. Harich, *Das Leben eines Künstlers* (1921); W. Mausolf, *E. T. A. Hoffmanns Stellung zu Drama und Theater* (1920); H. von Wolzogen, *E. T. A. Hoffmann und R. Wagner* (1906), and *E. T. A. Hoffmann, der deutscher Geisterseher* (1922); R. von Schaukal, *E. T. A. Hoffmann* (Zurich, 1923); V. Ljungdorff, *E. T. A. Hoffmann och ursprunget till hans konstnärskap* (Lund, 1924).

HOFFMANN, FRIEDRICH (1660–1742), German physician, a member of a family that had been connected with medicine for 200 years before him, was born at Halle on Feb. 19, 1660. On the founding of Halle university in 1693, he received the primarius chair of medicine, and he was charged with the framing of the statutes for the new medical faculty. He filled also the chair of natural philosophy. With the exception of four years (1708–1712) which he passed at Berlin in the capacity of royal physician, Hoffmann spent the rest of his life at Halle in instruction, practice and study, interrupted now and again by visits to different courts of Germany, where his services procured him honours and rewards. His fame became European. He died at Halle on Nov. 12, 1742.

Of his numerous writings a catalogue is to be found in Haller's *Bibliotheca medicinae practicae.* The chief is *Medicina rationalis systematica,* undertaken at the age of 60, and published in 1730. It was translated into French in 1739, under the title of *Médecine raisonnée d'Hoffmann.* A complete edition of Hoffmann's works, with a life of the author, was published at Geneva in 1740, to which supplements were added in 1753 and 1760.

HOFFMANN, JOHANN JOSEPH (1805–1878), German scholar, was born at Würzburg on Feb. 16, 1805. From the traveller, P. F. von Siebold (1796–1866) he acquired the rudiments of Japanese. He then learned Chinese, and became Japanese translator to the Dutch Colonial Ministry. Eventually he received a chair of Oriental languages at Leyden. He died at The Hague on Jan. 23, 1878. Hoffmann's chief work was his unfinished Japanese dictionary, begun in 1839 and afterwards continued by

L. Serrurier. Unable at first to procure the necessary type, he set himself to the cutting of punches, and even when the proper founts were obtained he had to act as his own compositor as far as Chinese and Japanese were concerned. His Japanese grammar (*Japanische Sprechlehre*) was published in Dutch and English in 1867, and in English and German in 1876.

HOFFMANN, MAX (1869–1927), German general, was born at Homburg on Jan. 25, 1869. He spent many years in Russia, and was sometime general staff officer in the provinces of Posen and East Prussia. In 1914 he was general staff officer to the VIII. Army, was present at Tannenberg, became quartermaster-general of the Eastern command, and in 1916 succeeded Ludendorff as chief of the general staff in the East, under Prince Leopold of Bavaria. From that time he was mainly responsible for the operations on the Eastern front. In Dec. 1917 he conducted, on the German side, the negotiations with the Russians at Brest-Litovsk, and in February signed the treaty with the Ukraine. After the war he engaged in a lively controversy with Ludendorff. The rift seems to have dated from Jan. 1918, when Hoffmann read to the Emperor, William II., a memorandum condemning Ludendorff's scheme of Polish annexations. He sharply criticized the German high command in his book (1923), *Der Krieg der versäumten Gelegenheiten* (the War of Lost Opportunities), which, in spite of the evident animus against Hindenburg, Ludendorff and Falkenhayn, is a document of considerable importance to the student of the war. In *Tannenberg wie es wirklich war* (1927) he impugned the official account of the victory of Tannenberg, which was, he says, due to strategic orders drawn up before Hindenburg and Ludendorff arrived, and to the tactics of Gen. François, who commanded the I. Corps, and went his own way in defiance of Ludendorff's orders. Gen. Hoffmann is credited with a scheme for military intervention in Russia in 1922, and he wrote a book against Bolshevism, entitled *An allen Enden Moskau* (1925). He died on July 8, 1927.

HOFMANN, AUGUST WILHELM VON (1818–92), German chemist, was born at Giessen on April 8, 1818. He first read law and philosophy at Göttingen and then studied chemistry under Liebig. He acted for a short time as *Privatdozent* at Bonn and then, in 1845, accepted the invitation, made at the suggestion of the Prince Consort, to become the first director of the new Royal College of Chemistry, London. In 1864 he returned to Bonn, and in the following year he succeeded E. Mitscherlich as professor of chemistry and director of the laboratory in the University of Berlin. He continued his excellent work there as teacher and researcher until his death on May 5, 1892. In 1868 Hofmann founded the German Chemical Society and he was for many years its President.

Hofmann's work covered a wide range of organic chemistry; his first research, carried out in Liebig's laboratory at Giessen, was on coal-tar, and his investigation of organic bases established the nature of aniline. His perception of the analogy between it and ammonia led to his famous work on the amines and organic ammonium bases and the allied phosphorus compounds, while his researches on rosaniline, which he first prepared in 1858, formed the first of a series of investigations on colouring matters which culminated in the discovery of quinoline red in 1887. Hofmann is also known for his discovery of allyl alcohol (with Cahours), of formaldehyde, hydrazobenzene and the iso-nitriles. He discovered a method of converting an amide into an amine containing one carbon atom less and this important reaction is now known by his name. Hofmann's method for determining molecular weight of liquids by means of vapour densities was an important contribution to chemistry. In addition to the investigations for which he was responsible he exercised considerable influence on chemical progress through the valuable work of his pupils. As a teacher, besides the power of accurately gauging the character and capabilities of those who studied under him, he had the faculty of infecting them with his own enthusiasm, and thus of stimulating them to put forward their best efforts. In the lecture-room he laid great stress on the importance of experimental demonstrations, paying particular attention to their selection and arrangement, though, since he himself was a somewhat clumsy manipulator, their actual exhibition was generally entrusted to his assistants. He was the possessor of a clear and graceful, if somewhat florid, style, which showed to special advantage in his numerous obituary notices or encomiums (collected and published in three volumes, *Zur Erinnerung an vorangegangene Freunde*, 1888).

See *Mem.* "Hofmann Memorial Lecture," *Journal of the Chemical Society* (1896).

HOFMANN, JOSEF CASIMIR (1876–), pianist and composer, was born at Cracow, Poland, Jan. 20, 1876. At seven he attracted Rubinstein's attention, becoming his pupil. Touring Europe at nine, he went to the United States two years later, giving 52 concerts, but was compelled to stop by the Society for Prevention of Cruelty to Children. He returned to Europe, studied further under Rubinstein, Urban and Moszkovski, and resumed public performances in 1894. When the Curtis Institute of Music, Philadelphia, was endowed in 1924, he was invited to head the piano department. He became the director in May 1927, not long after his naturalization as an American citizen. His compositions include a symphony, two concertos, five piano sonatas, an orchestral suite, *Mignonettes*, four *Old Dutch Songs*, *Trois Impressions* (M. Dvorsky) and *Valse Caprice*. He is the author of *Piano Playing* (1898) and *Piano Questions* (1900).

HOFMANN or **HOFFMANN, MELCHIOR** (*c.* 1498–1543/4), anabaptist, was born at Hall, in Swabia. He was a furrier of Livonia, and with others travelled to Sweden, preaching as he went. Fervid attacks on image worship led to expulsion, and Hofmann thereafter went from place to place in the Baltic States and in Germany, meeting Luther at Wittenberg. Frederick I. of Denmark appointed him a preacher at Kiel. He developed a Zwinglian view of the Eucharist; Luther was alarmed, and at a colloquy of preachers in Flensburg (April 8, 1529) Hofmann, John Campanus and others were put on their defence. Refusing to retract, he was banished, and at Strasbourg, to which he now turned, he was well received till his anabaptist development became apparent. Journeying to East Friesland (1530) he founded a community at Emden (1532). Despite the warning of John Trypmaker he returned in 1533 to Strasbourg, which was to be the seat of the New Jerusalem, and was arrested. He denied that he had made common cause with the anabaptists, but refused the articles of faith proposed to him by the provincial synod. The last notice of his imprisonment is on Nov. 19, 1543; he probably died soon after.

His works (*Weissagung vsz heiliger götlicher geschrifft* [1530] and *Prophecey oder Weissagung vsz warer heiliger götlicher schrifft* [1530]) influenced Menno Simons and David Joris. He has been claimed as a pioneer of some of the positions of Servetus. He maintained that all are elected to salvation, only the regenerate may receive baptism, and those who sin after regeneration sin against the Holy Ghost, and cannot be saved. His followers were known as Hofmannites or Melchiorites.

See G. Herrmann, *Essai sur la vie et les écrits de M. Hofmann* (1852); F. O. zur Linden, *M. Hofmann, ein Prophet der Wiedertäufer* (1885); H. Holtzmann, in *Allgemeine deutsche Biographie* (1880); Hegler in Hauck's *Realenzyklopädie* (1900).

HOFMANNSTHAL, HUGO VON (1874–), Austrian poet, was born in Vienna on Feb. 1, 1874. He took the degree of Ph.D. at the University of Vienna and when still a schoolboy originated the romantic school in Austria by his lyric and semi-dramatic poetry, which aroused much controversy at the time. He was not uninfluenced by Stefan Georg's example and Hermann Bahr's criticism, but the melody and colour of his language, and the art with which he gave poetic expression to complicated spiritual moods were new. He had genius for appreciating bygone cultures and a sensitive understanding of the beautiful in art and in nature.

Hofmannsthal is little indebted to contemporary realism, but his almost too susceptible personality is tinged by innumerable literary influences from the Attic tragedians down to Victor Hugo, Swinburne, Browning and D'Annunzio. This is especially noticeable in his dramatic poems, not a few of which are simply old plays of Sophocles, of Calderon, Molière and Otway cloaked

in modern form and spirit. Nevertheless he has an abiding place in the history of literature as founder of the whole German neo-romantic drama. Some of his dramas became known outside Austria and Germany through the music of his friend Richard Strauss, others through Reinhardt's Festival plays at Salzburg. His collected poems appeared in 1911, his collected prose began to appear in 1907. In later years he turned his attention to society comedy. The most characteristic of his original dramas are: *Gestern* (1891); *Der Tod des Tizian* (1892); *Der Tor und der Tod* (1893); *Der Abenteurer und die Sängerin* (1899); *Oedipus und die Sphinx* (1906); *Cristinas Heimkehr* (1910); and his libretti: *Elektra* (1903); *Der Rosenkavalier* (1911); *Ariadne auf Naxos* (1912); *Die Frau ohne Schatten* (1919); and *Der Unbestechliche* (1923).

See monograph by Sulger-Gebing (1905) and pamphlet by Borchardt (1905).

HOFMEISTER, WILHELM FRIEDRICH BENEDICT (1824–1877), German botanist, was born at Leipzig on May 24, 1824, was professor of botany at Heidelberg, and then at Tübingen. His first work was on the distribution of Coniferae in the Himalayas, but his attention was soon turned to the sexuality and origin of the embryo of Phanerogams, and he finally settled the question of the origin of the embryo from an ovum, as against the prevalent pollen-tube theory of M. J. Schleiden. His study of the embryology of Bryophytes and Pteridophytes led to his accounts of the germination of the spores and fertilization in *Pilularia, Salvinia, Selaginella.* His important *Vergleichende Untersuchungen der Keimung, Entfaltung und Fruchtbildung höherer Kryptogamen und der Samenbildung der Coniferen,* which appeared in 1851 (Eng. trans., 1862) demonstrated the life-story of liverworts, mosses, ferns, equiseta, rhizocarps, lycopodiaceae and even gymnosperms, and the analogy between these higher cryptogams and the conifers. It is the typical work of an heroic age of plant-morphology. Hofmeister died at Lindenau, near Leipzig, on Jan. 12, 1877.

See K. von Goebel, *Wilhelm Hofmeister* (1924, Eng. trs., 1926).

HOFMEYR, JAN HENDRIK (1845–1909), South African politician, was born at Cape Town on July 4, 1845. He was educated at the South African college. He was editor of the *Zuid Afrikaan* till its incorporation with *Ons Land,* and of the *Zuid Afrikaansche Tidjschrift.* By birth, education and sympathies a typical Dutch Afrikander, he set himself to organize the political power of his fellow-countrymen, and, when in 1879, he entered the Cape parliament as member for Stellenbosch, he became the real leader of the Dutch party. He held office for six months—as minister without portfolio in the Scanlen ministry from May to Nov. 1881. He held no subsequent official post in the colony, though, with Sir Thomas Upington and Sir Charles Mills, he represented the Cape at the intercolonial conference of 1887. Here he supported the proposal for entrusting the defence of Simon's Town to Cape Colony, leaving only the armament to be provided by the imperial government, opposed trans-oceanic penny postage and favoured an imperial customs union. At the colonial conference of 1894 at Ottawa he was again a Cape representative. In 1888 and in 1889 he was a member of the South African customs conference.

His power was based on his influence over the Dutch in Cape Colony, and his control of the Afrikander Bond. In 1878 he founded the "Farmers' Association," and, as the Cape farmers were almost entirely Dutch, the Association became a centre of Dutch influence. When the Bond was formed in 1882, with purely political aims, Hofmeyr obtained control of it, and in 1883 amalgamated the Farmers' Association with it. Under his direction the constitution of the Bond was modified by the elimination of provisions inconsistent with loyalty to the British Crown. But it remained an organization for obtaining the political supremacy of the Cape Dutch. (*See* CAPE COLONY: *History.*) His control over the Bond enabled him to make and unmake ministers and earned for him the name of "cabinet-maker of South Africa." Although officially the term "Afrikander" was explained by Hofmeyr to include white men of whatever race, in practice the influence of the Bond was always exerted in favour of the Dutch, and its power was drawn from the Dutch districts of Cape Colony. The sympathies of the Bond were thus always strongly with the Transvaal, as the chief centre of Dutch influence in South Africa. But Hofmeyr resented the reckless disregard of Cape interests involved in Kruger's fiscal policy; he feared that the Transvaal, after the gold discoveries of 1886, might overshadow all other Dutch influences in South Africa; above all he was convinced that the protection of the British navy was indispensable and he opposed Kruger's intention of acquiring an outlet to the sea in order to get into touch with foreign powers.

In 1890 Hofmeyr joined forces with Cecil Rhodes, who became premier of Cape Colony with the support of the Bond. But elements in the Bond grew alarmed at Rhodes's imperialism, and in 1895 Hofmeyr resigned his seat in parliament and the presidency of the Bond. Then came the Jameson raid. Once more Hofmeyr became president of the Bond. By an alteration of the provincial constitution, all power in the Cape branch of the Bond was vested in a vigilance committee of three, of whom Hofmeyr and his brother were two. As leader of the Cape Dutch, he protested against such abuses as the dynamite monopoly in the Transvaal, and urged Kruger to grant reasonable concessions rather than plunge into war. In July 1899 he went to Pretoria, and vainly supported the proposal of a satisfactory franchise law, combined with a limited representation of the Uitlanders in the *volksraad,* and in September urged the Transvaal to accede to the proposed joint enquiry. During the negotiations of 1899, and after the outbreak of war, the official organ of the Bond, *Ons Land,* was conspicuous for its anti-British attitude, and Lord Roberts suppressed it in the Cape Colony district under martial law. Hofmeyr never associated himself publicly with the opinions expressed by *Ons Land,* but neither did he repudiate them. His position was difficult, and shortly after the outbreak of war he withdrew to Europe. He refused to act on the "conciliation committee" which came to England in 1901 in the interests of the Boer republics.

Towards the close of the war Hofmeyr returned to South Africa and organized the Bond forces for the general election in Cape Colony in 1904, which resulted in the defeat of the Bond party. Hofmeyr retained his ascendancy over the Cape Dutch, but he was out of sympathy with the larger outlook on South African affairs taken by the younger Boer leaders in the Transvaal. In 1906 he offended the extreme section of the Bond by criticisms of the *taal* and his use of English in speeches. At the general election in 1908 the Bond, still largely under his direction, gained a victory at the polls, but Hofmeyr himself was not a candidate. In the renewed movement for the closer union of the South African colonies he advocated federation as opposed to unification. When, however, the unification proposals were ratified by the Cape parliament, Hofmeyr went to England as one of the Cape delegates in 1909 to submit the draft act of union to the imperial government. He died in London on Oct. 16, 1909.

See Jan Hendrick Hofmeyr, M.A. and Francis William Reitz, *The Life of Jan Hendrick Hofmeyr* (Cape Town, 1913).

HOGARTH, DAVID GEORGE (1862–1927), English archaeologist, was born on May 23, 1862, at Barton-on-Humber, Lincs, the son of a clergyman, and died at Oxford on Nov. 6, 1927. He had been president of the Royal Geographical Society since 1925 and keeper of the Ashmolean museum since 1909. He was not only one of the greatest scholars of his time but also a man of action who left his mark on the middle east through the magnificent work which he did as director of the Arab Bureau at Cairo during the World War.

Hogarth was educated at Winchester and Magdalen college, Oxford, of which he became a fellow in 1886. In 1893 he was elected a research fellow to carry out archaeological investigations in the Levant. He conducted explorations in Cyprus, Egypt, Ephesus, Carchemish and Crete (1887–1907). He was for a time director of the British school at Athens and in 1899 became director of the Cretan exploration fund.

In 1915 he was sent to Cairo by the director of naval intelligence with the temporary rank of lieutenant-commander to take charge of the communications with the Arab leaders which were intended

to lead to the Arab revolt against Turkish rule. Next year he began to build up at Cairo that Arab Bureau which drew into its service Gertrude Bell, Mark Sykes, T. E. Lawrence and other brilliant servants. He then returned to London to work there on Arab and middle-eastern problems, returning to Cairo in the last year of the war. In 1919 he was British commissioner at the Middle-East Commission of the Paris Peace Conference.

His works include *A Wandering Scholar in the Levant* (1896), which at once won for him the love of many readers; *Philip and Alexander of Macedon* (1897); *The Nearer East* (1902); *The Penetration of Arabia* (1904); *Carchemish I.* (1914); *The Wandering Scholar* (1925); *Kings of the Hittites* (1926); etc. etc.

HOGARTH, WILLIAM (1697–1764), the great English painter and pictorial satirist, was born at Bartholomew Close in London on Nov. 10, 1697. His father, Richard Hogarth, who died in 1718, was a school-master and literary hack, who had come to the metropolis to seek that fortune which had been denied to him in his native Westmorland. The son seems to have been early distinguished by a talent for drawing and an active perceptive faculty rather than by any close attention to learning. "Shows of all sorts gave me uncommon pleasure when an infant," he says, "and mimicry, common to all children, was remarkable in me. . . . My exercises when at school were more remarkable for the ornaments which adorned them than for the exercise itself." This being the case, he was apprenticed to a silver-plate engraver, Mr. Ellis Gamble, at the sign of the "Golden Angel" in Cranbourne street or Alley, Leicester Fields. For this master he engraved a shop-card which is still extant. His apprenticeship must have been concluded before the beginning of 1720, for in April of that year he appears to have set up as engraver on his own account. His desires, however, were not limited to silver-plate engraving. "Engraving on copper was, at 20 years of age, my utmost ambition." For this he lacked the needful skill as a draughtsman; and his account of the means which he took to supply this want, without too much interfering with his pleasure, is thoroughly characteristic. "Laying it down," he says, "first as an axiom, that he who could by any means acquire and retain in his memory, perfect ideas of the subjects he meant to draw, would have as clear a knowledge of the figure as a man who can write freely hath of the twenty-four letters of the alphabet and their infinite combinations (each of these being composed of lines), and would consequently be an accurate designer, . . . I therefore endeavoured to habituate myself to the exercise of a sort of technical memory, and by repeating in my own mind, the parts of which objects were composed, I could by degrees combine and put them down with my pencil." There is little doubt that his marvellous power of seizing expression owed less to patient academical study than to his unexampled eye-memory and tenacity of minor detail. But he was not without technical training, since he is known to have studied at Sir James Thornhill's then recently opened art school.

"His first employment" after he set up for himself "seems," says John Nichols, in his *Anecdotes*, "to have been the engraving of arms and shop bills." After this he was employed in designing "plates for booksellers." "Masquerades and Operas" (1724), the first plate he published on his own account, is a clever little satire on contemporary follies, such as the masquerades of the Swiss adventurer Heidegger, the popular Italian opera-singers, Rich's pantomimes at Lincoln's Inn Fields, and the exaggerated popularity of Lord Burlington's protégé, the architect painter William Kent, who is here represented on the summit of Burlington Gate, with Raphael and Michelangelo for supporters. This worthy Hogarth had doubtless not learned to despise less in the school of his rival Sir James Thornhill. Indeed almost the next of Hogarth's important prints was aimed at Kent alone, being that memorable burlesque of the unfortunate altarpiece designed by the latter for St. Clement Danes, which, in deference to the ridicule of the parishioners, Bishop Gibson took down in 1725. Hogarth's squib, which appeared subsequently, exhibits it as a very masterpiece of confusion and bad drawing. In 1726 he prepared twelve large engravings for Butler's *Hudibras*. These he himself valued highly, and they are the best of his book illustrations.

In 1727, Hogarth was engaged by Joshua Morris, a tapestry worker, to prepare a design for the "Element of Earth." Morris, however, having heard that he was "an engraver, and no painter," declined the work when completed, and Hogarth accordingly sued him for the money in the Westminster Court, where, on May 28, 1728, the case was decided in Hogarth's favour. It may have been the aspersion thus early cast on his skill as a painter (coupled perhaps with the unsatisfactory state of print-selling, owing to the uncontrolled circulation of piratical copies) that induced him to turn his attention to the production of "small conversation pieces" (*i.e.*, groups in oil of full-length portraits from 12 to 15 in. high), many of which are still preserved in different collections. "This," he says, "having novelty, succeeded for a few years." Among his other efforts in oil between 1728 and 1732 were "The Wanstead Conversation," "The House of Commons examining Bambridge," an infamous warden of the Fleet, and several pictures of the chief actors in Gay's popular *Beggar's Opera*.

On March 23, 1729 he was married at old Paddington church to Jane Thornhill, the only daughter of Sir James Thornhill. The match was a clandestine one. We next hear of him in "lodgings at South Lambeth," where he rendered some assistance to the then well-known Jonathan Tyers, who opened Vauxhall in 1732 with an entertainment styled a *ridotto al fresco*. For these gardens Hogarth painted a poor picture of Henry VIII. and Anne Boleyn, and he also permitted Hayman to make copies of the later series of the "Four Times of the Day." In return, the grateful Tyers presented him with a gold pass ticket *"In perpetuam Beneficii Memoriam."* It was long thought that Hogarth designed this himself. Mr. Warwick Wroth (*Numismatic Chronicle*, vol. xviii.) doubts this, although he thinks it probable that Hogarth designed some of the silver Vauxhall passes which are figured in Wilkinson's *Londina illustrata*. The only engravings between 1726 and 1732 which need be referred to are the "Large Masquerade Ticket" (1727), another satire on masquerades, and the print of "Burlington Gate" (1731), evoked by Pope's *Epistle to Lord Burlington*, and defending Lord Chandos, who is therein satirized. This print gave great offence, and was, it is said, suppressed.

By 1731 Hogarth completed the earliest of the series of moral works which first gave him his position as an original genius. This was "A Harlot's Progress." Almost immediately afterwards he must have begun to engrave them—a task he had at first intended to leave to others. From an advertisement in the *Country Journal; or, the Craftsman*, Jan. 29, 1732, the pictures were then being engraved, and from later announcements it seems clear that they were delivered to the subscribers early in the following April, on the 21st of which month an unauthorized prose description of them was published. We have no record of the particular train of thought which prompted these story-pictures; but it may perhaps be fairly assumed that the necessity for creating some link of interest between the personages of the little "conversation pieces" above referred to, led to the further idea of connecting several groups or scenes so as to form a sequent narrative. "I wished," says Hogarth, "to compose pictures on canvas, similar to representations on the stage." "I have endeavoured," he says again, "to treat my subject as a dramatic writer; my picture is my stage, and men and women my players, who by means of certain actions and gestures are to exhibit *a dumb show*." There was never a more eloquent dumb show than this of the "Harlot's Progress." In six scenes the miserable career of a woman of the town is traced out remorselessly from its first facile beginning to its degraded end. Nothing of the detail is softened, the whole is acted out with the hard, uncompassionate morality of the age the painter lived in, while the introduction here and there of one or two well-known characters such as Colonel Charteris and Justice Gonson give a vivid reality to the satire. It had an immediate success. To say nothing of the fact that the talent of the paintings completely reconciled Sir James Thornhill to the son-in-law he had hitherto refused to acknowledge, more than 1,200 names of subscribers to the engravings were entered in the artist's book. On the appearance of plate iii. the lords of the treasury trooped to the print shop for Sir John Gonson's portrait which it contained.

The story was made into a pantomime by Theophilus Cibber, and by some one else into a ballad opera; and it gave rise to numerous pamphlets and poems. It was painted on fan-mounts and transferred to cups and saucers. Lastly, it was freely pirated. There could be no surer testimony to its popularity.

From the mss. of George Vertue in the British Museum (Add. mss. 23,069–98) it seems that during the progress of the plates, Hogarth was domiciled with his father-in-law, Sir James Thornhill, in the Middle Piazza, Covent Garden (the "second house eastward from James Street"), and it must have been thence that set out the historical expedition from London to Sheerness of which the original record still exists at the British Museum. This is an oblong ms. volume entitled *An Account of what seem'd most Remarkable in the Five Days' Peregrination of the Five Following Persons, viz., Messieurs Tothall, Scott, Hogarth, Thornhill and Forrest. Begun on Saturday May 27th 1732 and Finish'd On the 31st of the Same Month. Abi tu et fac similiter. Inscription on Dulwich College Porch.* The journal, which is written by Ebenezer, the father of Garrick's friend Theodosius Forrest, gives a good idea of what a "frisk"—as Johnson called it—was in those days, while the illustrations were by Hogarth and Samuel Scott the landscape painter. John Thornhill, Sir James's son, made the map. This version (in prose) was subsequently run into rhyme by one of Hogarth's friends, the Rev. Wm. Gostling of Canterbury, and after the artist's death both versions were published. In the absence of other biographical detail, they are of considerable interest to the student of Hogarth. In 1733 Hogarth moved into the "Golden Head" in Leicester Fields, which, with occasional absences at Chiswick, he continued to occupy until his death. By December of this year he was already engaged upon the engravings of a second Progress, that of a Rake. It was not as successful as its predecessor. It was in eight plates in lieu of six. The story is unequal; but there is nothing finer than the figure of the desperate hero in the Covent Garden gaming-house, or the admirable scenes in the Fleet prison and Bedlam, where at last his headlong career comes to its tragic termination. The plates abound with allusive suggestion and covert humour.

"A Rake's Progress" was dated June 25, 1735, and the engravings bear the words "according to Act of Parliament." This was an act (8 Geo. II. cap. 13) which Hogarth had been instrumental in obtaining from the legislature, being stirred thereto by the shameless piracies of rival printsellers. Although loosely drawn, it served its purpose; and the painter commemorated his success by a long inscription on the plate entitled "Crowns, Mitres, etc.," afterwards used as a subscription ticket to the Election series. These subscription tickets to his engravings, let us add, are among the brightest and most vivacious of the artist's productions. That to the "Harlot's Progress" was entitled "Boys peeping at Nature," while the "Rake's Progress" was heralded by the delightful etching known as "A Pleased Audience at a Play, or The Laughing Audience."

Of the prints which followed the two Progresses, "A Modern Midnight Conversation," is an admirable drinking scene which comes between them in 1733, and the bright little plate of "Southwark Fair" although dated 1733, was published with "A Rake's Progress" in 1735. Between these and "Marriage *à la mode,*" upon the pictures of which the painter must have been not long after at work, come the small prints of the "Consultation of Physicians" and "Sleeping Congregation" (1736), the "Scholars at a Lecture" (1737); the "Four Times of the Day" (1738), a series of pictures of 18th century life, the earlier designs for which have been already referred to; the "Strolling Actresses dressing in a Barn" (1738), which Walpole held to be, "for wit and imagination, without any other end, the best of all the painter's works"; and finally the admirable plates of the Distrest Poet painfully composing a poem on "Riches" in a garret, and the Enraged Musician fulminating from his parlour window upon a discordant orchestra of knife-grinders, milk-girls, ballad-singers and the rest upon the pavement outside. These are dated respectively 1736 and 1741. To this period also (*i.e.*, the period preceding the production of the plates of "Marriage *à la mode*") belong two of those history pictures to which, in emulation of the Haymans and Thornhills, the artist was continually attracted. "The Pool of Bethesda" and the "Good Samaritan," "with figures 7 ft. high," were painted *circa* 1736, and presented by the artist to St. Bartholomew's hospital where they remain. They were not masterpieces; and it is pleasanter to think of his connection with Captain Coram's recently established Foundling hospital (1739), which he aided with his money, his graver and his brush, and for which he painted that admirable portrait of the good old philanthropist which is now loaned to the National Gallery, London.

In "A Harlot's Progress" Hogarth had not strayed much beyond the lower walks of society, and in "A Rake's Progress," his hero was taken from the middle classes. His masterpiece, "Marriage *à la mode,*" successfully depicted, as the advertisement has it, "a variety of modern occurrences in high life." The countess's bedroom, the earl's apartment with its lavish coronets and old masters, the grand saloon with its marble pillars and grotesque ornaments, are fully as true to nature as the frowsy chamber in the "Turk's Head Bagnio," the quack-doctor's museum in St. Martin's Lane, or the mean opulence of the merchant's house in the city. The engravings of "Marriage *à la mode*" were dated April 1745. Although by this time the painter found a ready market for his engravings, he does not appear to have been equally successful in selling his pictures. The people bought his prints; but the richer and not numerous connoisseurs who purchased pictures were wholly in the hands of the importers and manufacturers of "old masters." In Feb. 1745 the original oil paintings of the two Progresses, the "Four Times of the Day" and the "Strolling Actresses" were still unsold. On the last day of that month Hogarth disposed of them by an ill-devised kind of auction, the details of which may be read in Nichols's *Anecdotes,* for the paltry sum of £427 7s. No better fate attended "Marriage *à la mode,*" which six years later became the property of Lane of Hillingdon for 120 guineas. Something of this was no doubt due to Hogarth's impracticable arrangements, but the fact shows how blind his contemporaries were to his merits as a painter, and how hopelessly in bondage to the all-powerful picture-dealers. Of these latter the painter himself gave a graphic picture in a letter addressed by him under the pseudonym of "Britophil" to the *St. James's Evening Post,* in June 1737.

But if Hogarth was not successful with his dramas on canvas, he occasionally shared with his contemporaries in the popularity of portrait painting. For a picture, executed in 1746, of Garrick as Richard III. he was paid £200, "which was more," says he, "than any English artist ever received for a single portrait." In the same year a sketch of Simon Fraser, Lord Lovat, afterwards beheaded on Tower Hill, had an exceptional success.

Other important works are "The Stage Coach or Country Inn Yard" (1747); the series of 12 plates entitled "Industry and Idleness" (1747), depicting the career of two London apprentices; the "Gate of Calais" (1749), which had its origin in a rather unfortunate visit paid to France by the painter after the peace of Aix-la-Chapelle; the "March to Finchley" (1750); "Beer Street," "Gin Lane" and the "Four Stages of Cruelty" (1751); the admirable representations of election humours in the days of Sir Robert Walpole, entitled "Four Prints of an Election" (1755–1758); and the plate of "Credulity, Superstition and Fanaticism, a Medley" (1762), adapted from an earlier unpublished design called "Enthusiasm Delineated." Besides these must be chronicled three more essays in the "great style of history painting," viz. "Paul before Felix," "Moses brought to Pharaoh's Daughter" and the Altarpiece for St. Mary Redcliffe at Bristol. The first two were engraved in 1751–1752, the last in 1794. A subscription ticket to the earlier pictures, entitled "Paul before Felix Burlesqued," had a popularity far greater than that of the prints themselves.

In 1745 Hogarth painted that admirable portrait of himself with his dog Trump, which is now in the Tate gallery. In a corner of this he had drawn on a palette a serpentine curve with the words "The Line of Beauty." Much inquiry ensued as to the meaning of this hieroglyphic; and in an unpropitious hour the painter resolved to explain himself in writing. The result was the well-known *Analysis of Beauty* (1753), a treatise to fix "the fluctuating ideas of Taste," otherwise a desultory essay having

for pretext the precept attributed to Michelangelo that a figure should be always "Pyramidall, Serpent like and multiplied by one two and three." By the painter's adherents it was praised as a final deliverance upon aesthetics; by his enemies and professional rivals, its obscurities, and minor errors were made the subject of ridicule. Moreover, there were further humiliations in store for him. In 1759 the success of a little picture called "The Lady's Last Stake," painted for Lord Charlemont, procured him a commission from Sir Richard Grosvenor to paint another picture "upon the same terms." Unhappily on this occasion he deserted his own field of genre and social satire, to select the story from Boccaccio (or rather Dryden) of Sigismunda weeping over the heart of her murdered lover Guiscardo, being the subject of a picture in Sir Luke Schaub's collection by Furini which had recently been sold for £400. The picture, over which he spent much time and patience, was not regarded as a success; and Sir Richard rather meanly shuffled out of his bargain upon the plea that "the constantly having it before one's eyes, would be too often occasioning melancholy ideas to arise in one's mind." Sigismunda, therefore, remained upon his hands. It is now in the Tate gallery.

Hogarth's last years were embittered by an unhappy quarrel with his quondam friends, John Wilkes and Churchill the poet. Having succeeded John Thornhill in 1757 as serjeant painter (to which post he was reappointed at the accession of George III.), an evil genius prompted him in 1762 to do some "timed" thing in the ministerial interest, and he accordingly published the indifferent satire of "The Times, plate i." This at once brought him into collision with Wilkes and Churchill, and the immediate result was a violent attack upon him, both as a man and an artist, in the opposition *North Briton,* No. 17. The old artist was deeply wounded, and his health was failing. Early in the next year, however, he replied by that portrait of Wilkes which will for ever carry his squinting features to posterity. Churchill retaliated in July by a savage *Epistle to William Hogarth,* to which the artist rejoined by a print of Churchill as a bear, in torn bands and ruffles. "The pleasure, and pecuniary advantage," writes Hogarth manfully, "which I derived from these two engravings" (of Wilkes and Churchill), "together with occasionally riding on horseback, restored me to as much health as can be expected at my time of life." He produced but one more print, that of "Finis, or The Bathos," March 1764, a strange jumble of "fag ends," intended as a tail-piece to his collected prints; and on Oct. 26 of the same year he died at his house in Leicester Square. He was buried in Chiswick churchyard, where a tomb was erected to him by his friends in 1771, with an epitaph by Garrick. Not far off, on the road to Chiswick Gardens, still stands the little red-brick Georgian villa in which from Sept. 1749 until his death he spent the summer seasons. It was purchased in 1902 by Lieut.-Colonel Shipway of Chiswick, who turned it into a Hogarth museum.

As a painter Hogarth was harmonious in his colouring, wonderfully dexterous and direct in his handling, and in his composition. As an engraver his work is more conspicuous for its vigour, spirit and intelligibility than for finish and beauty of line. He desired that it should tell its own tale plainly, and in this he succeeded. But it is not as an engraver or a painter that he claims his unique position among English artists—it is as a humorist and a satirist upon canvas. Regarded in this light he has never been equalled, whether for his vigour of realism and dramatic power, his fancy and invention in the decoration of his story, or his merciless anatomy and exposure of folly and wickedness. If we regard him—as he loved to regard himself—as "author" rather than "artist," his place is with the great masters of literature,—with the Thackerays and Fieldings, the Cervantes and Molières.

BIBLIOGRAPHY.—The main body of Hogarth literature is to be found in the autobiographical *Memoranda* published by John Ireland in 1798, and in the successive *Anecdotes* of the antiquary John Nichols. Much minute information has also been collected in F. G. Stephens's *Catalogue of the Satirical Prints and Drawings in the British Museum.* But a copious bibliography of books, pamphlets, etc., relating to Hogarth, together with detailed catalogues of his paintings and prints, will be found in the *Memoir* of Hogarth by Austin Dobson. First issued in 1879, this was reprinted and expanded in 1891, 1897, 1902 and finally in 1907. A number of pictures by Hogarth are in private hands in England and the United States; but most of the best-known works have permanent homes in public galleries. "Marriage *à la mode,*" "Sigismunda," "Lavinia Fenton," the "Scene from the Beggar's Opera," the portraits of himself, his sister Mary and Dr. Hoadley are at the Tate gallery; the "Shrimp Girl," the "Gate of Calais," the "Family Group," the portraits of James Quin, his sister Ann, and his servants, are in the National Gallery; the "Rake's Progress" and the Election Series, in the Soane museum. There are also notable pictures in the Fitzwilliam museum at Cambridge and the National Portrait Gallery. At the print room in the British Museum there is also a very interesting set of 16 designs for the series called "Industry and Idleness," the majority of which formerly belonged to Horace Walpole. (A. Do.; X.)

HOG DEER (*Cervus porcinus*), a small reddish-brown deer, native to northern India, resembling a boar in its movements. It is hunted extensively and provides excellent sport. (*See* DEER.)

HOGG, JAMES (1770–1835), Scottish poet, known as "the Ettrick shepherd," was baptized at Ettrick, Selkirkshire, on Dec. 9, 1770. His ancestors had been shepherds for generations, and he himself was a shepherd from 1790 to 1799 at Yarrow to Mr. Laidlaw, who lent him books and encouraged his talent. On the recommendation of Sir Walter Scott, Constable published his miscellaneous poems (*The Mountain Bard*) in 1807. The proceeds of this book and of another on the treatment of sheep were invested by Hogg in a ruinous farming enterprise in Dumfrieshire, and the poet went to Edinburgh to make his living by writing. In 1817 he was provided by the duke of Buccleuch with a small farm at Altrive, Yarrow, and in 1820 he married Margaret Phillips. He died on Nov. 21, 1835, and was buried at his native place. Hogg is familiar to many readers as the "Shepherd" of Wilson's *Noctes Ambrosianae,* though the picture is no literal portrait. Hogg's most important volumes are: *Scottish Pastorals* (1801), *The Mountain Bard* (1807), *The Queen's Wake* (1813), *Evening Tales* (1820), *The Shepherd's Calendar* (1829) and *Lay Sermons* (1834).

See Hogg's "Memoir of the Author's Life, written by himself," prefixed to the 3rd ed. (1821) of *The Mountain Bard;* also *Memorials of James Hogg, the Ettrick Shepherd,* ed. by his daughter, Mrs. M. G. Garden (enlarged ed. with preface by Prof. Veitch, 1903), and Sir G. B. S. Douglas; *James Hogg* in the "Famous Scots" series (1899); also *The Poems of James Hogg,* selected by William Wallace (1903). *See* also Mrs. Oliphant, *Annals of a Publishing House,* vol. i. chap. vii., and G. Gilfillan, *First Gallery of Literary Portraits.*

HOGG, THOMAS JEFFERSON (1792–1862), English man of letters, was born in Norton, Durham. He was educated at Durham grammar school and at University college, Oxford, where he became the friend of Shelley, with whom in 1811 he was expelled from the university for refusing to disclaim connection with the authorship of the pamphlet *The Necessity for Atheism.* He then studied law at York for six months. Hogg's behaviour to Harriet Shelley interrupted his relations with her husband for some time, but in 1813 the friendship was renewed in London. In 1817 Hogg was called to the bar, and became later a revising barrister. In 1844 he inherited £2,000 under Shelley's will, and in 1855, in accordance with the wishes of the poet's family, began to write Shelley's biography. The first two volumes of it were published in 1858, but they proved to be far more an autobiography than a biography, and Shelley's representatives refused Hogg further access to the materials necessary for its completion.

HOGMANAY, the name in Scotland and some parts of the north of England for New Year's Eve, as also for the cake then given to the children. On the morning of Dec. 31, the children go from door to door singing:

> Hogmanay
> Trollolay
> Gie's o' your white bread and nane o' your grey;

and begging for small gifts or alms. These usually take the form of an oaten cake. The derivation of the term is very doubtful.

HOGNOSE, the name applied to the three species of the North American genus *Heterodon* of colubrine snakes. The name is due to the blunt snout of the commonest species, *H. platyrhinus,* which may reach a length of 3ft., and is a reddish brown above, with dark markings and whitish below. All species are harmless, feeding on small animals, eggs, etc. They are oviparous. *H. platyrhinus* is sometimes mistaken for the venomous copperhead (*q.v.*).

HOGSHEAD, a cask for holding liquor or other commodities, such as tobacco, sugar, molasses, etc.; also a liquid measure of capacity, varying with the contents. As a measure for beer, cider, etc., it equals 54 gallons. A statute of Richard III. (1483) fixed the hogshead of wine at 63 wine-gallons, *i.e.*, 52½ imperial gallons. The etymology of the word is disputed.

HOHENASPERG, an ancient fortress of Germany, in the kingdom of Württemberg, 10 m. N. of Stuttgart, stands on a conical hill (1,100 ft.), overlooking the town of Asperg. It was formerly strongly fortified and was long the State prison of Württemberg. Hohenasperg originally belonged to the counts of Calw; it next passed to the counts palatine of Tübingen and from them was acquired in 1308 by Württemberg.

HOHENFRIEDBERG or **HOHENFRIEDEBERG,** a village of Silesia, about 6m. from the small town of Striegau. It gives its name to a battle (also called the battle of Striegau) in the War of the Austrian Succession (*q.v.*), fought on June 3, 1745, between the Prussians under Frederick the Great and the Austrians and Saxons commanded by Prince Charles of Lorraine.

HOHENHEIM, a village of Germany, in the kingdom of Württemberg, 7 m. E.S.E. of Stuttgart by rail. It came in 1768 from the counts of Hohenheim to the dukes of Württemberg, and in 1785 Duke Karl Eugen built a country house here. This house with grounds is now the seat of one of the most important agricultural colleges in Germany, founded in 1817, raised to the position of a high school in 1865, and now a technical high school with university status.

HOHENLIMBURG, a German town, on the Lenne, in the Prussian province of Westphalia, 30 m. by rail S. of Dortmund. Pop. (1925) 15,519. Iron and metal industries, dyeing, cloth-making and linen-weaving are carried on. It is the chief town of the county of Limburg, and formerly belonged to the counts of Limburg, a family which became extinct in 1508. The castle of Hohenlimburg overlooks the town.

HOHENLINDEN, BATTLE OF. In this battle on Dec. 3, 1800, Moreau turned the tables on the Austrians, who had planned his encirclement, and, destroying them by an able countermanoeuvre, struck the decisive blow of the campaign in Germany. The result, combined with Napoleon's victory at Marengo in Italy, led to the peace of Luneville which ended the war of the Second Coalition. For an account of the battle *see* FRENCH REVOLUTIONARY WARS.

HOHENLOHE, a German princely family which took its name from the district of Hohenlohe in Franconia. At first a countship, its two branches were raised to the rank of principalities of the Empire in 1744 and 1764 respectively; in 1806 they lost their independence and their lands now form part of the kingdoms of Bavaria and of Württemberg. At the time of the mediatization the area of Hohenlohe was 680 sq.m. and its estimated population was 108,000. The family is first mentioned in the 12th century as possessing the castle of Hohenloch, or Hohenlohe, near Uffenheim, and its influence was soon perceptible in several of the Franconian valleys, including those of the Kocher, the Jagst and the Tauber. Henry I. (d. 1183) was the first to take the title of count of Hohenlohe, and in 1230 his grandsons, Gottfried and Conrad, supporters of the emperor Frederick II., founded the lines of Hohenlohe—Hohenlohe and Hohenlohe-Brauneck. The latter became extinct in 1390, while the former was divided into several branches, only two of which, however, Hohenlohe-Weikersheim and Hohenlohe-Uffenheim-Speckfeld (extinct in 1412), need be mentioned here. Hohenlohe-Weikersheim, descended from Count Kraft I. (d. 1313), also underwent several divisions, that which took place after the deaths of Counts Albert and George in 1551 being specially important. In 1551 the lines of Hohenlohe-Neuenstein and Hohenlohe-Waldenburg were founded by the sons of Count George, from which are descended the existing branches of the Hohenlohe family.

The former of these became Protestant, while the latter remained Catholic. Of the family of Hohenlohe-Neuenstein, which underwent several partitions and inherited Gleichen in 1631, the senior line became extinct in 1805, while in 1701 the junior line divided itself into three branches, those of Langenburg, Ingelfingen and Kirchberg. Kirchberg died out in 1861, but members of the families of Hohenlohe-Langenburg and Hohenlohe-Ingelfingen are still alive, the latter being represented by the branches of Hohenlohe-Ingelfingen and Hohenlohe-Öhringen. The Roman Catholic family of Hohenlohe-Waldenburg was soon divided into three branches, but two of these had died out by 1729. The surviving branch, that of Schillingsfürst, was divided into the lines of Hohenlohe-Schillingsfürst and Hohenlohe-Bartenstein; other divisions followed, and the four existing lines of this branch of the family are those of Waldenburg, Schillingsfürst, Jagstberg and Bartenstein. The principal members of the family are dealt with under their separate titles.

HOHENLOHE-INGELFINGEN, FRIEDRICH LUDWIG, PRINCE OF (1746–1818), Prussian general, entered the Prussian service in 1768, and fought in the campaign on the Rhine in 1794. In 1806 Hohenlohe commanded the left-wing army of the Prussian forces opposing Napoleon, having under him Prince Louis Ferdinand of Prussia. Disputes soon broke out between Hohenlohe and the commander-in-chief, the duke of Brunswick, the armies marched hither and thither without effective results and finally Hohenlohe's army was almost destroyed by Napoleon at Jena (*see* NAPOLEONIC CAMPAIGNS). He surrendered the remnant of his army at Prenzlau on Oct. 28, a fortnight after Jena and three weeks after the beginning of hostilities. After two years spent as a prisoner of war in France Hohenlohe retired to his estates. He died on Feb. 15, 1818. He had, in Aug. 1806, just before the outbreak of the French War, resigned the principality to his eldest son, not being willing to become a "mediatized" ruler under Württemberg suzerainty.

HOHENLOHE-INGELFINGEN KRAFT, PRINCE OF (1827–1892), soldier and military writer, son of Prince Adolf of Hohenlohe-Ingelfingen (1797–1873), prime minister of Prussia from 1856 to 1862, was born at Koschentin in Upper Silesia. He joined the Prussian Guard artillery in 1845. In the bold advance of the Guard corps on the Austrian right wing at Königgrätz in 1866 (*see* SEVEN WEEKS' WAR), he led the Guard reserve artillery with great success, and after the short war ended he turned his energies to the better tactical training of the Prussian artillery. In 1868 he was made a major-general and assigned to command the Guard artillery brigade. In this capacity he served in the Franco-German War, distinguishing himself at Gravelotte and Sedan; he was in control of the artillery attack on the fortifications of Paris. He retired in 1879 and died near Dresden on Jan. 16, 1892.

See his *memoirs, Aus meinem Leben* (ed. W. von Bremen, 4 vols., 1897–1907; new ed., 1 vol., 1915).

HOHENLOHE-SCHILLINGSFÜRST, CHLODWIG KARL VICTOR, PRINCE OF (1819–1901), German chancellor, was born on March 31, 1819, at Schillingsfürst in Bavaria, of mixed Catholic and Protestant parentage, which perhaps accounts for his tolerance in religious matters. He studied law, and entered the Prussian civil service in 1844, but his accession, under a family distribution of the Hohenlohe estates, as reigning prince of Schillingsfürst, entailed his resignation from the Prussian service in 1846. He then took his seat in the Bavarian *Reichsrat*, but his liberal sympathies and his desire to see a united Germany compromised his chances of advancement at the Bavarian court. Prince Hohenlohe married, in 1847, a Russian heiress, the Princess Marie of Sayn-Wittgenstein-Berleburg. He spent much time at various European courts, and was in touch with important people in Vienna, St. Petersburg (now Leningrad), and London.

It was Wagner, apparently, who persuaded the Bavarian king to place Hohenlohe at the head of his Government (*Denkwürdigkeiten*, i. 178, 211), and on Dec. 31, 1866, the prince was duly appointed minister of the royal house and of foreign affairs and president of the council of ministers.

As head of the Bavarian Government Hohenlohe's principal task was to discover some basis for an effective union of the South German States with the North German Confederation, and during the three critical years of his tenure of office he was, next to Bismarck, the most important statesman in Germany. He reorganized the Bavarian army on the Prussian model, brought about the military union of the southern States, and took a lead-

ing share in the creation of the customs parliament (*Zollparlament*), of which on April 28, 1868, he was elected a vice-president. On the question of the Vatican council Hohenlohe took up an attitude of strong opposition to the ultramontane position. He believed that the policy of Pius IX. of setting the Church in opposition to the modern State would prove ruinous to both, and that the definition of the dogma of papal infallibility, by raising the pronouncements of the Syllabus of 1864 into articles of faith, would commit the Church to this policy irrevocably. This view he embodied into a circular note to the Catholic powers (April 9, 1869) drawn up by Döllinger, inviting them to exercise the right of sending ambassadors to the council and to combine to prevent the definition of the dogma. The only practical outcome of Hohenlohe's action was that in Bavaria the powerful ultramontane party combined against him with the Bavarian "patriots" who accused him of bartering away Bavarian independence to Prussia. The combination was too strong for him; a bill which he brought in for curbing the influence of the Church over education was defeated, the elections of 1869 went against him, and in spite of the continued support of the king he was forced to resign (March 7, 1870).

Though out of office, his personal influence continued very great both at Munich and Berlin, and had not a little to do with favourable terms of the treaty of the North German Confederation with Bavaria, which embodied his views, and with its acceptance by the Bavarian parliament. Elected a member of the German *reichstag*, he was, on March 23, 1871, chosen one of its vice-presidents, and was one of the founders of the Liberal Imperial Party (*Liberale Reichspartei*), the objects of which were to support the new empire, to secure its internal development on Liberal lines, and to oppose clerical aggression as represented by the Catholic Centre. Hohenlohe strenuously supported Bismarck's anti-papal policy, the main lines of which (prohibition of the Society of Jesus, etc.) he himself suggested.

In 1873 Bismarck chose Prince Hohenlohe to succeed Count Harry Arnim as ambassador in Paris. In 1878 he attended the Congress of Berlin as third German representative, and in 1880, on the death of von Bülow (Oct. 20), secretary of State for foreign affairs, he was called to Berlin as temporary head of the Foreign Office and representative of Bismarck during his absence through illness. In 1885 he was chosen to succeed Manteuffel as governor of Alsace-Lorraine. In this capacity he had to carry out the coercive measures introduced by the chancellor in 1887–88, though he largely disapproved of them; his conciliatory disposition, however, did much to reconcile the Alsace-Lorrainers to German rule. He remained at Strasbourg till Oct. 1894, when, at the urgent request of the emperor, he consented, in spite of his age, to accept the chancellorship in succession of Caprivi. The events of his chancellorship belong to the general history of Germany. In general, during his term of office, the personality of the chancellor was less conspicuous in public affairs than in the case of either of his predecessors. His appearances in the Prussian and German parliaments were rare, and great independence was left to the secretaries of State. What influence the tact and experience of Hohenlohe exercised behind the scenes on the masterful will and impulsive character of the emperor cannot as yet be generally known.

Prince Hohenlohe resigned the chancellorship on Oct. 17, 1900, and died at Ragaz on July 6, 1901.

Prince Hohenlohe's *Denkwürdigkeiten* (2 vols., Stuttgart and Leipzig, 1906) are singularly full and outspoken, the latter quality causing no little scandal in Germany and bringing down on his son, Prince Alexander, who was responsible for their publication, the disfavour of the emperor.

For the Hohenlohes generally *see* A. F. Fischer, *Geschichte des Hauses Hohenlohe* (1866–71); K. Weller, *Hohenlohisches Urkundenbuch, 1153–1350* (Stuttgart, 1899–1901), and *Geschichte des Hauses Hohenlohe* (Stuttgart, 1904). *See* also Prinz Alex. Hohenlohe, *Aus meinen Leben* (edit. G. Anhäuser, 1925).

HOHENLOHE-WALDENBURG-BARTENSTEIN, LUDWIG ALOYSIUS, Prince of (1765–1829), marshal and peer of France, was born on Aug. 18, 1765. In 1784 he entered the service of the Palatinate, which he quitted in 1792 in order to take the command of a regiment raised by his father for the service of the emigrant princes of France. He fought under Condé in the campaigns of 1792–93, and then entered the service of Holland, and, when almost surrounded by the army of General Pichegru, conducted a masterly retreat from the island of Bommel. Napoleon offered to restore to him his principality on condition that he adhered to the confederation of the Rhine, but as he refused, it was united to Württemberg. After Napoleon's fall in 1814 he entered the French service, and in 1815 he held the command of a regiment raised by himself, with which he took part in the Spanish campaign of 1823. In 1827 he was created marshal and peer of France. He died at Lunéville on May 30, 1829.

HOHENLOHE-WALDENBURG-SCHILLINGSFURST, ALEXANDER LEOPOLD FRANZ EMMERICH, Prince of (1794–1849), priest and reputed miracle-worker, was born at Kupferzell, near Waldenburg, on Aug. 17, 1794. He was ordained priest in 1815, and in the following year he went to Rome, where he entered the society of the "Fathers of the Sacred Heart." He acquired a reputation as a miracle-worker at Munich and Bamberg, and great crowds were attracted. Ultimately the authorities interfered with his operations, and he went in 1821 to Vienna and then to Hungary, where he became canon at Grosswardein and in 1844 titular bishop of Sardica. He died at Vöslau near Vienna on Nov. 17, 1849. His writings were collected by S. Brunner in 1851. (*Aus dem Nachlasse des Fürsten Aloysius von Hohenlohe.*)

HOHENSTAUFEN, a German princely family which derived its name from a village and ruined castle near Lorsch in Swabia, now in Württemberg. Its members were emperors or German kings from 1138 to 1208, and again from 1214 to 1254. The earliest known ancestor was Frederick, count of Büren (d. 1094), whose son Frederick built a castle at Staufen, or Hohenstaufen, and called himself by this name. He supported the emperor Henry IV., who granted him the dukedom of Swabia in 1079, and gave him his daughter Agnes in marriage. In 1081 he remained in Germany as Henry's representative, but only secured possession of Swabia after a struggle lasting twenty years. In 1105 Frederick was succeeded by his son Frederick II., called the One-eyed, who, together with his brother Conrad, afterwards the German king Conrad III., held south-west Germany for their uncle the emperor Henry V. Frederick inherited the estates of Henry V. in 1125, but failed to secure the throne. He opposed the new emperor, Lothair the Saxon, who claimed some of the estates of the late emperor as crown property. A war broke out and ended in the complete submission of Frederick at Bamberg. In 1138 Conrad of Hohenstaufen was elected German king, and was succeeded in 1152, not by his son but by his nephew Frederick Barbarossa, son of his brother Frederick (d. 1147). Conrad's son Frederick inherited the duchy of Franconia which his father had received in 1115, and this was retained by the Hohenstaufen until the death of Duke Conrad II. in 1196. In 1152 Frederick received the duchy of Swabia from his cousin the German king Frederick I., and on his death in 1167 it passed successively to Frederick's three sons Frederick, Conrad and Philip. The second Hohenstaufen emperor was Frederick Barbarossa's son, Henry VI., after whose death a struggle for the throne took place between Henry's brother Philip, duke of Swabia, and Otto of Brunswick, afterwards the emperor Otto IV. Regained for the Hohenstaufen by Henry's son, Frederick II., in 1214, the German kingdom passed to his son, Conrad IV., and when Conrad's son Conradin was beheaded in Italy in 1268, the male line of the Hohenstaufen became extinct. Daughters of Philip of Swabia married Ferdinand III., king of Castile and Leon, and Henry II., duke of Brabant, and a daughter of Conrad, brother of the emperor Frederick I., married into the family of Guelph.

See F. von Raumer, *Geschichte der Hohenstaufen und ihrer Zeit* (Leipzig, 1878); B. F. W. Zimmermann, *Geschichte der Hohenstaufen* (Stuttgart, 1st ed., 1838; 2nd ed., 1865); F. W. Schirrmacher, *Die letzten Hohenstaufen* (Göttingen, 1871).

HOHENSTEIN (Hohenstein-Ernstthal), a town of Germany, in the republic of Saxony, on the railway Zwickau-Chemnitz,

12 m. N.E. of the former. Pop. (1925) 16,754. Industries include cotton weaving, the manufacture of machines, stockings, gloves and woollen fabrics, cotton printing and dyeing. There are copper and arsenic mines in the neighbourhood. Hohenstein was united to the town of Ernstthal in 1898. Another place of the same name is a town in East Prussia. Pop. (1925) 3,000. This Hohenstein was founded by the Teutonic Order in 1359.

HOHENZOLLERN DYNASTY. The Hohenzollerns were a German family of counts, who in the 11th century were living in comparative obscurity in the south-eastern corner of the empire, in the 12th received a Burgrafdom in Franconia, thanks to the friendship of one emperor, in the 15th were invested by another emperor with the electorate of Brandenburg, in the 17th acquired by marriage Prussia in the north-eastern corner of Germany, and at the same time fragments on the Rhine and the Ruhr, on its western frontier, in the 18th rounded off and enlarged their centrifugal possessions by conquest and also assumed the title of king, in the 19th outstripped the other German states by means of victorious wars, united them and thereby won the title of German emperors, and in the 20th, after an unsuccessful war, lost empire, kingdom, and markgravate at a blow and abandoned their defeated country to its fate.

When they entered the German empire, it was a very shadowy entity. Up to the 19th century they were never interested in the empire, much less in a position to consolidate it. They remained immersed in the factions of rival German dynasties, until at last they achieved the hegemony in a whole so solid that their disappearance left it unshaken. For exactly five centuries they extended and increased their rule over northern Germany, seldom lost territory, and then only for short times, and gradually consolidated a State that was only a patchwork of scattered fragments, with no organic connection.

Thus their State could only be held together from above, by an army of soldiers and an army of officials, by severity, police and punctuality; it was often found necessary to suppress by force the centrifugal forces of certain parts which had been accustomed to other dynasties or other forms of State, and always felt themselves rather German than Prussian. The basic principle of this dynasty thus came to be absolutism, which survived here longer and more vigorously than in most parts of Europe, looked on its citizens to the last as subjects, was opposed to any democratic movement, and sought to impress obedience as the chief virtue. In the place of national sentiment there arose a spirit of caste, and interest in the State went no further than the wish to belong to the upper caste. On top of this came a militaristic system, more prominent in domestic than in foreign affairs; for the Hohenzollerns were by no means more warlike than the majority of ruling houses, and their subjects cared less for the pursuit of the laurel than many another nation. It was the necessity of unifying their scattered subject peoples that gained the Hohenzollerns their bellicose reputation; and this is how the sober and peaceable Prussian nation has acquired a name for brawling.

The fortuitous character of the origin of this State, the lack of a great guiding line of development, is reflected and in part influenced by the personal characters of the dynasty. Of the 20 rulers who reigned in Brandenburg and Prussia for five centuries, from the first elector to the last emperor-king, there were not more than eight who ruled with efficiency, industry and talent, while the rest were weak and vain, and squandered the money and success accumulated by their fathers; and these two types followed one another in almost regular alternation, grandfather often resembling grandson, while their country flourished or decayed alternately, according to the personal characters of these almost unrestricted autocrats.

As these princes were generally long-lived (their reigns averaged 25 years each) the shocks of abrupt changes of character were mitigated. Moreover, the two greatest rulers had each nearly half a century to impress his nature on the people. These two rulers, the Great Elector and Frederick the Great, were able, thanks only to their very long reigns, to draw the tatters of the land together into a real State. These two, with Frederick William I. and William I., incorporated the best characteristics of the family: economy, industry, honesty, courage. Of them all, Frederick the Great alone showed any traces of genius.

Origins.—The name Hohenzollern, first borne by a certain Wenzel of Zollrin, is derived from the word "Söller," a watch tower or castle. The family demesne in Swabia extends from the upper Neckar to the Lake of Constance. In the 12th century one of these counts was invested by the emperor, whose friend he was, with the Burggravate of Nürnberg. His successors acquired further lands in the neighbourhood through purchase or marriage, and in the 14th century one of them was raised to the rank of prince of the empire. His son, the Burggraf Frederick, saved the life of the Emperor Sigmund, king of Hungary, in battle, and was appointed by him Imperial Governor in Brandenburg. The family thus divided, a secondogeniture was formed in Franconia, which ruled there from 1486 to 1791, when the territories in question became Bavarian. The original Swabian line, meanwhile, survived from 1251 to 1850. This line played a part in the outbreak of the war of 1870, one of its princes having come forward as candidate for the throne of Spain, a suggestion which France vetoed. His younger brother Charles (1839–1914) also aspired to a foreign throne, and became Prince and afterwards king of Rumania. His nephew and successor, Ferdinand of Rumania, the son of the prince intended for Spain, fought in the World War against Germany. The head of the Swabian line in 1919 was Prince William (b. 1867).

The Margraf Frederick, who became hereditary elector of Brandenburg in 1415, a brave and able man, was despised and opposed by the native, half-Slav nobles as a petty foreign prince, and felt so out of place that after ten years he returned home, leaving his son to rule in the desolate North. His successor, Frederick II. (1440–70) met with equally violent resistance from the nobles, and also from the towns, until, disregarding their ancient rights, he appeared with 600 horsemen before the gates of the young city of Berlin, took the city, built a castle on the Spree to overawe it, and made this new place in the middle of the sandy waste into his capital. He destroyed all old privileges, turned the citizens into subjects, deprived them of their courts, and in 1448, forced them to swear fealty to him, an oath which the people of Berlin kept until their first rebellion, 400 years later. This iron right hand of his knew not what his pious left hand was doing, for at the same time he founded an Order of holy living for noblemen; but at last, like his father, he abdicated in disgust—not before his reason had half given way.

Albert Achilles (1470–86), called by his contemporaries the "German Fox," and twice excommunicated by the pope, established a brilliant court, enslaved burgess and peasant (whose part consisted only of paying and serving), involved the country in unprofitable disputes—only to desert it in the end, like his two predecessors. All three, and their successors, the weak John (1486–99), who died young, and the brilliant, crafty Joachim I. (1499–1535) were hated in the land, which was still strange to them, although the family had now been ruling there for 100 years. John, a strong opponent of Luther, was also the first to show a mystic side. He dabbled in astrology, pursued and encouraged education, founded the first university, in Frankfurt on the Oder, but also passed many cruel sentences and once had 38 innocent Jews burned in the centre of Berlin.

More unbridled still was the life of Joachim II. (1535–71), who during his long reign built churches and castles with a lavishness that verged on madness, sought to outshine all other princes, squandered the burgesses' gold on favourites, mistresses and the chase, forbidding them the while to wear trunk-hose or to hold rich wedding feasts, but forcing them five times to pay his debts, which ran into millions.

His son and opposite, John George (1571–98), an Evangelical Protestant, as his father had been before him, economical, pious, father of more than 20 children, tried to make up the 2,500,000 thalers of debts with which his predecessors had saddled the country, lived quietly and respectably, and managed, by clever marriages for his relatives, to secure important heritages. His successor, Joachim Frederick (1598–1608) lived staidly also, and was wise enough to fashion himself a staff for all questions

of government by empanelling nine learned men on his privy council—the actual beginning of the Prussian bureaucratic State.

After him, John Sigmund (1608–19) reaped the fruits of the marriage arranged by his grandfather, and for the first time enlarged the land very considerably through his wife's heritage; he became duke in Prussia, and at the same time lord of rich and storied lands on the Ruhr, the Maas and the right bank of the Rhine, for the sake of which he turned Calvinist. Thus, without merit of his own, but also without war, he extended the land "from the Maas to the Memel," as the song said; yet had no pleasure of these strange lands, but sat disgruntled in the middle of a long chain of provinces, linked together by nothing but a dynasty that was still feeble. Under his successor it all went to pieces; this George William (1619–40), another of the frivolous, showy sort, the hunters and carousers, had none of the qualities needed to weather the storms of the Thirty Years' War, for, as Gustavus Adolphus said, "a new livery, a handsome horse or a pair of greyhounds drove everything else out of his mind." He remained neutral in the war, which nevertheless brought famine and misery into his lands. Thereupon he left Berlin, and went to Prussia, the duchy in the far north-east, where there was better fare and sport, leaving everything in ruin behind him, and bequeathing to his son a hopelessly disorganized country.

The Great Elector.—This twenty-year old youth, Frederick William (1640–88), rightly called the Great Elector, began by repairing all the damage his father had done. In the confusion of the war, the end of which was still far away, he built up a solid army, and played the rival combatants off skilfully against each other until he had a trained force of 8,000 men; all in great secrecy, for he was a master of dissimulation although also personally brave. Thus playing the double game which the times forced upon him, and which was also native to his character, he won the trick every time, through the power of his ever-growing army, which he employed now for, now against his neighbours. First he allied himself with Sweden, then ten months later broke this alliance and joined Sweden's mortal enemies, the Poles. Nor had he any compunction in signing a secret treaty with the "Roi Soleil," promising the German Imperial crown for the Dauphin if he himself only got back Pomerania. When Louis XIV. failed to pay the promised subsidies, the elector forthwith joined the league against him.

An excellent general, he never spared himself in the fight, fought in person among his men at the great victory over the Swedes at Fehrbellin in 1675, and generally developed gifts and qualities possessed by none of his forefathers, and not more than one of his successors. It was only blended slyness and courage that enabled him to assert his authority in Prussia, after an involved struggle to rid himself of Poland's suzerainty, and thus become master in his own house. But scarcely had he overcome the enemy abroad, when he turned in the same absolutist spirit against the enemy within, and as his ancestor had subdued Berlin, two centuries before, so he forced Königsberg to submit to him, in the teeth of the constitution, compelled the recalcitrant towns and nobles to do him homage, cancelled the privileges of the Estates where they inconvenienced him, and threw into prison the leader of the burgesses, against his pledged knightly word.

On the other hand, after a reign of nearly 50 years, he left behind him a unity, created by violence, but surpassed in Germany only by the house of Habsburg, hundreds of villages new-built, new canals, dykes and roads, the State revenue increased five-fold, a first-class army 30,000 strong, and the general awe of his neighbours. Shortly before his death, by one of his cleverest inspirations, he had invited into his country the Protestants expelled from France. Only now and then, and of special purpose, did he make a brave outer show; his nature was simple; he loved to water the flowers himself in his palace garden, in which, and afterwards in the country, he planted the pioneer potatoes, went himself to the market and bought singing birds, enjoyed unsophisticated pleasures, and in an age which despised burgess and peasant, was yet a fairly just ruler.

His son and successor was his opposite: a weak, vain and silly man, who tried to hide his hump back under a huge wig; affected, greedy and ungrateful. Frederick III. (1688–1713) had only one passion: he wanted to be king. At the age of ten he founded his first Order, and went on playing to the day of his death with feasts, processions and problems of etiquette. Seeking to embellish the ever-growing castle on the Spree, he discovered a great artist, Andreas Schlüter. When he founded the Academy of Arts, its first and also its second task was: the coronation of the king.

His wife, Sophie Charlotte, an enlightened princess from Hanover, who laid out the castle and town of Charlottenburg outside the gates of Berlin, unluckily meddled in politics, which were in the excellent keeping, not of the king, but of his tutor and adviser, the grave and indefatigable Danckelman. She hated this man's honesty and not only hunted him out of his offices, after he had ruled the land with success for a decade, but set the law against him, threw him into prison, and only released him ten years later. His place was taken by thieving adventurers. The work of the Great Elector was ruined.

Meanwhile Frederick took umbrage at the glory in which his cousins of Orange and Saxony were sunning themselves as kings of England and Spain, negotiated for several years with the emperor, and at last, by great promise of military help for Spain, extorted from him the concession that he would raise no objection to his coronation as king. This took place on Jan. 18, 1701 in Königsberg, with unexampled pomp, and cost 4,000,000 thaler, or two years revenue. The elector, who placed the crown on his own head, called himself henceforward Frederick I., king in Prussia.

Now he began to play at Versailles, founded dozens of grades among the courtiers, and kept a mistress, although he neither needed her nor liked her, for the sole purpose of taking her out publicly, at regular hours, like the king of France. At the same time, as price for kingly rank, he sent a part of his subjects to the emperor, and the emperor sent them to Spain, to death. The rest groaned under the most fantastic taxes, including a tax on wigs, or had to hand in the bristles of the swine they slaughtered, the king proposing to start a trade in bristles. The peasant had to spare the wild swine which trod down his field for the new king to shoot, and antelopes and aurochs were imported into Prussia.

It was fortunate that the son was once more of the economic, efficient type Frederick William I. (1713–40), unfairly overshadowed by the figure of his son, was one of the best rulers in Prussia. Short, fat, sound and active, pious, moral and thick-skulled, looking like a peasant whenever he laid uniform and pigtail aside, he stood four-square in life and in the State, asking none, always commanding, but usually commanding the right thing. His first act was to clear away all the paternal luxury, to send the favourites packing, to order simplicity in all things; for he had only one idea—economy. Simple in manner, more of a burgess than a king, he liked thick soups, drank thin beer, smoked moderate shag in his pipe, and only now and then let his ministers invite him to delicacies on which he would fall half in mockery, half in enjoyment. His idea of his post was that of a father of a family—a despotic one, of course. He interfered in everything, took account of no laws, clapped his bad ministers of State into jail, woke up the porters who kept people waiting, forced the rich burgesses of Berlin to build houses, forced his generals to buy the bad portraits of them that he insisted on painting in the evenings; ran, rode and drove about from five in the morning to six in the evening, inspecting, giving orders, and always finding fault.

All the same, he was usually just, and was popular, did everything for the country, nothing for himself and little for the upper classes. Out of the nobles, in particular, he squeezed so many taxes that they complained to the imperial council in Vienna, and won their appeal. Yet the king went on threatening them: "I will stabilize the sovereignty and set the crown as fast as a rock of bronze! I am king and lord, and will do what I wish! Holiness is God's, but all else must be mine!" But his severity grew milder as it reached the lower classes, worthy burgesses might rise to high posts, bad counts were thrown out, the peasant prospered again throughout the land. Tax-farmers and officials were punished for abuses, sometimes even hanged for them. When ravaged districts were to be restored, the king gave the money himself, rewarded every man who built a new house there with a post,

enlarged Berlin, made his residence in Potsdam, cut out all the sinecures at court, founded the *Kammergericht*, a treasury department to check expenditure and most important of all, the State Exchequer.

It was iron discipline; but the land prospered and got back much of the power and solidity which the Great Elector had given it. Compulsory military service was introduced in 1726—although only for burgesses and peasants. This compulsion was hated most by the educated classes in the towns, especially as the rules of the service were pedantic. The Great Elector created the Prussian military, but his grandson must answer for the militarism, for then it was that the barrack-yard tone spread like a pestilence through the people, whom the endless years of service spoiled for any more genial regime, so that they tortured themselves and the rest with rudeness and exactitude.

The king had a weakness for "tall fellows," whom he mistakenly held to be the best soldiers. He had the tallest men pressed in all Europe, paid fantastic prices, up to £3,700 a man, for them, spent 12,000,000 thaler on this toy, sold offices for it, broke the law, had giants stolen and carried away from abroad, started a sort of slave traffic, came to the edge of wars—all over the passion which this short, fat man entertained for the tall and slender. Here his piety and his economy broke down.

As he looked after the state like a *pater-familias*, so in his house he played the king, and with the best will in the world, he would have broken up any family life. Aghast, he saw his children go over into inevitable opposition, the daughters reading French books, the son playing the flute in a silk dressing-gown, instead of practising musket-drill as he should have done, having been born, as it were, in uniform. Finding in the crown prince the weaknesses and vanities of his own father renewed, he saw that they must be destroyed, and thrusting a cruel hand into the tangled woof of a complex young soul, driving a young man to desperation, by that very act he saved just what his nature held of genius. But for the horrors endured in his youth, Frederick II. would never have become "the Great." His father served Prussia well in many respects, and not least in saving his son for the State and for history.

Frederick the Great.—For Frederick II. (1740–86) was decidedly what his father called him, an "effeminate fellow." Things came to a crisis over a marriage which the young prince was to have concluded with the daughter of the king of England, but his father spoiled it. Even before this, at 16, when on a visit to the court at Dresden, he had made the acquaintance of another world, and thereafter shunned military service, accumulated debts and scandals, till his father, in a rage, beat him in the presence of strangers and once came near running him through. Then the prince tried to escape over the frontier, at some manoeuvring in the west, was hailed back, thrown into jail, with a friend who had helped him was sentenced to be shot as a deserter, was pardoned, but forced to see Katte, his friend, beheaded before his eyes, and finally came out of this affair, after a time of complete spiritual collapse, a changed man. He had become a cynic.

At first he began to study the country only to please his father, but he learned to value a fruitful activity and when the king, in his last years, saw the prince busy about his future task, he relaxed the military fetters, allowed him, when his work was done, to occupy himself, generally far from his unloved wife, with the teachings of Voltaire, with giving concerts in his country palace; for the king looked on all this only as a sort of recreation, like his own, which he mostly took in a room full of tobacco smoke, among doxies and bawdy stories. So it came that when he died, he called himself fortunate to have left such a son behind.

The young king had no love for the people, whom he called the *canaille*, but still less for the nobles. He loved nothing at all, in fact, except wit and his dogs, and perhaps his sister and a few old soldiers. But he applied that great tolerance which he had learned from Voltaire and from the ideas of Locke, called himself and felt himself the first servant of the State, allowed complete freedom of the press, had a caricature of himself hung lower down in the window, so that the people might see it better, and proclaimed at once that his people were free to be happy in their own fashion.

He abolished the tall fellows at once, but strengthened and enlarged the army, and put a stop to pedantry and brutality. He saved up, and spent little when he built himself a solitary, one-storied country house, the *Sanssouci*, where the best wits, not, indeed, out of Prussia, but mostly out of France, foregathered at his table; for the king was fond of speaking French, which he did as badly as he did German.

As crown prince, mostly out of boredom, he had written a thesis against Macchiavelli's "Prince," based on misunderstandings, but containing some principles which he afterwards followed: "The Prince is not lord, but servant of the people, his power rests in the last end only on the people's choice. No man has the right to allow himself unlimited sway over his fellow-men. Only the tyranny of government brings the peoples to rebellion." These principles of domestic policy accorded with the age and his own ideas; in foreign policy Frederick behaved exactly like Macchiavelli, denying any morality in affairs of State, or any valid consideration except personal interest. Thus, scarcely had he begun to reign, when he provoked a war to conquer Silesia, on which he had no claim. "My age, the fire of my passion" he wrote to a friend, "the thirst for glory, even curiosity, to tell you the whole truth, in short, a secret instinct has torn me out of pleasant ease and the satisfaction of reading my name in the gazettes and the history-books has seduced me." In the first and second Silesian Wars he was able, with the help of his father's army, to conquer this land from Maria Theresa and retain it.

In the decade of peace that followed he lived as a man of the world, not a philosophical one by any means, adorned himself with Voltaire's presence, dabbled in the arts and sciences, kept up the best opera in Europe, was generous towards artists, and wrote his own history so quickly that in 1746 he was already dictating the events of 1745. But when he was half-way through the forties, the consequences of his youthful ambitions rose up before him like black shadows. He saw the revenge of the empress of Austria join hands with the disfavour of the tsarina, the hate of the king of Saxony and the pride of the king of France allied with them, and all at once half Europe stood united against him, to destroy this young kingdom, become too strong.

Frederick went into the Seven Years' War (1756–63) with about 200,000 men against twice the number. This third war, which he had provoked through the conquest of Silesia, brought the enemy as far as Berlin and Sanssouci, and Frederick himself to the verge of despair. In this war a million men fell to no purpose, for it ended on approximately the *status quo ante*. Half of this million were Prussians. Some 30 years after those candid words on thirst of glory and curiosity, Frederick wrote: "Glory is vain. Have men ever deserved praise? They have only been praised because they made a stir." At the Peace of Hubertusburg, Frederick gained nothing, but also lost not so much as a village, although his enemies had meant to break the new great Power into pieces. This result, shattering in both ways, must have shattered the king as well, like the conflict with his father when he was crown prince. For the second time he returned home a changed man.

Although only 52 years of age, he looked an old man; although an old man, he had 23 years before him still. Now he became great. The work of reconstruction to which his conscience, his experience, his age, his loneliness alike urged him, showed him the father of his fatherland; all for the peasant and the poor, all, where possible, against the noble, all always against the idle. He quarrelled with Voltaire and most of the other Frenchmen; his sister was dead, his oldest friends were ageing around him, the circle fell silent, dust lay on the flute; only the greyhounds loved him, lay in his chairs, in his bed, and when they died, he set up marble memorials to them. In his will he wrote that he wanted to be buried beside them. He could still be interested in the French spirit, but the German was foreign and unsympathetic to him. That Kant, a Prussian professor, was building up a new world, that Herder and Klopstock, Lessing and Wieland were writing quite near him, he was unaware, or else disliked it; he wrote a sneering pamphlet against Goethe's *Götz von Berlichingen*; the fact was, he was neither philosopher nor poet, only a dilettante, and not even a good one.

On the other hand, he worked harder than any man in his State, harder, too, than any Hohenzollern before or after him. He drained morasses, planted woods, made roads, built countless houses, went on tours of inspection among his people, distrusted his officers, backed up the peasant against the count, even when he was in the wrong, and now lived truly in the heart of his people. At 70 he wrote, in the true spirit of Voltaire and the old Faust: "He who improves his land, makes waste land fruitful, and who drains swamps, he wins victories over barbarism."

Weak Monarchs.—His successor was one more of the bad sort. Frederick's nephew, Frederick William II. (1786–97), lazy and sensual, vacillating and romantic, managed in the single decade of his reign to squander on favourites, male and female, half of what his predecessors had spent seven decades in accumulating, and what chance brought him through a partition of Poland and a heritage in his own family was never assimilated and soon lost. The army soon became undisciplined, and when it was sent to fight the French revolution, it dared not even attack it. The day of Valmy, no victory for the French, yet made the deepest impression, for all Europe said that the army of Frederick the Great had ceased to fight.

The next one, too, was weak and without talent, although his life was simple, sober and respectable. Frederick William III. (1797–1840) imitated his ancestors' policy in the Thirty Years' War, and tried to preserve neutrality through the tempests of the Napoleonic Wars. He watched his neighbours' lands occupied, unperturbed, always spoke of "soothing" (which was not very appropriate) Napoleon, refused to listen to his wife, the talented and ambitious Queen Luise, and then suddenly found himself forced into war, after all, and at the Battle of Jena (1806) lost the fame of Frederick's army, and in the Peace of Tilsit lost more than half of his possessions—everything, in fact, west of the Elbe. He failed to recognize the natural saviour who offered himself to him, the Freiherr von Stein, one of Prussia's two great statesmen, and when von Stein made his entry into the Government conditional on the dismissal of the intriguing privy council, the king wrote to him: "You are a recalcitrant, stubborn, obstinate and disobedient servant of the State, full of your own genius and talents, and instead of looking to the good of the State, led only by caprices, swayed by passions and personal animosity."

All the administrative reforms which Stein and Hardenberg effected, were done in the king's despite; he was drawn into the Wars of Liberation and the alliance with Russia in 1813 against his will, he took no personal part in any battle, but entered conquered Paris in state. For all that, the popular struggle against France evoked the first democratic movement in Prussia. The towns got back the self-government filched from them 300 years before, in another form, the term of general military service was fixed at three years, the conduct of the State was concentrated in the hands of a ministry, which, however, was only empowered to debate, and not to decide. The grant of a constitution now could have bound together the disunited nations of the State, one third of which, into the bargain, were Catholics—a further point of difference. The king promised, indeed, in 1815, just before the last war against Napoleon, the rudiments of a constitution, which involved no losses for him, as the Estates envisaged were also only to have an advisory voice.

When the people had driven out the conquerors, it was quickly forgotten. The reaction, led by part of the Prussian nobility, fed by Metternich in Vienna, conquered in Prussia also; the Holy Alliance testified that kings were appointed by God, the fall of the Corsican willed by God, and the princes, therefore, infallible in their way. The king threw himself against the popular movement, dissolved athletic and students' associations, suppressed dangerous books and papers, dismissed professors, threw the most popular leaders into prison, punished every request for fulfilment of his promise as treasonable, filled the country with police and spies, or at least, was glad to let his servants do so.

The son was exactly such a failure as his father: Frederick William IV. (1840–61), a man of decided talent, but weak, confused, romantic; in person short-sighted, slovenly, thin-haired, he never dared do what he would, and only took a definite decision to abandon it as soon as taken. Liberal, like all crown princes, before his accession, he soon disappointed the people. The guiding idea of the day, citizenship, the contract between prince and people, he dismissed as nonsense, the sovereignty of the people he described as the principle of evil in the world, and tried vainly to gloss over his hostility to the people by smooth phrases.

It was only seven years later that he began to notice the gathering storms, and under the pressure of public opinion, convoked, in the shape of the "united diet" (1847) the first parliament that Prussia had seen, graded on the caste system, but yet empowered to reject State loans or taxes. In his very first speech, however, the king took everything back, declaring it to be God's will that he should reign—he was always adept at hiding his own fear of the people under a mystic light. The diet was closed again immediately, with nothing accomplished; but the February revolution in Paris soon after strengthened the people's forces in Berlin. When revolution broke out there in March 1848, when the people of Berlin broke their oath of loyalty exactly 400 years after they had sworn it, the king hesitated, characteristically, assembled troops, but immediately afterwards, in his mortal fear, issued a Patent promising a Liberal Constitution, which he proclaimed in person from the balcony of his palace.

Those first shots which can never be prevented in any riot, were fired by the military. Two hours later, 200 barricades had been erected in Berlin. The troops had the upper hand in the fighting, but the next day the king issued a proclamation "to my dear Berlin," begging the people to disperse quietly, and withdrew his own troops. He sat in his palace, irresolute, listened to all councils, approved a citizens' defence corps, proclaimed an amnesty, ordered a new ministry, till the beaten bourgeoisie were turned into victors by the Crown's timidity. Three days later there appeared an unintelligible proclamation, saying "Prussia was to be absorbed in Germany" and the king would take his place at the head of Germany. Elections were held for a parliament for Prussia and one for Germany. When the latter, sitting in Frankfurt, elected the king German emperor, on April 3, 1849, those who were nearest to him did not know whether he would accept or refuse the crown. Up to the last moment his chief intimates believed that he would accept. Suddenly he refused.

Out of fear of a coalition which threatened to form against him under Austria's leadership, he dropped all plans for uniting Germany, but took the oath to the new Prussian Constitution before the two Chambers. This reproduced the principles of the modern constitutions of other countries; but the ministers were still responsible to the king alone, who enjoyed the sole right of appointing them, and also the sole right of concluding treaties with foreign powers, and declaring war or concluding peace at discretion. Only the spirit of an absolutism 400 years old was capable of burdening itself with this two-fold responsibility which the king of Prussia received, and indeed, really assumed for the first time before the whole people, without himself being responsible to anyone but God. At the same time, these two most dangerous clauses cut the people off from any attempt to educate themselves politically, and gave the citizens an excuse for living on as subjects. Only so can it be explained how these provisions lived on into the 20th century. The next decade passed in Prussia amid the growing discontent of the Liberals, and the growing irritability of the sick king, till the king, too late, was declared of unsound mind and his brother became regent, and afterwards successor to the throne.

The German Empire.—William I. (1861–88) ascended the throne as a man of almost 64 years of age, and no one could have anticipated that he would retain it till his 91st year. He was suspect to all Liberals on account of his attitude in the days of the revolution, when he had had to escape out of the country, and sealed his unpopularity when, in Sept. 1862, he could find no other way out of the internal impasse than to appoint the notorious Junker, Otto von Bismarck-Schönhausen, his minister. That he kept, on the whole, on friendly terms with this man for 26 years without a break, in spite of many conflicts of opinion, and although he was convinced that he ruled by Divine Grace and at heart felt no greater inclination towards intimacy with a Junker

than with any other mortal, cannot be explained only by the successes of his minister. It is also a proof that this truly honest and chivalrous old gentleman admitted to himself the superiority of his servant, who, indeed, treated him like a master, and sometimes too, being nearly 20 years the junior, like a son. Besides, William was past the vagaries of youth and the ambition of manhood, and would have liked best to yield to old age's need of rest, had not his minister's uncanny energy led him ever onward on the path of daring.

For the King began by objecting to all the three wars which Bismarck had decided to wage, to put Prussia at the head of Germany, and thus to solve the German question without and against Austria. In 1864, 1866 and 1870 he swore not to draw the sword, yet in the end his adviser wrung his consent from him. Before the Schleswig-Holstein war he said that he really had no rights at all to these two duchies; before the war against Austria, that he would never shed German blood; before the war against France he gave way to Napoleon's and Grammont's arrogant demands to the limit of what was possible. But when he was swimming on the full tide of victory, it was only with great difficulty that he could be restrained by Bismarck's foresight from impolitic immoderation. He neither understood nor liked Bismarck's consistent purpose, for if Bismarck cared more for Prussia's greatness than for Germany's unity, the king cared even less for Germany, and he refused for weeks to assume the imperial title, which he thought looked "like a major's title," while clinging to the insignia of Prussia, like his brother before him, who had also refused to become emperor.

None of the important steps in the king's career were due to his own initiative; in fact, at the decisive moments at Nikolsburg, Gastein and Versailles, Bismarck had always had to employ threats of resignation, nervous breakdowns and outbursts of tears, before he got his way. "I carried him on my shoulders on to the imperial throne," he said afterwards, and it was true. In the end the king was so angry with him over the whole emperor business, that when he descended from his throne in the Hall of Mirrors at Versailles, on Jan. 18, 1871, he walked past Bismarck without a word, when he went to thank his generals.

The old monarch long remained strange to his people, and it was only through the surprising elevation of his position, and especially through his more than patriarchal age, that he achieved a gradual and tardy popularity. He always remained simple and very economical, as he had been brought up to be in Prussia's lean years; slept and died in his iron camp bed, but left over 20,000,000 marks. But he had a really warm and tactful heart, and like a true king, always managed to leave his chancellor a free hand and all possible glory, without losing any of his own natural dignity. This, and the loyalty with which he stood by his chief minister, although the great nobles tried very hard for years, and his wife for decades, to separate them, the gratitude with which he heaped honours and riches on the founder of his empire—this combination of qualities was not to be found in any of his ancestors. For all his unsophisticated mind, for all his narrow upbringing, William I., with his courage, his piety and his kingly nature was always a true nobleman.

His son, who mounted the throne a dying man, and ruled only 100 days, as Frederick III., had won by his share in famous battles, his good looks, and above all, his sorrows, a popularity which he bore with exemplary patience. In character he belonged rather to the romantic type of the family; when the empire was being founded, he proposed that the other princes should be compelled to do homage; he adored old thrones and brilliant pageants, and only betrayed his domineering instincts so seldom as he did because the superior intelligence of his wife, Victoria of England, primed him with democratic demands or catch-words.

The Ambitions of William II.—William II. (1888–1918) inherited both his mother's great gifts and her dilettantism, with his father's love of display; together with other ancestral qualities which Bismarck, in his character-sketch of the last emperor, summed up as follows: "From Frederick I. he inherited love of display, vanity and an autocratic nature; from Frederick William I. only the taste for tall fellows; from Frederick the Great only the love of interfering in his officials' business; from Frederick William II. a mystic turn and strong sexual impulses, from Frederick William IV. the desire to talk a lot."

The dangerous mixture of weaknesses and talents, in both of which William II. was rich, of vanity and timidity, both of which were equally strongly developed in him, is only partly to be explained by the withered arm which all his life he hid from the world and tried to overcome in his own soul by an exaggeratedly manly and military manner. An over-strict upbringing, especially from his mother, who was estranged from him, gave him, too, an unhappy youth reminiscent of the repression suffered by Frederick the Great. In this case, however, there was no instruction to mature the prince, no restraint to moderate him. On the contrary, fate willed it that at 29, suddenly and almost unprepared, he should inherit an empire which had grown steadily in power as he grew from boyhood to manhood. Could it be wondered at that the young monarch, impelled by the will to please, bemused with ideas of God's peculiar grace, inspired with the rise of his house, too long repressed, too suddenly master, began to follow the promptings of his vanity rather than of his duty? And how was a State whose constitution was still practically the same as in 1850, whose citizens had no political experience and in which the higher officials and officers had for centuries been drawn almost exclusively from the nobility—how was such a State suddenly to produce men with the courage to turn their backs on the throne, or even to warn the king? The empire was at its zenith. What could happen to it with the strongest army in the world, and an officialdom which ran as smoothly and as incorruptibly as a machine?

When the young emperor overthrew the old chancellor in March 1890, after 28 years' service, in the same brutal way as Frederick I. of old had cast aside his minister Danckelman and as William had suggested in talk among his friends, nothing hindered him from making himself supreme except lack of Frederick the Great's genius. He did not, indeed, like Frederick, unleash a war, for all his life, in natural and explicable fear he dreaded nothing so much as the danger of battle and war; but he dissolved the treaty with Russia on which Bismarck had bound the security of the empire. Almost at the same moment as William dismissed Bismarck, he cut the wire which linked Berlin to Petersburg, and so cleared away the obstacle which had kept the tsar aloof from a French *rapprochement;* and thus William opened the door for that war on two fronts which Bismarck, with an eye to Germany's unfavourable situation, had managed for three decades to prevent.

From now onward, the encirclement of Germany proceeded the more inevitably, as William, out of personal hatred of his uncle, Edward VII. of England, rejected every advance from England, even the offer of an alliance from Chamberlain, and instead of this aspired to colonies and began to build a great fleet—two things that Bismarck had avoided on the principle that Germany's dangerous situation forbade her from engaging in any adventures abroad. All these enterprises were accompanied by a flood of high-flown and even provocative speeches, the echoes of which made the cabinets of Europe, and the peoples too, uneasy for 25 years. To shout down his weakness, the emperor in these hundreds of public speeches proclaimed again and again his phrases of the shining armour, of the victorious German sword, of the mailed fist, Nibelungen loyalty and Neptune's trident, until the world he addressed held him for a warlike conqueror, only waiting for the moment to fall upon his neighbours.

In reality he was pushed on by the little military circle, that, in Prussia as everywhere else, was urging new wars after a generation of peace, called him a coward in secret, and thought out machinations how to bring him from words to deeds, from threats to mobilization. The middle classes listened with ironic smiles, paid less and less attention to these speeches every year, and buried themselves in business, which was flourishing everywhere. Only the workmen and Socialists, in their press, brochures and speeches uttered warnings, year after year, against the dangers of the ever-increasing boasting and court display. When the consequences of the imperial speeches became a national danger, in Nov. 1908, over an incautious interview in the *Daily Telegraph,* and all Germany arose and demanded a remedy, it was not the

Socialists, but members of the highest nobility who debated whether the emperor should not be put under control, as of unsound mind.

The murder of the Austrian heir to the throne in July 1914 was a personal blow to William, because the victim was his friend, and a prince by God's grace as well; his mind, too, appears at the time to have been in a state of maniac excitement, so that he encouraged the bellicose cabinet of Vienna with violent words, letters and marginal notes, and promised them help. Three weeks later, when all was lost, and his mind was passing through a state of less exaltation, his anger burned out, he shrank away from the threatening spectre of war, which he, oftenest of all men, had evoked, and sought at the last moment to avoid it. When the first signs of unrest began among a starving, bleeding people, he thought it could be crushed by force, as in peace. It was only when the general collapse began, in Oct. 1918, that in a memorable scene he sanctioned the new constitution, even as Frederick William IV. had not promised his till the first shots were heard in Berlin; and thus in the last weeks of his reign, against his declared will, yet founded that new democratic Germany in which ministers rule instead of kings, and are nominated by a people's parliament.

In vain first Wilson in America, then a section of public opinion in Germany, appealed to him to abdicate, to ease the situation of his country. He remained, until in the first days of November, the people rose in different cities and ports, and demanded his abdication. Even on Nov. 8, when his cousin and chancellor, Prince Max of Baden, himself proposed his abdication as a means of saving the monarchy, which could easily have been carried on by his grandson, a minor, the emperor refused, and in the end, when at last the capital itself rose, declared that he would abdicate as emperor, that is, from the empty title, but not from his place of real power as king of Prussia. But on the morning of the 10th, fear of sharing the fate of the tsar, and the advice of his Field-marshal Hindenburg sent him fleeing out of his country over the frontier into Holland.

Two hundred years earlier his forebear, the young Frederick the Great had planned to escape over the frontier, and had only been detained by a chance. Then his father's will had been that that prince should be shot for a deserter. Now the news that the Supreme War Lord had forsaken his country, in uniform, at the moment of her greatest need, evoked in the people neither hate nor rage, only an immense disappointment; for except the higher nobility, who knew the emperor's character, none of his enemies would have believed a Prussian king capable of such conduct. It destroyed the belief of the Prussians in the military basis of their State, which had been instilled into them for centuries as a maxim of morals and honour, and a great illusion fell shattered round the heads of loyal and faithful millions. Prussia and Germany became republics, not because the time was ripe, but because all their princes had become degenerate and defenceless, and vacated their 20 thrones without a blow.

Thus ended the dynasty of the Hohenzollerns, at the height of their power, after rising from burggrafs to emperors, from rulers of one million to 36,000,000, from a vassal state to the heads of Germany. Yet the deeds of the best Hohenzollerns were not in vain. It was only through their work and energy in welding the land together out of so many different parts that it was able to survive the fall of the dynasty without dissolving into its component parts; and only because Bismarck had united the many German states into one State could that *Reich* still survive, after the fall of so many dynasties, beaten in the field, compassed about by victorious enemies and temptations to secede. The best of the Hohenzollerns have their reward in history in the solidity of the German Republic as a national and linguistic unit. (E. Lud.)

Bibliography.—See *Monumenta Zollerana*, edited by R. von Stillfried and T. Märker (1852–90); *Quellen und Untersuchungen zur Geschichte des Hauses Hohenzollern*, edited by E. Berner (1901 fol.); R. von Stillfried, *Altertümer und Kunstdenkmale des erlauchten Hauses von Hohenzollern* (1852–67) and *Stammtafeln des Gesamthauses Hohenzollern* (1869); L. Schmid, *Die älteste Geschichte des erlauchten Gesamthauses der königlichen und fürstlichen Hohenzollern* (Tübingen, 1884–88); E. Schwartz, *Stammtafel des preussischen Königshauses* (Breslau, 1898); *Hohenzollernsche Forschungen, Jahrbuch für die Geschichte der Hohenzollern*, edited by C. Meyer (1891–1902); *Hohenzollern Jahrbuch, Forschungen und Abbildungen zur Geschichte der Hohenzollern in Brandenburg-Preussen*, ed. Seidel (Leipzig, 1897–1903); J. Höfner, *Die Hohenzollern und das Reich* (1918); H. Eulenberg, *Die Hohenzollern* (1926); E. Ludwig, *Wilhelm der Zweite* (1926; Eng. trans. E. C. Mayne, 1926). *See* also Prussia; Brandenburg; Germany, and the separate biographical articles on the Kings of Prussia and the German emperors.

HOKAN. This term unites as genetically related a number of North American Indian linguistic stocks, scattered over a large area and previously considered distinct. Dixon and Kroeber in 1913 (*Amer. Anthropologist*, vol. xv.) coined the name from the word for "two" in some north Californian dialects, including in the family Shasta (*q.v.*), Achomawi, Karok, Chimariko, Pomo (*q.v.*), Yana, Esselen, Yuman (*q.v.*), and subsequently Salinan, Chumash (*q.v.*), Washo, all in or near California, and Seri (*q.v.*) in Sonora and Tequistlatecan in southern Mexico. Sapir (*Intern. Journ. Am. Linguistics*, vol. i. 1920) added Coahuiltecan Karankawa, Tonkawa, and in 1925, (*Am. Anth.*, vol. xxvii.), Subtiaba in Nicaragua, suggesting further that Siouan, Muskogi, Caddo and Iroquois would ultimately prove to be related to Hokan-Coahuiltecan. The historic significance of these linguistic determinations, if confirmed, is considerable, but some authorities (Boas, Goddard, Michelson, Yhlenback) remain unconvinced of the validity even of the narrower Hokan family in California, though others (Rivet, W. Schmidt) accept the full findings. (A. L. K.)

HOKKAIDO, the Japanese name for the northern division of the empire (*Hoku* = north, *kai* = sea, and *do* = road), including Yezo, the Kuriles and their adjacent islets.

HOKUSAI KATSUSHŪKA (1760–1849), the greatest of all the Japanese painters of the Popular School (*Ukiyo-ye*), was born at Yedo (Tōkyō) in the 9th month of the 10th year of the period Horeki, *i.e.* Oct.–Nov. 1760. He came of an artisan family, his father having been a mirror-maker, Nakajima Issai. After some practice as a wood-engraver he, at the age of eighteen, entered the studio of Katsugawa Shunshō, a painter and designer of colour-prints of considerable importance. His disregard for the artistic principles of his master caused his expulsion in 1785; and thereafter—although from time to time Hokusai studied various styles, including especially that of Shiba Gokan, from whom he gained some fragmentary knowledge of European methods—he kept his personal independence. For a time he lived in extreme poverty, and, although he must have gained sums for his work which might have secured him comfort, he remained poor, and to the end of his life proudly described himself as a peasant. He illustrated large numbers of books, of which the world-famous *Mangwa*, a pictorial encyclopaedia of Japanese life, appeared in 15 volumes from 1812 to 1875. Of his colour-prints the "Thirty-six Views of Mount Fuji" (the whole set consisting of 46 prints) were made between 1823 and 1829; "Views of Famous Bridges" (11), "Waterfalls" (8), and "Views of the Lu-chu Islands" (8) are the best known of those issued in series; but Hokusai also designed some superb broadsheets published separately, and his *surimono* (small prints made for special occasions and ceremonies) are unequalled for delicacy and beauty. The "Hundred Views of Mount Fuji" (1834–1835), 3 vols., in monochrome, are of extraordinary originality and variety. As a painter and draughtsman Hokusai is not held by Japanese critics to be of the first rank, but this verdict has never been accepted by Europeans, who place him among the greatest artists of the world. He possessed great powers of observation and characterization, a singular technical skill, an unfailing gift of good humour, and untiring industry. He was an eager student to the end of his long life, and on his deathbed said, "If Heaven had lent me but five years more, I should have become a great painter." He died on May 10, 1849. (E. F. S.)

See E. de Goncourt, *Hokusaï* (1896); M. Revon, *Étude sur Hokusaï* (1896); C. J. Holmes, *Hokusai* (2nd ed., 1900); E. F. Fenollosa, *Catalogue of the Exhibition of Paintings by Hokusai at Tōkyō* (1901); E. F. Strange, *Hokusai* (1906). Perzynski. *Hokusai* (2nd ed., 1908); Vignier & Inada, *Yeishi, Choki, Hokusai* (1913); and Focillon, *Hokusai* (1914).

HOLBACH, PAUL HEINRICH DIETRICH, Baron d' (1723–1789), French philosopher and man of letters, of German origin, was born at Heidelsheim in the Palatinate. Holbach kept

open house in Paris for Helvétius, D'Alembert, Diderot, Condillac, Turgot, Buffon, Grimm, Hume, Garrick, Wilkes, Sterne, and for a time J. J. Rousseau. For the great *Encyclopédie* he compiled and translated a large number of articles on chemistry and mineralogy, chiefly from German sources. In 1767 *Christianisme dévoilé* appeared, in which he attacked Christianity and religion as the source of all human evils. This was followed up by other works, and in 1770 by a still more open attack in his most famous book, *Le Système de la nature,* in which he was probably assisted by Diderot. Denying the existence of a deity, and refusing to admit as evidence all *a priori* arguments, Holbach saw in the universe nothing save matter in spontaneous movement. What men call their souls become extinct when the body dies. Happiness is the end of mankind. "It would be useless and almost unjust to insist upon a man's being virtuous if he cannot be so without being unhappy. So long as vice renders him happy, he should love vice." Not less direct and trenchant are his attacks on political government, which, interpreted by the light of after events, sound like the first distant mutterings of revolution. Holbach exposed the logical consequences of the theories of the Encyclopaedists. Voltaire hastily seized his pen to refute the philosophy of the *Système* in the article "Dieu" in his *Dictionnaire philosophique,* while Frederick the Great also drew up an answer to it. Though in some passages clear and eloquent, the style of the *Système* is diffuse and declamatory, and asserts rather than proves its statements. Its principles are summed up in a more popular form in *Bon Sens, ou idées naturelles opposées aux idées surnaturelles* (Amsterdam, 1772). In the *Système social* (1773), the *Politique naturelle* (1773–74) and the *Morale universelle* (1776) Holbach attempts to rear a system of morality in place of the one he had so fiercely attacked, but none of his later writings had a tithe of the popularity and influence of his earlier work. J. J. Rousseau is supposed to have drawn his portrait in the virtuous atheist Wolmar of the *Nouvelle Héloïse.* He died on Jan. 21, 1789.

For further particulars as to his life and doctrines *see* Grimm's *Correspondance littéraire,* etc. (1813); Rousseau's *Confessions;* Morellet's *Mémoires* (1821); Madame de Genlis, *Les Diners du Baron Holbach;* Madame d'Épinay's *Mémoires;* Avezac-Lavigne, *Diderot et la société du Baron d'Holbach* (1875); T. Morley, *Diderot* (1878); N. P. Cushing, *Baron d'Holbach* (1914); R. Hubert, *D'Holbach et ses Amis* (1928).

HOLBEACH, a market town in Holland, Lincolnshire, England, on the M. and G.N. railway, 23½ m. N.E. of Peterborough. Pop. of urban district (1921) 5,382. All Saints' Church, with a lofty spire, is late Decorated. The grammar school, founded in 1669, occupies a building erected in 1877. Roman and Saxon remains have been found, and the market dates from the 13th century. There is some work in textiles, while brewing and malting are carried on.

HOLBEIN, HANS, the elder (*c.* 1460–1524), belonged to a celebrated family of painters in practice at Augsburg and Basle from the close of the 15th to the middle of the 16th century. He was born at Augsburg between 1460 and 1470, the son of Michael Holbein, a tanner; the brother of Sigismund and the father of Ambrosius and of Hans Holbein the Younger, all three painters. His name appears in the books of the tax-gatherers of Augsburg from 1494 onwards. Previous to that date he was a painter of name, and he executed in 1493, for the abbey at Weingarten, the wings of an altar-piece representing Joachim's Offering, the Nativity of the Virgin, Mary's Presentation in the Temple, and the Presentation of Christ, which now hang in separate panels in the cathedral of Augsburg. In these pieces and others of the same period, for instance in the altarpiece from the Chapel of St. Afra at Augsburg (1496) two parts of which are in the bishop's palace at Eichstätt, and in the "Coronation of the Virgin" in the Museum of Basle, we mark the impress of the school of Van der Weyden. In 1501 Holbein went to Frankfurt to paint the high altar for the Dominican monastery. In this task he was assisted by his younger brother, Sigismund, and by Leonhard Beck (museum at Frankfurt). After this date there is a marked change of style due, it is suggested, to his coming in touch with Mathias Grünewald in Frankfurt. In later works, such as the Basilica of St. Paul (1504) in the gallery of Augsburg, the wane of Flemish influence is apparent. But this altarpiece, with its quaint illustrations of St. Paul's life and martyrdom, is not alone of interest because its execution is characteristic of old Holbein. It is equally so because it contains portraits of the master himself, accompanied by his two sons, the painters Ambrose (*c.* 1494–*c.* 1519) and Hans the younger. Later pictures, such as the Passion series in the Fürstenberg gallery at Donaueschingen, or the "Martyrdom of St. Sebastian" in the Munich Pinakothek, contain similar portraits, the original drawings of which are found in old Holbein's sketch-book at Berlin. A self portrait in Silverpoint is in the museum at Chantilly.

After 1516 Hans Holbein the elder appeared as a defaulter in the registers of the tax-gatherers at Augsburg. He died at Issenheim in 1524. His art is distinguished for its delicate colour, its deep soft shadows; and for its lifelike portraiture. The elder Holbein belonged to the transition period, which preceded the Renaissance and in his later work he began to introduce Italian Renaissance ornaments. He was a prolific artist. Earlier than the Basilica of St. Paul, already mentioned, is the Basilica of St. Mary Maggiore, and a Passion in 11 pieces, in the Augsburg gallery, both executed in 1499. The Passion of Donaueschingen was finished after 1502, in which year was completed the Passion of Kaisheim, a conglomerate of 16 panels now divided amongst the galleries of Munich and Augsburg. Two altarpieces of the same class, commissioned for the monastery of St. Moritz at Augsburg in 1504–08, have been dispersed and lost. 1512 is the date of "The Miracle of St. Ulrich" for the Augsburg gallery. A portrait of an old man, dated 1513, is in the collection of Count Lanckoronski at Vienna. One of the most important works of the late period is "The Well of Life" (1519) in the museum at Lisbon. The sketch-books of Berlin, and the drawings at the museum of Basle give a lively picture of the forms and dress of Augsburg residents at the beginning of the 16th century. They comprise many portraits. He also made designs for glass painting. In the cathedral of Eichstätt in the churches of St. Ulrich at Augsburg and of St. James at Straubing windows designed by him are still to be seen.

See C. Glaser, *Hans Holbein der Ältere* (Leipzig, 1908).

HOLBEIN, HANS, the younger (1497–1543), German painter, son of Hans Holbein the elder, was born at Augsburg in 1497. He received the first lessons from his father. In 1515 he went to Basle with his brother Ambrosius and probably worked as an apprentice under Hans Herbst. One of his first patrons is said to have been Erasmus, for whom, shortly after his arrival, he illustrated with pen-and-ink sketches an edition of the *Encomium Moriae,* now in the museum of Basle. He designed titlepage-blocks and initials for new editions of the Bible and classics issued from the presses of Froben and other publishers; and executed some rough painter's work, a schoolmaster's sign in the Basle collection, a table with pictures of St. Nobody in the library of the University at Zurich. In contrast with these coarse productions, the portraits of Jacob Meyer and his wife in the Basle museum, one of which purports to have been finished in 1516, are miracles of workmanship. Two exquisite studies in silverpoint for these portraits are in the same collection. In 1517 Ambrosius matriculated in the guild of Basle; Hans went to Lucerne, where he was employed to paint in the house of Jacob Hertenstein. The portrait of young Benedict Hertenstein in the Metropolitan Museum of Art, New York, was executed at this time. In 1519 Holbein reappeared at Basle where he matriculated and, there is every reason to think, married.

Whether, previous to this time, he took advantage of his vicinity to the Italian border to cross the Alps is uncertain. Van Mander says that he never was in Italy; yet the spirit of Holbein's compositions for the Basle town hall, the scenery and architecture of his numerous drawings, and the cast of form in some of his imaginative portraits, make it likely that he should have felt the direct influence of north Italian painting. The Swiss at this period wandered in thousands to swell the ranks of the French or imperial armies fighting on Italian soil, and the road they took may have been followed by Hans on a more peaceful mission. The "Flagellation," and the "Last Supper" at Basle executed 1519–20 show

some acquaintance with Lombard methods of painting, whilst in other pieces, such as the series of the Passion in oil in the same collection, the modes of Hans Holbein the elder are agreeably commingled with a more modern, it may be said Italian, polish. The "Man of Sorrows and the Virgin" are set in Italian Renaissance architecture; the decoration of the walls of the house "Zum Tanz" with simulated architectural features of a florid character is Italian in conception; and his wall paintings in the town hall, if we can truly judge of them by copies, reveal an artist not unfamiliar with north Italian composition, distribution, action, gesture and expression. In his drawings too, particularly in a set representing the Passion at Basle, the arrangement, and also the perspective, form and decorative ornament, are Italian in spirit. Contemporary with these, however, and almost inexplicably in contrast with them as regards handling, are portrait drawings which are finished with German delicacy, and with a power and subtlety of hand seldom rivalled in any school. Curiously enough, the same contrast may be observed between painted compositions and painted portraits. The "Bonifacius Amerbach" of 1519 at Basle is acknowledged to be one of the most complete examples of smooth and transparent handling that Holbein ever executed. His versatility at this period is shown by a dead Christ (1521), a corpse in profile, and a set of figures in couples; the "Madonna and St. Pantalus," and "Kaiser Henry with the Empress Kunigunde" (1522), originally composed for the organ loft of the Basle cathedral, now in the Basle museum. Equally remarkable, but more attractive, though injured, is the "Virgin and Child between St. Ursus and a bishop," in the gallery of Solothurn. This picture is dated 1522, and seems to have been ordered for an altar in the minster of St. Ursus of Solothurn by Nicholas Conrad, a captain and statesman of the 16th century, whose family allowed the precious heirloom to fall into decay in a chapel of the neighbouring village of Grenchen.



BY COURTESY OF F. A. STOKES CO.

ONE OF THE 58 WOODCUTS DESIGNED BY HANS HOLBEIN, THE YOUNGER, FOR THE "DANCE OF DEATH"

Numerous drawings in the spirit of this picture, and probably of the same period in his career, might have led Holbein's contemporaries to believe that he would make his mark in the annals of Basle as a model for painters of altarpieces as well as a model for pictorial composition and portrait. He was gaining a freedom in draughtsmanship that gave him facility to deal with any subject. Though a realist, he was sensible of the dignity and severity of religious painting. His colour had almost all the richness and sweetness of the Venetians. Amongst the portraits which he executed in these years are those of Froben, the publisher, known only by copies at Basle and Hampton Court, and Erasmus, who sat in 1523, as he likewise did in 1530, in various positions, showing his face threequarters as at Longford, Basle, Parma and New York, and in profile as in the Louvre or at Hampton Court. Besides these, Holbein made designs for glass windows, and for woodcuts, including subjects of every sort, from the Virgin and Child with saints of the old time to the Dance of Death, from gospel incidents extracted from Luther's Bible to satirical pieces illustrating the sale of indulgences and other abuses denounced by reformers. Once only, after 1526, and after he had produced the "Lais" and "Venus and Amor," in the museum at Basle, did Holbein with impartial spirit give his services and pencil to the Roman Catholic cause. The burgomaster Meyer, whose patronage he had already enjoyed, now asked him to represent himself and his wives and children in prayer before the Virgin; and Holbein produced the celebrated altarpiece now in the palace of the ex-grand duke of Hesse at Darmstadt, the shape and composition of which are known to all the world by its copy in the Dresden museum. The drawings for this masterpiece are amongst the most precious relics in the museum of Basle.

The time now came when art began to suffer from unavoidable depression in all countries north of the Alps. Holbein saw that his chances were dwindling to nothing, and armed with letters of introduction from Erasmus to More, he crossed the Channel to England, where in the one-sided branch of portrait painting he found an endless circle of clients. Eighty-seven drawings by Holbein in Windsor castle, containing an equal number of portraits, of persons chiefly of high quality, testify to his industry in the years which divide 1528 from 1543. They are all originals of pictures that are still extant, or sketches for pictures that were lost or never carried out. Sir Thomas More, with whom he seems to have had a very friendly connection, sat to him for likenesses of various kinds. The drawing of his head is at Windsor. A pen-and-ink sketch, in which we see More surrounded by all the members of his family, is now in the gallery of Basle, and numerous copies of a picture from it prove how popular the lost original must once have been. At the same period were executed the portraits of Warham (Lambeth and Louvre), Wyatt (Louvre), Sir Henry Guildford (Windsor), Lady Guildford (New York), all finished in 1527, the astronomer Nicholas Kratzer (Louvre), Thomas Godsalve and his son (Dresden) in 1528. Of the portrait of Sir Bryan Tuke (undated) there are various replicas two of which claim to be original, one in London (Hugh Blaker), the other formerly with Miss Guest of Lunwood is in America. In 1528, Holbein returned to Basle, taking to Erasmus the sketch of More's family.

With money which he brought from London he purchased a house at Basle wherein to lodge his wife and children, whose portraits he now painted (1528). Of this time are the fine portrait drawing of a young man in a large soft hat (Basle), the miniature of Melanchthon (Hanover), and the Bible illustrations known as "Icones." He then witnessed the fury of the iconoclasts, who destroyed in one day almost all the religious pictures at Basle. The municipality, unwilling that he should suffer again from the depression caused by evil times, asked him to finish the frescoes of the town hall, and the sketches from these lost pictures are still before us. His "Rehoboam receiving the Israelite Envoys," and "Saul at the Head of his Array meeting Samuel," testify to Holbein's power, also proved at a later period by the "Triumphs of Riches and Poverty," executed for the Steelyard in London (but now lost).

The year 1530 saw him again on the move, and he landed in England for the second time. Here indeed political changes had robbed him of his earlier patrons. The circle of More and Warham was gone. But that of the merchants of the Steelyard took its place, for whom Holbein executed "The Triumphs of Wealth and Poverty" and the long and important series of portraits that lie scattered throughout the galleries and collections of England and the Continent, and bear date after 1532. The fine "Noli Me Tangere" at Hampton court dates from this period. Then came again the chance of practice in more fashionable circles. In 1533 the "Ambassadors" (London National Gallery), and the portrait of Thomas Cromwell (New York, Frick collection) were executed. Through Cromwell Holbein probably became attached to the court, in the pay of which he appears permanently after 1537. From that time onwards he was connected with all that was highest in the society of London. Henry VIII. invited him to make a family picture of himself, his father and family, which obtained a post of honour at Whitehall. His portrait of the king (Althorp, Earl Spenser) and the beautiful cartoon of a part of this fine piece at Chatsworth enables us to gauge its beauty before the fire which destroyed it in the 17th century. Then Holbein painted Jane Seymour in state (Vienna); he finished the "Southwell" (Uffizi), the "French Ambassador at the court of St. James, Sieur Morette" (Dresden), "Sir Thomas Le Strange" (London, Le Strange), "The Musician" (New York, Henry Goldman), and last, not least, Christine of Denmark (London National Gallery) who gave sittings at Brussels in 1538. During the journey which this worked involved, Holbein took the opportunity of revisiting Basle, where he made his appearance in silk and satin, and, *pro forma* only, accepted the office of town painter. His return to London in autumn enabled

him to do homage to the king in the way familiar to artists. He presented to Henry at Christmas a portrait of Prince Edward (Hanover). Again abroad in the summer of 1539, he painted with great fidelity the princess Anne of Cleves, at Düren near Cologne (Louvre). His portraits up to this time all display that uncommon facility for seizing character which his father enjoyed before him, and which he had inherited in an expanded form. No amount of labour, no laboriousness of finish—and of both he was ever prodigal—betrayed him into loss of resemblance or expression. No painter was ever quicker at noting peculiarities of physiognomy. Yet he was not a child of the 16th century, as the Venetians were, in substituting touch for line. We must not look in his works for modulations of surface or subtle contrasts of colour in juxtaposition. His method was to the very last delicate, finished and smooth, as became a painter of the old school.

Amongst the more important creations of Holbein's later time we should note his "Duke of Norfolk" at Windsor. A portrait of "Catherine Howard" discovered in 1909 is with J. H. Dunn in Canada. Two other portraits of 1541 (Berlin and Vienna), the Falconer at the Hague, and John Chambers at Vienna (1542), are noble specimens of portrait art; most interesting and of the same year is the likeness of Holbein himself, at the Pitti in Florence. Here Holbein appears to us as a man of regular features, with hair just turning grey, but healthy in colour and shape, and evidently well to do in the world. Yet a few months only separated him then from his death-bed. He was busy painting a picture of Henry the VIII. confirming the Privileges of the Barber Surgeons (Lincoln's Inn Fields), when he sickened of the plague and died after making a will, between Oct. 7 and Nov. 29, 1543 in London.

(J. A. C.)

The early authorities are Karel Van Mander's *Het leven d. Nederl. . . . Schilders* (1617) and J. von Sandrart, *Accademia Todesca* (1675). A. F. G. A. Woltmann, *Holbein und seine Zeit* (1874); G. S. Davies, *Holbein* (1903); A. B. Chamberlain, *H. H. the Younger* (1913); P. Ganz, *H. H. der Jungere* (Stuttgart and Leipzig, 1912).

HOLBERG, LUDVIG HOLBERG, Baron (1684–1754), Scandinavian writer, was born at Bergen, Norway, on Dec. 3, 1684. He was early left an orphan, and though his early education was provided by relatives, had a hard struggle at the University of Copenhagen, supporting himself by occasional tutorships. In 1704 he set out on his travels with 60 thaler in his pocket, but fell ill at Aachen, and had to make his way home on foot. In 1706–08 he was at Oxford working in the libraries there. On his return to Copenhagen he began to lecture at the University, and presently received from the king the title of professor for his *Introduction to the History of the Nations of Europe* (1711). He then obtained the Rosenkrantz grant for travel abroad. The years 1714–16 were spent in Italy and France, visiting the great cities. Holberg was still excessively poor, and travelled chiefly on foot. After his return to Denmark in 1716 he published his *Introduction to Natural and Popular Law*, but lived in extreme poverty until in 1718 he was appointed professor of metaphysics, and in 1720 of public eloquence, at Copenhagen.

Hitherto he had written only on law, history and philology, although in a Latin controversy with the jurist Andreas Hojer of Flensborg his satirical genius had flashed out. But now, and until 1728, he created an entirely new class of humorous literature under the pseudonym of Hans Mikkelsen. The serio-comic epic of *Peder Paars*, the earliest of the great classics of the Danish language, appeared in 1719. This poem was a brilliant satire on contemporary manners, and enjoyed an extraordinary success. But the author had offended in it several powerful persons who threatened his life, and if Count Danneskjold had not personally interested the king in him, Holberg's career might have had an untimely close. During the next two years he published five shorter satires. In 1721 Holberg became director of the first Danish theatre in Grönnegade, Copenhagen, where, in Sept. 1722, a Danish translation of *L'Avare* was produced. Until this time no plays had been acted in Denmark except in French and German, but Holberg now determined to use his talent in writing Danish comedy. The first of his original pieces performed was *Den politiske Kandestöber* (The Pewterer turned Politician); and before the end of 1722 he produced *Den Vaegelsindede* (The Waverer), *Jean de France, Jeppe paa Bjerget, and Gert the Westphalian*. Of these five plays, four are masterpieces. Holberg took no rest, and before the end of 1723 the comedies of *Barselstuen* (The Lying-in Room), *The Eleventh of July, Jakob von Thyboe, Den Bundeslöse* (The Fidget), *Erasmus Montanus, Don Ranudo, Ulysses of Ithaca, Without Head or Tail, Witchcraft* and *Melampe* had all been written, and some of them acted. In 1724 the most famous comedy that Holberg produced was *Henrik and Pernille*. But in spite of this unprecedented blaze of dramatic genius the theatre had to be closed for lack of money, Holberg composing for the last night's performance, in Feb. 1727, a *Funeral of Danish Comedy*. This excessive labour for the stage had undermined the poet's health, and in 1725 he had determined to take the baths at Aachen; but instead of going thither he wandered through Belgium to Paris, and spent the winter there. In the spring he returned to Copenhagen with recovered health and spirits, and worked quietly at his protean literary labours until the great fire of 1728.

In the period of national poverty and depression that followed this event, a puritanical spirit, which was little in sympathy with Holberg's dramatic or satiric genius, predominated. He therefore closed his career as a dramatic poet by publishing in 1731 his acted comedies, with the addition of five which he had no opportunity of putting on the stage. He adopted the serious tone of the new age, and busied himself for the next 20 years with historical, philosophical and statistical writings. During this period he published his poetical satire called *Metamorphosis* (1726), and his *Epistolae ad virum perillustrem* (1727), his *Description of Denmark and Norway* (1729), *History of Denmark, Universal Church History, Biographies of Famous Men, Moral Reflections, Description of Bergen* (1737), *A History of the Jews*, and other learned and laborious compilations. The only poem he published at this time was the famous *Nicolai Klimii iter subterraneum* (1741), afterwards translated into Danish by Baggesen. When Christian VI. died in 1747, pietism lost its sway; the theatre was reopened and Holberg was appointed director, but he soon resigned this arduous post. The six comedies he wrote in his old age did not add to his reputation. His last published work was his *Epistles*, in 5 vols. the last of them posthumous (1754). In 1747 he was created by the new king Baron of Holberg. He died at Copenhagen on Jan. 28, 1754, in the 70th year of his age. He was buried at Sorö, in Zealand. He had never married, and he bequeathed all his property, which was considerable, to Sorö college.

Holberg was not only the founder of Danish literature and the greatest of Danish authors, but he was, with the exception of Voltaire, the first writer in Europe during his own generation. Neither Pope nor Swift, who perhaps excelled him in particular branches of literary production, approached him in range of genius, or in encyclopaedic versatility. Holberg found Denmark provided with no books, and he wrote a library for her. When he arrived in the country, the Danish language was never heard in a gentleman's house. Polite Danes were wont to say that a man wrote Latin to his friends, talked French to the ladies, called his dogs in German, and only used Danish to swear at his servants. The single genius of Holberg revolutionized this system. He wrote poems of all kinds in a language hitherto employed only for ballads and hymns; he instituted a theatre, and composed a rich collection of comedies for it; he filled the shelves of the citizens with works in their own tongue on history, law, politics, science, philology and philosophy, all written in a true and manly style, and representing the extreme attainment of European culture at the moment. Perhaps no author who ever lived has had so vast an influence over his countrymen, an influence that is still at work after 200 years.

The editions of Holberg's works are legion. Complete editions of the *Comedies* are too numerous to be quoted; the best is that brought out in 3 vols. by F. L. Lichtenberg, in 1870. Of *Peder Paars* there exist at least 23 editions, besides translations in Dutch, German and Swedish. The *Iter subterraneum* has been three several times translated into Danish, ten times into German, thrice into Swedish, thrice into Dutch, thrice into English, twice into French, twice into Russian and once into Hungarian. The life of Holberg was written by Welhaven in 1858 and by Georg Brandes in 1884. Among other works may be mentioned those by Robert Prutz (1857) and A. Legrelle (1864).

HOLBORN, a metropolitan borough of London, England, bounded north-west by St. Pancras, north-east by Finsbury, south-east by the City of London, south and west by the City of Westminster and St. Marylebone. Pop. (1921), 43,192. Area 405·1 acres.

The name of Holborn was formerly derived from Old Bourne, a tributary of the Fleet. Of the existence of this tributary there is no evidence, and the origin of the name is found in *Holebourne,* the stream in the hollow, in allusion to the Fleet itself. The fall and rise of the road across the valley before the construction of the viaduct (1869) was abrupt and inconvenient. In earlier times a bridge here crossed the Fleet, leading from Newgate, while a quarter of a mile west of the viaduct is the site of Holborn Bars, at the entrance to the City, where tolls were levied. The residential district is mainly within the parish of St. George, Bloomsbury (derived from William Blemund, a lord of the manor in the 15th century). In the 18th century Bloomsbury was a wealthy residential quarter. From the 17th century until modern times the parish of St. Giles in the Fields was notorious as a home of crime and poverty. Here occurred some of the earliest cases of the plague. The neighbouring thoroughfare of Hatton Garden, leading north from Holborn Circus, is a centre of the diamond trade.

Ely Place takes its name from a palace of the bishops of Ely, who held land here as early as the 13th century. The property was acquired by Sir Christopher Hatton, lord chancellor under Queen Elizabeth, though the bishopric kept some hold upon it until the 18th century. The chapel of St. Etheldreda, the only remnant of the palace, is a Decorated structure with a vaulted crypt, itself above ground-level. The present parish church of St. Giles in the Fields, between Shaftesbury avenue and New Oxford street, dates from 1734. Here was a leper's hospital founded by Matilda, wife of Henry I., in 1101. Its chapel became the parish church on the suppression of the monasteries. The church of St. Andrew was built by Wren, but there are traces of the previous Gothic edifice in the tower. Close to this church is the City Temple (Congregational).

Two of the four Inns of Court, Lincoln's Inn and Gray's Inn, lie within the borough. Of the first the Tudor gateway opens upon Chancery Lane. To the west lies the square, with public gardens, still called, from its original character, Lincoln's Inn Fields. Gray's Inn, between High Holborn and Theobald's Road, and west of Gray's Inn Road, is of similar arrangement. Of the former Inns of Chancery attached to these Inns of Court the most noteworthy buildings remaining are those of Staple Inn, of which the timbered and gabled Elizabethan front upon High Holborn is a survival of its character in a London thoroughfare; and of Barnard's Inn, occupied by the Mercer's School. Both these were attached to Gray's Inn. Among other institutions in Holborn are the British Museum, north of New Oxford Street, the Royal College of Surgeons, in Lincoln's Inn Fields, with museum; the Royal Colleges of Organists, and of Veterinary Surgeons. Holborn returns one member to parliament.

HOLBROOKE, JOSEF CHARLES (1878–), English composer, was born at Croydon on July 5, 1878, his father being a pianist, and his Scottish mother a professional singer. When his father settled in London Josef became a chorister at St. Anne's Soho, and also attended the church school. In 1893 he entered the Royal Academy of Music, where he obtained medals, prizes and scholarships. On leaving the R.A.M. in 1896 he became pianist to a touring company, later returning to London and taking pupils. In 1900 Manns played his symphonic poem *The Raven* at one of the Crystal Palace Saturday concerts and since then his works, always vigorous and unconventional, have been constantly performed. They include the symphonic poems (with voice parts) *Queen Mab* (1904) and *The Bells* (1907); *Homage to Poe* (dramatic choral symphony) (1908); *Apollo and the Seaman* (symphonic music to Herbert Trench's poem, 1908); the operas *Children of Don* (produced in London in 1911); *Dylan* (London, 1913); *Bronwen* and *The Wizard* (Chicago, 1915); and *The Enchanted Garden* (opera-ballet, 1915). He has also written concertos for pianoforte (*The Song of Gwyn ap Nudd*) and violin, some five quartets, a horn trio, three quintets, four sextets and a quantity of smaller works.

See George Lowe, *Josef Holbrooke and his Work* (1920).

HOLCROFT, THOMAS (1745–1809), English dramatist, was born in London on Dec. 10, 1745, the son of a shoemaker who became a travelling hawker. Thomas became a stable boy at Newmarket, and in his evenings studied languages and music. After some experiments as a teacher, he became a player in 1771, and in 1778 produced a play, *The Crisis,* at Drury Lane. During a stay in Paris as correspondent of the *Morning Herald* he saw Beaumarchais's *Mariage de Figaro,* memorized it, and, on his return home, produced an English translation, *Follies of the Day,* at Drury Lane in 1784. His *Road to Ruin* (1791), a melodrama, was a great success and has been frequently revived.

Holcroft was in sympathy with the principles of the French Revolution, and became a member of the Society for Constitutional Information. On that account he was indicted for high treason in 1794, but was discharged without a trial. On returning, in 1802, from a two years' stay in Paris, he set up a printing business, which failed, like most of his financial undertakings. On March 23, 1809, Holcroft died. His self-education had been so creditable that he counted among his friends Coleridge, Charles Lamb, William Godwin and John Opie. Besides his numerous novels and plays, many of which were published anonymously, he produced able translations of plays, books on travel, political memoirs and scientific treatises.

Holcroft's *Memoirs written by Himself and continued down to the Time of his Death, from his Diary, Notes and other Papers,* by William Hazlitt, appeared in 1816, and have been re-edited in 1925 by E. Colby, who also published a bibliography of Holcroft's works in 1922.

HOLD. A nautical term applied to the interior or cargo-containing part of a ship, below the deck or lower-deck. The term hold-beam is applied to the beams crossing the ship above the hold. The derivation is not from the same root as the verb "to hold," but from the Dutch *hol,* a hole or cavity.

HOLDEN, SIR EDWARD HOPKINSON, 1ST BART. (1848–1919), English banker, was born on May 11, 1848, at Tottington, Lancashire. He became managing director (1898) and eventually chairman (1908) of the Birmingham and Midland Bank. He devoted himself to the development of the amalgamating policy of his bank, which ultimately became the London Joint City and Midland Bank (*see* BANKS AND BANKING). From 1898 he interested himself in international banking, and became as great an expert on foreign exchange questions as on home finance. He was the first of the larger London joint-stock bankers to open a foreign exchange department. In 1906 he was elected Liberal M.P. for the Heywood division of Lancashire and in 1909 received a baronetcy. In 1915 he went with Lord Reading to the United States on behalf of the Government and arranged there the Anglo-French loan. He died on July 23, 1919.

HOLDEN, SIR ISAAC, BART. (1807–1897), English inventor and manufacturer, was the son of Isaac Holden, a native of Cumberland, and was born at Hurlet, near Paisley, on May 7, 1807. His chief discoveries were his square motion woolcomber and a process for making genappe yarns, a patent for which was taken out by him in conjunction with S. C. Lister (Lord Masham) in 1847. The firm of Lister and Holden, which established a factory near Paris in 1848, carried on a successful business, and in 1859, when Lister retired, was succeeded by Isaac Holden and Sons, which became the largest wool-combing business in the world, employing upwards of 4,000 workpeople. In 1865 Holden entered parliament as Liberal member for Knaresborough; later he sat for the northern division of the West Riding, and for Keighley. He died at Oakworth House, near Keighley, on Aug. 13, 1897.

HÖLDERLIN, JOHANN CHRISTIAN FRIEDRICH (1770–1843), German poet and neo-Hellenist, was born on March 20, 1770, at Lauffen on the Neckar. He was destined for the church and studied theology at Tübingen. He was already the writer of occasional verses, and had begun to sketch his novel *Hyperion,* when he was introduced to Schiller, and obtained

through him the post of tutor to the young son of Charlotte von Kalb. A year later he went to Jena to attend Fichte's lectures, and to be near Schiller, who published some of his early writings in his periodicals *Die neue Thalia* and *Die Horen*. In 1796 Hölderlin became tutor in the family of the banker J. F. Gontard in Frankfort-on-Main. For Gontard's beautiful and gifted wife, Susette, the "Diotima" of his *Hyperion*, he conceived a violent passion; and she became at once his inspiration and his ruin. At the end of two years, during which time the first volume of *Hyperion* was published (1797), the crisis came, and the young poet suddenly left Frankfort. In spite of ill-health, he now completed *Hyperion*, the second volume of which appeared in 1799, and began a tragedy, *Der Tod des Empedokles*, a fragment of which is published among his works. His friends became alarmed by his nervous irritability, and he was induced to go to Switzerland, as tutor in a family at Hauptwill. There his health improved; and several of his poems, among which are *Der blinde Sänger*, *An die Hoffnung* and *Dichtermut*, were written at this time. In 1801 he returned home to arrange for the publication of a volume of his poems; but, on the failure of this enterprise, he was obliged to accept a tutorship at Bordeaux. "Diotima" died a year later, in June 1802, and the news is supposed to have reached Hölderlin shortly afterwards, for in the following month he suddenly left Bordeaux, and travelled homewards on foot through France, arriving at Nürtingen destitute and insane. Kind treatment gradually alleviated his condition, and in lucid intervals he occupied himself by writing verses and translating Greek plays. Two of these translations—the *Antigone* and *Oedipus rex* of Sophocles—appeared in 1804, and several of his short poems were published by Franz K. L von Seckendorff in his *Musenalmanach*, 1807 and 1808. In 1804 Hölderlin obtained the sinecure post of librarian to the landgrave Frederick V. of Hesse-Homburg, and went to live in Homburg under the supervision of friends; but two years later becoming irremediably but harmlessly insane, he was taken in the summer of 1807 to Tübingen, where he remained till his death on June 7, 1843.

Hölderlin's writings are the production of a beautiful and sensitive mind; they are intensely, almost morbidly, subjective. His passion for Greek literature led him entirely to discard rhyme in favour of the ancient verse measures. He desired to see the Greek spirit embodied in German literature. His poems are all short pieces; of his tragedy only a fragment was written. *Hyperion, oder der Eremit in Griechenland* (1797–1799), is a romance in letters, in which the stormy fervour of the "Sturm und Drang" is combined with a romantic enthusiasm for Greek antiquity. The interest centres not in the story, for the novel has little or none—Hyperion is a young Greek who takes part in the rising of his people against the Turks in 1770—but in its lyric subjectivity and the dithyrambic beauty of its language.

Hölderlin's lyrics, *Lyrische Gedichte*, were edited by L. Uhland and G. Schwab in 1820; and his *Samtliche Werke*, with a biography, by C. T. Schwab (2 vols. 1846); also *Dichtungen* by K. Köstlin (Tübingen, 1884), and (the best edition) *Gesammelte Dichtungen* by B. Litzmann (2 vols. Stuttgart, 1897). *See* also C. C. T. Litzmann, *F. Hölderlins Leben* (1890); A. Wilbrandt, *Hölderlin* (2nd ed. 1891); C. Müller, *Friedrich Holderlin, sein Leben und sein Dichten* (Bremen, 1894); J. Claverio, *La Jeunesse d'Hölderlin jusqu'au roman d'Hypérion* (1922); E. Lehmann, *Holderlins Lyrik* (Stuttgart, 1922); F. Sebass, *Hölderlin-Bibliographie* (Munich, 1922); M. Montgomery, *F. Hölderlin and the German Neo-Hellenic Movement* (Oxford, 1923, etc.); S. Zweig, *Der Kampf mit dem Dämon* (1925).

HOLDERNESSE, EARL OF, an English title borne by Sir John Ramsay and later by the family of Darcy. John Ramsay (*c.* 1580–1626), a member of the Scottish family of Ramsay of Dalhousie, was knighted for his share in rescuing James VI. from the hands of John Ruthven, earl of Gowrie, in Aug. 1600. In 1606 the king created him Viscount Haddington and Lord Ramsay of Barns, and in 1621 made him an English peer as earl of Holdernesse. Ramsay died in Feb. 1626, when his titles became extinct. In 1644 Charles I. created his nephew, Prince Rupert, earl of Holdernesse, but when the prince died unmarried in Nov. 1682 the earldom again became extinct. Conyers Darcy (1599–1689), who was made earl of Holdernesse in 1682 only a few days after the death of Rupert, was the son and heir of Conyers Darcy, Lord Darcy and Conyers (*c.* 1571–1654). Robert Darcy, fourth and last earl of Holdernesse, died in 1778.

HOLDHEIM, SAMUEL (1806–1860), Jewish rabbi, a leader of reform in the German Synagogue, was born in Posen, and died in Berlin on Aug. 22, 1860. He was educated by his father and then at Prague and Berlin. He was rabbi at Frankfort-on-the-Oder from 1836 to 1840 when he was transferred to the rabbinate of Mecklenburg-Schwerin. He then became an advocate of religious freedom and of reform within the Jewish community. At the rabbinical conferences of Brunswick (1844), Frankfort-on-the-Main (1845) and Breslau (1846), Holdheim strongly advocated the modification of ritual, especially with regard to Sabbath observance, marriage laws and liturgical customs. In 1846 he was chosen rabbi of the new Berlin congregation.

Besides numerous contributions to periodicals and essays, Holdheim published *Gottesdienstliche Vorträge* (1839), *Der religiöse Fortschritt im deutschen Judenthume* (1840), *Die Autonomie der Rabbinen* (1843), *Vortrage über die Mosaische Religion für denkende Israeliten* (1844), *Das Ceremonialgesetz im Messiasreich* (1845), *Gesch. der Judischen Reformgemeinde* (1857) and *Ma'amar La-Ishut* (1860). *See* I. H. Ritter in the *Jewish Quarterly Review*, i. 202 and *Geschichte der jüdischen Reformation* (vol. 3, 1865); Graetz, *Gesch. der Juden;* and D. Philipson's *History of the Reform Movement in Judaism* (1906).

HOLDICH, SIR THOMAS HUNGERFORD (1843–), K.C.M.G. (1902), K.C.I.E. (1897), was born at Dingley, Northants, on Feb. 13, 1843. In 1862 he passed out of Woolwich into the Royal Engineers. He served with the Bhutan Expedition (1865), in Abyssinia (1867), in the Afghan War (1878–1880), and on many frontier commissions, being promoted brevet-colonel in 1891. In 1892, he was appointed superintendent of the frontier surveys in India, holding this post until 1898. He acted as H.M. commissioner for the Perso-Baluch boundary in 1896, and for the Argentine-Chile boundary in 1902–1903. He was for two years president of the Royal Geographical Society (1916–1918).

His publications include: *The Indian Borderland* (1901); *The Countries of the King's Award* (1904); *India* (1904); *Tibet* (1906); *The Gates of India* (1909); *Political Frontiers and Boundary Making* (1916); *Boundaries in Europe and the Near East* (1918).

HOLGUÍN, a town of the high plateau country in the interior of Oriente province, Cuba, about 65 m. N.W. of Santiago de Cuba. Pop. (1919 census) 13,768. The town is near the Marañon and Jigüé rivers, on a plain from which hills rise on all sides except the east, where it is open to the winds of the plateau. Holguín was long the principal acclimatization station for Spanish troops. The oldest public buildings are two churches built in 1800 and 1809 respectively. Holguín has trade in cabinet woods, tobacco, Indian corn and cattle products, which it exports through its port Gibara, about 25 m. N.N.E., with which it is connected by railway. Holguín was settled about 1720 and became a *ciudad* (city) in 1751. In the Ten Years' War of 1868–78 and in the revolution of 1895–98 Holguín was an insurgent centre.

HOLIDAY, originally the "holy day," a festival set apart for religious observances as a memorial of some sacred event or sacred person; hence a day on which the ordinary work or business ceases. For the religious sense *see* FEASTS AND FESTIVALS; SUNDAY; and WAKE. It will suffice to deal here with public holidays, the observance of which is prescribed by the State. In one respect these have been diminished, in so far as saints' days are no longer regarded as entailing non-attendance at the Government offices in England, as was the case at the beginning of the 19th century. But while the influence of religion in determining such holidays has waned, the importance of making some compulsory provision for social recreation has made itself felt. In England four days, known as Bank Holidays (*q.v.*), are set apart by statute to be observed as general holidays, while the sovereign may by proclamation appoint any day to be similarly observed. In the British colonies there is no uniform practice, but in some Arbor day, Labour day, etc., have been added.

In the United States there is no legal holiday in the sense of the English bank holidays. A legal holiday is dependent upon State and territorial legislation. It is usual for the President to proclaim the last Thursday in November as a day of thanks-

giving; this makes it a legal holiday only in the District of Columbia, and in the territories, but most States make it a general holiday. Independence day (July 4) and Labour day (first Monday in September) are legal holidays in most States. There are other days which, in connection with particular events or in remembrance of particular persons, have been made legal holidays by particular States. The following list gives the most important of these.

The chief legal or public holidays are:

Jan. 1—New Year's Day—all the States, Territories and colonial possessions.

Feb. 12—Lincoln's Birthday—birthday of Abraham Lincoln, sixteenth president of the United States, celebrated in Alaska, California, Colorado, Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Jersey, New York, North Dakota, Ohio, Pennsylvania, South Dakota, Tennessee, Utah, Washington, West Virginia, Wyoming, and observed by governor's proclamation in Massachusetts.

Feb. 22—Washington's Birthday—birthday of George Washington, first president of the United States, celebrated in all the States, Territories and possessions.

Good Friday—movable religious holiday in memory of Christ's Crucifixion and death, celebrated legally in Connecticut, Delaware, Florida, Louisiana, Maryland, Minnesota, New Jersey, Pennsylvania, Philippines, Porto Rico and Tennessee. In Connecticut Good Friday is usually proclaimed by the governor as a day of fasting and prayer.

May 30—Memorial or Decoration Day—holiday observed in tribute to those who died in the military and naval service of the United States, observed on this date in all the States and possessions except Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, New Mexico, North Carolina, South Carolina and Texas. Most of the southern States have a corresponding memorial day but the date is not uniform.

July 4—Independence Day—anniversary of the signing of the Declaration of Independence of the thirteen original States from Great Britain, in 1776, celebrated throughout the United States and its possessions

Labor Day—First Monday in September—set apart by the labor organizations in the United States to be observed as a holiday, every State and Territory except Alabama, Wyoming and the Philippines.

Oct. 12—Columbus Day—anniversary of the day on which Columbus first sighted islands of the New World, celebrated in Arkansas, Arizona, California, Colorado, Connecticut, Delaware, Florida, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Washington, West Virginia and Porto Rico. In Arkansas and Kansas it does not affect notes or judicial proceedings.

Election Day—day of national and generally State elections (1st Tuesday after 1st Monday in November). Observed in every State and Territory except Alaska, District of Columbia, Hawaii, Illinois, Massachusetts, Mississippi, Ohio, Philippines and Vermont. In Illinois it is a legal holiday in Chicago and certain other cities. In Ohio it is a half holiday. In Maine it is a legal holiday only as to the courts.

Nov. 11—Armistice Day—anniversary of the signing of the Armistice in the World War, Nov. 11, 1918, observed in Alabama, Arizona, Arkansas, California, Colorado, Florida, Illinois, Iowa, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Jersey, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Vermont, Virginia and Hawaii. In other States by governor's proclamation only.

Thanksgiving Day—last Thursday in November, a semi-religious day of giving thanks, instituted by the Pilgrim Fathers at the gathering of their first harvest in the New World 1621, and since 1863 set apart by presidential proclamation as an annual holiday throughout the United States and its possessions.

Dec. 25—Christmas Day—Christian holiday in memory of the birth of Christ, celebrated throughout the United States and its possessions.

See M'Curdy, *Bibliography of Articles relating to Holidays* (Boston, 1905). (T. A. I.)

HOLINSHED (or HOLLINGSHEAD), **RAPHAEL** (d. *c.* 1580), English chronicler, belonged probably to a Cheshire family, and may possibly be identified with the Holinshed who matriculated from Christ's college, Cambridge, in 1544. About 1560 he came to London and was employed as a translator by Reginald or Reyner Wolfe, who was engaged in the preparation of a universal history. Holinshed worked for some years on this undertaking; but after Wolfe's death in 1573 the scope of the work was abridged, and it appeared as the *Chronicles of England, Scotland, and Ireland* (2 vols., 1578). Holinshed received valuable assistance from William Harrison (*q.v.*) and others, while the part dealing with the history of Scotland is mainly a translation of Hector Boece's *Scotorum historiae*. The chief interest of the work lies in the fact that it was largely used by Shakespeare and other Elizabethan dramatists; Shakespeare, who probably used the edition of 1587, obtaining from the *Chronicles* material for most of his historical plays, and also for *Macbeth, King Lear* and part of *Cymbeline*. Holinshed died about 1580.

A second edition of the *Chronicles*, enlarged and improved but without illustrations, which appeared in 1587, contained statements which were offensive to Queen Elizabeth and her advisers, and immediately after publication some of the pages were excised by order of the privy council. These excisions were published separately in 1723. An edition of the *Chronicles*, in accordance with the original text, was published in six volumes in 1808.

See W. G. Boswell-Stone, *Shakspere's Holinshed. The Chronicle and the historical plays compared* (1896).

HOLISM. Holism (from the Gr. *Holos*, whole) is the theory which makes the existence of "wholes" a fundamental feature of the world. It regards natural objects, both animate and inanimate, as wholes and not merely as assemblages of elements or parts. It looks upon nature as consisting of discrete, concrete bodies and things, and not as a diffusive homogeneous continuum. And these bodies or things are not entirely resolvable into parts; in one degree or another they are wholes which are more than the sum of their parts, and the mechanical putting together of their parts will not produce them or account for their characters and behaviour. The so-called parts are in fact not real but largely abstract analytical distinctions, and do not properly or adequately express what has gone to the making of the thing as a whole.

Holism and Science.—Holism is therefore a view-point additional and complementary to that of science, whose keywords are continuity and mechanism. The ideal of science is continuity, and its method is based on the analysis of things into more or less constant elements or parts, the sum of whose actions account for the behaviour of these things. Things thus become mechanisms of their parts; and the interactions of their invariable parts in a homogeneous time and space according to the rules of mechanics are sufficient to account for all their properties. This mechanistic scheme applies even to living bodies, as their material structures determine the functions which constitute life characters. Mind is similarly, though much more doubtfully, based on physical mechanisms and functions. Life and mind are thus considered as derivative and epiphenomenal to matter. The validity of this simple scientific scheme of things has been commonly, but never universally, accepted even among scientists. The inferior position it assigns to mind has remained an insuperable difficulty. And many biologists have also viewed its account of life as inadequate, and have supported the plea for *vitalism* or for life as a real force or factor additional to those which operate on the physical plane. Finally the scientific scheme has been seriously undermined by the most recent discoveries in physical and mathematical science, which have resolved matter into variable energy, have destroyed the homogeneity of space and time, and have thereby shaken the whole basis of fixed standards and accurate measurements on which the mechanistic scheme is founded. The value of the mechanistic concept for research is not questioned, but it can no longer be considered as a true index of the concrete character of the universe and its contents. Holism is an attempt to explore an alternative scheme which will yet avoid the pitfalls of vitalism.

What Are Wholes?—What is involved in the concept of a whole? In the first place, in so far as a whole is considered as consisting of parts or elements, they cannot be fixed, constant, or unalterable. To be parts in a whole they must be pliant, flexible and mouldable. Their adjustment in a whole implies their flexibility and adjustability. It must be possible for the part to be different in the whole from what it is outside the whole; and in different wholes it must be different in each case from what it is in its separate state. The atoms of matter and the electrons and protons of atoms are on this view not constant and identical throughout, either in their isolated states or in the wholes of

atoms, molecules and compounds which they compose. They are variable, although the limits of variation may be too small for measurement or observation. In so far as physical substances are wholes, their elements cannot be constant and unalterable, as they must be adjustable to the pattern of these wholes. In the second place, in so far as the elements or parts cohere and coalesce into the structure or pattern of a whole, the whole must itself be an active factor or influence among them; otherwise it is impossible to understand how the unity of a new pattern arises from its elements. Whole and parts mutually and reciprocally influence and modify each other; the one is pliant to and moulded by the other; the parts are moulded and adjusted by the whole, just as the whole in turn depends on the co-operation of its parts. The adjustive, directive, controlling influence of the whole is just as real as the rôle which the parts play in the make-up of the whole.

Holism and Evolution.—The concept of the whole as applied to natural objects thus implies two great departures from the orthodox scientific scheme. In the first place, matter, life and mind do not consist of fixed, constant and unalterable elements. And in the second place, besides the parts or the elements in things, there is another active factor (the whole) which science does not recognize at all. The whole has an influence and an effect all its own. Natural objects, inanimate as well as animate, are flexible patterns in which whole and parts influence and mould each other, and constitute a mobile dynamic equilibrium of all the elements involved. And in the dynamic variation of patterns which we call evolution the complexity of texture and unity of type increase *pari passu* from the earliest chemical beginnings to the highest mental levels. Evolution is just this progressive complexifying of parts or co-operating elements, with a simultaneous increase in unity of pattern with which they are blended. It is thus a rising series of wholes, from the simplest material patterns to the most advanced, which involve a complication of material, physiological and psychical elements, but with the aspect of unity, inner direction and central control always increasing. In other words, wholeness or holism characterizes the entire process of evolution, in an ever-increasing measure. And the process is continuous in the sense that the older types of wholes or patterns are not discarded but become the starting-point and the elements of the newer, more advanced patterns. Thus the material chemical patterns are incorporated into the biological patterns, and both of them into the subsequent psychical patterns or wholes. Each series of wholes progresses both in complexity of elements and unity of pattern up to a point, when it more or less suddenly mutates or swings into a new rhythm or type of pattern, which again shows the same holistic development, until it in turn gives birth to a new and higher type. While the lower grades are more mechanical, and the higher grades more holistic, the movement throughout is towards more and ever more wholeness. The central feature or character of the cosmic movement is therefore towards wholeness or holism. Electrons and protons, atoms and molecules, inorganic and organic compounds, colloids, protoplasm, plants and animals, minds and personalities are but some steps in this movement of holism.

Holism in Biology.—Organisms or biological wholes are not isolated units, but are genetically related, and arise as variations from each other. And they do not exist apart from their surroundings (which are themselves complexes of wholes) but on the contrary are in continuous contact with them, and evolve and vary partly in response to the stimulus which comes from them. The evolving wholes are in close and responsive relation to their environment, the influence of which on them is in part temporary, and confined to the individual duration of each whole, and in part (in so far as the racial links or germ-cells are affected and stimulated) perpetuated through generations of wholes. Whether in any case this influence is temporary or hereditary is a question of fact, to be ascertained by observation, and not by theoretical reasoning, as many geneticists have argued. The view of organisms as wholes, instead of mere mechanisms, and of their variations and genetic evolution as holistic is important, and gives the right orientation for the solution of biological problems. Thus variations are not isolated products of individual factors or genes, but are the expression of the total energy or developmental tendency of animals and plants (as wholes). The variation is holistic, that is to say, is the outcome of the total tendency of the organism, and not merely of a part of it. On no other principle is it possible to explain the interim survival of small or incipient variations, or of collateral variations emerging in associated groups, as they are too weak to fend for themselves; and can only be kept going by the entire weight of the organism behind them. In fact, the "selection" of the new variation is in such cases not the external natural selection to which Darwin attributed such importance, but the internal "holistic selection" due to the functioning of the animal or plant constitution as a whole. The subject is important but cannot be pursued further in this summary. (See *Holism and Evolution,* ch. viii.)

HOLISM AS CREATIVE ACTIVITY

So far in the above account holism has been put forward as a way out of some of the difficulties which, under the most recent scientific advances, arise on the orthodox mechanistic theory. But it is here further suggested as the solution of the greatest problem of all which has arisen from the more recent contact of science and philosophy. This is the problem of creativeness or epigenesis in evolution. It is a commonplace now that this is a growing evolving world, that new forms and types arise from the old, and that in the course of the history of the earth, the forms of life have progressed from the simplest and lowest to the very highly organized types of to-day, culminating in the human personality. The name "creative evolution" has in consequence been applied to this process. And the question arises as to the meaning of the term "creative" in this connection. There was the older philosophical view that the new is already existing in minutest shape, "preformed" in the old, and that the creative process is simply the unfolding or unpacking of the new forms already existing latent in the old forms. This "preformation" view has, however, been generally discarded by scientists, who have found it in conflict not only with the facts of the geological and palaeontological record, but also with those of embryology, which disclose the individual development as passing through the most curious phylogenetic phases. The creative or epigenetic view of evolution has in consequence been generally adopted, according to which the old gives rise to the genuinely new, to what cannot be reduced to the old and cannot be explained or accounted for by it alone. But this concept of creation or creativeness seems to involve a miracle: how can the higher arise from the lower, the more from the less, as this seems to imply that something can come from nothing? How can a variation or new species arise in some inexplicable unpredictable way from a lower simpler pre-existing state of affairs or species? Profs. Alexander[1] and Lloyd Morgan[2] accept the creative process "in natural piety" as an unaccountable fact. Prof. Boodin has somewhat fancifully suggested that the creatively new must in fact be an imported article, a new pattern imported to our world from another existing order of things in the universe.[3]

Where this order is to be found he does not say, though no doubt Sir Oliver Lodge would suggest the ether. Some again attempt to explain the riddle by virtually reading into the old what emerges in the new, and thus in effect returning to the "preformation" view,[4] to which some other thinkers[5] seem inclined in any case to return openly as the only way out. This is all very unsatisfactory, and the question arises whether we are forced to admit the existence of some mysterious irrational element within the central sphere of science. It would be most awkward for philosophy to make such an admission in respect of this key position of evolution. If science (so largely the product of reason) calls for the concept of creative evolution, and philosophy declares it a mystery beyond reason, philosophy appears to be stultified and virtually to abdicate her sovereign position. It is here suggested that the explanation is to be found in the concept of the whole. For this concept opens the door directly and simply to creative-

[1] *Space, Time and Deity* pp. 46–47.
[2] *Emergent Evolution* p. 35.
[3] *Cosmic Evolution* pp. 124–125.
[4] Lossky, *Journal of Philos. Studies,* Oct. 1927, p. 492.
[5] Otto, *The Idea of the Holy,* ch. xiv.

ness. The whole is creative; wherever parts conspire to form a whole, there something arises which is more than the parts. It is the very nature and concept of a whole to be more than its parts, as we have seen. The origin of a whole from its parts is an instance of the more arising from the less, the higher from the lower, in a way which does no violence to reason, but on the contrary follows from reason, because the concept of a whole in relation to its parts is a product of reason. Creative evolution is therefore an inexplicable process, unless we link it on to the concept of wholes, and look upon the creative growing evolving universe as a universe of wholes. It is the making of wholes which makes this universe creative, and the creative universe is therefore necessarily the holistic universe.

Categories of Holism.—Not only is the intimate character of reality illuminated, if not expressed, by the concept of holism, but the categories which are used to describe or explain all natural happening also stand in very close relation to that concept. It is only necessary to refer to four pairs of these categories—cause and effect, freedom and necessity, individuality and mechanism, and the psycho-physical relation.

(*A*) *Cause and Effect.*—The usual conception of the causal relation establishes an exact equation between cause and effect, and thus makes the element of creation or advance in natural happening unintelligible. For if the effect is never more than the cause, if cause is and must always necessarily be an exact measure of effect, this cannot be a creative progressive universe, and the causal category in this sense makes creative evolution impossible. The accepted fact of creative evolution is a proof that the usual concept of cause is too abstractly and narrowly conceived, that in the universe effect can and sometimes does transcend cause, although usually on so small a scale as to create the illusion of their equality. Here again the idea of wholes gives the clue and explanation. In so far as causes operate holistically, that is to say, where several factors contribute towards the making of new wholes, their operation is creative, there is more in the effect than in the cause or combination of causes, and real creative advance results. Purely mechanical causation (which is perhaps a mere fiction) is equative and is correctly expressed by the ordinary causal concept. But holistic causation, which is the real process, makes possible the increase and advance which is actually the fact in nature.

(*B*) *Freedom and Determination.*—In the same way and on the same grounds, the concept of the whole and of holistic happening resolves the old controversy between freedom and determination in nature. The chain of necessity arises from the ordinary causal concept which equates cause and effect without remainder, and thus makes the cause determine the effect completely. If this causal concept is wrong, the inference of necessity becomes unjustified. So far as there is an undetermined creative element in the holistic effect, not attributable to the conspiring causal elements, to that extent there is indetermination and freedom, infinitesimally small and practically negligible in physical causation, but much more marked and appreciable in organic happening, and still more so in mental process. An element of freedom thus becomes recognized as inherent in nature, which increases with the progress of evolution, until on the human level it attains considerable dimensions, and becomes the basis for moral responsibility. Freedom is native to the holistic universe, and is not merely an attribute of the human will, in accordance with the usual view.

(*C*) *Individuality.*—The concept of wholes is also basic to the category of individuality. The organic unity which constitutes a whole is in fact the ultimate basis of individuality. Of this there are traces in inorganic nature already, but it is only on the organic level that individuality assumes practical importance. Plants are individuals, perhaps without having any real individuality, but among the higher animals the feature of individuality becomes of real importance. Dogs, horses and even lower animals have distinct character and individuality. With the emergence of conscious mind in man, the aspect of individuality becomes all-important, and becomes the basis for the latest and greatest whole of evolution, the human personality. In mental development there are two aspects, the universal tendency, which culminates in the reason, creative of rational order and universal concepts and laws; and the contrasted individual tendency, which reaches an especial development in conscious mind, and constitutes the unique identity or self of the human personality. Individuality rising into personality is perhaps the chief differentia of the human level of evolution. Individuality and reason are the principal constituents of personality, and both are expressions of holism and have their roots in primitive holism.

(*D*) *Mind and Body.*—Throughout the evolutionary process, lower wholes have given birth to higher wholes and become incorporated with them. Thus material chemical patterns have produced life-patterns which have incorporated and not discarded the parent patterns. Mind is a new organ or pattern developed inside the earlier physical and biological structures; and the three, inextricably interwoven into a new pattern, constitute a new whole or personality. The three sets of patterns are not independent reals superimposed on each other; they have arisen the one inside the other and are blended into the whole of personality, which constitutes and explains the unity and inter-relations existing between the three. These relations of mind and body would be inexplicable on mechanical grounds, and have in fact presented an insoluble problem to philosophy through all ages. But here again the whole supplies the key. Once we view personality as a real whole, containing earlier blended wholes as its parts, the unity of the whole is seen to underlie and make possible the relations between them, which however are not mechanical but "holistic." Holistic relations are such as exist, not externally as between different parts, but internally as different aspects of the same whole. In fact, we have here reached the point where we may restate the concept of the whole above set forth, and show it, not as the relations of parts in and to a whole (because this formulation is provisional and still savours of mechanical associations) but as the contrasted aspects of the whole from the outside or the inside, from an external standpoint or from its own standpoint. The parts represent its external aspect, which is mechanical; the whole is its aspect from its own standpoint, the view of the whole as a self, so to say. The relation of whole and parts is thus transformed into the relation of self and not-self, with which we are acquainted as the subject-object relation in psychology. Wholeness is itselfness. The concept of the whole therefore, when properly understood, enables us to describe the nature of reality in terms which satisfy the conditions both of physics and psychology, and at the same time disclose body and mind as different (external and internal) aspects of the same thing. This is the key to all their relations. The reality, the true whole, is human personality in each case; apart from it the human body is neither human nor a body. Similarly mind apart from the whole of personality, becomes a functionless abstraction. The whole as creative explains the relation between matter and life, between body and mind. It rules out both materialism and parallelism. In the whole, for instance, mind arises as a new factor X on the basis of neuroses or neural elements *a*, *b*, *c*, etc., which become fused and synthesized, and to the extent that X is new it is also, and for that very reason, without a neural correlate. The psychical is thus more than its physiological neural antecedents, although arising from them, and the overplus in mind has no direct neural correspondents. The patterns of the new emergent wholes are different from and transcend those of the elements or lower wholes from which they have arisen and cannot be discovered by searching of the lower patterns.

Transvaluation in Holism.—The transformation of the external into the internal or "self" aspect is not confined to the mental level but is seen already on the level of organic life. Thus in the process of metabolism, an organism continually takes up external material which it transforms, and assimilates into its own system. On the mental level we see this process of transformation vastly accentuated. External stimuli and impressions are continuously assimilated and transformed into psychical elements; what is object or other becomes subject and self. In the subtle creative chemistry of the personality, otherness is ceaselessly converted into selfness, the material into the mental, the

necessary into the free. The conditions which externally determined and bound me become incorporated into the pattern of myself and are thus converted into elements in my own self-determination and freedom. All this only confirms the impression that in the whole the external or material is but an aspect or phase which is continually being passed in the creative process. The world-process tends from matter through life to mind and spirit, from necessity to freedom, from the externality of elements to the inwardness and selfhood of wholes. In this sense the world is truly, as Keats finely said, the valley of soul-making; but we must recognize that souls are only its climax phase, and that lower wholes of many grades characterize its earlier phases. Whole-making, rather than soul-making, would thus be a correct description of the world-process.

HOLISM IN PSYCHOLOGY

When we come to apply the above ideas and principles to psychology and ethics, we find that the results of holism are in close agreement with the facts. In both we find a continual epigenesis as well as a whole-making tendency associated with mental activity. There is an increasing building-up of higher patterns out of lower ones. Thus on the basis of neural sense-stimuli, synthetic sensations with a psychic character are built; sensations again blend into higher perceptions in which it is no longer possible to disentangle the fused sensations. Similarly concepts, judgments, general laws and principles are reached as the result of the synthesis and fusion of innumerable percepts, images, concepts and judgments. Elements of feeling and emotion and will are added, and purposes, rules and ideals are evolved which embrace vast details and effect ever more complex pattern-wholes. Nothing could be more wrong than the old discarded association psychology which viewed mental products as aggregates mechanically formed out of small atoms or items of experience. There is no such atomicity about mind; its action is throughout massive and holistic. Even below the level of conscious mind the psychic processes have this massive and consolidative character, as we see in habits and instincts. On the conscious level, in spite of the analytic character of intelligence, the underlying and controlling processes are holistic, and systematically fuse lower structures of experience into higher, more complicated patterns, which have the character of wholes, irreducible to their original components. Mental activity is throughout characterized by epigenesis and wholeness. The results of the new "Gestalt" or configuration psychology have added force to these considerations. Research has shown clearly that mental activity in the higher animals as well as humans produce patterns or structures of experience, which behave as wholes, and enter into other experiences as undivided and indivisible wholes. In fact the broken pattern is dead and ineffective. Like a period or a rhythm, the mental pattern has only value and effect as a whole.

It must, however, be recognized that mental patterns, however holistic in structure, are not true wholes on a par with natural wholes such as organisms. Technically it would be better to call them holoids, as they have the structure and many of the characters of wholes, but lack the individual existence and power of self-reproduction which natural wholes possess. Their power however must not be underrated. Mental wholes, such as the blended percepts and concepts which denote objects, can be quite individual and distinct; while ideas and ideals when fused with emotion may attain a force which gives them more than the power of real things. The great slogans of science and politics and religion are dynamic realities and have repeatedly produced the most far-reaching effects on history. As higher animals we find a natural environment for our development. As mental and ethical beings we create our own spiritual environment which in the end becomes to us more real and valuable than our natural environment. Nothing could show more significantly the creative whole-making power of human personality. Thus arise the vast holistic structures of science, art, literature and religion, with the still greater wholes of truth, goodness, beauty and love pointing the way to the future.

Holism in Sociology.—If the theory of holism is capable of illuminating the field of psychology and the other mental sciences, no less fruitful will be its application to the social sciences. The great structures of the State, the Church, and all the other institutions of society bear testimony to the whole-making power of human personality. In anthropology, sociology and politics, holism will not only simplify theory, but also bring those young sciences much nearer to the actual facts. The facts are essentially holistic and holism supplies the key for their interpretation. "We are members one of another" expresses truly the holistic nature of society. Here too, however, a word of warning is necessary. Just as in mental science, we are dealing here also with holoids rather than wholes. Society, the State, the Church and other social institutions are not real wholes, but structures on the analogy and with many of the properties of real wholes. The individuals who compose these structures are the real wholes, whose personalities are not suppressed or merged in the larger structures. On the contrary, the really important factor is and remains human personality, and its great creations in society have for their highest purpose the fostering and spiritual advancement of this supreme whole of personality which has been achieved in the course of evolution. This is not a mere matter of speculation, but one of the most far-reaching practical importance for the ordering of human society and the position of the individual in it.

Is Reality a Whole?—Going still farther afield, the question is raised whether reality itself is one and a whole, or whether it is a pluralistic structure in which individuality has full scope and an assured future. Here one can but ask the question without attempting to answer it. Perhaps in the end it will be found that no answer is possible. This is not a completed universe, but a universe in the making; and there may be wholes great and small in the making beyond the comprehension of our limited faculties. The destiny of the individual lies beyond human ken. Here is really a case for "natural piety."

Forms and Monads.—The concept of wholes is by no means unknown to philosophy or even to science, but no systematic use of it has been made by either of them. Science has on the whole followed the clue of mechanism, but is now getting to its limits. Philosophy more than once definitely approached the concept of the whole without however appreciating its real value. Thus Aristotle's remarkable doctrine of forms as the shaping element of matter is not far removed from the concept of the whole in relation to its parts. The monads of Leibnitz, again, approached the central concept of holism, but the time was not ripe for a full recognition, and the theory remained a metaphysical speculation. Holism is to-day in a happier position. It enthrones the idea of the whole in a setting prepared by science itself, and it appears therefore as a practical way out of very real difficulties both for science and philosophy.

Ethics and Metaphysics of Holism.—Although the theory of holism frankly accepts the material basis of the world and recognizes the natural order as idealism cannot, yet it fully justifies the claims of the spirit in the interpretation of the world. The concept of the whole enables us to overcome some of the most difficult and poignant contrasts in life and thought. We are constantly confronted with the opposition between matter and spirit, between the temporal and the eternal, between the phenomenal and the real. Holism shows these opposites as reconciled and harmonized in the whole. It shows whole and parts as aspects of each other; the finite is identified with the infinite, the particular with the universal. Eternity is contained in time, matter is the vesture and vehicle of spirit, reality is not a transcendent other-worldly order, but is immanent in the phenomenal. To attain to reality, we need not fly away from appearance; each little centre and whole in the world, however lowly, is a laboratory in which time is transmuted into eternity, the phenomenal into the real. The wondrous truth is everywhere; the plummet let down anywhere will reach to unknown depths; any cross-section in the world of appearance will reveal the very texture of reality. Everywhere the whole, even the least and most insignificant apparently, is the real wonder, the miracle which holds the secrets for which we are groping in thought and conduct. There is the within which is the beyond. To be a whole and to live in the whole becomes the

supreme principle, from which all the highest ethical and spiritual rules (such as the golden rule) follow. And it links these rules with the nature of things, for not only do goodness, love and justice derive from it, but also beauty and truth, which are rooted in the whole and have no meaning apart from it. The whole is in fact both the source and the principle of explanation of all our highest ideals, no less than of the earlier evolutionary structures already discussed.

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HOLKAR, the family name of the Mahratta ruler of Indore (*q.v.*), which has been adopted as a dynastic title. The termination *-kar* implies that the founder of the family came from the village of Hol near Poona.

HOLL, FRANK (1845–1888), English painter, was born in London on July 4, 1845, and was educated chiefly at University College School. He was a grandson of William Holl, an engraver of note, and the son of Francis Holl, A.R.A. Entering the Royal Academy schools as a probationer in painting in 1860, he exhibited at the Academy in 1864 "A Portrait" and "Turned out of Church," a subject picture. "A Fern Gatherer" (1865); "The Ordeal" (1866); "Convalescent" (the somewhat grim pathos of which attracted much attention) and "Faces in the Fire" (1867), succeeded. Holl gained the travelling studentship in 1868; the successful work was characteristic of the young painter's mood, being "The Lord gave, and the Lord hath taken away." Holl was much below Millais in portraiture. The range of his studies and the manner of his painting were narrower than those of Josef Israels, with whom, except as a portrait-painter, he may better be compared than with Millais.

In 1878 he was elected A.R.A., and exhibited "The Gifts of the Fairies," "The Daughter of the House," "Absconded" and a very fine portrait of Samuel Cousins now in the National Gallery, London. This last canvas is a masterpiece. Holl was elected R.A. in 1883 and in 1886 he produced a portrait of Millais as his diploma work, but his health rapidly declined and he died at Hampstead, on July 31, 1888. Holl's portraits include likenesses of Lord Roberts, painted for Queen Victoria (1882); the prince of Wales, Lord Dufferin, the duke of Cleveland (1885); Lord Overstone, Bright, Gladstone, Chamberlain, Sir J. Tenniel, Earl Spencer, Viscount Cranbrook and many others.

HOLL, KARL (1866–1926), German church historian, born at Tübingen on May 15, 1866, is famous for his work on *Luther* (vol. i. of his *Gesammelte Aufsätze zur Kirchengeschichte*, 1921). This book is a classic work, showing a profound knowledge of the period and a remarkable insight into the character of Luther himself. Holl was professor at Tübingen, then at Berlin, and in the year before his death rector of the university of Berlin.

Holl's works include: *Die Sacra Parallela des Johannes Damascenus* (1897); *Enthusiasmus und Bussgewalt beim griechischen Mönchtum* (1898); and *Die Bedeutung der grossen Kriege für das religiöse und Kirchliche Leben innerhalb des Protestantismus* (1917). *See* A. von Harnack and H. Lietzmann, *Karl Holl* (1926).

HOLLAND, CLIFFORD MILBURN (1883–1924), American engineer, was born at Somerset (Mass.), on March 13, 1883. He graduated at Harvard university in 1906, and was soon appointed assistant engineer of the Battery-Joralemon street tunnel, New York city. On the completion of this work in 1908, he was in charge of a portion of the Fourth avenue subway in Brooklyn. In 1914 he took direct charge of the Old Slip-Clark street and Whitehall-Montague street tunnels, and later of the Willoughby, 14th and 60th street tunnels in New York city, all, like the Battery-Joralemon street tunnel, connecting Manhattan and Long Island. On July 1, 1919, he became chief engineer of the New York and New Jersey interstate bridge and tunnel commissions for the construction of a vehicular tunnel under the Hudson river. He died on Oct. 27, 1924, at Battle Creek, Michigan. A short time after his death the Hudson river tunnel, connecting lower Manhattan with Jersey City, was officially named the "Holland Tunnel."

HOLLAND, SIR HENRY, BART. (1788–1873), English physician and author, was born at Knutsford, Cheshire, on Oct. 27, 1788. He studied medicine at Edinburgh (1806–11). In 1816 he began to practise in London. In 1840 he became physician in ordinary to Prince Albert, and in 1852 to the queen. He was created a baronet in 1853. He died on Oct. 27, 1873.

Sir Henry Holland was the author of *General View of the Agriculture of Cheshire* (1807); *Travels in the Ionian Isles, Albania, Thessaly and Greece* (1812–13, 2nd ed., 1819); *Medical Notes and Reflections* (1839); *Chapters on Mental Physiology* (1852); *Essays on Scientific and other Subjects contributed to the Edinburgh and Quarterly Reviews* (1862); and *Recollections of Past Life* (1872).

HOLLAND, HENRY FOX, 1ST BARON (1705–1774), English statesman, second son of Sir Stephen Fox, was born on Sept. 28, 1705. Inheriting a large share of the riches which his father had accumulated, he squandered it soon after attaining his majority, and went to the Continent to escape from his creditors. He contracted a wealthy marriage which enabled him, in 1735, to enter parliament as member for Hindon, Wiltshire. He became the favourite pupil and devoted supporter of Sir Robert Walpole. He was surveyor-general of works from 1737 to 1742, was member for Windsor from 1741 to 1761; lord of the treasury in 1743, secretary at war and member of the privy council in 1746, and in 1755 became leader of the House of Commons, secretary of state and a member of the cabinet under the duke of Newcastle. In 1757, in the rearrangements of the government, Fox was ultimately excluded from the cabinet, and became paymaster of the forces. During the Seven Years' War, Fox devoted himself mainly to accumulating a vast fortune. In 1762 he again became leader of the House, with a seat in the cabinet, under the earl of Bute, and exercised his skill in cajolery and corruption to induce the House of Commons to countenance the Treaty of Paris of 1763; as a recompense, he was raised to the House of Lords with the title of Baron Holland of Foxley, Wiltshire. In 1765 he was forced to resign the paymaster generalship, and four years later a petition of the livery of the city of London against the ministers referred to him as "the public defaulter of unaccounted millions." The proceedings brought against him in the court of exchequer were stayed by a royal warrant and he justified the delays by appealing to custom. He died at Holland House, Kensington, on July 1, 1774. By his wife, Lady Georgina Caroline Lennox, he had four sons: Stephen, 2nd Lord Holland (d. 1774); Henry (d. an infant); Charles James (*see* FOX, CHARLES JAMES); and Henry Edward (1755–1811), soldier and diplomatist.

HOLLAND, HENRY RICH, 1ST EARL OF (1590–1649), 2nd son of Robert, 1st earl of Warwick, and of Penelope, Sir Philip Sidney's "Stella," daughter of Walter Devereux, 1st earl of Essex, was baptized on Aug. 19, 1590, educated at Emmanuel college, Cambridge, knighted in 1610, and returned to parliament for Leicester in 1610 and 1614. In 1610 he was present at the siege of Juliers. Favours were showered upon him by James I. He was made gentleman of the bedchamber to Charles, prince of Wales, and captain of the yeomen of the guard; and in 1623 he was raised to the peerage as Baron Kensington. In 1624 he was sent to Paris to negotiate the marriage treaty between Charles and Henrietta Maria. In September he was created earl of Holland, and in 1625 was sent on two further missions, first to Paris to arrange a treaty between Louis XIII. and the Huguenots, and later to the Netherlands with Buckingham. He held various places under Charles I., but deserted his cause in 1641. He was chosen by the parliament in March and July 1642 to communicate its votes to Charles, who received him with studied coldness. He was appointed one of the committee of safety in July, and joined Essex's army at Twickenham, where, it is said, he persuaded him to avoid a battle. In 1643 he appeared as a peacemaker, and after failing to bring over Essex, he returned to the king. His reception, however, was not a cordial one, and after the first battle of Newbury he once more returned to the parliament. Once again he renewed his allegiance to the king's cause; and after endeavouring to promote the negotiations for peace in 1645 and 1647 he took up arms in the second Civil War, received a com-

mission as general, and put himself at the head of 600 men at Kingston. He was defeated on July 7, 1647, captured at St. Neots shortly afterwards, and imprisoned at Warwick Castle. He was sentenced to death, and was executed together with Hamilton and Capel on March 9, 1649.

HOLLAND, HENRY RICHARD VASSALL FOX, 3RD BARON (1773–1840), was the son of Stephen Fox, 2nd Baron Holland, and his wife née Lady Mary Fitzpatrick. He was born at Winterslow House, Wiltshire, on Nov. 21, 1773, and his father died in 1774. He was admitted to the privy council in 1806, and on Oct. 15 entered the cabinet "of all the talents" as lord privy seal, retiring with the rest of his colleagues in March 1807. His loyalty as a Whig during the long subsequent period of opposition was rewarded by his appointment as chancellor of the duchy of Lancaster in the cabinet of Lord Grey and Lord Melbourne, and he died in office on Oct. 22, 1840. Lord Holland is notable, not for his unimportant political career, but as a patron of literature, as a writer, and as a leader in the Whig political and literary world of the time. Lady Holland (d. Nov. 16, 1845) made for herself in London the position filled in Paris during the 18th century by the society ladies who held "salons." Lord Holland's *Foreign Reminiscences* (1850) contain much amusing gossip from the Revolutionary and Napoleonic era. His *Memoirs of the Whig Party* and *Further Memoirs* (1852) are important contemporary authorities. Holland had two legitimate sons, Stephen, who died in 1800, and Henry Edward (d. 1859) 4th and last Lord Holland who edited his father's *Reminiscences* and *Memoirs*.

See *The Journal of Elizabeth, Lady Holland,* edited by the earl of Ilchester (1908); and Lloyd Sanders, *The Holland House Circle* (1908).

HOLLAND, HENRY SCOTT (1847–1918), English divine, was born at Ledbury, Hereford, on Jan. 27, 1847. He was educated at Eton and at Balliol college, Oxford; in 1872 he was ordained, becoming the same year a tutor at Christ Church. In 1882 he was senior proctor of the university, and the same year was made a canon of Truro and examining chaplain to its bishop. He was appointed a canon of St. Paul's in 1884, and in 1886 precentor. He refused the offer of the see of Norwich in 1893, but in 1910 was appointed regius professor of divinity at Oxford. He died at Oxford on March 17, 1918. Scott Holland was closely associated with the Christian Social Union for many years. He was a successful tutor and a popular professor; but it is as a preacher that he is most vividly remembered.

See his *Life,* by Stephen Paget (1921).

HOLLAND, JOHN PHILIP (1841–1914), American inventor, was born at Liscannor, County Clare, Ireland, in 1841. He was educated at Limerick, and was a schoolmaster in Ireland prior to migrating to the United States. He was teaching in New Jersey when the Civil War broke out and the conflict between the "Merrimac" and the "Monitor" suggested to him the idea of a submarine. He became a pioneer in this field and one of the most successful designers of submarine craft. The first boat, built in 1875, was a failure and it was not until his ninth attempt in 1898 that he produced a serviceable submarine. This boat was commissioned for the U.S. navy.

His great achievement was the furnishing of the submarine with two methods of propulsion, a 50 h.p. gasolene engine to be used when on the surface and electric storage batteries when submerged. The British admiralty acquired all the patents for Great Britain, although his avowed purpose had been to invent a craft that would overcome the British naval supremacy. Holland then turned his attention to the construction of submarines for seagoing purposes, and all his subsequent boats were built for the U.S. navy. He died at Newark (N.J.) on Aug. 12, 1914.

HOLLAND, JOSIAH GILBERT (1819–1881), American author and editor, was born in Belchertown (Mass.), July 24 1819. He graduated in 1843 at the Berkshire medical college at Pittsfield (Mass.), and after practising medicine and making an unsuccessful attempt to establish a hospital for women, he taught for a while in Richmond (Va.), and Vicksburg (Miss.). In 1849 he became assistant editor under Samuel Bowles, and three years later one of the owners of the Springfield (Mass.) *Republican.* After travelling in Europe he moved to New York in 1870, where he became editor and one-third owner of *Scribner's Monthly* (after 1881 *The Century*).

Dr. Holland's earlier books were published over the pseudonym "Timothy Titcomb." His highly popular writings include a *History of Western Massachusetts* (1855), and a *Life of Abraham Lincoln* (1865). He died Oct. 12, 1881.

See Mrs. H. M. Plunkett's *Josiah Gilbert Holland* (1894).

HOLLAND, PHILEMON (1552–1637), English scholar, "the translator-general in his age," was born at Chelmsford, Essex, the son of a clergyman, John Holland, who had been in exile with Miles Coverdale during the Marian persecution. Having become a fellow of Trinity college, Cambridge, he was incorporated at Oxford (July 11, 1585) and studied medicine. About 1595 he settled as a doctor in Coventry, but chiefly occupied himself with translations, which included Livy, Pliny's *Natural History,* Plutarch's *Morals,* Suetonius, Ammianus Marcellinus and Xenophon's *Cyropaedia.* He published also an English version, with additions, of Camden's *Britannia.* His Latin translation of Brice Bauderon's *Pharmacopaea* and his *Regimen sanitatis Salerni* were published after his death by his son, Henry Holland (1583–?1650).

HOLLAND, RICHARD or **RICHARD DE HOLANDE** (*fl.* 1450), Scottish writer, author of the *Buke of the Howlat,* was secretary or chaplain to the earl of Moray (1450) and rector of Halkirk, near Thurso. He was afterwards rector of Abbreochy, Loch Ness. He was an ardent partisan of the Douglases, and on their overthrow retired to Orkney and later to Shetland. He was employed by Edward IV. in his attempt to rouse the Western Isles through Douglas agency, and in 1482 was excluded from the general pardon granted by James III. to those who would renounce their fealty to the Douglases.

The poem, entitled the *Buke of the Howlat,* written about 1450, shows his devotion to the house of Douglas:—

> On ilk beugh till embrace
> Writtin in a bill was
> O Dowglass, O Dowglass
> Tender and trewe!
>
> (ii. 400–403).

and is dedicated to the wife of a Douglas—

> Thus for ane Dow of Dunbar drew I this Dyte,
> Dowit with ane Dowglass, and boith war thei dowis,

but all theories of its being a political allegory in favour of that house may be discarded. The poem, which extends to 1,001 lines written in the irregular alliterative rhymed stanza, is a bird-allegory, of the type familiar in the *Parlement of Foules.*

The text of the poem is preserved in the Asloan and Bannatyne mss. Fragments of an early 16th century black-letter edition, discovered by D. Laing, are reproduced in the *Adversaria* of the Bannatyne club. Of the many editions *see* that by F. J. Amours in *Scottish Alliterative Poems* (Scottish Text Society, 1897), pp. 47–81. (*See* also Introduction, pp. xx.–xxxiv.)

HOLLAND, SIR (THOMAS) ERSKINE (1835–1926), English international jurist, son of Thomas Agar Holland, poet, and rector of Poynings, Sussex, was born on July 17, 1835, and educated at Brighton college and Balliol college, Oxford. He studied Greek philosophy and was elected Fellow of Exeter college. In 1863 he was called to the Bar (Lincoln's Inn), joining the Home Circuit. In 1874 he was appointed Vinerian Reader in English Law at Oxford, and later in the same year, on the resignation of Dr. Bernard, Chichele Professor of International Law and Diplomacy, a post which he held for 36 years. In 1875 he became associate (and later member) of the Institut de Droit International, which held a meeting in Oxford on his invitation in 1880. The Naval Prize Act (1894) was drafted by him, and also the Admiralty Manual of Prize Law (1888). He was particularly interested in law in its scientific and literary aspects, and in 1894 gained the Swiney Prize for his *Elements of Jurisprudence* (13 editions). The War Office made use of his services in drafting orders for troops in the field, and these were subsequently co-ordinated and published under the title of *Laws of war on land* (1904). In 1903–5 he served on the Royal Commission on the Supply of Food in Time of War and attended the Geneva Conference (1906) as plenipotentiary. In 1917 he received his knight-

hood. He died on May 24, 1926. He had five sons, including Sir Robert Erskine Holland, and one daughter.

HOLLAND, officially the kingdom of the Netherlands (*Koningrijk der Nederlanden*), a maritime country in the north-west of Europe commonly known as Holland. This name, however, is that of the former countship which was largely the political nucleus of the kingdom. North Holland and South Holland (*q.v.*) are but two of the 11 constituent provinces. Their geographical importance is partly indicated by their population, for they are the most densely populated political units.

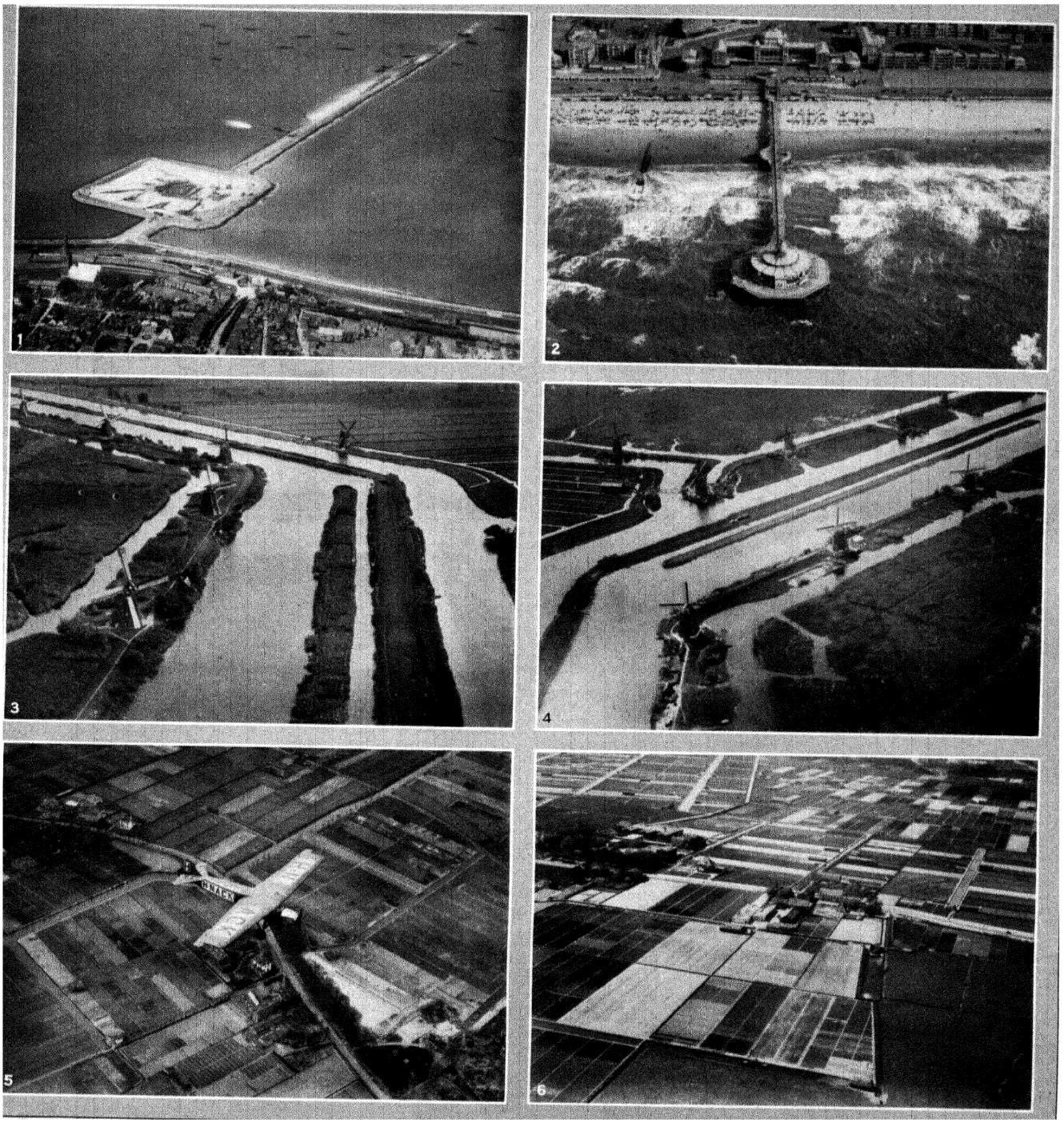
Topography.—Holland is bounded eastward by Germany, south by Belgium, west and north by the North sea, and at the north-east corner by the Dollart. From slightly below Stevensweert to the south-west corner of Limburg the boundary line is formed by the river Maas or Meuse. At Maastricht, however, a portion lies beyond the left bank of the river, about 7,900 ft. from the outer glacis of the now dismantled fortress. The boundary is defined *"la ville de Maastricht . . . avec un rayon de territoire de douze cents toises à partir du glacis extérieur de la place"* (Item 2, Art. IV. of Treaty between Holland and Belgium, April 19, 1839). On the east a fairly continuous natural boundary is represented by the line of marshy fens extending along the borders of Overyssel, Drenthe and Groningen. South of this the line is less definite, but the Maas in its great swing between Roermond and Grave runs just west of the German frontier. The kingdom extends from 53° 33′ (Rottum island off Groningen) to 50° 46′ (South Limburg), and from 3° 22′ (near Sluis, Zeeland) to 7° 13′ (East Groningen). The greatest length from north to south is thus about 190 m.; its breadth varies considerably, the maximum from south-west to north-east entirely within its borders is about 160 miles. The area shows continual variation, diminishing by coastal erosion and increasing by diking and drainage operations. In 1926 the total land area was estimated at 12,593 sq.m. or, inclusive of inland waters 13,210 sq.m.; an estimate in 1920 gave 15,760 sq.m. for land, inland waters, gulfs and bays. In no other country of Europe have the inhabitants been so instrumental in modifying the character of their home territory.

Coast and Relief.—The surface features and sea boundaries of the Netherlands are profoundly influenced by the fact that the country largely consists of the delta portions of two rivers, that of the Maas, commencing at Liége beyond southern Limburg, and that of the Rhine, commencing at Bonn; these delta areas overlap in northern Limburg and North Brabant, and from there northwards Zeeland can be interpreted as a portion of the same deltas plus deltaic material from the Schelde. The deltas are the direct result of the convergence of the waters of the three rivers into a tidal-node area where crest neutralizes trough and produces non-scouring conditions. North of the Zeeland archipelago the tidal set is more definitely north-east as the flow is assisted by prevalent winds and by the non-tidal water drift; consequently the ebb set of the tide cannot return all material carried forward by the flow. In addition, Scandinavian inland ice swept southward with its limit, in the Netherlands, roughly along the north-west—south-east line Zaanvoort—Maartensdijk—Rhenen—Nijmegen. Dependent on the former presence of this ice-sheet are the existing glacial ridges which occur in Drenthe, Overyssel, and particularly in Gelderland, and which have not only acted as watersheds and materially affected the drainage of to-day but have also had important effects on natural and cultivated vegetation and on the related activities of the Dutch people.

The ridges, which run broadly north to south, are the result of tangential compression of the ice; they have a core of distorted and contorted fluviatile material of southern origin, and their lower slopes are locally covered by boulder clay, northern boulders or fluvio-glacial debris. The last is sandy in character and frequently fills the hollows between the ridges. Five main ridges have been determined: Emmen to Groningen, Enschede to Gotmarsum, Lochem to Havelte, Arnhem to Hattem, Rhenen to Bussum. West of the last ridge the glacial deposits sink below sea level, but have been proved in North Holland by borings. (*See* "Physiographic Regions of the Netherlands" by P. Tesch, *Geographical Review* [New York, 1923] pp. 507–517.) The summit height occurs on the Gelderland ridge north of Arnhem, where Imbosch mound reaches 110 metres (361 ft.). The non-glaciated lands are low but show a slight increase of height south-eastward until south Limburg is reached; the increase there is rapid for that land, both geologically and orographically, belongs to the plateau bordering the north Ardennes. As a result of this it presents the Dutch with their only source of home coal. The summit height for all the Netherlands is in the extreme south-east corner, where Holland, Germany and Belgium meet; here "Four Countries View" (Moresnet [Eupen-Malmédy] now belonging to Belgium was the fourth) reaches 322 metres (1,057 ft.). The amount of land exceeding 1,000 ft. is microscopic and very little exceeds even 150 ft. More than 35% lies less than a metre above Amsterdam level. (Throughout the Netherlands, and also in adjacent German areas, the basis of the official measurement of altitudes is the *Amsterdamsch Peil* [A.P.]; *i.e.*, Amsterdam average high-water level of the **Y** at the time when it was open to the Zuider Zee.) Fully a quarter of the country in the west, fortunately fringed by the sand dunes, is actually below Amsterdam Zero. Extreme depths reach 16–20 ft. below; nevertheless the land is cultivated.

The coast forms a bold sweeping curve, concave to the sea in its south-western part and convex in its north-eastern section, broken in the south at the Zeeland—S. Holland archipelago, and again in the north, where such channels as the Marsdiep, Vlie, and Friesche Gat among the West Frisian Islands give entrance to the Zuider Zee (*see* IMPOLDERING) and to that waterland (wadden) which, extending along the Friesland-Groningen coast and beyond, is invaded by the sea at each flood. The characteristic features of the coast are the chains of sand dunes nearly 200 m. in total length fringed by a broad, sandy beach shelving gradually seaward. In general, the dunes seldom exceed 30–40 ft. though near Haarlem, *i.e.*, in the centre of the unbroken strip, the High Blinkert is nearly 200 ft. above A.P.; northwards where the winds have a wider sweep over the open sea the dunes are themselves wider, even exceeding 2½ m. from west to east at Schoorl north-west of Alkmaar. The two main dune chains were formed in successive ages. The land bridge between Dover and Calais foundered and tidal currents swept eastward carrying sandy fragments of England and France which were built up into submarine shelly sandbanks between Calais and Texel; the banks lengthened and joined, though gaps remained opposite to the river mouths; at low tide sand dunes were blown on to these banks. New dunes grew on new banks seaward and cradled little flats of old beach between their successive ridges. This phase ended probably much prior to A.D. 300, as suggested by archaeological evidence and proved by other lines of study; *e.g.*, the upper parts have had all lime removed by weathering but lower down there are abundant small fragments of common shells, while still below these is the basal sand-bed with whole valves of the same shells. (These remnants are sufficiently valuable to be worth extraction as a source of building lime in a land where the main calcareous deposits are as remote as the chalky hills of south Limburg.)

The next and present period of dune-building was probably dependent on coast border changes near the Straits of Dover, or on local oscillations of the land and water levels, or on both. In any case, the upper portions of the basal sand-banks of the oldest, *i.e.*, eastern, of the Old Dunes, are now several feet below A.P. of to-day, and certain Roman structures have been discovered below sea level. In some areas the Old Dunes have been entirely destroyed and the new dunes rest direct on new estuarine polder-clay, as in Zeeland-Flanders; along the greater part of the coasts of North Holland and South Holland both sets still exist with the newer on the seaward side though some new dune sands have been carried eastward and locally overlie the old dunes and the plains between them, and some have reached and even overwhelmed coastal patches on the Zuider Zee. This tendency to an eastward drift is artificially arrested by the planting of reed grass. The westward growth of the line of dunes has within recent times changed seaports to inland towns, and a new settlement has arisen on the new coast, *e.g.*, Egmond and Egmond



PHOTOGRAPHS, ROYAL DUTCH AIRLINES, FROM ORIENT AND OCCIDENT

AERIAL VIEWS IN THE NETHERLANDS

1. One of the great dykes of the Zuyder Zee reclamation project under construction. It will extend from Medemblik (foreground) to the island of Wieringen, which is already connected with the mainland of North Holland province. This dyke will make it possible to transform a water area of about 76 square miles into fertile land
2. Pier and bathing beach of Scheveningen, Holland's most fashionable bathing resort, as seen from the sea. The centre building is the Kurhaus, or Grand Hôtel des Bains

3 and 4. Inland polder fields showing the canals, windmills and dykes by means of which these fertile lands, which constitute a great part of Holland, have been recovered from the sea

5 and 6. Bulb-fields near Haarlem, the centre of Dutch bulb-growing. In spring, when the hyacinths and tulips are in bloom, this impoldered land presents a magnificent variety of colours. In June and July, after the flower season is over, the bulbs are brought to the bulb-barns (seen in the photographs) to be cleaned, sorted, dried and stored away. Vegetables are also widely cultivated in the rich land around Haarlem

aan-Zee. (*See* NORTH HOLLAND.) There is thus a distinct west to east zoning in the Netherlands. The physical difference between adjacent strips has had important effects on the activities of the Dutch peoples. In the lee of the dunes are the dune pans, which are naturally marshy through the defective drainage of the clay-like soil, but the *geest* grounds where dune and pan meet can be planted with trees. The marshy pan is then gradually drained and cultivated, whilst the numerous springs at the dune base can be made to provide water for local use in the little settlement thus developed. Many old towns in North and South Holland, *e.g.*, The Hague and Leyden have so originated. Modern developments have allowed the dune-base drinking water to be carried considerable distances—Amsterdam was so supplied in 1853, and other towns more recently. Beyond the *geest* lands are the low fens, usually still very marshy but gradually being reclaimed; still farther eastward, in North Holland, is the Zuider Zee, succeeded in turn by the eastern margin fenland, and finally by the elm and poplar patches, sandy heaths, high fens, and riverine meadow strips of the eastern frontier, which in every respect are much less typical of the accepted conception of Dutch scenery.

The entire drainage of the Netherlands is ultimately into the North sea. The principal rivers are the Rhine, the Maas (Meuse) and the Schelde (Scheldt), and each has its origin outside the country, whilst in the case of the Schelde only its two great sea channels are within the territory of the Netherlands. The Rhine in its course through this land is merely the parent stream, splitting up into Rhine and Waal above Nijmegen, Rhine and Yssel above Arnhem, Crooked Rhine and Lek (which takes most of the waters), near Wijk-by-Duurstede and at Utrecht into Old Rhine and Vecht, finally reaching the sea through the sluices at Katwijk. The Yssel and the Vecht reach the Zuider Zee; the other branches the North sea. The Maas, whose lower course is almost parallel to that of the Waal enters the Netherlands in the extreme south, forms the international boundary as far as Stevensweert, crosses Limburg to its north junction with North Brabant, and then closely follows the north boundary of North Brabant; from this province it receives its large lower tributaries, the Mark and the Dommel-Aa. Up to 1907 the main stream joined the Waal at Gorinchem and flowed to Dordrecht. From here Maas waters reached the sea by Old Maas and De Noord; the latter joining the Lek and reaching the sea as the New Maas. From Gorinchem the New Merwede (constructed in the second half of the 19th century) extends between dikes through the marshes of the Biesbosch to the Hollandsch Diep. These great slowly flowing rivers are very important waterways. In the Waal ordinary high-tide water reaches beyond Gorinchem; in the Lek the limit is at Vianen; in the Yssel, above the Katerveer, near Zwolle; and in the Maas near Heusden. During spring tides, in each case the effect is felt considerably farther up-stream; *e.g.*, in the Lek to Culemborg.

Into the Zuider Zee there also flow the Eem from Utrecht province; the Vecht, with its tributaries Regge and Dinkel, from Overyssel; and numerous shorter streams from Friesland. The total length of navigable channels is about 1,200 m., diminished during summer on account of shallows. The smaller streams, except where they rise in the fens, often fertilize a strip of grassland in the midst of the barren sand, and are responsible for the existence of many villages along their banks. Artificial irrigation is also practised by means of some of the smaller streams, especially in the east and south-east, and in the absence of streams a canal system is sometimes specially constructed for the same purpose. The low-lying areas at the confluences of the rivers, being readily laid under water, have been frequently chosen as sites for fortresses, but probably the greatest value of the rivers, apart from their direct use as waterways for transport, is their indirect use in this respect, viz., to act as permanent water supplies for the numerous canals. Practically every stream of any size in the Netherlands functions in this capacity.

Lakes.—Obviously lakes are particularly numerous though small; the largest have been drained. (*See* IMPOLDERING.) Many existing ones are merely marshes or flooded peat-pits, while several contain entrapped sea water. The typical "Lake District" is in Friesland. East of the Meppel-Leeuwarden line are several, *e.g.*, Fleussen, Tjeuke Meer, Sloter Meer, Sneeker Meer, noted for their abundance of fish or for their beauty of situation.

Dikes.—Some of the earliest inhabitants of the Netherlands of whom there is definite record were the Free Frisians, living in the far north of the country. They were not subdued by the Romans until A.D. 47, and prior to this had settled long enough to build extensive mounds (*terpen* or *wierden*) on the marshes exposed to inundation. These at first were merely high enough to protect the few rude huts on their summits from the normal rise of the tide, but in course of time the accumulated débris of settlement and drifted material increased their height and extent, so that they became safe refuges during mildly abnormal rises of tide. The experience thus gained, together with the presence over a considerable area of northern erratic boulders (*see* RELIEF) allowed the early inhabitants to build primitive dikes at the coast edge. The increased food resources of these newer sites led to the abandonment of many of the inland mounds, though many of the older towns and villages of Friesland and Groningen each still occupies a separate *terp*. The primitive dikes were steadily improved and much more ambitious schemes were launched, both here and in other parts of the Netherlands, particularly in the 12th and 13th centuries when the steady sinking of the land, or rise of the sea, created such serious problems. During this period the great sand-dune fringed fresh-water basin, the *Flevo lacus*, of the Romans gradually increased in size, for the lower river channels which formerly carried the water seawards became the waterways by which the sea entered the sinking basin; about A.D. 1300 *Flevo lacus* had become a real southern sea bay, *Almare* of the North sea. Apparently this Zuider Zee inundation was more gradual than the catastrophic ones of A.D. 1277, when 30 villages in the lower Ems basin were destroyed on the formation of the Dollart, or the disastrous flood of 1421 when the Hollandsch Diep gave entrance to a sea which caused the destruction of 72 villages and more than 100,000 lives, and converted a prosperous agricultural colony into a forest of reeds—*Biesbosch*. Again, a century later (1532) the fertile east of South Beveland, with 3,000 inhabitants, was submerged in a single flood and to-day it remains as Verdronken (Drowned) land.

In view of the possibility of ever-recurrent even though minor inundations, *e.g.*, in 1916, the Netherlanders have wisely devoted much money and applied the talents of skilled engineers to the construction of protective works. These of necessity must be of enormous size. Westkapelle dike, situated between Westkapelle and Domburg, and the Hondsbossche Zeewering, from Kamperduin to near Petten, were built in the 15th century and were reconstructed and extended between 1860 and 1884; even such massive structures as these need constant inspection and maintenance, for although large blocks of basalt, as at Westkapelle, or of granite, as at the Helder, are used, yet gigantic wooden piles have been necessary to reach the more solid material below and to act as supports for the masonry. Many of the older piles had been riddled by the pile-worm (*Teredo navalis*), as its ravages were not detected until 1731. At the present day electrical treatment is used for the destruction of the pests, and the engineers also have available the more resistant ferro-concrete pile. A corps of engineers (*De Waterstaat*) is exclusively occupied on protection and reclamation works. In consequence, the detailed construction of the dike varies to meet the specific difficulties of different parts of the Netherlands. Probably Westkapelle is the finest of its type in the world; it is over 2 m. long, has a seaward sloping face of 300 ft., and on its ridge (39 ft. broad) carries a road and service railway. Many others are of interest, as the Helder dike, about 5 m. long, 12 ft. wide (carrying a road), with its end plunging 200 ft. into the sea at an angle of 40°. Such dikes as these are sea protection works; other dikes guide rivers and guard the adjacent lands.

Canals.—Parallel dikes either strengthen or replace the banks of rivers which are then deepened and kept permanently supplied with water. They then rank as canalized rivers, *e.g.*, the New Merwede canal, from Amsterdam to the Rhine. In other

cases the dikes bound newly cut excavations in preparation for entirely artificial canals. Typical of the largest is the North Holland canal (1819–1825) 46 m. long, 130 ft. broad and 20 ft. deep, with its level at Buickloot, 10 ft. below the average level of the sea at half-tide. It runs from Amsterdam, where it is controlled by the vast sea-gates (Willems Sluis), to the Helder; another is the North sea canal (1865–76) which, 15 m. long, 65–110 yd. wide and 22–26 ft. deep runs from Amsterdam almost due west to the North sea. As the surface of this canal is 20 in. below mean water level at Amsterdam it has been provided with gigantic locks and ponderous sea-gates apart from protective piers and dams. The total of navigable canal in the Netherlands is about 2,000 m.

Dike-dams have also been thrown across rivers to control them, and several old towns owe their origin to such dams as Amsterdam (1257) across the Amstel, Edam across the Y, and many others. Dams with lock-gates are used to close the sea exits not only of canals but of rivers also. Those of the Old Rhine near Katwijk aan Zee were built in 1807 to control the river. As far back as A.D. 839 a hurricane closed the river's mouth by sand accumulation: for nearly 1,000 years the pent-back waters spread out forming a huge swamp; a canal was cut and three sets of locks were built with 2, 4 and 5 pairs of gates. These are closed during high tide (even during low tide with a strong on-shore wind) and are then successively opened to allow the accumulated water to escape, through the final control of the five pairs of seaward gates for 5–6 hr. at each ebb. The skill in dike and dam building manifests itself in the later erections of the great railway embankments such as those carrying the Flushing line over the island chain to the mainland, or the still more striking individual great bridge (1868–71) over the Hollandsch Diep which is 1⅝ m. wide.

Impoldering.—The presence of a dike is frequently sufficient in itself to cause an increase in the land available for occupation, as on the seaward face muds and sands are deposited by the sea. These become clad with vegetation and at certain states of the tide can be grazed; the area consolidates and another seaward dike can then be erected. Nevertheless, the big reclamation schemes generally result from the total enclosure of a marshy area by encircling dikes. The isolated area occasionally improves by the mere shutting out of further water, but usually the entrapped water is removed by pumping it into outside drainage channels or canals. In particularly difficult cases this may necessitate the lifting of the water to successive levels by a series of individual pumps. The land thus reclaimed, *polder,* is normally extremely fertile. Although a great part of the Netherlands has now been impoldered the practice, on any considerable scale, dates back only to the period when heavy pumping became possible. The windmill was first so used in the 14th century and showed a high degree of reliability on the wide wind-swept lowlands, but to-day with water control needed over much greater areas with an intricate system of canal and sluice, polder, dike and ditch, other pumping plants are being extensively used, such as steam and electrical. Fortunately, the more artistic windmill is likely to function for many years yet in this land deficient in coal and water power. Of the great and numerous impoldering schemes only a few can be selected.

The most spectacular have been carried out in North Holland and South Holland. Near Alkmaar is the Schermer polder, the drainage of which demanded channels at four different levels. Immediately south of it are the Beemster, Wormer and Purmer polders centring on Purmerend. Here the Beemster (1608–12) produced some of the most valuable agricultural land in the Netherlands. Still larger is the famous Haarlemmer polder. Up to 1840, Haarlemmer Meer was 18 m. long, 9 m. broad and 14 ft. deep, and had been produced by the ponding back of the Rhine in the 15th century and by the crumbling away of the banks of the Y. It began to imperil Amsterdam, Haarlem, Leyden and Utrecht, and its draining (1848–53) was largely a safety measure, nevertheless the reclaimed land, about 72 sq.m., has proved so valuable that the cost of the scheme (about £1,000,000) has already been repaid nearly threefold. Subsequently the Y polder was reclaimed during the construction of the North sea canal.

The largest impoldering scheme on record has now been commenced. On June 14, 1918, a law was passed for the draining of part of the Zuider Zee. The work commenced in 1924 and is expected to take 15 years. The first stage will add four polders of a total area of about 820 sq.m. (nearly the size of Limburg) to the country, at an outlay cost of about £5½ millions. The main dike will extend from the island of Wioringen broadly north-east to the Friesland coast thus enclosing what will ultimately be a great fresh-water lake. The largest—the south-east polder (about 420 sq.m.) will extend from the coast, near Kampen, to south-west of Amsterdam, near Muiden; the north-east polder (about 200 sq.m.) will follow a curving course through the island of Urk but leaving the Yssel channel unobstructed; the south-west polder (about 123 sq.m.) will run north-east from Marken and sweep back north-west to near Enkhuizen; the north-west polder (about 76 sq.m.), running south-east from Wieringen, will practically fill the bay now existing north-west of Enkhuizen. Such giant schemes as this one and those already completed raise serious and somewhat technical questions, such as temporary storage of waters removed by pumping, the construction of permanent reservoirs for the canal schemes, and, above all, the complicated legal matters relating to drainage and water rights. For information on these, *see* the *Gedenboek uitgeven ter gelegenheid van het fiftig-jarig bestaan van het koninklijk Instituut van Ingenieurs* 1847–97 ('s Gravenhage, 1898).

Climate.—Neither in latitude nor in altitude has the country a wide range, for from north to south it is less than 3°, and very little land exceeds 300 ft.; hence the climate is somewhat similar throughout. Nevertheless, as the winter isotherms do tend to run due north and south, and the summer isotherms to parallel the coast, then the east is more extreme than the west and the Netherlands, as a whole, have a colder winter than east England between the same latitudes. The recorded absolute minimum is nearly −6° F (38° frost). Utrecht may be considered as roughly central; here the average for the coldest month (January) is 34·2° F, while farther east much of the traffic is ice-borne during winter. The average for the hottest month (July) at Utrecht is 62·6° F. The south-west winds prevail for about nine months annually raising the winter temperatures, but are replaced by the April–June north-west winds, which produce a cooler summer. As a consequence of the wind direction the west part of the country, particularly along the dunes, is wetter than the east. The annual total rainfall average for the whole country is not high, probably less than 28 in.; the figures for Utrecht are 27·5 in. annually, with July–Sept. (9·2 in.) as the three wettest months, and Feb.–April (4·7 in.) as the three driest. This early spring minimum results in actual shortage in the east during dry years and some of the canals are then used as irrigation channels. The mean annual number of "rain-days" slightly exceeds 200, but probably more important is the constant high degree of humidity (exceeding 80%) consequent on the large amount of standing water; marsh mists and sea fogs are frequent, and seem to have harmful effects in Friesland and Zeeland, where the medical statistics for pulmonary diseases suggest rather disquieting conditions.

Fauna.—In densely populated areas with no extensive forests, the fauna seldom present unusual varieties. In the Netherlands the otter, marten and badger are found, though rarely, but the weasel, ermine and pole-cat are more common. In the 18th century wolves roamed the country in large numbers; now they are unknown. Wild roebuck and deer are found in the drier wooded regions to the east of the country; here foxes are still plentiful. In the dunes and other sandy stretches the hare and rabbit occur in large numbers. Birds are unusually well represented; about 240 different kinds are regular inhabitants, although nearly 200 of these are migratory. The woodcock, partridge, hawk, water-ousel, magpie, jay, raven, various kinds of owls, pigeon, wren, lark, titmouse and others breed in the Netherlands while birds of passage include the buzzard, kite, quail, wild fowl of various kinds, thrush, wagtail, linnet, finch and nightingale. The beautiful plumaged heron haunts

the mud-flats and the protected house-stork with its large clumsy nest is a typical Dutch feature. Fish are important; eels are trapped and smoked as food reserves; flat-fish are a source of wealth in the Zuider Zee, herrings are netted in the North sea and shell-fish, chiefly oysters, are dredged in Zeeland.

Flora.—The four physiographical divisions, namely, the heath-lands, pasture-lands, dunes and coasts are characterized by different flora. Heath and ling cover the waste sandy regions in the east of the country. In the more damp and marshy meadow-lands the bottom is covered with marsh trefoil, carex, smooth equisetum, and rush, while common water-lilies, water-soldier, reed-mace, flag and bur-reed are seen in the ditches and pools. Dune flora types are usually stunted and meagre as compared with the same forms elsewhere. The most important plant, sown annually to bind the loose sand together, is the Dutch *helm*, or smooth reed-grass (*Arundo arenaria*). It is much used for mat-making in Drenthe and Overyssel. The dewberry bramble and the buckthorn also help to bind the sand together. Furze and common juniper, used as a flavouring in the "Hollands" gin of Schiedam, occur both on the dunes and on the eastern heaths. The most general of the other dune plants are thyme, small white dune-rose, wall pepper, fever-wort, common asparagus, sheep's fescue grass, Solomon-seal and the marsh orchis. Certain plants are specially cultivated to assist in consolidating the mud flats and in enlarging the littoral deposits; of these the sea-aster flourishes in the northern Wadden (*see* COAST) giving place nearer shore to sand-spurry and to floating meadow grass, which afford pasture for cattle and sheep. Along the coast of Overyssel and in the Biesbosch lake club-rush is extensively planted for the basketry and other plaiting industries. In the northern half of the Zuider Zee the common sea-wrack is gathered for trade purposes during the summer months. Except for the pollarded willows found along the rivers on the clay lands, nearly all the natural wood is confined to the sandy gravel soils; here copses of elm, poplar, birch and alder are common.

Colonies.—The colonial possessions of the Netherlands include territories in the East Indies and the West Indies. The former, the Dutch East Indies, dating back to 1602, consists of a large number of low-latitude Pacific islands of an approximate total area of 735,000 sq.m. with a population of over 51 millions (1925), in which oriental natives vastly predominate; for example in 1926 the remarkably densely populated islands of Java and Madura (717 persons per sq.m.) had less than 170,000 Europeans out of a total population of 37,000,000. The Dutch West Indies, dating back to 1667, consist of Surinam and Curaçao with the dependencies of the latter; the total area is less than 55,000 sq.m., and the population in 1926 was almost exactly 200,000, of whom very few were Europeans.

Population.—The following shows the area and population of the Netherlands according to the communal population lists of Dec. 31, 1926.

Province	Area in English sq.m. Dec. 31, 1926	Population, Dec. 31, 1926
North Brabant	1,920	823,863
Gelderland	1,940	798,580
South Holland	1,133	1,814,536
North Holland	1,065	1,420,098
Zeeland	707	249,991
Utrecht	526	384,574
Friesland	1,248	401,388
Overyssel	1,295	483,185
Groningen	883	388,846
Drenthe	1,028	222,785
Limburg	847	508,760
Total	12,593	7,526,606

The last census was taken in 1920—population 6,865,314 of whom 3,410,262 were males showing less disparity between the sexes than is the case in other non-belligerent European countries. Other census returns indicate a steady and considerable population increase. Approximate figures (to nearest one-eighth million) were 1829, $2\frac{5}{8}$; 1849, 3; 1869, $3\frac{5}{8}$; 1889, $4\frac{1}{2}$; 1909, $5\frac{7}{8}$. The 1926 communal returns indicate that South Holland and North Holland, with the high density of 1,628 and 1,333 persons to the sq.m. respectively, are the most populous provinces; at the other extreme are Drenthe with 217 and Friesland with 322. At the beginning of the 20th century the order was the same. The average density for the whole country during this period has increased from 404 to 597·7 per sq. mile The most striking total increases in the provinces are South Holland from 981 and North Holland from 905, but the largest percentage increase is Limburg with 81%. No province has diminished in density, but Zeeland, with 313 in 1900 and 354 in 1926, has shown the least change. The townward movement continues and the percentage of rural population has fallen from 62·89 in 1889 through 56·27 in 1909, 54·37 in 1920 to 53·64 in 1926. The excess of births over deaths has shown a steady decrease in the period 1923–26 (inclusive) but has averaged about 109,000 per annum. Emigration (mostly to North America) has been slight in the same four years, averaging less than 4,000 per annum. The largest towns in 1926 were Amsterdam 726,527, Rotterdam 562,991, The Hague 408,634, Utrecht 151,055. Next in order between 50,000 and 100,000 were Groningen, Haarlem, Arnhem, Nijmegen, Tilburg, Leyden, Eindhoven, Maestricht, Apeldoorn and Dordrecht. In 1926, 47 towns in all had a population exceeding 20,000 each.

Constitution and Government.—The first Constitution of the Netherlands dates to 1814 (*see* HISTORY), but has been revised at intervals; most recently in 1917 and 1922. The important revisions of 1815 and 1840 were consequent on the addition and the secession, respectively, of the Belgian provinces. The Netherlands form a constitutional and hereditary monarchy, succession being in both the male and female line according to primogeniture, though female succession takes place only in default of male heirs. The widely-interpreted executive power of the State is vested exclusively in the sovereign, whose age of majority is 18 years. The whole legislative power rests conjointly in the king and the States-General (parliament). The upper chamber of parliament, 50 members, is elected for six years by the Provincial States (*see* LOCAL GOVERNMENT, below) and half retire, by rotation, at the end of three years. Each member not resident in The Hague, where the States-General meets, is allowed an expense grant of 10 guilders per day during the parliamentary session, but unless holding special office is otherwise unpaid. The sovereign's executive power is in part exercised by responsible ministers, who hold office at the pleasure of the sovereign. There are at present ten ministers controlling finance, foreign affairs, interior with agriculture, justice, colonies, war, public works (Waterstaat), marine, labour and instruction. The posts are salaried (16,000 guilders per annum), though an additional special grant, for representation, is made to the minister of foreign affairs. The lower chamber, which shares with the Government alone the privilege of initiating new bills and proposing amendments, consists of 100 deputies who are elected directly for four years and retire *en bloc*. Each deputy receives an annual salary of 5,000 guilders together with travelling expenses. Certain legislative and many executive matters are normally referred to a State council (*Raad van Staat*) consisting of 14 members appointed by the sovereign, who is also president of the council.

Since Dec. 12, 1917, suffrage has been universal for all Dutch subjects of 25 years of age, though reasonable exclusions are made in the case of certain civil disabilities. Elections are on a basis of proportional representation and the sovereign has the power to dissolve either or both chambers, subject to new elections within 40 days and a new assembly within two months.

Local Government.—Each of the 11 provinces has a local representative body—the "Provincial States," composed of members, not less than 25 years of age. All members are elected for four years by the inhabitants of the province who make use of a franchise system resembling that employed for selection of the lower chamber deputies. The Provincial States, which vary in size according to the number of inhabitants in the province, elect the members of the upper chamber of the States-General, collect local taxes and legislate on welfare schemes of special and peculiar importance to the province though all such financial

and legislative matters have to receive crown sanction. The Provincial States meet twice annually but their executive work and the daily administration of provincial affairs is in charge of 64 of their number (six from each province excepting Drenthe, which supplies four members). These, who constitute a permanent paid committee are termed the Deputed States. The Provincial States, as is the case with the Deputed States, are presided over by a salaried crown commissioner who, in the latter body, is the chief magistrate of the province. This becomes necessary because an important duty of the deputed States is the administration of the common law in the several provinces. Each of the communes (1,081 in 1927) elects a local council varying in size from seven to 45 members. Each member must be 23 years of age and a resident in the commune; the electoral system resembles that in use for the higher bodies. The communal council raises taxes, administers a municipal budget and makes and enforces communal by-laws subject to the approbation of the Deputed States. The crown appoints a mayor, with a six years' term of office, to preside over the communal council which vests its executive power in a college consisting of the mayor and two to six aldermen (*wethouders*). The mayor, as a direct crown representative, not only controls the municipal police but also supervises the work of the communal council and may suspend their resolutions for 30 days, though this extreme step must be reported to the Deputed States for more authoritative deliberation.

Justice.—Trial by jury is unknown in the Netherlands. Minor offences are tried by one judge in the cantonal court, of which 101 exist. More serious cases reach one of the 23 district tribunals with one or three judges in attendance. Beyond these are five courts of appeal, widely spaced over the country, which in turn are subject to the high court (*hooge raad*) of the Netherlands, which sits at The Hague with five judges in deliberation. The high court is not only the final court of appeal on points of law but is also the tribunal for the members of the States-General and for all high Government officials, including judges; the last are normally appointed for life by the sovereign. Recently, as a part of the reform movement in treatment of young criminals, juvenile courts have been called into existence. At these courts children's civil cases are tried by a specially selected judge, who also administers justice in relation to certain criminal acts of persons below the age of 18 years. During the three years 1924–26 there were on an annual average 7,700 males and 320 females in the 28 prisons; 16,300 males and 850 females in the 27 houses of detention; and 2,900 males and 33 females in the five State-work establishments. The State reformatories are of two types: (*a*) the more severe reformatory; and (*b*) the disciplinary school. In the latter, children are admitted by request of parents or guardians. The former during the 1924–26 period had an annual attendance of 900 boys and 100 girls and the latter 430 boys and 85 girls—the last number showing a steady yearly increase.

Charitable Institutions.—The guiding principle, based on the law of 1854, with regard to pauperism in the Netherlands has been that the State takes charge only when private charity fails, and although recent reorganization has tended to reduce the number and somewhat limit the activities of private charities they still occupy a more prominent position in the life of the community than is the case in many countries. The most important of such private institutions aim rather at the utilization of labour in new areas coupled with instruction courses designed to render labour available for new activities. Special mention should be made of the agricultural colonies controlled by the Society of Charity. (*See* DRENTHE.) Nevertheless, in 1925, the State disbursed over 55 million guilders in normal poor relief; a figure which was largely increased by unemployed relief. In 1916 a Government scheme of unemployment insurance was initiated.

A feature of Dutch culture is the large number of prosperous institutions for the encouragement of science and the fine arts; the majority of these institutions were founded during the century (1750–1850). In addition to the strictly national societies, numerous municipal institutions and associations cater for more than local interests. From a long list of such valuable culture aids perhaps special reference can be made to the institute of Language, Geography and Ethnology of the Dutch Indies (founded 1851 at The Hague) which has undoubtedly contributed materially to sympathetic understanding and the successful administration of Holland's distant colonies.

Religion.—Although the royal family and a large number of the inhabitants belong to the Reformed Church yet entire liberty of religious conscience is granted to citizens of the Netherlands—a continuation of that feature of religious liberty first stated in the revised Constitution of 1848. Financially, the practice is illustrated by the State budget (1928) when the following approximate allowances were made. Protestant churches 1,411,000 guilders; Roman Catholics 579,000; Jews 15,000; Jansenists 12,000. The 1920 census analysis showed the following total adherents throughout the country. Dutch Reformed Church 2,826,633; other Protestants 832,000; Roman Catholics 2,444,583; Jews 115,223; Jansenists 10,461; unknown 1,010 thus leaving the significantly large total of 635,240 (nearly 10%) of other creeds or of no creed. The government of the Reformed church is Presbyterian and its present organization dates from 1852. The controlling body is the main "synod" of deputies meeting annually. The provincial synods at the end of 1927 numbered ten, subdivided into 44 classes and a still larger number of circles drawn from 1,348 parishes in the care of about 1,650 ministers. (These figures include Walloon, English, Presbyterian and Scotch churches whose church government differs but little from that of the much larger Dutch Reformed Church.) Each congregation is governed by a "church council," and the scheme of supervision of ecclesiastical administration, though complicated, covers all stages from the main synod to the individual "church council"; financial control is much more individual. In 1853 the Roman Catholic Church in the Netherlands, previously merely a mission in the hands of papal legates and vicars, was elevated to an independent ecclesiastical province. (*See* UTRECHT PROVINCE.) In 1927 there were one archbishop (of Utrecht), four bishops and 1,295 parishes. The Roman Catholic element is most marked in the southern provinces of Limburg and North Brabant though the bishoprics have a much wider extension. The Jewish population of the Netherlands is largely consequent on the influence of Portuguese Jews at the end of the 16th and of German Jews in the beginning of the 17th century. In 1870 they were reorganized under a central authority,—The Netherlands Israelite church. In 1927 the Jews had 146 communities in the country. (For further details of the above and other religious bodies see *The Church in the Netherlands*, by P. H. Ditchfield, London, 1893.)

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Geology.—Except in Limburg, where, in the neighbourhood of Maastricht, the upper layers of the chalk are exposed and followed by Oligocene and Miocene beds, the whole of Holland is covered by recent deposits of considerable thickness, beneath which deep borings have revealed the existence of Pliocene beds similar to the "Crags" of East Anglia. They are divided into the *Diestien,* corresponding in part with the English Coralline Crag, the *Scaldisien* and *Poederlien* corresponding with the Walton Crag, and the *Amstelien* corresponding with the Red Crag of Suffolk. In the south of Holland the total thickness of the Pliocene series is only about 200 ft., and they are covered by about 100 ft. of Quaternary deposits; but towards the north the beds sink down and at the same time increase considerably in thickness. The Pliocene beds were laid down in a broad bay which covered the east of England and nearly the whole of the Netherlands, and was open to the North Sea. There is evidence that the sea gradually retreated northwards during the deposition of these beds, until at length the Rhine flowed over to England and entered the sea north of Cromer. The appearance of northern shells in the upper divisions of the Pliocene series indicates the approach of the Glacial period, and glacial drift containing Scandinavian boulders now covers much of the country east of the Zuider Zee. The more modern deposits of Holland consist of alluvium, wind-blown sands and peat. Of late years an intensive boring campaign has revealed many interesting details of ancient rock-structures buried at great depths, both coal and salt deposits having been reached in Limburg and at various points near the German frontier. For details *see* Jaarverslag der Rijksopsboring van Delfstoffen (annual reports published by the Government). (G. E., R. H. RA.)



BY COURTESY OF THE NETHERLANDS RAILWAYS

SEA-COAST FISHERMAN AND WIFE

ECONOMIC AND FINANCIAL CONDITIONS

The existence of the Netherlands as an independent State dates from the Union of Utrecht, 1579. The 17th century was characterized by a degree of economic and commercial expansion, which made of the Netherlands and especially of the city of Amsterdam one of the great financial and commercial centres—for a time the greatest of all. Colonial expansion and flourishing science and art were the keynotes of this period, which is known as "the golden century" of Dutch history and is so vividly described in Sir William Temple's *Observations upon the United Provinces of the Netherlands* (1673). A period of stagnation and partial collapse then followed. The former spirit of enterprise waned and the Dutchman of the 18th century was characterized by a predominantly *rentier* mentality. The founding of the kingdom of the Netherlands in 1813 brought little change at first, notwithstanding the many efforts, and not least of all by William I., to imbue commerce and industry with fresh life. It was not until the second half of the 19th century that a new period of expansion and prosperity commenced, in which the Dutch colonies in Asia played their full share. This new growth is associated on the one hand with the general economic development of western Europe, in which Holland—so favourably situated for international traffic—reaps her full share, and on the other hand with the important agrarian and industrial revival in Holland. Moreover, the financial position of Holland in the world has, especially since the World War, considerably improved.

Population.—On Dec. 31, 1927, Holland had a population of 7,626,100. In 1830 the total population was 2,613,500, in 1869 3,580,000. The increase since the beginning of the present century is seen from the following table:

Year	(Per 1,000 inhabitants)			Population
	Births	Deaths	Increase	
1899	32·1	17·2	14·9	5,104,100
1909	29·1	13·3	15·5	5,858,200
1913	28·3	12·4	15·9	6,212,700
1919	24·4	12·0	16·3	6,752,100
1923	26·0	9·9	16·0	7,149,800
1927	23·1	10·3	12·8	7,626,100

The increase (1928) is about 100,000 per annum, a figure only exceeded in Europe by Bulgaria, Lithuania, Poland, Rumania and Russia. The birth-rate, however, shows a distinct tendency to fall, whereas a further decrease of the very low death-rate is scarcely possible.

As shown by the following table, the move to the towns has been very marked, especially since 1870:

Census at end of the years	Communities with a population of more than 20,000 in 1920	Other communities	State
1830	100	100	100
1849	116·2	117·3	117·0
1869	142·5	134·5	137·0
1889	209·4	156·4	172·6
1909	320·5	181·7	224·2
1920	391·9	205·7	262·7

In 1920 2,722,000 persons out of a population of 6,865,000 were employed in industry or a profession, as follows:

Figures for the Professions in 1920		
I. *Industry*		
Metallurgic industry and shipbuilding	196,000	
Building trade	191,000	
Manufacture of foodstuffs and luxury articles	177,000	
Clothing, dyeing and cleaning	124,000	
Textiles	66,000	
Miscellaneous	274,000	
Total		1,028,000
II. *Agriculture*		623,000
III. *Trade*		272,000
IV. *Transport*		262,000
V. *Domestic servants*		221,000
VI. *Liberal professions*		143,000
Total including other miscellaneous		2,722,000

A comparison of these figures with previous ones shows that, in the last decades in particular, the degree of employment in industry and transport has gone up (57% and 99% respectively since 1899). The figure for agriculture shows the least increase (8% since 1899).

Agriculture and Cattle-breeding.—Nearly half the territory of the Netherlands lies below sea-level. From the earliest times, intensive cattle-breeding has been a feature of this part of the country, while more recently horticulture has also flourished there. Agriculture is confined to the clay regions, and the higher and sandy regions where these are suitable.

The division of the cultivated land is as follows (in hectares):

	1833	1926
Arable land	756,949	891,761
Horticulture	23,847	64,202
Arboriculture and fruit gardens	22,036	39,458
Meadows	1,003,050	1,266,502
Woods	169,026	249,107
Total	2,064,908	2,511,030

The small farm is a characteristic feature. Only 2·11% of the farms in 1921 had an area of more than 100 hectares, whilst no less than 56% of the farms were managed by the owners themselves. The general agricultural crisis in Europe in the eighties, due for the most part to the considerable imports of grain from the United States, did not lead in the Netherlands to the introduction of grain taxes. By a system of information and guidance and in other ways, the State supported agriculture, and more up-to-date working methods, more intensive culture, and co-operation have helped it to get through the difficult years. The results, in so far as these are reflected in the increase of the yield per hectare, can be gathered from the following statement relating to the principal agricultural products:

Product	Hectares cultivated	Yield in 1,000 hectolitres	Yield per hectare, average for the years	
	1926		1876-80	1921-25
Rye	197,298	4,881	17·4	28·6
Potatoes	170,336	44,211	112·0	253·0
Oats	154,028	7,109	37·0	42·8
Fodder	112,168	..	..	..
Sugar-beet	61,564	2,111,000*	23·4*	32·3*
Wheat	53,340	1,965	21·2	36·9
Peas	36,521	984	20·5	31·8
Barley (Winter)	9,520	458	36·1	45·7
Barley (Spring)	17,035	774	27·1	44·1
Beans	22,073	629	20·5	29·5
Seeds	18,037	..	..	..
Flax	13,851	10,455*	0·43*	0·64*

*In 1,000 kg.

Cattle-breeding also had difficult years to face during the same period. Although essentially dependent on export, it had failed to pay sufficient attention to the quality of the product, with the consequence that other countries like Denmark were able to outbid Holland on the dairy products market. Here especially co-operation, encouraged by the State, had much to do. Co-operative dairy factories and officially controlled standardized qualities of butter have led to a great improvement, whilst the improved water and land communications have greatly facilitated sales. This is also the case with regard to horticultural products.

For 1923 the value of the agricultural and dairy produce was estimated as follows, in millions of guilders:

Agriculture	436·9	Horticulture	131·9
Cattle breeding	660·0	Forestry	7·3

In the absence of protective tariffs, the development of agricultural production has become more and more independent of home consumption. Only ¼ of the total amount of wheat consumed is produced in the country itself. On the other hand ⅓ of the total dairy produce is available for export (the figures are for 1923).

Industry.—On account of its geographical situation and the nature of the soil, the Netherlands' principal resources were agriculture, cattle-breeding, commerce and shipping. The soil contains no ores, the extraction of coal is of recent date, and there were no iron- or steel-works until a short time ago. Consequently the stimulus, usually exercised by these basic industries upon other branches of industry, was absent and Dutch industry was mainly confined to those branches connected with agriculture and cattle-breeding, to ship-building and to those needed local purposes. There have however been certain other industries in existence for a long time, such as textiles, earthenware and paper.

The transition from handicraft to mechanical production was gradual, and, compared with the surrounding countries, late. An exception to this is the cotton industry, which was called into existence with the help of the Dutch Trading Company (Nederlandsche Handel Maatschappij, established in 1824), and found an extensive market in the Dutch East-Indies. Towards the end of the 19th century however, industrialization began to make considerable progress. The increase in population made it necessary to seek new resources, the long crisis in agriculture brought down wages and, thanks to the existing free trade system, raw materials and semi-manufactured products could be imported free, or almost free, of duty.

Industrialization was much accelerated by the World War. Although many emergency industries, called into being as a result of the cessation of imports, have disappeared or decreased, the net result of these years has been expansion and modernization of producing plant. After a reaction due to the general economic crisis in 1921, this plant provided a sound basis for the development which has shown itself ever since.

According to figures produced by the Central Office for Statistics—mainly for 1923, but completed from other sources—the value of the output of Dutch industry for 1923 may be estimated at 1,875 million guilders.

The coal mining industry deserves special mention. Its beginnings date from the end of last century, an increasing percentage of the production now emanating from State-owned mines (1926: 5,200,000 tons as against 3,400,000 tons from private mines). The total annual output, which in 1910 reached 1,292,000 tons, is now well over 10,000,000 tons. The total Dutch consumption of coal is estimated at 12,000,000 tons a year.

The trend of industry since 1920 is reflected in the following figures:

	Unemployment index figure	Number of lost working days (in 1,000 days)	
		Strikes	Lock-outs
1920	5·8	1,680	609
1921	9·0	1,203	77
1922	11·0	778	279
1923	11·2	700	3,245
1924	8·8	410	4
1925	8·1	631	129
1926	7·3	217	3
1927	7·5	..	..

The index figures, which include short time, relate to persons coming under the unemployment insurance system (297,600 in 1927). The figures vary considerably with the season and the different professional groups. They are highest in Dec. (figures for 1927) (12·7) and Jan. (13·2), lowest during the summer months (4·9–5·6). The diamond industry (21·0) and cigar industry (10·4) always yield high figures, while, as a result of seasonal fluctuations, the building trade also shows a high average (14·6).

Commerce.—The great importance of Holland as a centre of trade and traffic has always had a great influence on its tariff policy. Besides, about the middle of last century, the principles of Manchester Liberalism were adopted by Holland more completely than by other continental countries. After a number of shipping duties had already been reduced about 1850, the general revision of 1862 brought a free-trade tariff, under which 5% was levied on manufactured products and 2% or 3% on part of the semi-manufactured products, whereas raw materials and the other semi-manufactured products could be imported free of duty. During the war some protectionist measures were introduced temporarily. In 1924—chiefly for revenue purposes—a new Tariff Act was put into operation, providing for an 8% duty on manufactured products. Luxuries are in some cases taxed higher (12%–20%); products other than those for direct consumption are still taxed at 5%; raw materials are for the most part free of duty.

The following figures show the importance of Dutch trade, excluding transit trade which—in view of the geographical situation of the country—is also of prime importance.

Foreign Trade (in millions of guilders)

Year	Imports	Exports	Excess of import over exports
1918	608·4	381·2	227·1
1919	2,825·7	1,411·3	1,414·4
1920	3,332·4	1,701·5	1,630·9
1921	2,240·2	1,369·6	870·6
1922	2,027·6	1,221·2	806·4
1923	2,009·2	1,303·2	703·0
1924	2,363·5	1,660·7	702·9
1925	2,455·3	1,807·7	647·6
1926	2,441·9	1,749·2	692·7
1927	2,548·9	1,899·7	649·2



PHOTOGRAPHS, ROYAL DUTCH AIRLINES, FROM ORIENT AND OCCIDENT

TOWNS AND CITIES OF HOLLAND AS SEEN FROM THE AIR

1. The heart of Amsterdam, the chief city, though not the political capital of Holland, showing the square known as the Dam. The prominent building in the centre is the Royal Palace, formerly the Town hall, built in the 16th century by Jacob van Kampen. To the right of it is the Nieuwe Kerk, a late Gothic cruciform church originally built about 1408 and several times restored
2. Middelburg, the ancient capital of the province of Zeeland. In the centre of the old town, which is surrounded by a ring from which the newer streets diverge, is the abbey of St. Nicholas dating from the 11th century, and near it the clock tower, 280 feet high, known as "De Lange Jan," whose chimes ring every 7½ minutes
3. Delft, in the province of South Holland, about 5 miles from The Hague. The New Church (erected in the 14th century), seen in the centre of the photograph, contains the tomb of William the Silent
4. Aerial view of Rotterdam, a great port and commercial centre, looking down on the business section and the boulevard Coolsingel
5. The harbour of Flushing (Vlissingen), from which a daily packet service is maintained to Folkestone, England. The inner harbour for the large fishing fleet is shown in the photograph
6. Government buildings at The Hague, political capital of the Netherlands. At the upper left corner of the artificial lake, the Vyver, is the Mauritshuis. On one side of the lake is seen the Binnenhof, in the centre of which is the Ridderzaal (Knights' Hall) built in 1252, where the Queen of Holland opens parliament every year. Other buildings are the Treveshall, the first Chamber of the States General (used since 1853 as Assembly hall of the States of Holland and West Friesland), and the palace of the States General. The square beyond is the Plein

Of imports the following deserve special mention (figures for 1927 in millions of guilders):

Wheat and wheat flour	118·3	Coffee	55·1
Maize	116·8	Copra	43·2
Timber	79·5	Cotton	41·6
Linseed	65·7	Cotton yarns	39·1
Coal (import-balance)	55·5		

Of exports:

Cotton goods	94·1	Margarine	57·4
Pork	93·8	Eggs	50·9
Butter	85·8	Vegetables	49·0
Cheese	76·7	Condensed milk	45·0
Sugar	58·2	Flower bulbs	39·9

Owing to the considerable improvement of the Dutch trade statistics in 1917 a comparison of values with pre-war figures is not possible, while the quantitative figures also can only be compared with reserves. These reserves apply to the following figures (millions of kilograms):

	1913	1927
Imports	21,302	28,619
Exports	5,848	14,338

The share of the various countries in Dutch trade is shown in the following figures (percentages of total value, 1926):

	Imports	Exports
Germany	27·34	21·77
Belgium	11·08	8·21
U.S.A.	10·57	4·55
United Kingdom	9·47	27·62
Dutch East-Indies	5·92	7·31
Argentina	5·83	0·82
France	4·63	4·73

Transport. *Maritime Shipping.*—The supplanting of sailing vessels by steamships did not take place in Holland until after other countries had given the lead: the following figures indicate the development of the Dutch merchant fleet:

Year	Sailing vessels		Steamships		Total	
	Number	Tonnage (1,000 tons)	Number	Tonnage (1,000 tons)	Number	Tonnage (1,000 tons)
1905	479	54·5	271	357·8	750	411·3
1910	440	45·8	324	488·5	764	534·3
1913	400	40·2	387	647·4	787	687·6
1915	390	44·6	397	725·5	787	770·1
1920	231	22·2	606	968·6	837	990·8
1921	217	20·2	683	1,174·8	900	1,195·0
1922	214	19·9	692	1,286·5	906	1,306·4
1923	199	18·8	694	1,319·1	893	1,337·9
1924	179	16·8	696	1,302·8	869	1,319·5
1925	168	15·9	721	1,312·0	889	1,327·9
1926	149	14·3	768	1,309·8	917	1,324·1

According to Lloyd's Register of ships over 100 tons, the share of the Netherlands in the fleet of the world was, in 1898: 1·8%, in 1913: 2·8% and in 1926: 4·0%.

The first steamship company dates from 1825 ("Amsterdamsche Stoomvaartmaatschappij") with a regular service to Hamburg; about 1830 a service to Hull was instituted and in 1840 services to London and certain Baltic towns; the company was taken over in 1877 by Messrs. van Es of Rotterdam. In 1856, another steamship company was founded, the "Koninklijke Stoomboot Maatschappij," originally only for the Baltic, but afterwards greatly extended. About 1870, a regular service with the Dutch East-Indies was established by the "Stoomvaart Maatschappij Nederland" of Amsterdam and by the "Rotterdamsche Lloyd" of Messrs. Ruys (in 1875, English capital and English ships came in and in 1883 it became a joint-stock company). The "Nederlandsch Amerikaansche Stoomvaartmaatschappij" was founded during the same period (1873); the connection with the West-Indian colonies was established in 1883 ("Koninklijke West-Indische Maildienst," later taken over by the "Koninklijke Stoomboot Maatschappij"), and that with S. America in 1907 by the "Koninklijke Hollandsche Lloyd," and with S. Africa in 1920 by the "Holland Zuid-Afrika Lijn." Also worthy of mention are those Dutch companies which have lines outside Europe, viz. the "Koninklijke Paketvaart Maatschappij" (1888) (Dutch East Indies) and the "Java-China-Japan Lijn" (1902).

The shipping of the Dutch ports considerably expanded after extensive improvements had been effected; Amsterdam, already in 1825 connected with the North Sea by the "Noord-Hollandsche Kanaal," obtained direct access to the sea in 1876 by the "Noordzeekanaal." As the large river connecting Rotterdam with the sea was always subject to becoming blocked with sand, here too the building of a canal ("Nieuwe Waterweg")—completed in 1896—was necessary. The development of shipping of the Dutch maritime ports may be seen from the following figures:

Vessels Entering

	Number	Thousands of registered tons
1880	8,164	3,438
1890	9,475	5,446
1900	12,307	9,458
1910	14,864	14,035
1913	16,996	18,198
1915	6,341	6,622
1920	11,114	11,351
1925	21,005	27,303
1926	28,852	36,602

Before the war one fourth of these vessels flew the Dutch flag; in 1913 the percentage was 25·8; in 1924, 33·07; 1925, 29·58; and 1926: 28·22. The greater part of these entered at the port of Rotterdam; in 1913, 67·9% of the total number, against 13·5% at Amsterdam; 1926: 59·39% and 15·58% respectively. At the same time, the traffic in the ports situated on the Nieuwe Waterweg west of Rotterdam considerably increased (1926: Vlaardingen 9·50%, Schiedam 3·05%, Hook of Holland 1·77%).

Inland Navigation.—An extensive network of rivers, extended by innumerable canals, has led to a considerable development of inland shipping in Holland. The inland fleet consisted in 1920 of 13,000 ships of a tonnage of 1·9 million tons.

The following table gives figures for the inland shipping on some of the most important waterways, to Germany and Belgium, as well as from Amsterdam to Rotterdam and the Rhine.

Total Inland Shipping in Thousands of Tons of 1,000 Kg.

Year	Rhine (German frontier)	Canal through Zuid-Beveland (Antwerp-Rhine)	Amsterdam-Rotterdam	Merwede-kanaal (Amsterdam-Rhine)
1913	52,354	16,897	3,203	10,593
1926	85,931	23,834	4,301	18,759

The importance of transit traffic is evident. The depression caused by the war reached its maximum (as far as the traffic on the Rhine is concerned) in 1918, with 11,624,000 tons.

Railways and Tramways.—Owing to water transport being of such prime importance in Holland, railways developed relatively late; for the same reason they have never been in a position to yield large profits. Since about 1860, the building of railways was largely carried out by the State. In 1916 the two big companies, which had in the mean time absorbed most of the private companies, entered into a pooling agreement—"Nederlandsche Spoorwegen"—whereby the mutual profits or losses are divided on the basis of the capital of each participant. In both companies, the State holds the majority of the shares and has guaranteed a 5% dividend to the share-holders.

After a separate electric line had been built in 1908 between The Hague and Rotterdam (28 km.), the existing line Amsterdam-Rotterdam (84 km.) was electrified in 1927. Competition with motor-bus lines is often very strong and in 1928 the Dutch railways took the operation of motor-bus lines into their own hands. Since the war, the financial results obtained by the Dutch railways have been far from favourable; in 1922, 1923 and 1924 the

State had to meet a deficit of 32·9, 30·5 and 23·0 million guilders respectively. The causes must be sought in the increase of expenditure on staff—in connection with the introduction of the eight-hours day—and in the increase in price of coal: this last factor however belongs to the past and in 1927 the accounts again showed a small surplus (2 million guilders).

Besides the railways there is an extensive tramway system; here too the competition of the motor-buses is strongly felt.

1926	Length of lines (Kilometres)	Traffic receipts		Total including miscellaneous receipts (Million guilders)
		Passengers	Goods	
Railways	3,629	76·5	83·3	159·8
Inter-urban tramways	2,687	10·8	5·3	17·0
City tramways	310	27·6		27·6

Post Office: Telegraph and Telephone. *Postal Service.*—In 1926 the postal service transmitted—

Class of mail	Millions		
	Inland	Abroad	Total
Letters	170·5	73·7	253·2
Postcards	84·7	16	100·7
Printed matter	404·8	43	447·8

The number of letters and postcards increased from 14·3 in 1875 to 47·0 in 1926 per head of population.

Postal Check and Clearing Department.—This service was established in 1918 and was closed Oct. 1923–Oct. 1924 for reorganization. Since it was reopened no interest has been paid on the accounts.

Year	Number of accounts	Deposits in millions of guilders
1918	13,720	37·9
1919	21,824	77·9
1920	32,582	95·4
1921	55,410	138·4
1922	86,885	209·4
1925	113,224	496·6
1926	120,037	103·9

Telegraph and Telephone Services.—The telegraph system comprised in 1926 47,051 km. of wires; 2·4 million inland telegrams were transmitted, and 3·1 million abroad. The inter-urban telephone system covered 291,121 km. of wire, besides 235 local systems, which in the big cities are run by the municipalities.

1926	Millions of guilders	
	Capital invested	Profits
Postal Service	23·1	6·5
Clearing Department	1·7	1·2
Telegraph Service	24·0	3·3
Telephone Service	76·6	5·2

Postal Savings Bank.—The deposits at the end of the year were as follows, in millions of guilders:

1900	84·7	1920	273·0
1910	164·3	1925	311·5
1915	189·1	1927	321·9

Money and Credit. *Monetary System.*—The present unit, the Dutch guilder, dates from the Constitution of 1798. From 1816 till 1847, the double standard ruled in Holland with a ratio of 1:15·87 between gold and silver. The law of Nov. 26, 1847 introduced the single silver standard with the silver guilder of 9·450 grammes fine silver. The fall in the price of silver about 1870 caused the Government to withdraw in 1873 the free silver coinage for private persons. The silver guilder, however, remained legal tender up to any amount.

Besides the silver guilder, a gold ten-guilder piece was introduced a few years later. By the law of June 26, 1875 the gold pieces contain 6·048 grammes of fine gold, may be coined for private persons and are legal tender up to any amount; thus the present system of the so-called "limping standard" was introduced. Gold coins have however never been in use for large amounts. The system was re-defined by the coinage law of May 28, 1901. Owing to the rise in the price of silver the alloy in the silver coins was reduced in 1919 from $\frac{945}{1000}$ to $\frac{720}{1000}$. One guilder = 1s. 8d.; £1.— = 12·107 guilders.

The Netherlands Bank.—The Netherlands Bank was established in 1814. It is a purely private undertaking, which has been granted the monopoly of the issue of bank notes. The share capital is 20 million guilders. Two members of the directorate (the president and the secretary) are appointed by the queen, whilst a royal commissioner exercises a general control, on behalf of the Government.

When the World War broke out the circulation of bank notes amounted to about 300 million guilders. During the war, this increased to 1,000 million guilders, but afterwards gradually fell (by June 25, 1928 to 768 million guilders). The balance in current-account on that date amounted to 50 millions, including the holdings of the Treasury. The Bank Charter leaves the percentage of cover of the circulation to be fixed by royal decree. Before the war, this cover amounted to 40% of the total volume of bank notes, balances in current-accounts and bank drafts. When the war broke out, this percentage was reduced as a precautionary measure to 20%, and during a very short period the cover was slightly under 40%.

During the war the gold reserve, which amounted to about 162 million guilders in July 1914, considerably increased. In 1918 the maximum of about 730 million was reached; then followed a gradual fall to about 400 million. On June 25, 1928 the gold reserve was about 435 million, which, together with the silver reserve of about 24 million guilders, constituted a cover of approximately 56%.

The bill holding and loans were as follows:

(*In millions of guilders*)

	June 27, 1914	June 25, 1928
Inland bills	66	48
Foreign bills	20	197
Loans	59	103

There is no legal obligation upon the bank to convert its bank notes into gold. In 1903, however, the bank assured the Government that it was prepared to continue to keep its gold reserve available for export, in the event of a rise in the exchange-rates above gold-parity, at the price of 1,653·44 guilders per kg. fine for bullion, and corresponding prices for gold coins, as long as it was in a position to do so. During the war, this declaration became inoperative owing to the ban on exports of gold; Holland and the Dutch East Indies returned to the gold standard at the same time as Great Britain, Australia and New Zealand—April 29, 1925; the prohibition to export gold was withdrawn and the declaration re-established.

The position of the Netherlands Bank has changed considerably in the course of time; the development of private banking, especially since 1911, has gradually given it the character of a bankers' bank. Since 1889 the State has participated in its profits, its share being gradually increased. After payment of a dividend of 1½% to the shareholders, ¾ of the balance is allotted to the State, whose share is increased up to ⅞ as soon as the dividend exceeds 7%. The bank acts, free of charge, as agent of the Treasury, whereas the Government has the right to take up a non-interest bearing loan to an amount not exceeding 15 million guilders.

Commercial Banks.—The rise of the private credit banks dates from about 1860. Owing to the concentration movement, which was started in 1911, five big banks have gradually come to the front, and have built up an extensive network of branch-offices and a clearing-system in the provinces, with the assistance of some provincial banking institutions.

During the World War and the first few years after it, the business of the private banks grew rapidly. The crisis of 1920–21 brought a change. One bank had to be liquidated and a few others needed financial support. Nevertheless, the big banks have displayed great capacity of endurance. Since 1924, the bank figures have again shown an increase.

The following figures from the joint balance sheets of the five principal banks:

(*In millions of guilders*)

	1914	1920	1927
Capital	118	271	246
Reserves	38	162	133
Outside resources	347	1,428	1,170
Loans	275	1,125	813
Bills	92	336	331
Securities and syndicates	73	126	119

In the years after the war, the increased importance of Amsterdam as an international financial centre led to the establishment of several foreign—chiefly German—banks there.

The requirements in mortgage credits are met by a large number of medium-size mortgage banks. The existence of a large number of small banking institutions and middlemen of all kinds —especially in connection with small credits—is still a feature of Holland.

Stock Exchange.—The fact that Holland has for centuries been a country of capital exports and to a large extent still is, is reflected in the stock-exchange transactions. A considerable number of foreign funds, mostly bonds, are registered on the Amsterdam stock exchange; Dutch colonial funds also play a prominent part.

Issues.—The development of issues of stocks and bonds (not including conversion loans and treasury bonds) is as follows:

(*In millions of guilders*)

Year	Issues		Total
	Internal	External	
1913	156		156
1921	491	18	509
1924	354	49	403
1927	163	351	514

These figures show that foreign issues have very much increased during the last few years. The share of the principal countries in the foreign issues in 1927 was—Germany, 134 million (guilders), France 63, Belgium 31 and the United States 20.

Public Finances.—The financial position of the State during the first few years after the re-establishment of independence in 1813 was not very brilliant. The national debt, which in this year amounted to 619·9 million guilders, had more than doubled in 1844, principally on account of the difficulties which ended in 1830 with the separation of the Netherlands and Belgium. In 1844 the national finances were entirely reorganized, the national debt converted and the State expenditure restricted. Since then the surpluses from the Dutch East Indies, which had begun to flow in since the introduction of the compulsory tilling of State domains, proved of great assistance to the Dutch treasury. It was possible with these surpluses not only to finance the building of railways out of income, but at the same time to redeem part of the national debt. In the eighties, in consequence of the growth of new principles of colonial policy and temporary military operations, the surpluses from the Indies stayed away. At the same time the expenditure of the State began to increase, with the result that the position of the State finances became less favourable. The expenditure has increased rapidly since the end of the previous century: the ordinary expenditure, which amounted to 113 million guilders in 1880, was 154 million guilders in 1900 and 238 million in 1913.

The World War entailed heavy burdens for Holland—neutral though she was. The mobilization of the army, the distribution of foodstuffs and unemployment involved considerable expenditure, whereas the proceeds from taxation could be but slightly increased, which necessitated borrowing on a large scale. The increase in State expenditure continued after the Armistice, due primarily to house building by the State on a large scale, extension of social measures and increase in the general level of prices. Receipts and expenditure connected with the war and the crisis following upon it, formed a separate chapter of the budget during the years 1914–24. Its receipts consisted of a tax on war profits and a supplement on certain taxes levied during this period. The expenditure incurred in connection with the crisis totalled 2,375 million guilders The service of war loans and post-war crisis loans is administered apart from the budget itself, being defrayed out of certain taxes raised specially for this purpose and out of a supplement on a number of other taxes. The conditions on which these loans had to be contracted were often burdensome. The Government has however now been able to redeem and convert part of them.

The fall in the level of prices and the cutting-down of a number of items of State expenditure are reflected in the budget figures since 1923. The ordinary expenditure, which reached its maximum in 1922 with 632·4 million guilders, has fallen again to 591·8 millions for 1928; the extraordinary expenditure of 284·0 million guilders in 1921 was reduced to 49·1 million in 1927; in 1928 it increased to 173·4 millions, as a result of further redemptions of national debt. The receipts consist for the most part of taxes (546·3 million guilders in 1928), while the balance (1928: 183·3 million guilders) is made up from numerous smaller items, of which at present interest and reimbursement of advances are the principal factors. Part of these items is regarded as extraordinary receipts. The profits of Government undertakings belong to this category; they are however very small. In 1928 the extraordinary receipts amounted to 56 3 million guilders in all.

The origin of the present system of taxation is to be found partly in the taxes introduced during the period of French domination, and partly in levies existing earlier. A State income-tax was introduced in 1892–93. During the war and the succeeding years a number of crisis-taxes were levied and most of the existing taxes increased. In 1926, a beginning was made with some reductions. In 1928, the proceeds from direct taxation formed 48·8% of the total tax proceeds. Among these, income tax yielded 15·6%, the dividend and bonus tax 5·1%, the national defence tax 5·0%; consequently all the taxes on income together yielded 25·7%. The tax on real and personal property yielded 6·1%, taxes on consumption 28·2% and customs 10·4% of the total amount.

The consolidated national debt increased from 1,148·4 million guilders on Jan. 1, 1914 to 2,916·4 million guilders on Jan. 1, 1925; on Jan. 1, 1928 it amounted to 2,739·9 million guilders. While in 1928 130 millions of interest had to be paid, 49·4 millions were redeemed under the redemption-scheme and 187·5 millions outside. The floating debt of the State amounted to 13·2 million

Items of State Expenditure (*in thousands of guilders*)

	1900	1913	1928
Royal House, Civil List, Parliament, etc.	1,417	2,159	3,515
Internal Administration	23,634	25,176	58,217
Post Office, Mint and Statistical Office	12,344	24,818	9,958
Ministry of Justice	6,553	10,557	24,444
Foreign Office	708	1,188	3,395
Colonies	1,463	2,945	5,900
National defence	32,616	41,859	68,427
Health and housing	267	6,101	24,755
Social welfare	91	2,190	56,282
Poor relief	481	1,384	2,351
Education, art and science	11,786	35,248	120,674
Religion	2,220	2,264	2,436
Fisheries	225	715	828
Agriculture	689	5,018	6,165
Industry and commerce	357	7,452	4,561
Railways	5,907	4,614	12,008
Shipping	8,324	10,534	24,912
Public works	3,375	3,948	33,288
National debt	34,706	38,119	359,025
Other expenditure	7,203	11,538	69,552
Total	154,166	238,727	890,693

guilders on Jan. 1, 1914, 858·7 million on Jan. 1, 1922, and 251·5 million on Jan. 1, 1928. This last figure is however counterbalanced by floating claims to an amount of 275·9 millions on the same date, arising, *inter alia*, from advances of the Treasury to communes, colonies and foreign countries.

Judged in the light of their total expenditure the municipalities are as important as the State. The provinces however have only a subordinate position. The following figures for 1926 may be of interest:

(In millions of guilders)

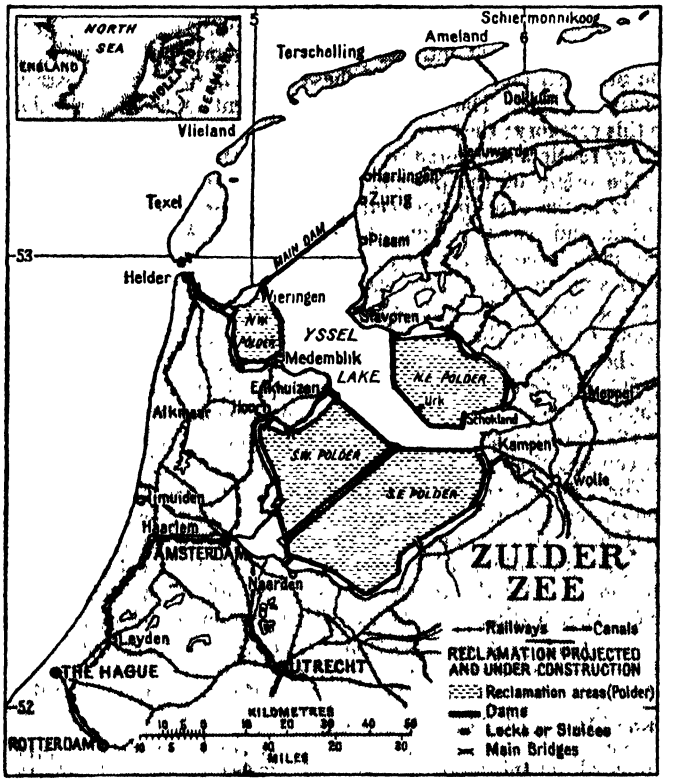
	State	Municipalities	Provinces
Ordinary expenditure*	697·3	562·7	64·4
Extraordinary expenditure	78·7	146·6	59·9
Debts (Jan. 1)	3,182·8†	1,917·2‡	171·7
Proceeds from taxes	567·2	205·1	16·8

*Including interest and loan redemptions.

†306·3 millions of which are short term debts as against short term claims amounting to 283·5 million guilders.

‡Including 628·5 millions of advances of the State.

The municipalities and the provinces meet their expenditure partly from their own taxes and partly from contributions from the State.



MAP SHOWING PROJECTED RECLAMATION OF THE ZUIDER ZEE, HOLLAND
Tentative plans were decided upon by a commission in 1894, but subsequently altered. Actual construction began in June, 1920. Operations to 1929 have been on the new ship-canal and on the dams; the filling in of the polders being left to the last. The four reclaimed areas (polders) total 553,500 acres. The outstanding feature of the present plan is retension of the old waterfront by providing water-ways between the mainland and the reclaimed areas

The taxes per head of population in 1925–26 amounted (in guilders) to: State taxes—74 55, Communal—27.89, Provincial—2 35: Total—104.83.

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(G. W. T. B.)

DEFENCE

Historical.—From the 16th century, when the Dutch won their emancipation from the yoke of Spain, through the struggles against Louis XIV in the 17th and early 18th centuries, Dutch soldiers were constantly engaged in conflicts. Holland was overrun in 1787 by a Prussian army, and in 1795 was conquered by the French under Pichegru, a reorganized Dutch army subsequently taking part under French direction in the Napoleonic wars. Dutch troops fought against Napoleon at Waterloo, but it was not until after the separation from Belgium in 1830 that the history of the present-day all-Dutch army can be said to begin. Holland remained neutral in the World War.

Present-day Army, Recruitment and Service.—The Army is on a militia basis, resembling the Swiss. The Kingdom of the Netherlands is now divided into 12 recruiting areas. All Dutch subjects who are resident, or whose legal guardians are resident in Europe on Jan. 1 of the year of their 19th birthday are registered for military service, as also are certain foreigners domiciled in the Netherlands. Certain exemptions are allowed, either permanent or temporary, for family or professional reasons. Up to 19,500 of the annual contingent drawn by lot are posted to the regular army, the remainder performing some other State service. Military liability for service lasts until Oct. 1 of the 50th year of age for officers, the 45th year for non-commissioned officers, and the 40th year for other ranks. Men liable to service with the colours do a first period of training and a repetition course. All men of the ages prescribed can be called up for military service in war, threat of war or other emergency. The first period of training lasts for 5½ months (which may be reduced to 4 months for those who have previous military training) in dismounted corps and for 9 to 15 months (with the same proviso) in other branches of the service. Exemptions are allowed. The period may be divided, or it may be extended for lack of efficiency. An advanced course, with further exemptions, is done within 6 years of the first period course. This may be done in two periods to complete 40 days, with an extension of 7 days for non-commissioned officers.

There is also a second-line or landsturm, in which service is voluntary. This force is divided into landsturm associations and special corps, in which 300 hours' training are done every year. The landsturm associations (6 groups) conduct preliminary military training. The landsturm corps carry out motor transport, marine and railway services and anti-aircraft lookouts. Enrolment for the former is for men not liable to military service; in the latter for men, and some women, over 16 years of age.

Strength and Organization.—The Budget effectives show only a cadre of about 1,400 officers and 414 non-commissioned

officers (April 1, 1927). To these must be added a proportion of the annual contingent of 19,500 when undergoing training. The staff of the volunteer landsturm numbers 226, and the gendarmeries about 1,200, with 800 police in addition. The infantry is organized in 8 brigades, each of 3 regiments, and a cyclist regiment; the cavalry in 2 regiments each of 4 squadrons and a reserve squadron; the artillery in 4 field "brigades" each of 2 regiments of 3 batteries, in 2 batteries of horse artillery, 1 regiment of 8 companies of fortress artillery, one of 4 companies of coast artillery, and a "corps" of 2 companies of anti-craft artillery; the engineers in one regiment of 3 battalions, each of 2 companies; other services in proportion. The gendarmerie is organized in 4 divisions, the military police in 4 companies. The infantry use the Mannlicher rifle, mounted troops the Mannlicher carbine, while the artillery is armed with the Krupp 7·5 cm. gun.

Colonial Forces.—In the *Dutch East Indies* (Java) 2 divisions and 12 extra battalions and a company are maintained. European inhabitants, if Dutch subjects, are liable to compulsory service European and native volunteers complete the numbers. The Budget effectives (1928) number 35,878 (28,908 infantry, 981 cavalry, 2,347 artillery and 917 engineers). The infantry in the field army is organized in 6 regiments, each of 3 four-company battalions; the cavalry in 6 squadrons, depot squadron and signal unit; the artillery in 3 regiments, 2 tractor howitzer batteries and 1 fortress company. The command is vested in a Lieutenant General, who is also head of the war department. There is a military air force of 261 (28 officers) included in the above figures, organized in 3 groups, each of 3 flights, with 6 fighting and 24 reconnaissance machines. In the *Dutch West Indies* (Surinam and Curaçao) a small garrison of about 350 is maintained (1928).

Administration.—The War office is the central authority. The minister has the usual departments under him, including a general staff. There is a council of national defence, of which the commander-in-chief of the army is a member, and there are four general officers commanding military areas (The Hague, Arnheim, Breda and Amersfoort).

Headquarters of the 1st Division are at The Hague, the 2nd Division at Arnheim, the 3rd Division at Breda and the 4th Division at Amersfoort. The Headquarters of the "divisions" of gendarmerie are at Hertogenbosch, Maastricht, Arnheim and Groningen. The companies of military police have their Headquarters at The Hague, Amsterdam, Breda, Nijmegen and Zutphen, with main Headquarters at The Hague.

There is a senior military college at The Hague to train officers for the Staff and higher commands (2 year course). At Breda there is a Royal Military Academy to train cadets for commissions and officers of all arms (3 months courses).

The chief points of special interest are the existence of a School for Chemical Warfare under the engineers, a carrier pigeon service at the General Staff and a school for "storm troops" of the 1st and 4th Divisions.

The defensive strength of the Netherlands lies in the power to create inundations. The water-levels are complicated, and the system known only to expert specialists. There are headquarter staffs for the fortified lines covering Dutch territory and for those specially covering the Helder.

The military Air Force, consisting of a staff and 2 companies with Headquarters at Soesterberg and a detachment at Schipol, is directly under the General Staff. Not counting machines used for training, there are 17 fighting aeroplanes and 53 for reconnaissance, no bombing machines.

(*See* also the *League of Nations Armaments Year-Book*, 1928 (Geneva). (G. G. A.)

Navy.—The navy of the Netherlands protects the Dutch waters and coasts and also provides defence for the Dutch East Indies (*q.v.*). There are four coast defence ships (5,000 to 6,500 tons), two cruisers, three armoured gun-boats, four sloops, five destroyers (510 tons), and four destroyers of 1,620 tons. In addition, Holland possesses eight torpedo-boats, 24 submarines, 12 mine-layers and two submarine depôt-ships. There were (1928) two further destroyers under construction, and the budget the same year provides for an expenditure of 40,555,610 florins. (X.)

HISTORY

Rise of the Republic.—The following article deals with the history of the Netherlands after the confederation of 1579. For the events preceding that year the reader is referred to the article NETHERLANDS.

The Union of Utrecht, by which the northern provinces were confederated, was signed on Jan. 29, 1579. It remained in force until the fall of the Dutch republic in 1795, and its formation may therefore be taken as the starting-point of the history of the newly created state; but that state was as yet so far from being fully grown that its leaders did not even consciously desire either republicanism or independence. In this first stage it was a loose federation, for defence, finance, and other limited purposes. The States General were still controlled by the estates of the provinces, in which the work of government had always been shared between the estates and a monarch or his representative. It was eight years before the possibility of a monarch was ruled out, and throughout the whole history of the republic there was never a finally satisfactory adjustment between the powers of the estates, among which the States of Holland were predominant (*see* HOLLAND, COUNTY AND PROVINCE OF), and those of the stadholders (*q.v.*), the old royal lieutenants, who continued to exercise the executive functions which had been theirs as the overlord's representatives. Collisions between the estates and the stadholders were to lead to constant strife and to five successive revolutions: in 1618, in 1650, in 1672, in 1747, and in 1787. For the first 30 years after the Union of Utrecht the war of independence was being waged, and constitutional developments were dictated by its fortunes. William the Silent, who was supreme in Holland and Zeeland, did not welcome the union, because he still hoped to unite all the 17 provinces against Spain. That, however, proved to be impossible, and the military situation grew alarming. Maastricht, Koevorden, Groningen, Delfszyl, Steenwyk were lost. Philip felt himself strong enough to pronounce the "ban" against William, that is, to declare him an outlaw whom anyone might lawfully kill. William saw that, without foreign aid, the northern provinces could not maintain themselves. He therefore gained the support of France by the offer of the sovereignty of the Netherlands to the duke of Anjou, brother of the French king. With the reservation of ultimate control in all important matters to the states, this arrangement was made in the treaty of Plessis-les-Tours, in Sept. 1580. Anjou, who took the field next year, was inaugurated early in 1582 as duke of Brabant and of Gelderland, count of Flanders and lord of Friesland. He did not become count of Holland and Zeeland. In these provinces he was distrusted as a Catholic, and they would have no sovereign except William himself, who reluctantly yielded to their insistence and had agreed, before his death, to accept the title of count. At the same time the northern provinces solemnly repudiated the sovereignty of Philip II. and declared themselves absolved from their allegiance to him (July 26, 1581). In 1581 and 1582 military events continued unfavourable: more fortresses were lost, and Anjou was chafing at the limitations imposed on his sovereignty. On Jan. 17, 1583, his troops attempted to obtain possession of the city of Antwerp. By the vigilance of the citizens, this "French Fury" was frustrated, and in June the discredited Anjou returned to France, where he died whilst planning his return. William continued to organize defence from his refuge in Delft, though with little success, for Zutphen fell. He had been severely wounded by one of the gunmen let loose by Philip's ban; on July 10, 1584, another, a fanatical young Catholic from Franche-Comté, named Bálthazar Gérard, got admission to his house and shot him.

The States and Leicester.—The loss of the "Father of his Country" made the position of the rebels almost desperate, but their courage did not flag. His eldest son being in the hands of the Spaniards, the second, Maurice of Nassau, was appointed president of the newly constituted Council of State, and stadholder of Holland and Zeeland: but as he was still only 17 years old, the real leadership passed for the time being to the ablest men of the estates, in particular to Paul Buys, advocate of Holland until 1585, and Johan van Oldenbarnevelt, who was to hold that office from 1586 until 1618. They tried to revive the French



BY COURTESY OF (3, 5, 6) THE NETHERLANDS RAILWAYS; PHOTOGRAPHS, (1, 4) PUBLISHERS PHOTO SERVICE, (2) BURTON HOLMES FROM EWING GALLOWAY

CANAL AND STREET SCENES IN PICTURESQUE TOWNS OF THE NETHERLANDS

1. Dordrecht, shipping town in the province of South Holland; one of the wealthiest of Dutch ports during the Middle Ages. Old gabled houses line the canal
2. Marken, one of the "dead cities of the Zuyder Zee." Marken was separated from the mainland in the 13th century by an inrush of the sea. This island village is a picturesque spot, much visited by tourists. The attire of the little boy in breeches (foreground) indicates that he has reached the age of five; if younger than that he would be dressed in skirts and bonnet. He is under the age of seven, for his hair is not yet cut
3. A canal scene in Delft, showing the shady streets along the waterside. Delft craftsmen preserve the traditions of the faience pottery industry, which during the 17th and 18th centuries made the city's name famous throughout Europe
4. Business district of Amsterdam, Holland's most important commercial city, showing the dam or dyke of the Amstel, a canalized river. The city, cut by five semi-circular canals and many intersecting ones, is in reality composed of a succession of islands
5. The promenade at Scheveningen, a fashionable seaside resort. Paved with brick and bordered by hotels and shops, the promenade extends for about a mile along the beach
6. Another canal scene in Dordrecht, showing canal and small boats

were called Remonstrants, to the States of Holland. Among the liberal-minded men of affairs who composed that body they had many adherents, including the advocate himself, though not the representatives of Amsterdam, the leading town. The States tried to preserve unity, first by silencing the controversy and, when that failed, by taking the side of the Remonstrants; but Maurice and four provinces out of seven in the States General took the orthodox Calvinist side. The States General wished to call a national Synod or Church Assembly to settle the disputed questions, but the States of Holland refused their consent. Exasperated by their failures, they passed a resolution which asserted the principle of provincial independence in such a way as to threaten the unity of the republic; they raised levies of local militia (waardgelders) to enforce their will, and instructed the contingents of the regular army paid by Holland that they owed no allegiance to the "generality." The States General and Maurice, with the army behind him, overawed the opposition and removed its leaders from their positions in the town governments. Oldenbarnevelt, the famous Hugo Grotius, and others were arrested. A special tribunal was erected to try, or rather to condemn, them. Meanwhile the national Synod had met at Dordrecht (Dort) on Nov. 13, 1618. Its decisions were entirely against the Arminians, who were silenced. The Synod closed on May 9, and four days later Oldenbarnevelt, in spite of long public service, was beheaded.

THE GOLDEN AGE

The twelve years of truce came to a conclusion in 1621, and, Maurice and his party being supreme, the war with Spain was automatically resumed. Three years earlier the Thirty Years' War had broken out, and the Dutch frontiers were therefore merely one of the theatres of a general conflict. The republic at first failed to adapt its policy to the new conditions, and Maurice had lost his old vigour. After failing to relieve Breda from Spinola's siege, he died on April 23, 1625. His younger brother Frederick Henry (*q.v.*), now prince of Orange, who succeeded him in all his titles and offices, was an abler politician and a competent soldier. During his stadholdership of more than a quarter of a century the golden age of the republic set in. Political and religious affairs became more harmonious; the stadholder maintained a princely court; learning, literature, and painting reached a dazzling brilliance. Commerce flourished; an eastern empire was acquired, and large, though not lasting, conquests were made in South America. The capture of the Mexican silver fleet by Piet Hein, in 1628, was the greatest of many naval exploits (*see* DUTCH EAST INDIA COMPANY; DUTCH WEST INDIA COMPANY). Financial and other help came from England and France, the latter in exchange for the grant of naval assistance to Cardinal Richelieu for the subjugation of the Huguenots in La Rochelle. This was withdrawn, but the old dreams of international religious solidarity were ending. In 1626 Oldenzaal was recovered, and in 1627 Grol. In 1629 Frederick Henry captured the virgin fortress of Hertogenbosch (Bois-le-duc), and the seizure of Wesel interrupted the enemy's communications by the Rhine. Two years later, there came the defeat of an invading fleet in the Slaak, and in 1632 the taking of Maastricht, a crossing of the Meuse. After this there were negotiations for peace, which in spite of the growth of a peace-party in Holland, led to nothing. A treaty of alliance with France in 1635 opened the prospect of a partition of the southern Netherlands between the French and Dutch, but the dissensions of the allies and the good generalship of their new opponent, the Cardinal Infant Ferdinand, prevented any notable success until 1637, when Breda was retaken. The grudging grants of supply from the province of Holland were insufficient for ambitious plans in the next two years, and a dash on Antwerp was frustrated; but Spanish sea-power received a smashing blow when on Oct. 21, 1639, a great fleet of warships and transports under Oquendo was engaged in the Downs by Martin Tromp. Incidentally this gave umbrage to Charles I. of England, a squadron of whose navy had watched this battle in waters where he claimed a sovereignty. He and his father had already, in connection with the herring fishery and other matters, tried to assert this claim of maritime sovereignty against the Dutch. Commercial jealousy of the Dutch was becoming strong in England, and there was a growing tale of grievances against their East India Company, of which the "massacre of Amboyna" of 1623 was the most sensational. But Charles, far from being able to press these home, was in need of help against the opposition which was soon to break out in civil war. He therefore consented to the marriage of his daughter Mary, the princess royal, to Frederick Henry's 14-year-old son William, who had been recognized as his father's successor in all his offices. This was the first of three marriages of princes of Orange with English princesses, a social promotion which was to bring the republic into the cross-currents of dynastic interests. It had no influence on the course of war. Two great changes now brought the possibility of a satisfactory peace in sight. Portugal, subject to Spain since 1580, broke away again in 1640, and the Spaniards, besides being weakened in Europe, had no longer much reason for maintaining the colonial quarrel with the Dutch, since it was in the Portuguese spice-islands and Brazil, now lost to Spain, that the Dutch had established themselves. The other great change was the rise of France as a military power. At Rocroy, in 1643, the Spaniards were thoroughly beaten by the French. The danger opened out was that the southern Netherlands might pass from decadent Spain to the rising power of France. Negotiations were begun in that year which ultimately led to a settlement. While they were in progress, Frederick Henry won his last victories. In 1644 he captured Sas van Ghent, in 1645 Hulst, thus gaining a foothold on the southern bank of the Scheldt. The frontier-line to which he had pushed forward his armies remained almost unaltered until the end of the republic. He died on March 14, 1647, less than a year before the Treaty of Münster (part of the Peace of Westphalia), in which this frontier was confirmed. The Scheldt was closed to trade, as it had been, in fact, since 1572. Dutch independence was finally recognized, and with it all that had been gained in the East and West. The "eighty years' war" was over.

William II.—It had been terminated by a separate peace which left France and Spain at war, and that had not been to the liking of the able and ambitious young soldier, William II., who had lately succeeded his father. With the support of Zeeland and Utrecht he had opposed the settlement. For the time being the States of Holland, with the help of the other provinces, had easily got their way; but the peace meant a renewal of the contest which had arisen after the truce of 1609 between the Orangist tendency towards constitutional unity and the decentralizing policy of the pacific oligarchies of the states. The latter had its stronghold in the patriciate of Amsterdam, then the richest trading city of the continent. William entered upon secret negotiations for a renewal of the war in alliance with France, of which the daring purposes were to be a partition of the southern Netherlands and the restoration of his exiled cousin, Charles II. of England. The domestic counterpart of this was to be the strengthening of his own powers. Issue was joined over the disbanding of the troops rendered superfluous by the conclusion of peace. The States General, in which the other six provinces now took the prince's side, wished to retain the cadres of the disbanded regiments, which could thus be quickly raised to a war-footing; the States of Holland objected, and ordered the disbanding of those troops for which they provided the money. There thus arose an intricate legal question similar to that of 1618, and the resources of the constitution were exhausted in the attempt to settle it. On July 31, 1650, six leaders of the States of Holland were clapped into the castle of Loevestein, from which the states party were known until long afterwards as the Loevestein faction. Troops under the command of William Frederick, stadholder of Friesland, moved against Amsterdam. The gates were manned; but the town council had no heart to fight. It made its submission. William used his success as skilfully as he had won it. The prisoners were released, and he was virtually master of the republic. His triumph ended suddenly: he died of smallpox on Nov. 6.

The Rule of the States.—A week after William's death his widow gave birth to a son, who was to become William III. of Orange and of England. This child was now the head of the house of Orange; but the power of that house was only what a strong

man could make it. The Loevestein party took its opportunity. A Great Assembly of the provinces, like the States General but more numerous and solemn, met at The Hague on Jan. 18, 1651, to regulate the constitution for this "first stadholderless period." Its results were to strengthen the sovereignty of the provinces within their own borders, including the control of the army and religion. This implied the preponderance of Holland, by far the richest and strongest in external and general affairs. None of the provinces, except Friesland and Groningen, which remained faithful to William Frederick, now had a stadholder. This limitation of the central and executive powers aggravated the defects of the constitution; delays, obstructions and disputes were multiplied; but the Dutch were experts in public business, and they worked this cumbrous machine through 20 years of difficulties and dangers until the greatest crisis of their history, for which alone it proved inadequate. Much of the credit for this is due to John de Witt, the son of one of the prisoners of Loevestein, who became *raadpensionaris* (council pensionary) of Holland in 1653 (*see* HOLLAND, COUNTY AND PROVINCE OF). He had no equal in the art of political management, and few in that of international diplomacy; but with these he combined higher gifts. His intellectual distinction, his broad and deep political knowledge, entitle him to be called the most scientific statesman of his time. His appointment came during the course of the first English war. The commercial and colonial rivalry with England had been growing hotter all through the century. In the year 1651 it reached boiling-point. The Dutch had declined far-reaching proposals of alliance from the new sister-republic and Orange partisans had insulted the ambassadors of the regicides. The English navy, in stamping out royalist resistance, interfered with Dutch commerce. The celebrated Navigation Act inflicted, or rather was meant to inflict, a severe blow on the Dutch carrying trade. The war was fought entirely at sea. It lasted from May 1652 to April 1654, in which time there were 12 fleet actions. This evenly balanced fighting was something new in naval history; the Dutch commanders, Tromp (killed Aug. 10, 1653), and de Ruyter, did wonders, as did the Englishmen, Blake and Monk. Dutch commerce suffered enormously. In the end the English had the upper hand, and the Protestant idealist Cromwell, now Protector, had no wish to continue the war. In the Treaty of Westminster (April 5, 1654), the Dutch agreed to pay compensation for the East Indian claims and to make the formal acknowledgment of the British sovereignty of the narrow seas by saluting with the flag. Another condition was added, since the States General refused to accept it, in a secret treaty which the States of Holland under de Witt's influence made as a separate sovereign state. In this Holland was pledged to the Act of Seclusion, by which the prince of Orange, in despite of popular opinion, was to be excluded from the office of stadholder. Baltic affairs next gave trouble. The trade there was of great importance to the Dutch, and was adversely affected by the war between Sweden and Denmark (1657–60). By a skilful use of force and diplomacy John de Witt, in concert with France and England, imposed a settlement. The expulsion of the Dutch from Brazil had led to war with Portugal in 1657, but this too was satisfactorily terminated in 1661. Meanwhile, Charles II. had been restored, and to conciliate him de Witt, secured the repeal of the Act of Seclusion. The dynastic question was however subordinate. It was in an alliance not with England but with France (1662) that the Dutch put their trust. Parliament re-enacted and strengthened the Navigation Act. Dutch posts on the West Coast of Africa were seized (1664) in time of peace; the colony of New Netherland was seized soon afterwards and its capital New Amsterdam renamed New York after James, duke of York. The second English war broke out in 1665. This too was an obstinately contested sea-war. The land operations were insignificant, but it differed from the first war in that it was not a mere duel, the English having as an ally the bishop of Münster, against whom the Dutch were aided by the French, in accordance with the alliance of 1662. The general result was less favourable to the English, and negotiations were already in progress when the Dutch made their memorable raid on the Medway and burnt the British fleet where it had been unwisely laid up in harbour. Naturally they had the better of the treaty. True, New Netherland was handed over in exchange for Surinam and Run; but it may be doubted whether it could have had much future under the Dutch. The commercial and maritime clauses included concessions by the English. In the following year de Witt and Sir William Temple negotiated the triple alliance of England, Holland and Sweden. The purpose of this was to force a peace upon Louis XIV., who in 1667 had invaded the Spanish Netherlands and now was making dangerous progress. In later days, when England and Holland stood side by side against French ambition, the alliance was famous as an anticipation of their policy; but its immediate consequences were far from splendid. Louis did indeed make peace, for which he had other sufficient reasons, but he kept it for no more than four years, and he spent those years in preparing the way for a new war of aggression in which the Spanish Netherlands were still the ultimate objective, but the direct enemy was the Dutch republic, which had taken upon itself to be their friend. Louis' diplomacy isolated the Dutch completely. Charles II. sold himself cheap by the Treaty of Dover (1670); neither to Sweden nor to Spain, nor to any among the German states, could the republic look for support. John de Witt with all his foresight had not done enough. The fleet was strong and well-equipped, but, from jealousy of its Orange sympathies the oligarchs had neglected the army. By 1672 Louis was ready. He moved against the eastern frontier in apparently overwhelming force. The English picked a quarrel over the salute to the flag and, before declaring war, attacked a Dutch merchant fleet in the Channel.

William III.—In this extremity it was futile to resist the wave of feeling which demanded that William of Orange should be called to power; he became stadholder of Zeeland, stadholder of Holland, captain-general of the Union (June 1672). Unable to hold the frontier on the line of the Yssel, he prevailed on his countrymen to save the more westerly territory by opening the dikes and awaiting the enemy behind the inundations of the "Old Holland Water-Line." The French were held up within a day's march of Amsterdam. The insulting peace-terms offered by Louis were rejected. Unhappily, those heroic days were stained by a brutal crime. In The Hague an infuriated mob set upon John de Witt and his brother Cornelius and tore them limb from limb.

For the next 40 years Dutch history turned on the struggle against France. William, though not the equal of the French marshals who opposed him, was the most resolute man in Europe. In the field he never admitted defeat, and in diplomacy he seldom met it. Before the end of 1673 the direct danger to the existence of the Dutch republic was ended. Brandenburg, the emperor and Spain were induced to declare war against France. William was able to come out and surprise the Rhine fortress of Bonn, thus threatening the enemy's communications. In 1674 the land war made no great headway, but at sea the English, among whom a powerful section were unfriendly to Louis, had had enough. The Treaty of Westminster (Feb. 14) provided for the restoration of all conquests. Before very long Charles found it to his interest to work for a time with the anti-French party, and the improvement in the republic's military and diplomatic situation was signally shown by the marriage (1677) of William to Mary, the elder daughter of Charles's heir presumptive, the duke of York. The bridegroom had still his war to finish, but the years 1675–77 had been tolerably successful at sea, though not in the principal theatre, and negotiations were already in progress. They terminated by the general settlement of Nijmwegen (Aug. 1678), in which, though it marked the greatest extent of Louis's conquests, the Dutch surrendered nothing. Ten years elapsed before the next war between Holland and France, and in contrast with the period before 1672 they ended with the almost complete isolation of Louis XIV. England remained an uncertain factor until 1688, when the clumsiness of James and Louis, the generous patriotism of the Dutch regents, including those of Amsterdam, and the genius of William brought about one of the decisive events of modern times. William and Mary became king and queen of England (*see* FRANCE: *History;* ENGLISH HISTORY). In Holland

this greatly raised William's authority, which in no way suffered from his frequent absences in his kingdom. He still had to contend with the particularism of the regents in Amsterdam and elsewhere, but his mastery of Dutch political devices was equal to that of John de Witt, and he exercised a less restricted power as stadholder of Holland than as king of England. In the war he was undisputed head of the Allies. Holland's part was subordinate to that of England, and she suffered both by sea and land only less severely than in the earlier wars of the century; but by the peace of Ryswyk (1697) she gained, besides the indirect benefit of William's recognition as king, a favourable commercial treaty. Afterwards she garrisoned a number of "barrier fortresses" in the Spanish Netherlands. This barrier policy was, however, unsound. The mercantile Dutch did not desire an extension of frontiers but trusted to making themselves safe in the south, as they had already done in the east, by maintaining garrisons which should shore up the resistance of buffer-states, strong enough to serve for defence but too weak to be dangerous. In the great war of the Spanish Succession, which began soon after William's death in 1702 and was a continuation, with still greater stakes, of the last war, one weakness of this scheme at once became apparent. Spain was now in alliance with France, and the garrisons could not hold on in what had thus become an unfriendly country.

William's death began a second "stadholderless period" which lasted until 1747. In 1672 the stadholdership in his five provinces had been declared hereditary, but William died childless and the jealousy of Holland prevented the appointment of his cousin, the stadholder of Friesland and Groningen. The evils of this disunion were, however, mitigated by the statesmanship of Antonie Heinsius (council-pensionary 1689–1720), and the duke of Marlborough (deputy captain-general and British ambassador at The Hague) who carried on the tradition of William III. After the fall of Marlborough, however, a treaty settlement was made (1713–15) which disappointed Dutch expectations. Small patches of territory on the Meuse were gained. In the southern Netherlands, now handed over by Spain to Austria, a barrier was conceded less advantageous than had been promised by the English during the course of the war.

THE REPUBLIC IN DECLINE

The finances of the republic were exhausted. From this time it was no longer one of the Great Powers; but its geographical situation, and the wars of its great neighbours, England and France, made international politics the ruling factor in its destiny. Economic decline began to set in seriously towards the middle of the 18th century, so that the political influence of the Dutch was further diminished. They supported the Hanoverian dynasty in England by sending troops when it was in danger, but they followed in general a policy of peace and abstention from European complications. In 1723–31 they departed from this in order to obtain the suppression of the East India Company, which the Emperor, Charles VI., had set up at Ostend in the Austrian Netherlands, a competitor which might have undone much of the advantage gained by the Dutch from the closing of the Scheldt (*see* OSTEND COMPANY). In exchange for this suppression they guaranteed the Pragmatic Sanction, by which Maria Theresa was to succeed to all the hereditary dominions of her father, Charles VI., and therefore they were unable to avoid joining, in 1743, in the war of the Austrian succession. They were now, as in 1689–1713, in alliance with the English and Austrians against the French, but they confined their help to unimportant contingents and subsidies. The French under Marshal Saxe made short work of the Austrian Netherlands and the barrier fortresses. After holding back in the hope that the Dutch would be neutral, they marched in 1747 into the defenceless Dutch territory south of the Scheldt, Dutch Flanders. Then followed a parody of the revolution of 1672. Popular opinion everywhere demanded a stadholder who should save the country as it had been saved by William III. The man marked out by fate was William IV., prince of Orange, and already stadholder of Friesland, Groningen and Gelderland and the son-in-law of George II. of England. He was the grandson of that cousin of William III. who had been stadholder of the northern provinces. Some English men-of-war in port in Orangist Zeeland gave the first impulse to a swift and bloodless revolution, by which he became stadholder of the remaining provinces and captain and admiral general of the Union. Before long his offices were declared hereditary. He was an eloquent speaker and a believer in constitutional legality, but he lacked all the qualities of the man of action. His high hopes of effective Dutch exertions in the war came to nothing; even in the making of the Treaty of Aix-la-Chapelle in 1748 he had no influence. He and still more his adviser, Willem Bentinck van Rhoon, saw the need for reform in the system of taxation and the machinery of government; but they could not overcome the slackness and obstructiveness of the regents. By the time of William's death (Oct. 22, 1751) nothing remained of the dreams of a revived republic strongly led by a stadholder in the old alliance with Austria and England. In the Seven Years' War (1756–63) the republic remained neutral. After the death in 1759 of William's English widow, Anne, the States were regents for her son who was declared to be of age in 1766. William V. was a man of the feeblest character, ruled by his spirited wife, Frederica Wilhelmina of Prussia. In the American War of Independence he favoured the English; most of the Dutch people sympathized with the rebellious colonists. It was, however, the interference of the British with neutral shipping which brought the Dutch into their fourth English war. By a majority of four provinces to three the States General decided to join the "Armed Neutrality," the combination promoted by Catherine II. of Russia (1780). The war which ensued was an unrelieved disaster. Party strife paralysed every organ of the State, and, though a stout fight was put up in the indecisive naval action of the Dogger Bank (1780), the Dutch could not hinder the English from taking possession of all their shipping and all their colonies. In the Treaty of Paris (1784), deserted by their allies, they had to give up Negapatam in southern India and grant the English the right of navigating through the Moluccas. The economic effects of the war had been disastrous.

Perhaps undeservedly but not unnaturally it was the stadholder and his party who were blamed for these humiliations, and the strongest element in the republic for the next few years was that of the successors of the old "states party." These were the "Patriots," liberals inspired by French philosophical ideas and politically inclined to France. They used their power to hamper and limit that of the stadholder. In 1784 the emperor, Joseph II., took advantage of these dissensions to announce his intention of opening the Scheldt, and the Dutch had no means of averting this except by the payment of a heavy compensation. But the Patriots went too far, and the opponents of France were determined not to lose their chances of controlling Dutch policy through the house of Orange. Sir James Harris, the British ambassador, had long been preparing a stroke. In 1787 the king of Prussia, on the pretext of an insult offered to his niece, dispatched an army of invasion. Amsterdam capitulated, the Patriots were driven from office and William V. was restored.

This might have been the prelude to fundamental reforms had not Dutch history been projected into a new era by the French revolution. In 1792 the French threw open the Scheldt, as Joseph II. had threatened to do. They declared war on George III. of England in the following year, and they were merely registering the results of 1787 when they included the prince of Orange in the declaration. The course of events in the war and in France protected the Dutch until the winter of 1794–95, when the army of Pichegru swept all before it, even the fleet being captured in the Texel by cavalry which crossed the ice. William V. and his family fled to England. All the characteristic institutions of the antiquated republic were done away with, and the French and patriots together organized the Batavian republic on the French model (1795–98). The Dutch soon found what it was to be a client-state of France. The English seized all their colonies, shut up all their shipping and at Camperdown (1797) destroyed their navy. Constitutions, growing less democratic, followed one another as in France. At the peace of Amiens England restored the

Cape of Good Hope and the West Indian colonies, only to occupy them anew when war was resumed in 1803. In 1805 Napoleon imposed a new constitution and Rutger Jan Schimmelpenninck took the leading place with the title of council-pensionary. In the next year, however, the French emperor sent his brother Louis to Holland to rule it as a king. Louis, particularly in the matter of the continental system, put his subjects' interests before his master's: hence in 1810 he had to abdicate. The country was incorporated in the French empire and had to pay its share of men and money for Napoleon's costly last campaigns.

MONARCHY

When Napoleon was defeated at Leipzig in 1813 there was a general rising of the Netherlands. The prince of Orange, the son of William V., who had died in exile, hastened back and, amid general enthusiasm, accepted at Amsterdam (Dec. 1813) the title of sovereign prince The drafting of a constitution was begun. Next year the powers victorious over Napoleon decided to set up, as a bulwark against the French a state uniting all the Netherlands, divided since 1579, together with the bishopric of Liége and the little duchy of Bouillon. At its head was Orange with the title of William I., king of the Netherlands (*q.v.*). His share in the German inheritance of the Nassau family was exchanged for Luxembourg, of which he became grand duke, thus bringing it into a personal union with his kingdom. When Napoleon returned from the hundred days, the king's son and heir, now called prince of Orange, at the head of the Dutch troops, won distinction at Quatre Bras and at Waterloo, where he was wounded. King William's coronation at Brussels on Sept. 27, 1815, inaugurated a new era, which had its own problems, but in which those of the older history of the country were finally settled by national unity under a hereditary monarchy.

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FROM 1815 TO 1914

The inclusion of the Belgian Netherlands in the new State of William I. set Dutch statesmanship a great task. In the conception of the European Powers who had promoted the creation of the United Netherlands kingdom (of England in the first place) it was to be a bulwark against the aggression of France. This conception harmonised quite naturally with the heroic traditions of Dutch foreign policy of which the House of Orange could consider itself to be in a special sense the guardian, but which were regarded as out of date by those who had no further national ambition beyond neutrality. Yet from another point of view less obvious to European diplomacy, the union might have been expected to appeal to Dutch public opinion. The Flemish half of the southern Netherlands had since the forced separation in the eighties of the 16th century become estranged from the northern Netherlands; during the 20 years of annexation to France which had just been brought to a close, the upper classes had been deliberately, and to a large extent successfully, denationalized. Yet the origins of Dutch civilization had been rooted in Flanders and even now the mass of the people north of the ancient linguistic frontier, however completely out of touch with the literary language or the thought of Holland, still preserved their dialects in their original purity. The union might well seem a great opportunity to win them back for Dutch nationality.

The Belgian Revolution.—The king and his principal advisers, Van Hogendorp, Falck, Van Maanen, saw matters in this light. The government endeavoured to restore the Dutch language to its natural position in the public life of the Flemish regions and it tried to base a new conception of a greater Netherlands nationality on what the king ostentatiously called "the national language." The inclusion of the Walloons in his kingdom was inevitably a hindrance to a policy of this kind, which moreover had to overcome the strong gallophil proclivities of the leading classes in Flanders. The conflict with the Roman Catholic hierarchy which the king, heedless of the warning example of Joseph II.'s reign—did not avoid, tended to alienate the sympathies of the Flemings even more than of the Walloons, who, moreover, were especially benefited by the judicious and untiring care which the king bestowed on the economic development of his country. Yet when in 1830, under the immediate effect of the July revolution in France, the rising against Dutch rule began at Brussels, it was the Walloons who, with the gallicized Bruxellois assumed the initiative. The Flemish provinces followed only after the first reverses of the government, and in fact, in the new Belgian Kingdom, which owed its birth to French influences and French interference, they were destined to play a subordinate part. The Dutch regime had not lasted long enough to weld them and the northern provinces together in a conscious national unity, but it had, by reversing the process of gallicization and introducing a system of elementary education, saved the Flemish language from extinction and paved the way for the Flemish movement which is an important element in the 20th Century life of Belgium and in the relations between Holland and Flanders.

Dutch public opinion had taken little interest in the great work that had been done in the south for Dutch civilization. It made no distinction between Flemings and Walloons, and when the revolution broke out it embraced all Belgians in the same resentment, and while largely responding in 1831 to the king's call for an invasion of Belgium in order to obtain better terms of separation, the Dutch people were relieved that the union had come to an end. At the time of the restoration the Dutch people shaken by the vicissitudes of the "French period" and impoverished by the loss of trade had entrusted their interests to William of Orange with the confidence of exhaustion. The years of union with Belgium are marked by an absence of interest in public affairs, surprising on the part of a people with the political tradition of the Dutch. When the Belgian opposition began to ask, ever more insistently, for ministerial responsibility and similar reforms, the Dutch had only supported the government with greater docility. Events after 1831 brought about a change in this attitude.

It had become clear almost at once after the insurrection of the southern provinces that no help was to be expected from the powers (which 16 years before had helped to form the united Netherlands kingdom) to coerce the rebels back under the sovereignty of William I. The attention of Russia, Prussia and Austria, was soon distracted by an insurrection in Poland, while England, especially after the formation of the Whig cabinet in November, was anxious to settle the whole question in amicable consultation with France. The international conference which met in London at the request of William I. to discuss the matter had, on December 20, 1830, pronounced the dissolution of the kingdom. The principles of separation which it laid down a month later were not inacceptable to Dutch opinion, but in June–July 1831 the

conference drew up the so called eighteen articles, which differed essentially from the Bases of January and which Holland rejected. When Leopold I. accepted them, William I. denounced the armistice and in the ten days' campaign the Dutch army routed the Belgians and withdrew only when a French army appeared on the scene. The demonstration was not without effect. The conference again altered its verdict and the twenty-four articles (Oct. 1831) were much more favourable to Holland. But William I. refused to accept them, ostensibly on account of the loss of part of Luxemburg, in reality because he had not given up hope of recovering the lost provinces. It was not until March 1838 that he intimated his readiness to accept the twenty-four articles; and more than a year later the definitive treaty of separation between Holland and Belgium was signed at London and guaranteed in a collective treaty by the five Powers.

The treaty left to Holland the ancient territory of the Dutch republic with the addition of a strip of land along the Maas in order to connect the old enclaves of Maastricht and Venlo with the body of the country. It was as a compensation for this strip of land that the king in his capacity of Grand Duke ceded the Walloon part of Luxemburg to Belgium. The Belgians undertook to share the burden of the public debt of the defunct kingdom. The Scheldt was declared to be free to international navigation and Holland undertook to maintain its navigability. (*See* also BELGIUM.)

Constitutional Reform.—The obstinacy with which King William had maintained his "system of persistence" from 1831 to 1838 had greatly embarrassed Dutch finances and had roused Dutch public opinion against the system of irresponsible government which in 1814 had been accepted without a murmur. The Government had been able to finance the protracted mobilization only by drawing largely on the colonies. Here the so-called "cultures-system" had been introduced by Van den Bosch who had first been governor-general, then minister of the colonies. This system really meant a return to the principles of the Dutch East India company; under it the Dutch Government asserted a monopoly for trading in agricultural articles obtained by forced labour on a large scale. The Netherlands Trading Company which the king had founded in 1824 and in which he had a considerable personal interest, was drawn into the service of the government cultures, and both through it and directly, the State made enormous annual profits. Altogether, these financial transactions which the constitution by committing the government of the colonies to the king's sole care shielded from the control of the chambers, evoked much criticism and intensified the demand for a revision of the constitution. In 1840 a revision was undertaken, which, in addition to certain further not very important changes, brought colonial finance under the competence of the chambers. A few weeks afterwards the king abdicated.

Under William II., the drastic fiscal measures necessary to avoid a public bankruptcy were forced through by Van Hall but at the same time it appeared that the revision of 1840 had by no means satisfied liberal opinion, and the agitation for a further strengthening of the power of the States-General continued.

The leader of liberal thought in the country was J. R. Thorbecke, professor of constitutional law at Leyden and member of the second chamber. In 1844 he with eight other liberal members introduced a bill for further revision. In the chamber, elected on a narrow property basis, there was no majority for his ideas, but instructed middle class opinion outside was largely with him. Yet when in 1848 the Government suddenly moved in his direction, it was impelled by the revolutionary events in France and Germany rather than by any immediate menace in the country itself.

It was largely the personal action of the highly-strung king which caused the victory of the liberal ideas to be so complete. Thorbecke's was the ruling mind in the royal commission which elaborated the new constitution, but his domineering and somewhat pedantic temper brought him many enemies and kept him out of the ministries formed in that eventful year. The largely conservative States-General dared not block the way when the king himself led the forces of progress, and in Oct. 1848 the new constitution came into force, under which full ministerial responsibility, complete control by the States-General of public finance and of colonial administration, direct elections, freedom of meeting, and many other features characteristic of the liberal parliamentary system of government were introduced.

The Liberal Party.—King William II. died a few months later and it was under his son, William III., who was personally inclined towards autocratic principles and in particular distrusted Thorbecke, that the first great lesson in the practice of parliamentary government was taught, when the new king saw himself obliged to entrust the hated statesman with the formation of a ministry. The lesson had not been taught so completely but that in 1853, when the institution of a new Roman Catholic hierarchy gave rise, in Holland as in England, to an outburst of Protestant feeling, the king at once used the opportunity to get rid of Thorbecke. And it was not until 1868, after the king had obstinately maintained in power a conservative cabinet under Heemskerk and two general elections had been fought on the issue of royal versus parliamentary ministries that the question was definitely decided in the liberal sense.

Thorbecke's first ministry (he was again at the head of the Government from 1862 to 1866 and died shortly after the formation of his third cabinet in 1872) produced a great record of legislative achievements. The liberal State, postulated in the new constitution, was realised by means of organic laws, regulating the electoral system, provincial and municipal administration. A navigation act did away with differential treatment of Dutch shipping, a first step in the direction of complete free trade. The impulse given by Thorbecke lost much of its force after his resignation in 1853. In his second ministry it was especially the colonial question that claimed attention. Van den Bosch's "cultures system," the profits of which had become hardly less dear to the hearts of parliamentary governments than they had been to the autocratic king, was attacked both on account of the hardships it meant to the native populations and in the name of liberal economics: "free labour" was advocated in the interests of the Javanese and of Dutch capitalists alike. On this point Thorbecke and his more radical colonial minister, Fransen van de Putte differed, and it was not until 1870 that the "cultures system" was abolished; only government cultures of coffee were maintained for a further number of years.

Education Controversy.—During the whole of this period liberalism may be said to have been the only vital force in Dutch political life. The conservatives had no principle of their own to oppose it; they only questioned and retarded. Other parties, however, were in being, the guardians of distinct and positive traditions of their own, and if so far they had been powerless, or had not cared to exert their power against liberalism, the time had now come when they had begun to oust the colourless conservatism of men like Van Hall and Heemskerk and to play an increasingly important part in politics.

The Catholics had long supported the Liberal Party, to whose political progenitors, the Patriots, they owed possession since 1795 of full citizens rights, and whose victory in 1848 had enabled them to organise their church again. After the outburst of Protestant fury in 1853, Thorbecke had found a constituency in the Catholic South (at Maastricht). The formation of the kingdom of Italy, Pius IX.'s challenge of liberal principles, and the rise of ultramontanism disturbed these friendly relations. The Catholics were organised in a separate party and as they numbered about one third of the total population, this party was bound to be a powerful one. Its views on the education question soon brought it into active opposition to the Liberals and at the same time brought about an alliance with another party, which in the past had always been its chief enemy.

Calvinism had suffered a long eclipse. In the first decades of the 19th century the prevailing tone in religious life was "liberal" and "enlightened." Among the people the old doctrines lingered on, and in the '30s there had been a Calvinist secession from the Reformed Church, which William I., imbued with Napoleonic *"étatism"* and erastianism, had vainly tried to dragoon back to conformity. At the same time, a religious revival, influenced by Swiss Huguenots (hence its French name: the Réveil), and com-

parable to evangelicanism in England, had affected a number of men and women in other classes of society. To this group belonged Groen van Prinsterer, who attempted to apply orthodox protestant principles to politics. He effected a contact between the new anti-revolutionary idealism and the old popular Calvinism, and through sheer force of personality he was able to appear as Thorbecke's chief opponent in the chamber, the bearer of a principle to which Liberalism had to define its attitude. It was only after his death in 1876 however, that, helped by the political awakening and enfranchisement of the lower classes, and by pooling forces with the Roman Catholic Party, the new leader of the Anti-Revolutionary Party, Dr. Abraham Kuyper, could undermine the Liberal ascendancy until, at length, in 1901, it crashed.

It was the education question that made the Calvinist-Catholic coalition possible. Holland had possessed a national elementary school system since 1806. The constitution of 1848 laid down that the Government was to give constant care to it and to see that public elementary instruction was available in all parts of the kingdom. According to an act passed in 1857, the public elementary school was to educate the child to "all social and Christian virtues," a provision which it was hoped would meet the objection of the orthodox to the "neutral," or as they said, the "godless," character of the State schools. It did nothing of the sort, and when in 1878, the Liberals under Kappeyne van de Coppello strengthened the Act of 1857 without making any concessions to the religious scruples of orthodox Protestants and Catholics, the agitation was doubled in intensity. It was urged that to make these groups of the population pay towards the upkeep of State schools to which conscience forbade them sending their children so that they had to pay again for the upkeep of private denominational schools was the height of unfairness, and it was proposed that the State should give financial support to privately managed denominational schools as well. This demand was strenuously resisted by the Liberals, and the constitution, by committing public elementary instruction to the Government's especial care, undoubtedly made it difficult to go very far in the direction of state support for denominational education. The constitution could be altered only by the two-thirds vote of a specially elected States General. So the first coalition (Anti-Revolutionary cum Catholic) ministry, 1887–91, could only make a modest beginning with the subsidizing of denominational schools, which did not at all satisfy their followers.

The Franchise.—The coalition majority in 1887 was the direct outcome of an extension of the franchise which increased the number of electors from 140,000 to 300,000, in a population of 4,400,000. The Liberal Party had failed to adapt itself to the new circumstances. In 1889 there was a secession from the Liberal Party to found a Radical Party. The rump nevertheless evolved tendencies too radical to the taste of some, who seceded in 1894 and formed a Free Liberal Party. The multiplication of groups has ever since characterized Dutch parliamentary life. Another Party had meanwhile made its appearance. In 1887 the first Socialist was elected to the second chamber. The growth of the Socialist Party was at first slow, not only because of internal dissensions, but also because Holland was still a not very strongly industrialized country. Moreover, the bulk of the working-class population was still without the vote. The new franchise act of 1896 carried by Van Houten, a member of the Liberal Cabinet, increased the number of voters to 577,000 but this was still far removed from universal suffrage. It was again the constitution that blocked the way, but the failure of the Liberal Party to solve the question in a bold fashion alienated working class sympathies from it. Yet shortly before its final fall from power, the Liberals produced a cabinet that firmly tackled the social legislation which many considered to be long overdue. Workmen's insurance against accidents, improvement of housing conditions, compulsory education for children from six to twelve, were all measures carried by the Goeman Borgesius ministry between 1897 and 1901.

Progress.—A very great change had by this time taken place in the economic and intellectual life of the country. Holland had been very slow in recovering from the exhaustion which the interruption of overseas trade during the "French period" had caused. The working class population of the towns remained poor, capital cautious and unenterprising, the whole tone of society middle class and dull. In the universities theology and philology still flourished; Beets and Potgieter, Busken Huet and Douwes Dekker (Multatuli) were writers of real distinction; the Hague school of painters in the '60s and '70s produced work of lasting value. Yet on the whole Dutch life was narrow and uninspired, and with the exception of the first named, the writers mentioned felt profoundly dissatisfied and criticized often with an almost despairing bitterness. In the last quarter of the century however, hope for the future was born afresh. The rapid economic development of Germany and especially of the industrial districts on the Rhine after 1870 was an important factor in this process. It enabled Rotterdam to grow into a port of the first magnitude. But the national revival manifested itself in many ways. Amsterdam was given good access to the sea by the construction of the North sea Canal to Ymuiden (1865–76). Rotterdam, too, got its New Waterway (1866–71). Lakes were turned into land, waste grounds were reclaimed. In Twente and North Brabant textile industries grew up, while along the rivers shipbuilding yards increased in numbers. The Dutch merchant fleet, too, began to grow rapidly. Economic development and increasing prosperity reacted on politics. The new vitality of the Socialist movement as well as the democratic tendencies of the Anti-Revolutionary and Catholic Parties, and generally the vigour with which social reconstruction was debated and undertaken, were largely attributable to the passing of material stagnation. Literature, too, in the '80s entered upon a period remarkable for enthusiasm and faith in the future no less than for brilliant achievements. In fact the promise of the *Nieuwe Gids* movement was hardly fulfilled, although especially in the domain of poetry Dutch literature has been permanently enriched by it and the language and the spirit of the nation were profoundly stimulated. In the universities nothing perhaps was more noteworthy than the revival of scientific studies which was to bear its richest fruit a little later and in the 20th century.

Achin.—In the sphere of colonial government, too, a new spirit began to make itself felt as the 19th century approached its close. One expedition after another was undertaken to bring regions which had so far been only nominally parts of the Dutch empire under effective control. The war with Achin, which had dragged on since 1873 was brought to a close by General Van Heutz who, when shortly afterwards (1904) he was made Governor-General, directed the last and most energetic stage of this forward movement in the whole of the Archipelago. At the same time, while the resources of the islands were developed by capitalistic enterprise, the Government began to display a more active care for the economic and intellectual welfare of the Indian peoples.

Home Politics.—At home meanwhile, in 1901, the clerical parties had won a decisive victory at the polls and a cabinet was formed by Dr. Kuyper. This remarkable man, a dissident minister of religion, a powerful writer and a speaker with a gift of arresting statement, had for 25 years already exercised an enormous influence over the orthodox Calvinist section of the Dutch people. His advent to power opened a stormy chapter in Dutch politics. Events, however, took an unexpected turn. A further installment of educational reform was procured by the act making it possible to found private universities on a denominational basis. This act emancipated the existing Calvinist University of Amsterdam (a different body from the municipal university of that town) and enabled the Catholics too, to erect a university of their own (Nijmwegen, 1924). But the programme of social reform, sponsored by Dr. Kuyper's colleague Talma, was slow in materializing. Instead, in 1903, Dr. Kuyper got into a very violent conflict with the growing forces of trades-unionism and socialism when he used the forces of the State to break a railway strike. From that moment onwards, the Socialists denounced him as a ruthless opponent of the proletariat and derided his professions of democratic sentiment and religious faith as cant. The general election of 1905 resulted in a deadlock. A very weak Liberal Government was formed, which was in 1907 replaced by another Coalition Government. The political situation did not permit Dr. Kuyper's strong personality to be included, and when

HOLLAND



PHOTOGRAPHS, (2-6) A. G. VAN AGTMAAL-BAARN BY COURTESY OF THE NETHERLANDS RAILWAYS, (1) EWING GALLOWAY

COSTUMES AND HOUSE INTERIORS OF THE NETHERLANDS

1. A woman of Zoutelande, Zeeland. The bare floor, made either of terra cotta or white or blue brick, is typical of many Dutch houses of the middle classes. The national love of flowers is reflected by the potted plants in the window
2. A group of women with market baskets in Flushing (Vlissingen) on the Zeeland coast. With the exception of ornamented caps the costumes of this section are inconspicuous, being of a dark colour, generally blue
3. Zeelanders. The tightly fitting caps of the women are of fine cambric or linen, and the short-sleeved gowns are cut low to display the chemise which is elaborately embroidered. The wing-like puffs on the shoulders are a local fashion. The most distinguishing features of the male costume are the embroidered, silver-buttoned vest and the belt buckle, also of silver, which ranges, according to the prosperity of the wearer, from a small size to a diameter of about 6 inches
4. Scene in Volendam, fishing village of the Zuyder Zee. The brick streets and the gabled houses with their small *stoepen* are characteristic of the Dutch village. The children's costumes closely resemble those of their elders
5. Interior of a home on the island of Marken. The curtains conceal cupboard beds, an economical wall feature found in many rural houses. The woman's coiffure follows a local style which demands long braids
6. Dutch rural interior. The family is grouped about the fireplace, the chimney piece of which, shaped like an overhanging hood, is decorated with a flounce of light print *schoorsteenval* and with a row of plates

in 1909 the general election led to further disaster for the Liberals, he nevertheless remained discarded.

Heemskerk was the leading member of this Government which was somewhat too moderate in its religious policy for the more fanatical Kuyperians, whose zeal for social reform was gratified by the grandiose scheme for state disability and old age insurance on which the minister of labour, Talma, worked strenuously. The scheme, however, had not yet been carried into effect when the defeat of the Coalition at the polls in 1913 hung it up indefinitely.

The parties of the Left proved unable, in 1913, to assume the responsibilities of government. The once powerful Liberal Party was now broken up into several sections; moreover, the Socialist Party now claimed a large proportion of the forces of the Left, and there was little sympathy between it and the so-called Free Liberals. An attempt was made, nevertheless, to form a coalition of the Left, under Dr. Bos, the Radical leader, on a programme that included universal suffrage. The Free Liberals agreed to this programme, but the Socialists, although their leader, P. J. Troelstra, was in favour of accepting, refused to co-operate.

In this difficulty an extra-parliamentary cabinet was formed by Cort van der Linden. In conformity with the verdict of the electors it bore a decidedly "Left" character, but it attempted to find final solutions for both the questions which had long paralysed Dutch political life. Cort van der Linden and his colleagues proposed to bring about a revision of the constitution (for which purpose a two-thirds majority of the chamber is required) by an agreement of all parties. In it the Clerical groups would find the solution of the school problem and the Liberals, Radicals and Socialists the final extension of the suffrage.

Although faced with the problems arising out of the World War, the Government persevered with this task, and indeed the quickened sense of national solidarity helped it rather than otherwise. In 1917 its programme was carried out. Universal suffrage and proportional representation were introduced; at the same time, the principle of absolute equality with regard to the public exchequer of "public" undenominational education, and "private" denominational education, was conceded in full and written in the Constitution.

THE WORLD WAR

Although Holland did not take part in the World War, it was a great event in her history.

Neutrality.—Holland's situation has always been a perilous one, not only because she is surrounded on all sides by the nations whose wars convulse Europe, but because important waterways, on which her neighbours' trade depends, flow out into the sea across her territory. In the years before the war, more than one acute controversy between the two opposing groups of European Powers had centred round the position of Holland. First, Belgium had been used in an attempt to make Holland give up her attitude of detachment. The Dutch-Belgian *rapprochement*, which was so much talked about in those years, did not proceed from the Dutch-speaking Flemings, but from Francophil circles. It never went very far, and it was forgotten in the outcry raised over the proposal to fortify the mouth of the Scheldt which was submitted by the Dutch Government to the Chamber in 1910. The contention, however, that Holland was obliged, or even that it had the right, to allow Entente forces to use the Dutch part of that river in case of a German threat to Antwerp was quite untenable. The Entente Governments tacitly recognized the correctness of Holland's behaviour, and in 1911 and 1912 official visits of President Fallières to The Hague and of Queen Wilhelmina to Brussels and Paris made it plain to the World that there was no ill-will between Holland and the Entente.

Probably, indeed, a desire to allow Germany no possible pretext for an attempt to occupy the Dutch ports in case of an Anglo-German conflict had as much to do with the decision to fortify the mouths of the rivers as any idea that the fortifications might ever actually be used against Great Britain. While English and French newspapers were protesting against this scheme, Holland was also remodelling her system of land defence to excellent effect. The German general staff were so much impressed with these reforms that they thought it necessary to rearrange their plan of operations for the event of a war with France. From Von Moltke's memoirs it appears that at the time of his predecessor, Von Schlieffen, the German staff intended to violate Dutch as well as Belgian territory, trusting that when they rushed their armies westward through the Dutch province of Limburg (which juts out to the south, covering part of the eastern frontier of Belgium), the Dutch Army would remain inactive behind the "water line," the inundated area, which protects only the western part of the country. Von Moltke, realizing that the Dutch army was made mobile and would be used to strike, even if only the outlying province of Limburg were violated, decided to respect Dutch neutrality, although the détour necessitated by the change of plan would delay the German advance from Crefeld by some precious days.

Holland's attitude, then, in those crucial years was strictly and impartially neutral. The sympathies of the public could less easily be controlled. The memories of the Boer War had already lost much of their bitterness, largely owing to the grant of self-government to the late Boer republics and the consequent appeasement in South Africa itself. The economic prosperity of the country was to a certain extent bound up with the tremendous development of the German hinterland since 1870, but the Dutch people felt oppressed by the militarist temper and the blatant imperialism which appeared to possess their powerful eastern neighbour. On the outbreak of war in 1914, it was the violation of Belgian neutrality and the subsequent acts of repression in the occupied territory which made the deepest impression and determined the attitude of Dutch public opinion.

The Government at once proclaimed, and rigidly maintained to the end, strict neutrality. Inevitably there were times when each group of belligerents felt Holland's neutrality, however impartially administered, as a burden. The British navy was able to see to it that Holland did not provide Germany with the food and other materials she wanted from overseas, but the enforcement of the blockade gave rise to a good deal of friction. Moreover, Holland's neutrality undoubtedly had the effect of covering Germany's right flank. On the other hand, the closure of the Scheldt, once Antwerp had fallen, was all to the advantage of Great Britain, as Germany was thus prevented from using Antwerp as a submarine base.

Disputes about particular points were practically continuous, but the sincerity and reality of Dutch neutrality were recognized on both sides, and neither attempted to use violence against Holland. The efficiency of Holland's defense forces contributed to this. The army, 450,000 strong, had been mobilized without a hitch in the last days of July 1914, and was kept on a war footing, at a great cost financially and morally, till 1918. It had to cope with no serious incidents. Some thousands of Belgian and British troops were interned after the fall of Antwerp. German and British aeroplanes sometimes strayed on to Dutch territory. The naval forces occasionally had to intern a submarine or a destroyer, and to them fell the dangerous work of mine-sweeping along the Dutch coast. The Government carried out its international obligations as a neutral with consistent firmness and moderation.

The Blockade.—Unfortunately, frequent cases arose in which the vague principles of international law could be variously interpreted. Great Britain, for instance, protested when Holland excluded armed merchantmen from her harbours, contending that the article in Holland's original proclamation of neutrality to which Mr. Loudon, the foreign minister, appealed was drawn when Germany's resort to unrestricted submarine warfare was not foreseen; and it was in reply to those utterly illegal methods that Britain had started arming her merchantmen. In this case Holland maintained her attitude. The sand and gravel dispute, which dragged on throughout 1917 and 1918, was more acrimonious, and at one time endangered Holland's neutrality. The Entente Governments protested against Holland's allowing the Germans to use her waterways for the transport of sand and gravel to Belgium for use in the construction of a new kind of ferroconcrete dugouts. Both belligerents put the severest pressure on Holland, Great Britain penalizing her for concessions to

Germany, Germany threatening her for concessions to Britain. Loudon at last consented to ration this traffic on the footing of pre-war statistics; but in the spring of 1918 when Germany was making her final offensive, Ludendorff wanted this arrangement to be used as a pretext to overrun Holland and make a dash for the Dutch ports. An ultimatum was actually presented, and only the determined intervention of representatives of the civil power in Germany prevented Ludendorff from having his way.

The most real difficulties, however, were economic; and these began to be of the most tragic importance to the Dutch people in 1915. For Holland international commerce is not a luxury but a necessity. It directly supports an important part of the community, Dutch industries are dependent on it for most of their raw materials and their coal, while four-fifths of the grain supply comes from abroad. Seaborne trade was gradually extinguished as the war went on. The Germans began by laying mines in front of the English ports. The British retaliated by laying a minefield in the North sea. In order to make their blockade of Germany effective they exercised an ever more stringent control over imports into the adjacent states, regardless of the provisions of the Declaration of London. They prescribed to neutral traffic a route along the south coast of England, so as to be able to examine cargoes at leisure. The Germans then prescribed the route round the North of Scotland, and declared the Channel area an area of war. In March 1915 the Entente Powers did away with all distinctions between legitimate and contraband trade, and prohibited the import into Holland of all goods, whatever their nature, which could be suspected of being destined for transmission to Germany. All goods imported into Holland had to be consigned to an unofficial body (the Netherlands Oversea Trust), which possessed the confidence of the Entente authorities and undertook that they should go no further.

The Allies gradually assumed control of the entire economic life of Holland, allowing her the bare necessities of life, withholding anything that could be used to replace goods sent to Germany. Even Holland's trade with her own colonies was subject to this control. As Holland depends on Germany for certain indispensable articles, *e.g.*, coal, she was driven to export food which she really could not do without, in order to obtain them in exchange. Meanwhile in 1915 Dutch vessels had begun to fall victims to German U-boats. After the unrestricted submarine war had been proclaimed early in 1917, practically all overseas traffic ceased. Food scarcity became almost as serious in Holland as in Germany itself, certainly more serious than in England. In the last stages of the war Holland's industrial life was at a complete standstill.

FROM 1918 TO 1928

Negotiations with Belgium.—One big surprise was the discovery that Belgium proposed to advance at the Peace Conference certain claims involving Dutch sovereignty. In the first months of the war, when the Germans advanced through Belgium, a stream of Belgian refugees had sought safety on Dutch soil, where they were hospitably received. At one time their number exceeded 1,000,000, and their support, the provision of food and shelter, was an exceedingly heavy charge. In spite of this Holland found herself decidedly unpopular in some of the Allied countries. The firm refusal of the Dutch Government in 1920 to surrender the ex-Emperor William, who had taken refuge there in Nov. 1918, gave rise to excited denunciations of Holland's alleged tenderness for the Hohenzollerns. Holland's attitude in the war was widely represented in the most unfriendly light. Belgium declared that Holland's claim to sovereignty over the Scheldt mouth, and her action in closing it against the Allied forces, had made the defence of Antwerp impossible, while her possession of the province of Limburg had hindered the defence of Belgium's eastern frontier, which ought to have been based on the River Maas. It has been argued above that Holland's action in the war had really benefited the Allied cause, but the opposite contention was made by the Belgian *Comité de politique nationale*, which advocated annexation of the disputed regions. It claimed that Belgium should be given sovereignty over Dutch Flanders, on the left bank of the Scheldt, and over Dutch Limburg, on the ground that the treaties of 1839, guaranteeing the neutrality of Belgium, having lapsed, these territories were now necessary for her protection. The question was eventually referred to direct negotiation between the two countries. (*See* H. W. V. Temperley, *History of the Peace Conference in Paris*, vol. ii., pp. 192 *seq.*, 1920.)

These negotiations on new arrangements for the régime on the Scheldt, on the Ghent Terneuzen canal, etc., were, however, carried on in a somewhat unfavourable atmosphere. Dutch public opinion was greatly irritated. The populations of Limburg and Dutch Flanders protested their loyalty to the Dutch fatherland. Meanwhile the annexationist agitation in Belgium went on, and was still supported by the Government, as was proved when a secret circular, emanating from the Belgian Foreign Office to "Belgian agents" in Dutch Limburg, was disclosed by Flemings friendly to Holland. Yet the Dutch Government was prepared to go far to meet Belgian wishes.

Early in 1920 a treaty in which several Dutch concessions were laid down was ready for signature, when a new dispute arose, about the sovereignty of the Wielingen channel, which connects the Schelde estuary with the open sea. Although that channel runs along the Belgian coast within the three-mile limit, Holland had exercised sovereign rights over it since mediaeval times. But, later, when conditions everywhere grew more stable, the treaty of 1920 was signed at The Hague on April 3, 1925, without Holland having changed her attitude towards the Wielingen question, which was suffered to remain in its original state, the Belgians basing their claim on the three-mile limit, the Dutch on ancient rights of possession.

Ratification by Holland was, however, delayed by prolonged political crisis; and meanwhile it was subjected to lively criticism. In 1919 and 1920 Holland had been willing to make economic concessions to avoid a threat to her sovereign rights; and Van Karnebeek's conduct of the delicate negotiations had been generally admired. When in 1925, however, the treaty was at last published in its entirety, the danger which loomed so large five years before seemed altogether negligible, and the proposed concessions were scrutinized entirely on their merits, wide-spread dissatisfaction manifesting itself at the one-sided character of the treaty. When the Second Chamber on Nov. 11, 1926, nevertheless approved it, the agitation redoubled in intensity, with the result that on March 24, 1927, the First Chamber, with 33 votes against 17 rejected it.

Effects of the Treaty.—Criticism had mainly centred round two points. Firstly there was Holland's consent to the construction over her territory of canals from Antwerp to Moerdyk and from Antwerp to Ruhrort; these canals were obviously intended to deflect to Antwerp part of the Rhine trade from its natural course down the river; a plan which was naturally deeply resented at Rotterdam. Secondly the provisions for a new Dutch-Belgian régime on the Scheldt were generally thought to be too far-reaching. New conversations were begun between the two Governments in Oct. 1928.

Home Affairs.—The first elections under the new suffrage law after the revision of the constitution were held while the war was still going on, and resulted in further disaster for the Liberal groups; the Cort van der Linden administration resigned, and another Calvinist-Catholic cabinet was formed (July 1918). The Premier, Ruys de Beerenbrouck, was a Catholic, a thing without precedent in Dutch history. This Government's mandate was confirmed by the elections of 1921, when the Coalition parties increased their number of seats to 60 out of the 100 which constitute the second chamber. At the elections of 1925 they lost some ground, but still retained the majority, and when Ruys retired, Colÿn, leader of the Calvinist anti-revolutionary party, formed another Coalition cabinet. In Nov. 1925 internal disagreements compelled that Government to resign. Each of these elections since proportional representation came into force meant a further stage in the disintegration of the Liberal parties, of which only the Radical group held its own. The Socialists, on the contrary, made a big advance in 1918, and although they suffered a setback in 1921 they more than retrieved their for-

tunes in 1925. They then numbered 24 members and were the second largest party in the chamber after the Catholics with 32. The 1921 election was the first at which women's suffrage was in full working order. Six out of the 100 seats were occupied by women in the chamber of 1925.

The years of Coalition Government through which Holland passed after the Armistice can be divided into two very distinct periods. The years 1919 and 1920 were feverish ones, when a fallacious sense of prosperity stimulated enterprise in business and politics alike. It is not perhaps unfair to connect the zeal for social reform which characterised those days with a certain nervousness which remained after the "November days" of 1918.

But the fictitious prosperity was succeeded by a severe depression. Shipping and shipbuilding particularly felt the effects, and no place suffered more from the occupation of the Ruhr area and from the preference granted by France to her own and Belgian commerce than the great port of Rotterdam. When international conditions improved in 1924, economic conditions in Holland soon felt the effect. Yet unemployment remained still a drain on Dutch resources. The one really bright spot in the picture was the prosperity of the East Indian "cultures."

Meanwhile, the stress of the times occasioned a radical change in the Government's policy. Economy came to be the cry. The building subsidies were cut down. In order to enable Dutch industry to compete with the countries with debased currencies, dispensations from the act restricting the hours of labour were freely granted. On yet another point a revulsion of feeling manifested itself against legislation passed almost without opposition a few years previously. The new cabinet of the Right had to carry into practice the general provision of financial equality for denominational education which their predecessors had written into the Constitution. It was now felt that the multiplication of small State-subsidized schools, which resulted from Dr. De Visser's (the minister of education 1918–25) measures, overburdened the taxpayer.

During the years 1922–4 Dutch politics centred round the financial situation. In the early summer of 1923 the Government strengthened itself with a new minister of finance, Mr. Colÿn, who two years later was to succeed Mr. Ruys in the premiership. Colÿn, a strong personality, was expected to carry out a programme of ruthless economy. The prime object of Colÿn's severe policy, at all events, was reached: in the course of 1925 the budget was balanced. An improvement in the yield of direct taxation, as a consequence of the economic revival, contributed to this event.

In spite of this success, Colÿn's Government soon was unable to carry on. It was freely predicted at the time that the elimination of the education grievance would soon bring about the dissolution of the Coalition, and that thus the way would become clear for a more natural grouping of parties on economic and political lines. In Oct. 1923 it was thought that the knell of the Coalition had been sounded when 10 Catholics joined the parties of the Left and the bill for the strengthening of the naval defences of the Dutch East Indies was rejected. After a crisis of several months, however, the Coalition was patched up and the elections of June–July 1925 were fought on the old lines. Colÿn formed a new Government in July. But a new crisis was occasioned by a motion, introduced by an independent Christian Historical member of the chamber, to abolish diplomatic representation at the Vatican, which had been introduced during the war by the Cort van der Linden Government. The whole Christian Historical Party voted for it, and the motion was carried. The Liberals, Radicals and Socialists, while caring little for the question itself, had voted for the motion in order to show up the unreality of the Coalition. The Catholic ministers in Colÿn's cabinet resigned on Nov. 11, 1925, and the next day the premier offered the resignations of himself and all his other colleagues.

Co-operation between the Christian Historicals and the Roman Catholics had now become exceedingly difficult, but the hopes of those who wanted to see the Coalition give way to a new grouping of parties were disappointed. Radicals and Socialists have long aspired to an alliance with the Catholics, among whom democratic tendencies are strongly, although by no means exclusively, represented. An attempt (Nov. 24–Dec. 1, 1925) on the part of the Radical leader, Marchant, to form a democratic ministry, however, met with a unanimous refusal from the Catholics, in spite of Marchant's offer to rescind the vote against the Vatican legation. The result was that Dutch parliamentary politics appeared to have reached an absolute deadlock. After a crisis of unprecedented duration, Jonkheer De Geer, therefore, on March 3, 1926 formed a non-parliamentary cabinet with a programme of all-round economy, including reductions in the army and navy and productive State works for the unemployed.

The frequent resort to extra-parliamentary cabinets is a curious feature of modern Dutch politics. It should not be regarded as a reversion to the system of royal government. The system has grave drawbacks, but as long as the numerous parties in the chamber cannot combine, it will probably be indispensable.

Latest Developments.—Up to 1928 the De Geer administration had been successful enough. The economic situation greatly improved, unemployment declined and the yield of taxation increased. Some anxiety was caused by communist outbreaks in the Dutch East Indies (Nov. 1926), which, however, were easily put down. While the Dutch Socialists are inclined to criticize methods of repression, they deprecate the appeal to force on the part of Indian nationalists and admit that Dutch rule cannot yet be dispensed with. The Government, for its part, does not consider that the communist movement, limited as it is to a small portion of the Indian peoples, would warrant an interruption, or even a slowing down, of constitutional evolution, and a plan for giving to native elected members a majority of the seats of the *Volksraad* was passed by the States General in Oct. 1928.

Now that the shocks of the war period have been overcome, it may be discerned that the vigorous movement of material and intellectual expansion which began in the last decades of the 19th century has not yet spent its force. New industries are still coming into being, as for instance, the Phillips electrical works at Eindhoven, the artificial silk industry at Breda, etc. At the same time, agriculture, especially cattle breeding and dairy farming, horticulture, all of which a generation ago began to make very successful use of new methods of organization and scientific research and on an even larger scale to produce for the English and German markets, are greatly flourishing. The coalfields in South Limburg, to which attention was directed when during the war the supply of German coal ran short, have been developed, in part, under State management, with striking success. A gigantic scheme for the reclamation of the Zuider Zee, which is to add a 12th province to the country is in the course of execution. Amsterdam has since the war advanced in importance as an international banking centre, while with Rotterdam it counts among the great commercial ports of the continent. The Olympic Games of 1928 were held at the new Amsterdam stadium.

The growing reputation of Dutch architecture and its influence on the appearance of Dutch towns has already been mentioned. Meanwhile the fame of Dutch science stands very high. No less than 17 Nobel prizes have been won by Dutch scientists.

The political emancipation of the Calvinist and Catholic sections of the nation, as well as the organization and rise in prosperity of the working class, has added variety and depth to Dutch intellectual life. The growth of a feeling of kinship with the Flemish people, who are again making a valuable contribution of their own to Netherlands civilization, is widening the national horizon.

For the literature of Holland, *see* DUTCH LANGUAGE AND LITERATURE.

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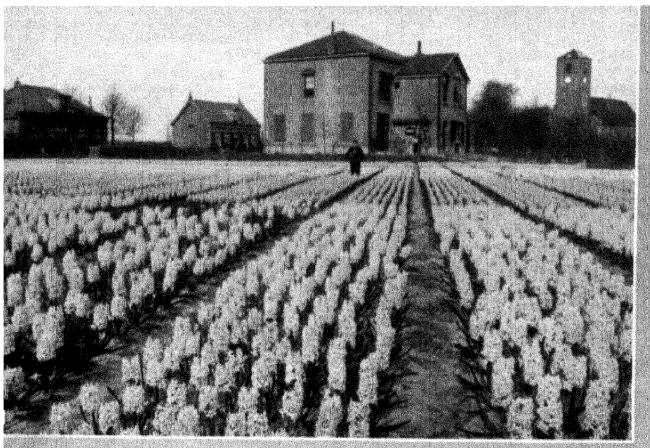
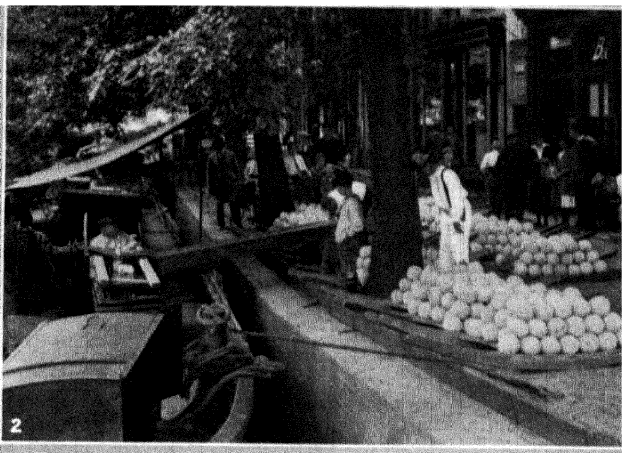
HOLLAND, COUNTY AND PROVINCE OF. The first mention of Holland in any document is found in an imperial *gift brief* dated May 2, 1064. A comparison with other documentary evidence leads to the identification of Holland with the *forestum Merweda,* or the bush-grown fenland lying between the Waal, the old Meuse and the Merwe. It is the district surrounding the town of Dordrecht. A portion of the original Holland was submerged by a great inundation in 1421, and its modern appellation of Biesbosch (reed-forest) is descriptive of what must have been the condition of the entire district in early times. The title count of Holland appears to have been first borne by the Frisian count Dirk III., who founded Dordrecht (*see* below). It was not, however, till late in the 11th century that his successors adopted the style *"Hollandensis comes"* as their territorial designation, and that the name Holland becomes gradually extended northwards to connote all the land subject to the rule of the counts between Texel and the Maas.

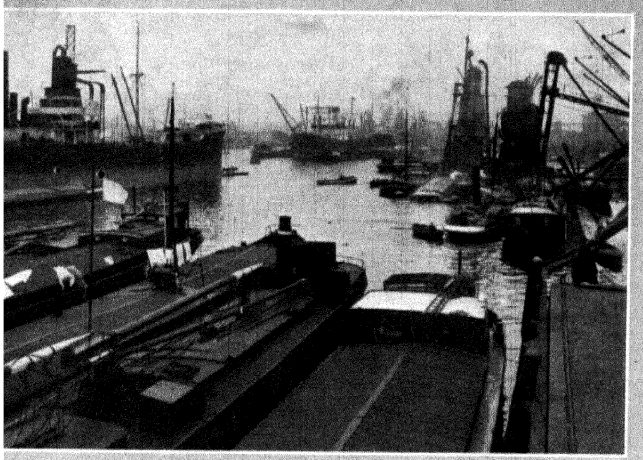
The First Line of Counts.—The beginnings of the history of this feudal State centre in the abbey of Egmont in the archives of which its records have been preserved. In 922 Charles the Simple gave in full possession to a count in Frisia, Dirk by name (a shortened form of Diederic, Latin Theodoricus), "the church of Egmont with all that belonged to it from Swithardeshage to Kinhem." This man, usually known as Dirk I., died about 939 and was succeeded by his son of the same name, Dirk II., the founder of the abbey of Egmont. He obtained in 983 from the emperor Otto III., with whom he was in great favour, a considerable extension of territory, that now covered by the Zuider Zee and southward down to Nijmwegen. In other words his rule extended over the whole country from the right bank of the Meuse to the Vlie. He appears also to have exercised authority at Ghent. He died in 988. His elder son Arnulf was count till 993, when he was slain in battle against the west Frisians, and was succeeded by his 12-year-old son Dirk III. In his minority the boy was despoiled of almost all his possessions, except Kennemerland and Maasland. Afterwards he made himself master not only of his ancestral possessions, but of the district on the Meuse known as the Bushland of Merweda (*forestum Merweda*), hitherto subject to the see of Utrecht. In the midst of this marshy tract, at a point commanding the courses of the Meuse and the Waal, he built a castle (about 1015) and began to levy tolls. Around this castle sprang up the town of Thuredrecht or Dordrecht. The possession of this stronghold was so injurious to the commerce of Tiel, Cologne and the Rhenish towns with England that complaints were made by the bishop of Utrecht and the archbishop of Cologne to the emperor, who commissioned Duke Godfrey of Lorraine to chastise the young Frisian count. Duke Godfrey invaded Dirk's lands with a large army, but was totally defeated with heavy loss (July 29, 1018). This victory of 1018 is often regarded as the true starting-point of the history of the county of Holland. Having thus established his rule in the south, Dirk next proceeded to bring into subjection the Frisians in the north. He appointed his brother Siegfrid or Sikka as governor over them. In his later years Dirk went upon a pilgrimage to the Holy Land from which he returned in 1034; and ruled in peace until his death in 1039.

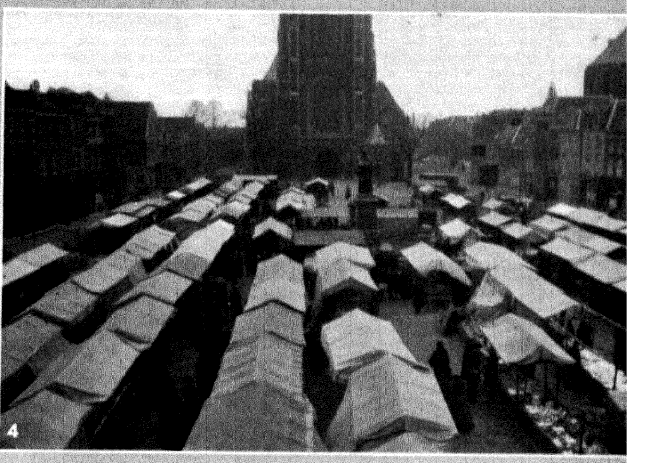
His son, Dirk IV., was one of the most enterprising of his warlike and strenuous race. His reign was marked by a notable victory over an imperial army which had occupied Zeeland (1047). It is in his time that the dispute between the counts of Flanders and Holland for the possession of Zeeland and Walcheren began. In 1049 he was killed in battle against the forces of a coalition headed by the archbishop of Cologne and the bishop of Utrecht. He was succeeded by his brother Floris I., who, like his predecessors, was hard-fighting and tenacious. He found a formidable adversary in the able and warlike William, who, becoming bishop of Utrecht in 1054, was determined to recover the lost possessions of his see; and in 1058, in alliance with Hanno, archbishop of Cologne, Egbert, margrave of Brandenburg, the bishop of Liège and others, invaded the Frisian territory. At first success attended the invaders and many places fell into their hands, but finally they were surprised and defeated near Dordrecht. The counts of Guelders and Louvain were among the prisoners that fell into the hands of Floris. The attack was renewed in 1061. In a battle at Nederhemert Floris met with his death in the hour of victory. He was succeeded by his son, Dirk V. a child, under the guardianship of his mother, Gertrude of Saxony. Bishop William seems now to have seized his opportunity and occupied all the territory that he claimed. In this he was confirmed by two charters of the emperor Henry IV. (April 30 and May 2, 1064). Among the possessions thus assigned to him is found *comitatus omnis in Hollandt cum omnibus ad bannum regalem pertinentibus.* An examination of these documents shows the possessions of Dirk as *in Westflinge et circa oras Rheni, i.e.,* west of the Vlie and around the mouths of the Rhine. Gertrude and her son appear to have withdrawn to the islands of Frisia (Zeeland), leaving William in undisturbed occupation of the disputed lands. In 1063 Gertrude contracted a marriage with Robert, the second son of Baldwin V. of Flanders. On his marriage his father invested him with Imperial Flanders, as an apanage including the islands of Frisia (Zeeland) west of the Scheldt. He now became guardian to his stepson, in whose inheritance lay the islands east of the Scheldt. Robert thus, in his own right and that of Dirk, was ruler of all Frisia (Zeeland), and thus became known among his Flemish countrymen as Robert the Frisian. On the death of Bishop William of Utrecht (April 17, 1076) Dirk V. with the help of his stepfather Robert recovered the county of Holland and the other lands which the bishop had held. Henceforth the Frisian counts became definitively known as counts of Holland. Dirk V. died in 1091 and was succeeded by his son Floris II. the Fat. This count had a peaceful and prosperous reign of 31 years. After his death (1122) his widow, Petronilla of Saxony, governed in the name of Dirk VI., who was a minor. The accession of her half-brother, Lothaire of Saxony, to the imperial throne on the death of Henry V. greatly strengthened her position. The East Frisian districts, Oostergoo and Westergoo, were by Lothaire transferred from the rule of the bishops of Utrecht to that of the counts of Holland (1125). But the Frisian peasants and fishermen were equally refractory to the rule of any distant overlord, and after a rebellion in 1132 they were replaced under the bishop's authority by the emperor Conrad III. (1138). Dirk VI. was succeeded in 1157 by Floris III.

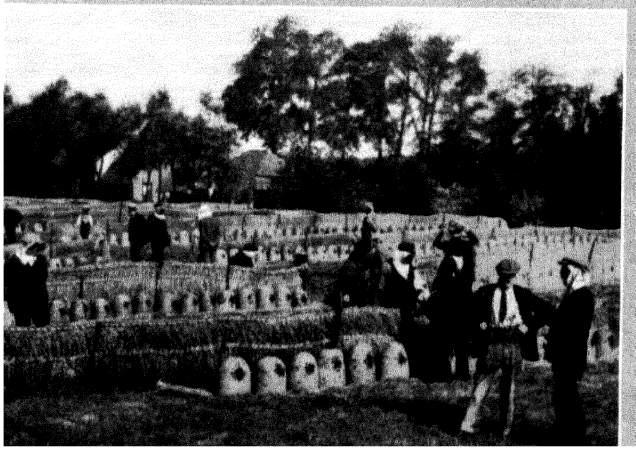
Floris III. reversed the traditional policy of his house by allying himself with the Hohenstaufen. He became a devoted adherent and friend of Frederick Barbarossa, whom he accompanied upon the third Crusade, of which he was a distinguished leader. He died in 1190 at Antioch of pestilence. His son, Dirk VII., had a stormy, but on the whole successful reign. Contests with the Flemings in West Zeeland and with the West Frisians, stirred up to revolt by his brother William, ended in his favour. The brothers were reconciled and William was made count of East Friesland. In 1202, however, Dirk was defeated and taken prisoner by the duke of Brabant, and had to purchase peace on humiliating terms. He died early in 1204, leaving as his only issue a daughter, Ada, aged 17 years. Her succession was challenged by William, count of East Friesland, who became undisputed count of Holland in 1206. He took an active part in the events of his time. He fought by the side of the emperor Otto IV. in the great battle of Bouvines in 1214 (*see* PHILIP AUGUSTUS), and was taken prisoner. Two years later he accompanied Louis, the eldest son of Philip Augustus, in his expedition against King John of England. William is perhaps best known in history by his part in the fourth Crusade. He distinguished himself greatly at the capture of Damietta (1219), and died in 1222. The earliest charters conveying civic privileges in the county of Holland date from his reign—those of Geertruidenberg (1213) and of Dordrecht (1220). His son Floris IV., being a minor, succeeded him under the guardianship of his maternal uncle, Gerard III. of Gelderland. He maintained in later life close relations of friendship with Gerard, and supported him in his quarrel with the bishop of Utrecht (1224–26). Floris was murdered in 1235 at a tournament at Corbie in Picardy by the count of Clermont. Another long minority followed his death, during which his brother Otto, bishop of Utrecht, acted as guardian to his nephew William II.

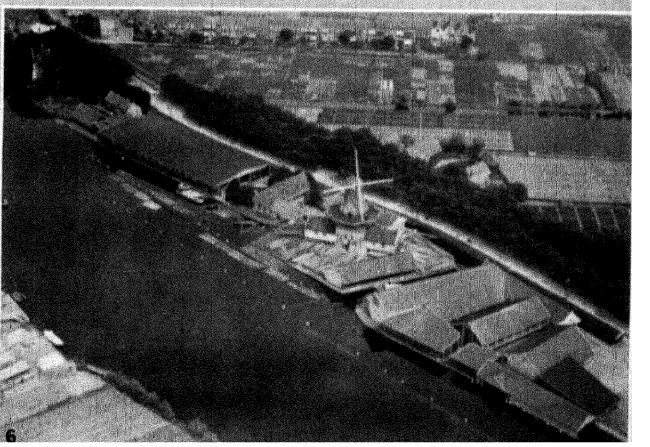












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VIEWS OF INDUSTRIAL HOLLAND

1. Hyacinth field near Haarlem, a centre of the bulb-growing industry. These plants, which are exported to all parts of the world, are cultivated with extreme care, the bulb not being ready for market until five years after it has budded out on the mother bulb
2. Loading Edam cheeses for market. Although some Dutch cheese is still made on the farm with home equipment, a large amount is manufactured in factory dairies, many of them owned by co-operative groups and all supervised by the government. It is estimated that about 15,000,000 kilograms of full-cream Edam cheese (40% cream) are produced yearly
3. Rotterdam harbour, showing floating steam cranes and grain elevators. The steam cranes are equipped with automatic grapples and other appliances for the unloading of coal, and the floating elevators can handle from 180 to 200 tons of corn per hour. The port handles a heavy river traffic from Germany in addition to ocean traffic
4. Great Market, Delft, on market day. In the background can be seen Nieuwe Kerk, formerly the church of St. Ursula, built in 1396-1496, where William the Silent is buried. The statue in the market place is that of Hugo Grotius, erected in 1886
5. International bee market at Veenendaal, the largest in the world. Situated in the honey-producing district of Veluwe, the Veenendaal market usually displays from 2,000 to 2,500 swarms of bees, each swarm selling for 5 to 8 Dutch gulden ($2.00 to $3.20). They are purchased by foreign farmers chiefly for the purpose of introducing a fresh strain into old swarms
6. A saw-mill at Leyden on the banks of the so-called "Old Rhine." The Dutch wood industry and its most important branch, that of sawing and planing, were greatly stimulated by the introduction of steam; where the windmill, as that in the photograph, has not been replaced, it has in a majority of cases been supplemented, by steam appliances

Floris V.—William II. became a man of mark. Pope Innocent IV., having deposed the emperor Frederick II., caused the young count of Holland to be elected king of the Romans (1247). William took Aachen in 1248 and was there crowned king; and after Frederick's death in 1250, he had a considerable party in Germany. He was on the point of proceeding to Rome to be crowned emperor, when in an expedition against the West Frisians he perished, going down, horse and armour, through the ice (1256). Like so many of his predecessors he left his inheritance to a child. Floris V. was but two years old at his father's death; and he was destined during a reign of 40 years to leave a deeper impress upon the history of Holland than any other of its counts. Floris was a man of chivalrous character and high capacity; alike in his troubles with his turbulent subjects and in the perennial disputes with his neighbours he pursued a strong, far-sighted and successful policy. But his active interest in affairs was not limited to the Netherlands. He allied himself closely with Edward I. of England, and secured great trading advantages for his people; the staple of wool was placed at Dort (Dordrecht) and the Hollanders and Zeelanders got fishing rights on the English coast. So intimate did their relations become that Floris sent his son John to be educated at the court of Edward with a view to his marriage with an English princess. To balance the power of the nobles he granted charters to many of the towns. Floris made himself master of Amstelland and Gooiland; and Amsterdam, destined to become the chief commercial town of Holland, counts him the founder of its greatness. Its earliest extant charter dates from 1275. In 1296 Floris forsook the alliance of Edward I. for that of Philip IV. of France, probably because Edward had given support to Guy, count of Flanders, in his dynastic dispute with John of Avesnes, count of Hainaut, Floris's nephew (*see* FLANDERS). Shortly afterwards a conspiracy of disaffected nobles was formed against him, and he was basely murdered in the castle of Muiden (June 27, 1296). The burghers and people, who knew him to be their best friend, took such vengeance on his slayers as permanently to reduce the power of the nobles.

With his son, John I. (1296–99), husband of Eleanor, daughter of Edward I., the first line of counts ended after a rule of nearly 400 years. Europe has perhaps never seen an abler series of princes than these 14 lineal descendants of Dirk I. Excepting the last, there is not a weak man among them. Physically handsome and strong, model knights of the days of chivalry, hard fighters, wise statesmen, they were born leaders of men; always ready to advance the commerce of the country, they were the supporters of the growing towns, and likewise the pioneers in the task of converting a land of marshes and swamps into a fertile agricultural territory rich in flocks and herds. As individuals they had their failings, but one and all were worthy members of a high-souled race.

The House of Avesnes.—The first count of the new line, who took the title of John II., was the son of John of Avesnes, count of Hainaut, and Alida, sister of William II. of Holland. On his succession the Zeelanders were hostile, and a long struggle ensued before his authority was generally recognized. In 1301 Bishop William of Utrecht invaded Amstelland, but was killed in battle. John made use of his victory to secure the election of his brother Guy as bishop in his place. A war with the Flemings followed, in which the Flemings were at first victorious, but after a struggle of many vicissitudes they were at length driven out of Holland and Zeeland in 1304. John II. died in that year and was succeeded by his son William III., surnamed the Good (1304–37). In his reign the long-standing quarrel with Flanders was finally settled by the treaty of 1323, by which the full possession of West Zeeland was granted to William, who on his part renounced all claim in Imperial Flanders. The Amstelland with its capital, Amsterdam, which had hitherto been held as a fief of Utrecht, was by William, on the death of his uncle Bishop Guy, finally annexed to Holland. This count did much to encourage civic life and to develop the resources of the country. He had close relations through marriage with the three principal European dynasties of his time. His wife was Jeanne of Valois, niece of the French king; in 1323 the emperor Louis the Bavarian wedded his daughter Margaret; and in 1328 his third daughter, Philippa of Hainaut, was married to Edward III. of England. By their alliance William III. occupied a position of much dignity and influence, which he used to further the interests of his hereditary lands. He was in all respects a great prince and a wise and prudent statesman. He was succeeded by his son, William IV., who was the ally of his brother-in-law, Edward III., in his French wars. He was killed in battle against the Frisians in 1345. He left no children, and the question as to the succession now brought on Holland a period of violent civil commotions. His inheritance was claimed by his eldest sister, the empress Margaret, as well as by Philippa of Hainaut, or in other words, by Edward III. of England. Margaret came in person and was duly recognized as countess in Holland, Zeeland and Hainaut; but returned to her husband after appointing her second son, Duke William of Bavaria, as stadholder in her place. In 1349 Margaret was induced to resign her sovereignty, and the stadholder became count under the title of William V. This was the time of the formation of the famous parties in Holland, known as Kabbeljauws (Cods) and Hoeks (Hooks); the former, the burgher party, were the supporters of William, the latter the party of the disaffected nobles, who wanted to catch and devour the fat burgher fish. The struggle between the nobles and the cities broke out into civil war. In 1350 the nobles invited Margaret to return to Holland. Edward III. came to her aid, winning a sea-fight off Veere in 1351; a few weeks later the Hooks and their English allies were defeated by William and the Cods at Vlaardingen—an overthrow which ruined Margaret's cause. Edward III. shortly afterwards changed sides, and the empress saw herself compelled (1354) to come to an understanding with her son, he being recognized as count of Holland and Zeeland, she of Hainaut. Margaret died two years later, leaving William, who had married Matilda of Lancaster, in possession of the entire Holland-Hainaut inheritance (July 1356). But before the close of 1357 he showed such marked signs of insanity that his wife, with his own consent and the support of both parties, invited Duke Albert of Bavaria, younger brother of William V., to be regent, with the title of *Ruward* (1358). William lived in confinement for 31 years. Albert died in 1404, having ruled the land well and wisely for 46 years, first as Ruward, then as count. He was succeeded by his son, William VI., in 1404. On his accession to power William upheld the Hooks, and secured their ascendency. His reign was much troubled with civil discords, but he was a brave soldier, and was generally successful in his enterprises. He died in 1417, leaving an only child, a daughter, Jacqueline (or Jacoba), who had in her early youth been married to John, heir to the throne of France.

Accession of the Burgundian Dynasty.—At a gathering held at The Hague (Aug. 15, 1416) the nobles and representatives of the cities of Holland and Zeeland had promised at William's request to support his daughter's claims to the succession. But John of France died (April 1417), and William VI. about a month later, leaving the widowed Jacqueline at 17 years of age face to face with a difficult situation. She was at first welcomed in Holland and Zeeland, but found her claims opposed by her uncle, John of Bavaria, supported by the Cod party. Every one from whom she might have expected help betrayed her in turn, her second husband John IV. of Brabant, her third husband Humphrey of Gloucester, her cousin Philip the Good of Burgundy, all behaved shamefully to her. Her romantic and sad life has rendered the courageous and accomplished Jacqueline the most picturesque figure in the whole history of Holland. She struggled long against her powerful kinsfolk, nor did she know happiness till near the end of her life, when she abandoned the unequal strife, and found repose with Francis of Borselen, Ruward of Holland, her fourth husband. Philip the Good, duke of Burgundy, craftily seized him, and thereby in 1433 the duchess Jacqueline was compelled to cede her rights over the counties of Holland and Hainaut. Consequently at her death in 1436, as she

left no children, Philip succeeded to the full and undisputed possession of her lands. Now, with the extinction of the Bavarian line of counts, Holland ceased to have an independent existence and became an outlying province of the growing Burgundian power (*see* BURGUNDY). Holland during this time contented herself with growing material prosperity. Her herring fishery, rendered more valuable by the curing process discovered or introduced by Benkelszoon, brought her increasing wealth, and her fishermen were already laying the foundations of her future maritime greatness. It was in the days of Duke Philip that Lorenz Koster of Haarlem contributed his share to the discovery of printing. During the reign of Charles the Bold (1467–77) the Hollanders, like the other subjects of that warlike prince, suffered much from the burden of taxation. They were much aggrieved by the establishment of a high court of justice for the entire Netherlands at Mechlin (1474) which was regarded as a serious breach of their privileges. The succession of Mary of Burgundy led to the granting to Holland, as to the other provinces of the Netherlands, of the Great Privilege of March 1477, which restored the most important of their ancient rights and liberties (*see* NETHERLANDS). A high court of justice was established for Holland, Zeeland and Friesland, and the use of the native language was made official.

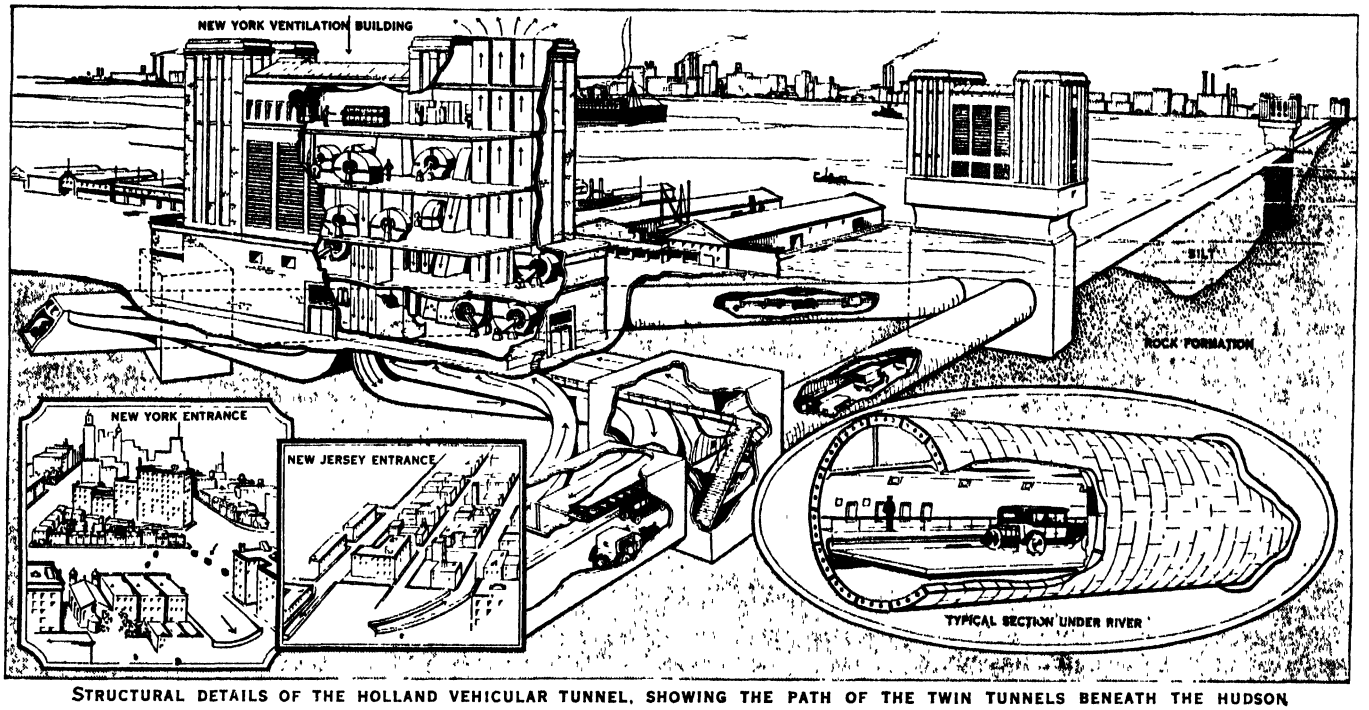
HABSBURGS AND THE HOUSE OF ORANGE

By the sudden death of the Duchess Mary in 1482 her possessions, including the county of Holland, passed to her infant son, Philip, under the guardianship of his father the Archduke Maximilian of Austria. Thus the Burgundian dynasty was succeeded by that of the Habsburgs. During the regency of Maximilian the turbulence of the Hooks caused much strife and unrest in Holland. Their leaders, Francis of Brederode and John of Naaldwijk, seized Rotterdam and other places. Their overthrow finally ended the strife between Hooks and Cods. The "Bread and Cheese War," an uprising of the peasants in north Holland caused by famine, is a proof of the misery caused by civil discords and oppressive taxation. In 1494, Maximilian having been elected emperor, Philip was declared of age. His assumption of the government was greeted with joy in Holland, and in his reign the province enjoyed rest and its fisheries benefited from the commercial treaty concluded with England. The story of Holland during the long reign of his son and successor Charles III. (1506–55), better known as the emperor Charles V., belongs to the general history of the Netherlands (*see* NETHERLANDS). On the abdication of Charles, his son Philip II. of Spain became Philip III., count of Holland, the ruler whose arbitrary rule in Church and State brought about the revolt of the Netherlands. His appointment of William, prince of Orange, as stadholder of Holland and Zeeland was destined to have momentous results to the future of those provinces (*see* WILLIAM, 1533–1584).

The Revolt of the Netherlands.—The capture of Brill and of Flushing in 1572 by the Sea-Beggars led to the submission of the greater part of Holland and Zeeland to the authority of the prince of Orange, who, as stadholder, summoned the states of Holland to meet at Dordrecht. This act was the beginning of Dutch independence. From this time forward William made Holland his home. It became the bulwark of the Protestant faith in the Netherlands, the focus of the resistance to Spanish tyranny. The act of federation between Holland and Zeeland brought about by the influence of William was the germ of the larger union of Utrecht between the seven northern provinces in 1579. But within the larger union the inner and closer union between Holland and Zeeland continued to subsist. In 1580, when the sovereignty of the Netherlands was offered to the duke of Anjou, the two maritime provinces refused to acquiesce, and forced William to accept the title of count of Holland and Zeeland. In the following year William in the name of the two provinces solemnly abjured the sovereignty of the Spanish king (July 24). After the assassination of William (1584) the title of count of Holland was never revived.

In the long struggle of the united provinces with Spain, which followed the death of William, the brunt of the conflict fell upon Holland. More than half the burden of the charges of the war fell upon this one province; and with Zeeland it furnished the fleets which formed the chief defence of the country. Hence the importance attached to the vote of Holland in the assembly of the States-General. That vote was given by deputies at the head of whom was the advocate (in later times called the grand pensionary) of Holland, and who were responsible to, and the spokesmen of, the provincial states. These states, which met at The Hague in the same building as the States-General, consisted of representatives of the burgher oligarchies (regents) of the principal towns, together with representatives of the nobles, who possessed one vote only. The advocate was the paid minister of the states. He presided over their meetings, kept their minutes and conducted all correspondence, and, as stated above, was their spokesman in the States-General. The advocate (or grand pensionary) of Holland therefore, if an able man, had opportunities for exercising a very considerable influence, becoming in fact a kind of minister of all affairs. It was this influence as exerted by the successive advocates of Holland, Paul Buys and Johan van Oldenbarneveldt, and the pensionaries, of whom John de Witt was the greatest, which ensured the undisputed hegemony of Holland in the federation, in other words, of the burgher oligarchies who controlled the town corporations of the province, and especially Amsterdam. This authority of Holland was, however, more than counterbalanced by the extensive powers with which the stadholder princes of Orange were invested; and the chief crises in the internal history of the Dutch republic are to be found in the struggles for supremacy between two, in reality, different principles of government. On the one side the principle of provincial sovereignty which gave to the voice of Holland a preponderating weight that was decisive; on the other side the principle of national sovereignty personified in the princes of Orange, to whom the States-General and the provincial states delegated executive powers that were little less than monarchical. Until the final destruction of the federal republic by the French armies in 1795, the perennial struggle went on between the Holland or federal party (*Staatsgesinden*) centred at Amsterdam—out of which grew the Patriot Party under William V.—and the Orange or Unionist Party (*Oranjegesinden*), which was strong in the smaller provinces and had much popular support among the lower classes. The French conquest swept away the old condition of things never to reappear; but allegiance to the Orange dynasty survived, and in 1813 became the rallying point of a united Dutch people. At the same time the leading part played by the province of Holland in the history of the republic has not been unrecognized, for the country ruled over by the sovereigns of the house of Orange is always popularly, and often officially, known as Holland.

Constitution.—The full title of the states of Holland in the 17th and 18th centuries was: *de Edele Groot Mogende Heeren Staaten van Holland en Westfriesland.* After 1608 this assembly consisted of 19 members, one representing the nobility (*ridderschap*), and 18, the towns. The member for the nobles had precedence and voted first. The interests of the country districts (*het platte land*) were the peculiar charge of the member for the nobles. The nobles also retained the right of appointing representatives to sit in the College of Deputed Councillors, in certain colleges of the admiralty, and upon the board of directors of the East India Company, and to various public offices. Each town (as did also the nobles) sent as many representatives as it pleased, but the 19 members had only one vote each. Each town's deputation was headed by its pensionary, who was the spokesman on behalf of the representatives. Certain questions such as peace and war, voting of subsidies, imposition of taxation, changes in the mode of government, etc., required unanimity of votes. The states of Holland sat at The Hague in the months of March, July, September and November. During the periods of prorogation the continuous oversight of the business and interests of the province was, however, never neglected. This duty was confided to a body called the College of Deputed Councillors (*het Kollegie der Gekommitteerde Raden*), which was itself divided into two sections, one for the south quarter, another for the north quarter.



STRUCTURAL DETAILS OF THE HOLLAND VEHICULAR TUNNEL, SHOWING THE PATH OF THE TWIN TUNNELS BENEATH THE HUDSON RIVER AND THE METHOD OF VENTILATION

The grand pensionary presided over the meetings of the college, which had the general charge of the whole provincial administration, especially of finance, the carrying out of the resolutions of the states, the maintenance of defences, and the upholding of the privileges and liberties of the land. With particular regard to this last-named duty the college deputed two of its members to attend all meetings of the States-General, to watch the proceedings and report at once any proposals which they held to be contrary to the interests or to infringe upon the rights of the province of Holland. The College of Deputed Councillors might be described as a vigilance committee of the states in perpetual session.

HOLLAND, a city of Ottawa county, Michigan, U.S.A., 25 m. S.W. of Grand Rapids, on Macatawa bay (or Black lake), 5 m. from Lake Michigan. It is served by the Pere Marquette railroad, by lake steamers to Chicago the year round, and by motor-bus lines in every direction. The population was 12,183 in 1920 (82% native white) and was estimated locally at 14,000 in 1928. Within 10 m. of the city are numerous resorts, which in summer add at least 15,000 to the population. Holland was founded by Dutch settlers in 1847, under the leadership of the Rev. A. C. Van Raalte, and the population is still predominantly of Dutch descent. It is the seat of Hope college, founded in 1851 by the Dutch Reformed Church, and of the Western Theological seminary of the same denomination (1869); and two weekly papers printed in Dutch are published here. The city has substantial manufacturing industries, with an output in 1925 valued at $19,175,476; and the traffic of its harbour in 1925 (50,661 tons) was valued at $13,177,000. Its leading products are hot-air furnaces, smokeless furnaces and stokers, furniture, shoes, pianos, drugs, cosmetics and food products. Holland was chartered as a city in 1867.

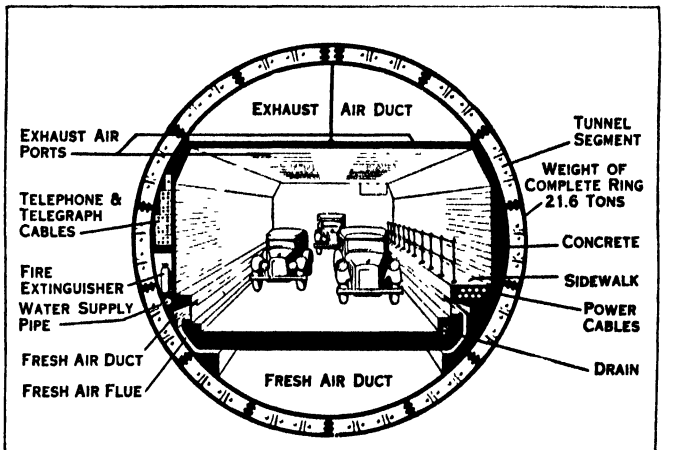
HOLLAND. A cloth so called from the country where it was first made. It was originally a fine plain linen fabric of a brownish colour—unbleached flax. Several varieties are now made: hollands, pale hollands and fine hollands. They are used for casement curtains, aprons, blinds, shirts, blouses and dresses.

HOLLANDER, BERNARD (1864–), British physician and writer on medical subjects, was born in Vienna in 1864. He came to London in 1883, and was naturalized in 1899. He published in 1899 the results of his first investigation into the localization in the brain of the fundamental psychical functions. He has written many papers for various learned societies, and is well known for his studies of abnormal mental conditions and as an exponent of psychotherapy.

His many publications include *The Mental Functions of the Brain* (1902); *Scientific Phrenology* (1902); *Psychotherapeutics of Insanity* (1908); *The Unknown Life and Works of Dr. Francis Joseph Gall* (1909); *The Insanity of Genius* (1913); *In Search of the Soul and the Mechanism of Human Thought, Emotion, and Conduct* (1920); *Psychology of Misconduct, Vice and Crime* (1922).

HOLLANDS: *see* SPIRITS.

HOLLAND VEHICULAR TUNNEL. In 1906 the States of New York and New Jersey created the New York State bridge and tunnel commission and the New Jersey Interstate bridge and tunnel commission for the purpose of studying means of vehicular intercommunication across the Hudson river, which separates them. The joint commission recommended a vehicular tunnel



BY COURTESY OF THE WESTINGHOUSE LAMP CO.

SECTIONAL STUDY OF ONE OF THE TWIN TUBES OF THE HOLLAND VEHICULAR TUNNEL

from Canal street in the borough of Manhattan to Journal square, Jersey City. In 1919 actual preparations for construction began under the direction of Clifford M. Holland, who died on Oct. 27, 1924, and was succeeded by Milton C. Freeman. Mr. Freeman died on March, 24, 1925 and was succeeded by Ole Singstad, who was in charge of the work until its completion.

The first 40ft. boring shield was set up in the Canal street shaft on Sept. 11, 1922. On Oct. 29, 1924, the first two entries were connected. The total cost of construction was $48,400,000. It has provided two tunnels, 9,250ft. long and 29ft. 6in. in diameter,

each capable of accommodating a double line of traffic. Its designed capacity is 46,000 vehicles per day.

The tunnel is ventilated by fresh air forced through the spaces between the roadway and the bottom of the tube, and drawn by fans through a similar space at the top. The provision for traffic control and for fire emergencies are unusually complete. The tunnel was opened for traffic on Nov. 12, 1927, and its capacity was found to be considerably greater than anticipated.

HOLLAR, WENZEL or **WENCESLAUS** (VACLAF HOLAR) (1607–1677), Bohemian etcher, was born at Prague on July 13, 1607, and died in London, being buried at St. Margaret's church, Westminster, on March 28, 1677. The earliest of his works that have been handed down are dated 1625 and 1626; they are small plates, and one of them is a copy of a "Virgin and Child" by Dürer, whose influence upon Hollar's work was always great. In 1627 he was at Frankfurt, working under Matthew Merian, an etcher and engraver; thence he passed to Strasbourg and thence, in 1633, to Cologne. There he attracted the notice of the famous amateur Thomas, earl of Arundel, then on an embassy to the imperial court; and with him Hollar travelled to Vienna and Prague, and finally came in 1637 to England. Though he lived in the household of the earl of Arundel, he seems to have worked not exclusively for him, but to have begun that slavery to the publishers which was afterwards the normal condition of his life. In his first year in England he made for Stent, the print-seller, the magnificent View of Greenwich, nearly a yard long, and received thirty shillings for the plate. Afterwards there is mention of his fixing the price of his work at fourpence an hour, and measuring his time by a sand-glass. The earl of Arundel left England in 1642 and Hollar passed into the service of the duke of York. With other Royalist artists, notably Inigo Jones and Faithorne, he stood the long and eventful siege of Basing House; and there exist some hundred plates from his hand dated during the years 1643 and 1644. Taken prisoner, he escaped or was released, and joined the earl of Arundel at Antwerp, where he spent eight years, the prime of his working life, and produced his finest plates of every kind, his noblest views, amongst them being "The Long View of London from the Bankside," his miraculous "muffs" and "shells" and the superb portrait of the duke of York. In 1652 he returned to London and lived for a time with Faithorne the engraver near Temple Bar. During the following years were published many books which he illustrated:—Ogilby's *Virgil and Homer*, Stapylton's *Juvenal*, and Dugdale's *Warwickshire*, *St. Paul's* and *Monasticon* (part i.). After the Great Fire he produced some of his famous "Views of London"; and it may have been the success of these plates which induced the king to send him in 1668 to Tangier, to draw the town and forts. During his return to England occurred the desperate and successful engagement fought by his ship the "Mary Rose," under Captain Kempthorne, against seven Algerine men-of-war, a brilliant affair which Hollar etched for Ogilby's *Africa*. He lived eight years after his return, still working for the booksellers and retaining to the end his wonderful powers; witness the large plate of Edinburgh (dated 1670), one of the greatest of his works. He died in extreme poverty, his last recorded words being a request to the bailiffs that they would not carry away the bed on which he was dying.

Almost complete collections of Hollar's works exist in the British Museum and in the library at Windsor Castle. Two admirable catalogues of his plates have been made, one in 1745 (2nd ed., 1759) by George Vertue, and an exhaustive one (Berlin, 1853) by Parthey.

HOLLES, DENZIL HOLLES, BARON (1599–1680), English statesman and writer, second son of John Holles, first earl of Clare (*c.* 1564–1637), by Anne, daughter of Sir Thomas Stanhope, was born on Oct. 31, 1599. He was in early youth the playmate and intimate companion of Prince Charles. In 1624 Holles was returned to parliament for Mitchell in Cornwall, and in 1628 for Dorchester. On March 2, 1629, when Sir John Finch, the speaker, refused to put Sir John Eliot's Protestations and was about to adjourn the House by the king's command, Holles with another member thrust him back into the chair and swore "he should sit still till it pleased them to rise." Meanwhile Eliot, on the refusal of the speaker to read the Protestations, had himself thrown them into the fire; the usher of the black rod was knocking at the door for admittance, and the king had sent for the guard. But Holles, declaring that he could not render the king or his country better service, put the Protestations to the House from memory, all the members rising to their feet and applauding. He, with others, was arrested and arraigned first in the Star Chamber and subsequently in the King's Bench. When brought upon his *habeas corpus* before the latter court Holles offered with the rest to give bail, but refused sureties for good behaviour, and argued that the court had no jurisdiction over offences supposed to have been committed in parliament. On his refusal to plead he was sentenced to a fine of 1,000 marks and to imprisonment during the king's pleasure. Holles was confined, first in the Tower of London, and then in the Marshalsea. His resistance to the king's tyranny did not prove so stout as that of some of his comrades in misfortune. Having given the security demanded for his good behaviour, he was liberated early in 1630, and retired to the country.

Holles was a member of the Short and Long Parliaments assembled in 1640. According to Laud he was now "one of the great leading men in the House of Commons," and he sought to find means of preserving his brother-in-law, Strafford, from execution. He was one the chief movers of the Protestation of May 3, 1641. He took up the impeachment of Laud to the House of Peers, supported the Londoners' petition for the abolition of episcopacy, and the Root and Branch bill. Together with Pym, Holles drew up the Grand Remonstrance, and made a vigorous speech in its support on Nov. 22, 1641, in which he argued for the right of one House to make a declaration, and asserted: "If kings are misled by their counsellors we may, we must, tell them of it."

After the failure of the attempt by the court to gain over Holles and others by offering them posts in the administration, he was one of the "five members" impeached by the king Holles at once grasped the full significance of the king's action, and after the triumphant return to the House of the five members, on Jan. 11, threw himself into still more pronounced opposition to the king's policy.

On the outbreak of the Civil War (*see* GREAT REBELLION) Holles took a command in the field, fighting at Edgehill and at Brentford. But he soon returned to London, moderated his tone, and advocated peace and a settlement of the disputes by concessions on both sides. He supported the peace negotiations on Nov. 21 and Dec. 22, 1642, and his attitude led to a breach with Pym and the more determined party. In June 1643 he was accused of complicity in Waller's plot, but swore to his innocency; and his arrest with others of the peace party was even proposed in August. In November Holles and Whitelocke headed the commission appointed to treat with the king at Oxford. He endeavoured to convince the royalists of the necessity of yielding in time, before the "new party of hot men" should gain the upper hand. Holles and Whitelocke had a private meeting, not reported to parliament, with the king, when at Charles's request they drew up the answer which they advised him to return to the parliament. Holles was also a commissioner at Uxbridge in Jan. 1645. As leader of the moderate (or Presbyterian) party Holles now came into violent antagonism with Cromwell and the army faction, and was one of those who sought to secure Cromwell's impeachment.

On June 16, 1647, eleven members including Holles were charged by the army with various offences against the state, followed on the 23rd by fresh demands for their impeachment and for their suspension, which were refused. On the 26th, however, the eleven members, to avoid violence, asked leave to withdraw. They were recalled, expelled, imprisoned and again recalled.

Holles was one of the commissioners appointed to treat with the king at Newport on Sept. 18, 1648, and was one of those who stayed behind the rest in order to urge Charles to compliance. On Dec. 1 he received the thanks of the House. On the occasion of Pride's Purge on Dec. 6 Holles absented himself and escaped to France. From his retirement there he wrote to Charles II. in 1651, advising him to come to terms with the Scots as the only means of effecting a restoration; but after the alliance he refused Charles's offer of the secretaryship of state. In March 1654 Crom-

well sent Holles a pass "with notable circumstances of kindness and esteem." The date of his return to England is uncertain, but in 1656 Cromwell's resentment was again excited against him as the supposed author of a tract, really written by Clarendon. Holles appears to have been imprisoned, for his release was ordered by the council on Sept. 2, 1659.

Holles took a leading part in the Restoration, was one of the 34 commissioners appointed to try the regicides, and entered the House of Lords as Baron Holles in 1661. He was ambassador to France (1663–66), and an envoy at the peace with Holland at Breda (1667). He became with Halifax and Shaftesbury a leader in the resistance to the domestic and foreign policy of the court, and in 1676 was summarily dismissed from the council. In order to bring about the downfall of Danby (afterwards duke of Leeds) and the disbanding of the army, which he believed to be intended for the suppression of the national liberties, Holles engaged (1677–1679), as did many others, in a dangerous intrigue with Courtin and Barillon, the French envoys, and Louis XIV.; he refused, however, the latter's presents on the ground that he was a member of the council, having been appointed to Sir William Temple's new modelled cabinet in 1679. Barillon described him as at this period in his old age "the man of all England for whom the different cabals have the most consideration," and as firmly opposed to the arbitrary designs of the court. He showed moderation in the Popish Plot, and on the question of the exclusion of James, duke of York, followed Halifax rather than Shaftesbury. He died on Feb. 17, 1680.

The character of Holles has been drawn by Burnet (*Hist. of His Own Times* vi. 257, 268), with whom he was on terms of friendship. "Hollis was a man of great courage and of as great pride. . . . He was faithful and firm to his side and never changed through the whole course of his life. . . . He argued well but too vehemently; for he could not bear contradiction. He had the soul of an old stubborn Roman in him. He was a faithful but a rough friend, and a severe but fair enemy. He had a true sense of religion; and was a man of an unblameable course of life and of a sound judgment when it was not biased by passion."

See C. H. Firth in the *Dictionary of National Biography* and authorities there quoted.

HOLLIDAYSBURG, a borough in the mountainous region of central Pennsylvania, U.S.A., 8m. S. of Altoona; the county seat of Blair county. It is served by the Pennsylvania railroad. The population was 4,071 in 1920 (96% native white). Coal, iron and limestone abound in the vicinity. The borough has foundries and machine shops and other manufacturing industries.

HOLLOWAY, THOMAS (1800–1883), English patent-medicine vendor and philanthropist, was born at Devonport, on Sept. 22, 1800, of humble parents. At the age of 28 he came to London where he met Felix Albinolo, an Italian, from whom he obtained the idea for the ointment which was to carry his name all over the world. The secret of his enormous success in business was due almost entirely to advertisement, in the efficacy of which he had great faith. He soon added the sale of pills. He is remembered by the two princely foundations—the Sanatorium and the College for Women at Egham (*q.v.*), endowed by him towards the close of his life, more than a million sterling having been set apart by him for their erection and permanent endowment. In the deed of gift of the college the founder credited his wife, who died in 1875, with the advice and counsel that led him to provide what he hoped might ultimately become the nucleus of a university for women. The philanthropic and somewhat eccentric donor (he had an unconcealed prejudice against doctors, lawyers and parsons) died of congestion of the lungs at Sunninghill on Dec. 26, 1883.

HOLLOW-WARE. Hollow-ware is a term which may be used to describe all articles of concave shape employed for domestic, particularly culinary, purposes; but actually, according both to the popular and to the trade usage, it is applied only to those which are made of metal. Even with this limitation the term covers a wide variety of articles, which are produced by several distinct industries. Some account of the development of those industries will show how the various branches of the manufacture grew up. It is not necessary to look back beyond the middle of the 18th century, since it was not till then that any considerable variety in the types of article in use began to appear. At that time the metal kitchen utensils, such as kettles, pans, and ale-warmers, were made of sheet copper, brass or, less frequently, iron; whilst cast bronze skillets, which corresponded to the modern saucepans, and cauldrons were very common. Non-ferrous metal vessels of these various types were frequently tinned on the inside. The lighter domestic hollow-ware, such as kettles, trays, jugs and cups, was occasionally made of tinplate and sometimes japanned. Articles of this material, besides being produced by tinmen in many different parts of Europe, were made in quantity in south Wales and south Staffordshire under the name of "Pontypool" wares. Further, utensils such as plates, bowls, dishes and cups, were often made of pewter; while similar articles of a more expensive kind were of silver or silver-plate. Cast-iron was employed only for the heavier and cruder types of hollow-ware, *e.g.*, cauldrons and mortars, because the charcoal-smelted iron, which was then the only kind available, ran too thick to be cast into light domestic utensils.

During the latter half of the 18th century important changes occurred. The use of coke in the blast furnace resulted in the production of an iron which was suitable for the manufacture of light cast pots and pans, and so foundries began to be established for this purpose in several British industrial centres, particularly in south Staffordshire, at West Bromwich and Wolverhampton. During the same period a process was introduced for coating the interior of cast and wrought-iron hollow-ware with tin, and this, since it obviated the danger of rust, greatly extended the use of iron at the expense of non-ferrous articles. Further, a new alloy, known as Britannia metal, of which the constituents were copper, tin and antimony, came to be used for making tea and coffee-pots; so that by 1800, in addition to the older types of copper, brass, sheet iron, pewter, silver-plate and tinplate and japanned hollow-ware, there were tinned and "black" cast-iron and Britannia metal articles. Soon after 1800 stove-dried varnish began to be employed as an outside coating for tinned iron kettles and pans.

Introduction of Enamelling and Galvanizing.—Before 1850, in addition to the improvements which were made in finishing processes, several new varieties of hollow-ware came into existence. Processes had long been known for the coating of iron with vitreous enamel and, early in the century, they had been applied by Continental producers; but it was not until about 1840 that an enamelled hollow-ware manufacture was established in Great Britain. From then onwards enamelled ware began slowly to supersede tinned articles, chiefly owing to the former's resemblance to glazed pottery and to the ease with which it could be cleaned. A few years later the makers of wrought-iron utensils adopted a process for covering their goods with zinc, and so the galvanized iron hollow-ware trade came into existence. British producers in this branch of industry benefited greatly by the increased colonial demand which occurred after the middle of the century. Meanwhile, the electro-plating trade had risen to prominence after 1840 and began to produce teapots and similar articles, which had before been made of pewter, tinplate, silver-plate or Britannia metal. For a time this last material was used as a base metal in the manufacture of electro-plate ware; but it was slowly superseded by German or nickel silver, which bore a considerable resemblance to it. During the '30s, moreover, the stamp began to come into use in the sheet metal branches of the industry, particularly in tinplate ware production in which thin sheets were employed; and, after this time, many articles such as dishes and pans, which had previously been made of separate pieces of metal brazed together, came to be raised out of a single sheet. There were, however, many kinds of tinplate ware which still had to be made by the older methods; and the stamp was not used to any extent, even in the '60s, for the production of heavier gauge cooking utensils of wrought-iron.

Stamped Steel and Aluminium Ware.—Up to the '70s, while most of these branches of the industry had come into existence in Europe and North America, only the British manufac-

turer had developed a large export trade, and he then sent his goods to Europe and the United States, besides supplying most of the hollow-ware used in the colonies and a large proportion of the African, Indian and South American demands. During the next decade, however, a new form of wrought hollow-ware, made of stamped steel, came into use, and although British manufacturers took up its production, a large quantity came to be imported into England before the end of the century and sent to her previous foreign markets. The change was associated with the rise of the German steel industry after 1880. Before basic Bessemer and Siemens-Martin steel came into use, most of the manufacturing operations in the wrought branch of the industry had been done by hand, as wrought-iron did not lend itself readily to manipulation by presses and stamps. The new mild steel, however, being more ductile, could be treated in that way, and it was therefore possible to produce machine-made steel articles, which were much cheaper than either cast- or wrought-iron wares. Consequently, steel sheets superseded iron sheets as the raw material of the tinned, enamelled, galvanized and "black" sections of the wrought trade; and since enamelled stamped steel hollow-ware could be produced at a low cost, other branches of the industry began to suffer. The demand for cast-iron cooking utensils fell off both in Great Britain and in many of her foreign markets. Partly for the same reasons and partly because of a change of fashion, the use of tinplate kettles, baths, cups, pans and teapots, and of japanned trays and coal-scuttles declined in Europe and England, although the colonial demand did not suffer to the same extent.

These tendencies continued up to the outbreak of the World War, and after 1918 the decay of the manufacture of cast-iron and of certain types of tinplate wares was accelerated by the increasing use of aluminium hollow-ware. Aluminium was first employed in this trade during the later '90s, and up to 1914 the quantity produced was comparatively small. Germany was the first country to develop the manufacture, and most of the aluminium ware used in Great Britain during the years immediately preceding the war came from that source. The experience which was gained in 1914–18 in the manipulation of the metal, however, encouraged British manufacturers to take up the production of domestic utensils of this new type when the demand for munitions came to an end; and during the post-war years a large British output has been maintained. The supersession of cast-iron by enamelled stamped steel and aluminium utensils since the beginning of the 20th century has been stimulated by the increasing use of gas and electric stoves for cooking purposes. In consequence of this development the greater strength of cast-iron ware is no longer such an advantage as it once was; while articles made of that material are less economical in the use of fuel than the lighter forms of hollow-ware.

Manufacture of Hollow-ware in the 20th Century.—As may be inferred from the above historical account, the hollow-ware in use in the 3rd decade of the 20th century may be classified into sections. The first group consists of cast-iron utensils which are either enamelled, tinned, or "black." The "black" ware usually takes the form of Dutch ovens and pots for the use of African natives, South Americans and Indians, and very little is sold in Great Britain or in the civilized western countries. The other wares, which are coated on the inside with enamel or tin and on the outside with stove-dried varnish, consist of frying-pans, saucepans, kettles and other utensils employed for cooking, and are in common use in Europe and in countries colonized by Europeans. These articles are first cast from a special quality of pig-iron, and are then annealed. From the annealing ovens they go to be turned and polished on lathes, after which they are enamelled or tinned. The handles are usually made of wrought-iron and are riveted on to the body of the articles in the mounting shops. Finally, the wares pass to the stoving and varnishing departments. The lids are usually made of tinned or enamelled steel, or are pressed out of tinplate.

The second group covers wrought hollow-ware, which is generally formed from mild steel sheets, and which may be either "black," tinned, enamelled or galvanized. The first three varieties consist of similar types of articles to those produced by the cast section; but the enamelled ware, which is the most important type, also comprises such things as jugs, colanders, bowls, buckets, cups, baths and plates, and thus covers a very wide range of domestic utensils. Many of these articles are fashioned under the stamp or drawing-press, while some, *e.g.*, frying-pans, are spun on the lathe. When a weld is required, the operation is commonly effected by the aid of electricity or of gas. The later processes in this branch of the industry resemble those which have already been briefly described in connection with the various kinds of cast hollow-ware. The latter are more durable and less likely to be adversely affected by heat; while the wrought wares have the advantage of being cheaper, lighter, and more economical in the use of fuel.

Galvanized ware is more suitable for outdoor purposes, or for uses not connected with food preparation, and it comprises such articles as dust-bins, watering-cans, and common coal-scuttles. It seldom consists of articles similar to those which are enamelled, though the two sections overlap at a few points—such things as buckets, baths, washing-bowls and water-cans being common to both. Galvanized ware is, of course, of a lower grade than the enamelled variety. Presses and stamps are employed in the manufacture of certain classes of galvanized utensils; but many of the articles most typical of this trade are of a shape that do not lend themselves to machine production, and a great deal of hand labour is necessary, the more so because much of the ware is made of low-grade steel, which will not stand up to mechanical methods of production.

Some of the more ornamental tinplate and japanned wares, such as tea and coffee-pots, kettles, japanned coal-scuttles, trays, and travelling trunks, have, as already indicated, been superseded in Great Britain by other types; but a great quantity of hollow-ware is still made of this material, and there is a considerable export trade to the dominions, and to tropical and semi-tropical countries. As in the case of galvanized ware, while machinery has been introduced for performing some operations, the nature of many of the tinplate articles is such that hand labour cannot be largely dispensed with for shaping and joining.

The latest type of hollow-ware, viz., aluminium, takes the form of a wide variety of utensils, such as are associated with the enamelled and tinplate ware trades and with the pottery industry, and it ranges from large cast pots for industrial uses to light saucepans, cups and plates. Machinery is as extensively used in this manufacture as in the stamped steel hollow-ware trade; but owing to the nature of the metal, the lathe is more commonly used to shape the cheaper qualities of ware than is the stamp or press. The handles of aluminium articles are usually made of iron or steel, although sometimes a composition which is a non-conductor of heat is used.

Finally there remains to be mentioned the hollow-ware made of brass, copper, electro-plate and nickel silver. This is of an ornamental and expensive kind, and although copper and brass coal-scuttles are produced in fair quantities, these types do not form, in the 20th century, a considerable proportion of what can be strictly regarded as hollow-ware.

The census of production of 1924 affords some indication of the relative importance of the different branches of the hollow-ware industry in Great Britain at that date. As far as the value of its total annual production was concerned, the tinplate branch ranked highest, being slightly ahead of both the wrought enamelled and galvanized sections of the trade, and producing more than twice as much as the aluminium branch. The extent to which cast-iron has been superseded is illustrated by the fact that the value of the total annual output of all types of cast hollow-ware amounted to only three-fifths of that of aluminium and to about a quarter of that of wrought enamelled hollow-ware.

The British Manufacture.—The distinction which has been drawn between the different types of hollow-ware is reflected in the activities of the firms engaged in their manufacture. The large concerns naturally have a wide range of products; but even they specialize on particular kinds of ware. Thus, several manufacturers who were originally makers of enamelled and tinned cast-

iron utensils have taken up the production of stamped steel articles of the same type; the larger firms in the galvanizing section make wrought tinned articles similar in nature to their staple products; and aluminium and sheet copper goods are often manufactured in the tinplate ware factories. But, for the most part, firms concentrate on one of the following five groups; enamelled and tinned steel, the various kinds of cast-iron tinplate and japanned, galvanized, and aluminium ware. The small concerns limit themselves to some sub-division of these main groups, *e.g.*, to "black" native pots, or to galvanized buckets.

The firms engaged in producing enamelled hollow-ware in Great Britain are very few in number, there being only 18 in the wrought and 13 in the cast section. It is not surprising to find, therefore, that the factories in these two sections of the enamelled ware trade are much larger in size than those which make only galvanized, tinplate, "black," or tinned articles. The large scale of these undertakings may be attributed to the fact that the enamelled ware manufacturers require a larger plant and a higher degree of technical knowledge than those in other branches of the industry. In this section firms exist which employ 700 or 800 workers, and in it there is no place for the small producer.

On the other hand, "black" cast-iron hollow-ware is often made in small foundries; and in the tinplate and galvanized ware branches of the industry, where little machinery can be used, many small producers employing under a dozen workers exist. In these branches, indeed, the large factory is exceptional. The manufacturers of aluminium hollow-ware require a good deal of machinery; but although there are two or three large firms in this trade, the majority of those who specialize in aluminium articles employ less than a hundred Few manufacturers of hollow-ware confine themselves exclusively to that product. The foundries, for instance, frequently produce electrical castings and "oddwork"; *i.e.*, general ironmongery; the tinplate ware factories make such things as oil-stoves; and all hollow-ware firms concern themselves with other types of hardware.

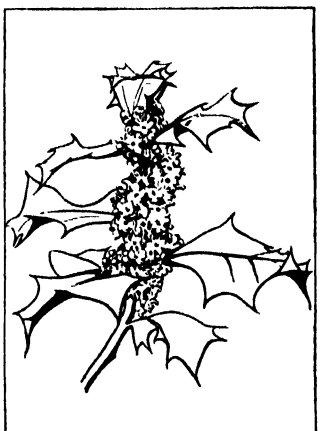
The chief sub-divisions of the British hollow-ware industry have been localized since the early 19th century in Birmingham and district, particularly at West Bromwich and in the neighbourhood of Wolverhampton; and in 1921 over three-quarters of the 11,076 people engaged in the manufacture of cast and wrought hollow-ware of iron and steel in Great Britain were found in that area, most of the remainder being in south Wales. The coal and the excellent iron and casting sand of south Staffordshire were originally responsible for this concentration of the trade. These causes, however, have long ceased to operate, and it has been the presence of skilled labour and of experienced manufacturers which has maintained the industry in this locality during the first three decades of the 20th century, when the pig-iron required for the foundry cupolas has had to be brought from Derbyshire, and when the steel sheets, which form the raw material of the wrought section, has been obtained from south Wales, or, since the war, to some extent from abroad. Tinplate wares have also been made extensively in Birmingham and Wolverhampton; but in this branch the district has lost some of its importance as a producing centre, owing to the decline in the demand for the type of product in which it has specialized, and greater London and Lancashire were in 1921 the chief seats of the industry. Aluminium hollow-ware manufacture, however, has come to be situated largely in the Birmingham neighbourhood, partly because makers of other types of hollow-ware in that locality have taken up its manufacture, and partly because those who were setting up new establishments were attracted to the district by the presence of the type of labour they required.

The term "hollow-ware" is seldom used in America to describe this group of manufactured articles. These objects are referred to as enamel-ware, aluminum-ware and by various other names. These are discussed under the articles HOUSEHOLD APPLIANCES; TINPLATE; ALUMINIUM and in related subjects.

There is no satisfactory work on the hollow-ware industry or on hollow-ware in general. For an illustrated account of hollow-ware in use before the 19th century *see* J. S. Lindsay, *Iron and Brass Implements of the English House* (1927). *See* also W. H. Jones, *Japan, Tinplate Working and Iron Braziers' Trades in Wolverhampton* (1900), and several articles in *The Birmingham and Midland Hardware District*, ed. Samuel Timmins (1866), for information concerning the historical development of the different branches of the industry. *See* also The Reports of the Census of Production (1924), and of Committees on Wrought Enamelled Hollow-ware (Cmd. 2634), and on Aluminium Hollow-ware (Cmd. 2530), set up under The Safeguarding of Industries Act, 1921. (G. C. A.)

HOLLY (*Ilex*), a large genus of trees and shrubs of the family Aquifoliaceae, containing about 180 species. The genus finds its chief development in Central and South America; is well developed in Asia, especially the Chinese-Japanese area, and has but few species in Europe, Africa and Australia. In Europe, where *I. Aquifolium* is the sole surviving species, the genus was richly represented during the Miocene period by forms at first South American and Asiatic, and later North American in type (Schimper, *Paléont. végét.* iii. 204, 1874). The leaves are generally leathery and evergreen, and are alternate and stalked; the flowers, commonly dioecious, are in axillary clusters and have a persistent four- to five-lobed calyx, a white, rotate four- or rarely five- or six-cleft corolla, with the four or five stamens adherent to its base in the male, and a two- to twelve-celled ovary; the fruit is a globose, usually red drupe, containing two to sixteen one-seeded stones.

The common European holly, or Hulver, *I. Aquifolium*, is an evergreen shrub or low tree, having smooth, ash-coloured bark, and wavy, pointed, smooth and glossy leaves, 2 to 3 in. long, with a spinous margin. The flowers, which appear in May, are ordinarily dioecious, as in all the best of the cultivated varieties in nurseries. Darwin (*Diff. Forms of Flow.*, 1877, p. 297) says of the holly: "During several years I have examined many plants, but have never found one that was really hermaphrodite." Shirley Hibberd, however (*Gard. Chron.*, 1877, ii. 777), mentions the occurrence of "flowers bearing globose anthers well furnished with pollen, and also perfect ovaries." The holly occurs in Great Britain, north-east Scotland excepted, and in western and southern Europe, from as high as 62° N. lat. in Norway to Turkey and the Caucasus and in western Asia. It is found generally in forest glades or in hedges, and does not flourish under the shade of other trees. In England it is usually small, probably on account of its destruction for timber, but it may attain to 60 or 80 ft. in height. Some of the trees on Bleak Hill, Shropshire, are said to be 14 ft. in girth at some distance from the ground. The holly is abundant in France, especially in Brittany. It will grow in almost any soil not absolutely wet, but flourishes best in rather dry than moist sandy loam. The holly is propagated by means of the seeds, which do not normally germinate until their second year, by whip-grafting and budding, and by cuttings of the matured summer shoots. Transplantation should be performed in damp weather. It is rarely injured by frosts in Great Britain, where its foliage and bright red berries in winter render it a valuable ornamental tree. There are numerous holly varieties. Some trees have yellow, and others white or even black berries. In the fruitless variety *laurifolia*, "the most floriferous of all hollies (Hibberd), the flowers are highly fragrant; the form known as *femina* is, on the other hand, remarkable for the number of its berries. The leaves in the unarmed varieties *aureo-marginata* and *albo-marginata* are of great beauty, and in *ferox* they are studded with sharp prickles. The holly is of importance as a hedge-plant, and is patient of clipping. Evelyn's holly hedge at Say's Court, Deptford, was 400 ft. long, 9 ft. high and 5 ft. in breadth.



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

BRANCH OF HOLLY (ILEX AQUIFOLIUM), SHOWING THE SMALL WHITISH FLOWERS

The wood of the holly is even-grained and hard, especially when from the heartwood of large trees, and almost as white as ivory, except near the centre of old trunks, where it is brownish. It is employed in inlaying and turning, and, since it stains well, in the place of ebony, as for teapot handles. When dry it weighs about 47½ lb. per cu.ft. From the bark of the holly bird-lime is manufactured. The leaves are eaten by sheep and deer, and in parts of France serve as a winter fodder for cattle. The berries provoke in man violent vomiting and purging, but are eaten with immunity by birds.

The custom of employing holly and other plants for decorative purposes at Christmas is one of considerable antiquity, and has been regarded as a survival of the usages of the Roman Saturnalia, or of an old Teutonic practice of hanging the interior of dwellings with evergreens as a refuge for sylvan spirits from the inclemency of winter. A Border proverb defines an habitual story-teller as one that "lees never but when the hollen is green" Several popular superstitions exist with respect to holly. In the county of Rutland it is deemed unlucky to introduce it into a house before Christmas Eve. In some English rural districts the prickly and non-prickly kinds are distinguished as "he" and "she" holly; and in Derbyshire the tradition obtains that according as the Holly brought at Christmas into a house is smooth or rough, the wife or the husband will be master.



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

HOLLY BRANCH (ILEX AQUIFOLIUM)

In North America some 12 native species occur, found chiefly in the south-eastern United States. The American holly (*I. opaca*), very similar in appearance and uses to the European holly, is a slow growing tree, sometimes 40 ft. or 50 ft. high, with a trunk 3 ft. or more in diameter. It grows in moist woods, mostly near the coast, from Massachusetts to Florida, westward to Texas, and northward in the Mississippi valley to Missouri and Indiana. Like the Old World holly, it is much used for Christmas decoration. The dahoon holly (*I. Cassine*), a shrub or small tree, sometimes 25 ft. high, with oblong, spineless and mostly toothless evergreen leaves, is found from Virginia to Florida and westward to Arkansas and Texas, and also in Cuba and the Bahamas. The cassena or emetic holly (*I. vomitoria*), called also yaupon, Carolina tea and Indian black-drink, because of its use by the Indians as an emetic and purgative, has nearly the same geographic range as the dahoon. It usually grows 10 ft. to 15 ft. high, and has small, minutely wavy-toothed leaves, about 1 in. long, and small fruits. Several North American species have deciduous leaves Of these the best known is the Virginia winter-berry or black alder, a shrub, 6 ft. to 15 ft. high, native to swamps from Connecticut to Wisconsin and south to Florida and Missouri. The foliage turns black and falls off in autumn, leaving bright red persistent fruits which are used for winter decoration. Other deciduous species are the smooth winter-berry (*I. laevigata*), native to swamps from Maine to Pennsylvania and Georgia; the swamp holly (*I. decidua*), widely distributed in the south-eastern States, and the mountain holly (*I. monticola*), of the Allegheny Mountain region. (*See* INKBERRY; MATE; WINTER-BERRY.)

HOLLYHOCK, *Althaea rosea*, a perennial plant of the family Malvaceae, a native of China, which has been cultivated in Great Britain for about three centuries and long since widely grown in America. The ordinary hollyhock is single-blossomed, but the florists' varieties have all double flowers, of white, yellow, rose, purple, violet and other tints, some being almost black. The plant is in its prime about August, but by careful management samples may be obtained in blossom from July to as late as November. Hollyhocks are propagated from seed, or by division of the root, or by planting out in rich sandy soil, in a close frame, with a gentle bottom heat, single eyes from woodshoots, or cuttings from outgrowths of the old stock or of the lateral offsets of the spike. The seed may be sown in October under cover, the plants obtained being potted in November, and kept under glass till the following April, or, if it be late-gathered, in May or June, in the open ground, whence, if required, the plants are best removed in October or April. In many gardens, when the plants are not disturbed, self-sown seedlings come up in abundance about April and May. Seedlings may also be raised in February or March, by the aid of a gentle heat, in a light and rich moist soil; they should not be watered till they have made their second leaves, and when large enough for handling should be pricked off in a cold frame; they are subsequently transferred to the flower-bed. Hollyhocks thrive best in a well-trenched and manured sandy loam. The plant is susceptible of great modification under cultivation. The forms now grown are due to the careful selection and crossing of varieties. It is found that the most diverse varieties may be raised with certainty from plants growing near together.

The young shoots of the hollyhock are very liable to the attacks of slugs, and to a disease occasioned by a fungus, *Puccinia malvacearum*, which is a native of Chile and attained notoriety in the Australian colonies, and finally, reaching Europe in 1869, threatened the extermination of the hollyhock, the soft parts of the leaves of which it destroys, leaving the veins only remaining. It has been found especially hurtful to the plant in dry seasons. It is also parasitic on the wild mallows. The disease appears on the leaves as minute hard pale-brown pustules, filled with spores which germinate without a resting-period, but when produced late in the season may last as resting-spores until next spring. In hot dry seasons, red-spider injures the foliage very much, but may be kept at bay by syringing the plants frequently with plenty of water.

HOLLYWOOD, Calif., U.S.A., the principal seat of the motion-picture industry, was annexed to Los Angeles (*q.v.*) in 1910.

HOLLYWOOD, a city of Broward county, Florida, U.S.A., on the East coast, 18m above Miami; on Federal highway 1, and served by the Florida East Coast and the Seaboard Air Line railways. The population was estimated locally at 7,500 in 1928. The city has 8m. of ocean beach, a deep-water harbour, several manufacturing industries and large hotels. In 1920 the site was a palmetto jungle; in 1927 the assessed valuation of property was $45,910,230. The city was incorporated in 1926.

HOLMAN, JAMES (1786–1857), known as the "Blind Traveller," was born at Exeter on Oct. 15, 1786. He entered the British navy in 1798, and was invalided out in 1810. He became totally blind, but nevertheless travelled widely in Europe. In 1822 he set out to go round the world, but after travelling through Russia into Siberia, he was arrested as a spy at a point 1,000 m. beyond Smolensk, and after being conducted to the frontiers of Poland, returned home by Austria, Saxony, Prussia and Hanover. (*See* his *Travels through Russia, etc.*, 1825.) Travelling by another route he accomplished his purpose and his journey is described in *A Voyage round the World, including Travels in Africa, Asia, Australasia, America, etc., from 1827 to 1832* (4 vols., 1834–35). His last journeys were through Spain, Portugal, Moldavia, Montenegro, Syria and Turkey. He died in London on July 29, 1857.

HOLMES, SIR CHARLES JOHN (1868–), English painter and writer on art, was born at Preston on Nov. 11, 1868. He was educated at Eton and Oxford. He worked in the publishing firm of Rivington, Ballantyne and Arnold from 1889–91. In 1903 he became editor of the *Burlington Magazine;* he was Slade professor in Oxford (1904–10); director of the National Portrait Gallery (1909–16); director of the National Gallery (1916–28). He was knighted in 1921. From his early youth he devoted his spare time to the study of art. Encouraged by Charles Ricketts, he etched some 85 plates from landscape drawings during the period from 1892–97. In 1900 he began to exhibit at the New English Art club, of which he was elected a member in 1904. In 1924 he became an associate of the Royal Society of Painters in Water Colour. The subjects of his paintings are mainly taken in the north country, and his style was formed by his study of Japanese art and the old masters. His

theories on art are explained in *Notes on the Science of Picture Making* (1909). Other publications by him are *Hokusai* (1900); *Hiroshige* (1902); *Constable* (1902); *Notes on the Art of Rembrandt* (1911); *The Tarn and the Lake* (1913); *Constable, Gainsborough and Lucas* (1922); *The National Gallery, Italian Schools* (1923); *The Netherlands, Germany and Spain* (1925); *The Making of the National Gallery 1824–1924* (1924). The following public galleries have works by him:—The Tate gallery, the British Museum, Manchester, Johannesburg, the Ashmolean at Oxford and Melbourne.

HOLMES, OLIVER WENDELL (1809–1894), American writer and physician, was born Aug. 29, 1809, at Cambridge (Mass.), one of the "Brahmin caste of New England." From Phillips (Andover) academy he entered Harvard in the "famous class of '29," made further illustrious by the charming lyrics which he wrote for the anniversary dinners from 1851 to 1889, closing with the touching "After the Curfew."

Turning next to medicine, and convinced by a brief experience in Boston that he liked it, he went to Paris in March 1833, where he studied industriously, and in his vacations visited the Low Countries, England, Scotland and Italy. Returning to Boston at the close of 1835, filled with a high professional ambition, he sought practice, but achieved only moderate success. Social, brilliant in conversation, and a writer of gay little poems, he seemed to the grave Bostonians not sufficiently serious. He won prizes, however, for professional papers, and lectured on anatomy at Dartmouth college. He wrote two trenchant and witty papers on *Homoeopathy and its Kindred Delusions* (1842); also a valuable paper on the malarial fevers of New England. In 1843 he published his essay on the *Contagiousness of Puerperal Fever*, which brought upon him bitter personal abuse; but he maintained his position with dignity, temper, and judgment; and in time he was honoured as the discoverer of a beneficent truth. The volume of his medical essays holds some of his most sparkling wit, his shrewdest observations, his kindliest humanity. In 1840 he married Amelia Lee Jackson, a lady of rare charm alike of mind and character. In 1847 he was appointed professor of anatomy and physiology in the Medical school of Harvard university, the duties involving the giving of instruction also in kindred departments, so that, as he said, he occupied "not a chair, but a settee in the school." He delivered the lectures on anatomy until Nov. 1882, and in later years these were his only link with the medical profession. They were fresh, witty and lively; and the students were sent to him at the end of the day, when they were fagged, because he alone could keep them awake. In later years he made few finished contributions to medical knowledge; his eager and impetuous temperament caused him to leave more patient investigators to push to ultimate results the suggestions thrown out by his fertile and imaginative mind.

In 1836, being in that year the Phi Beta Kappa poet at Harvard university, he published his first volume of *Poems*. Among these earlier lyrics was "The Last Leaf," one of his most delicate combinations of pathos and humour. In 1856–57 James Russell Lowell agreed to edit a new magazine on condition that he could secure the assistance of Holmes. Holmes, who heretofore had stood rather outside the literary coterie of Cambridge and Boston, accepted with pleasure. He christened the publication *The Atlantic Monthly;* and, as Howells afterwards said, he "not only named but made" it, for in each number of its first volume there appeared one of the papers of the *Autocrat of the Breakfast Table.* The opening of the *Autocrat*: "I was just going to say when I was interrupted" is explained by the fact that in the *Old New England Magazine* (1831–33) Dr. Holmes had published two *Autocrat* papers, which, by his wish, were never reprinted. In the commercial panic of 1857 the new magazine would inevitably have failed had it not been for these fascinating essays. Their originality of conception, their wit and humour, their suggestions of what then seemed bold ideas, and their expression of New Englandism, all combined to make them so popular that the most harassed merchant in that gloomy winter purchased them as a dose of cheering medicine. *The Atlantic Monthly* in return made Dr. Holmes. A success so immediate and so splendid settled the rest of his career; he ceased to be a physician and became an author. These 12 papers were immediately (1858) published as a volume. No sooner was the *Autocrat* silent than the *Professor* (1859) succeeded him at the breakfast table. The *Professor* was preferred by more thoughtful readers, though it has not been so widely popular as the *Autocrat*. Twelve years later, in 1871, the Landlady had another boarder, who took the vacant chair—the *Poet* (1872). But here Holmes fell a little short. In these three books, especially in the *Autocrat* and the *Professor*, Holmes wrote as he talked at many a dinner table in Boston, but not so well. The animation and clash of talk roused him The dinners of the Saturday Club are among Boston's proudest tradition, as they were the chief pleasure of Holmes's life. There he met Emerson, Longfellow, Whittier, Lowell, Sumner, Agassiz, Motley and many other charming talkers, and among them all he was admitted to be the best.

There were characters and incidents, but hardly a story, in the *Autocrat* and the *Professor*. Holmes had an ambition for more sustained work, and in 1861 his novel, *Elsie Venner*, at first called *The Professor's Story*, was published. This was illuminated throughout by admirable pictures of character and society in the typical New England town. But the rattlesnake element was unduly extravagant, and in other respects the book was open to criticism as a work of art. It was written with the same purpose which informed the greatest part of Holmes's literary work. By heredity he was a theologian; no other topic enchained him more than did the stern and merciless dogmas of his Calvinist forefathers. His humanity revolted against them, his reason condemned them, and he set himself to their destruction as his task in literature. In spite of attacks made on him as a freethinker and a subverter of Christianity, he returned six years later to the same line of thought in his second novel, *The Guardian Angel* (1867). This, though not so well known as *Elsie Venner*, has some of the same merits. In 1884 and 1885 it was followed by *A Mortal Antipathy*, an inferior production.

Holmes generally held himself aloof from politics, and from those "causes" of temperance, abolition and woman's rights which enthralled most of his contemporaries in New England The Civil War, however, aroused him for the time; finding him first a strenuous Unionist, it quickly converted him into an ardent advocate of emancipation. His interest was enhanced by the career of his elder son Oliver. Holmes wrote some ringing war lyrics, and in 1863 delivered the Fourth of July oration in Boston, which showed a masterly appreciation of the stirring public questions of the day. In 1878 he paid an affectionate tribute to one who had been his dear friend, the historian John Lothrop Motley. In 1884 he contributed the life of Emerson to the American "Men of Letters" series. He admired the "Sage of Concord," but was not quite in intellectual sympathy with him. Nevertheless in spite of this handicap the volume proved very popular. In 1888 he began the papers which he happily christened *Over the Tea Cups.* As a *tour de force* on the part of a man of nearly fourscore years they are very remarkable.

After his return from Paris in 1835 Dr. Holmes lived in Boston, with summer sojournings at Pittsfield and Beverly Farms, and occasional trips to neighbouring cities, until 1886. He then undertook a four months' journey in Europe, and in England had a sort of triumphal progress. On his return he wrote *Our Hundred Days in Europe* (1887), a courteous recognition of the hospitality and praise which had been accorded to him During this visit Cambridge university made him Doctor of Letters, Edinburgh university made him Doctor of Laws, and Oxford university made him Doctor of Civil Law. Already, in 1880, Harvard university had made him Doctor of Laws. He died on Oct. 7, 1894, and was buried from King's Chapel, Boston, in the cemetery of Mount Auburn. (J. T. M.)

BIBLIOGRAPHY.—Among the editions of Holmes's works are the Riverside (13 vols., 1891), The Standard Library (15 vols., including Morse's biography 1896), and the Autocrat edition (13 vol., 1904). Holmes's *Complete Poetical Works* (1895) were edited by H. E Scudder. The most complete edition of his *Speeches* is that published in 1913. Caroline Ticknor by a series of gleanings from his works presented *Dr. Holmes's Boston* (1915). The principal biography is

by J. T. Morse, *Life and Letters of Oliver Wendell Holmes* (1896). Other monographs are by James Ball (1878), Emma E. Brown (1884), Samuel M. Crothers (1910), W. H. Schroeder (1909), L. W. Townsend (1909), Louis Vossion (1896). *See* also the *Bibliography* by G. B. Ives (1907).

HOLMES, OLIVER WENDELL (1841–), American jurist, was born at Boston on March 8, 1841, the son of Oliver Wendell Holmes, poet and essayist. He graduated from Harvard in 1861. On the outbreak of the Civil War in that year he enlisted and served three years in the 20th Mass. Volunteers, rising to the rank of lieutenant-colonel. He was wounded three times—at Ball's Bluff, Antietam and Fredericksburg. He concluded his military career as aide-de-camp on the staff of the 6th Division, retiring in July 1864. In that year he began the study of law at Harvard, obtaining his LL.B. in 1866, and was admitted to the Suffolk (Mass.) bar on March 4, 1867. He practised law in Boston, and in 1870 was appointed instructor in constitutional law at Harvard, at the same time becoming editor of *The American Law Review*, which latter position he held for three years. In 1871–72 he was university lecturer in jurisprudence. In 1873 he edited the 12th edition of Kent's *Commentaries*, since recognized as the standard edition. In the same year he became a member of the firm of Shattuck, Holmes and Munroe and engaged in an active practice.

In 1880 Holmes was appointed lecturer on common law at the Lowell Institute. His articles in *The American Law Review* contained the germs of the lectures which he delivered before the institute and these in turn, in an amplified form, were published in 1881, under the title *The Common Law*. The object of the work was to present a general view of the common law, and this was done with a wealth of illustration, a charm of language and a clarity of reasoning which, apart from the erudition displayed, gave Holmes an international reputation. In 1882 he was appointed professor of law at the Harvard Law school, but resigned to accept an appointment on Dec. 8 of the same year as associate justice of the supreme court of Massachusetts. This position he occupied for 17 years, becoming chief justice on Aug. 2, 1899. On Dec. 4, 1902, he became an associate justice of the Supreme Court of the United States. As a judge he has uniformly favoured a liberal interpretation of the constitution and his opinions have been conspicuous for their literary style and epigrammatic force. In 1924 he was awarded the Roosevelt Memorial Association medal for the development of public law. In addition to the works already mentioned he published in 1891 a small volume of *Speeches*, reissued with additions in 1913, and *Collected Legal Papers* (1920).

HOLMES, WILLIAM HENRY (1846–), American anthropologist, was born in Harrison county, O., on Dec. 1, 1846. He graduated in 1870 from McNeely Normal college (Ohio) and in 1872 became an assistant in the U.S. Geological Survey. He was with the F. V. Halden survey in the Rocky Mountain States for eight years, being assistant geologist 1875–80. In 1880 he was appointed geologist and continued his western explorations. From 1888 to 1894 he served as archaeologist with the Bureau of American Ethnology. After a brief period as curator of anthropology at the Field Columbian museum in Chicago (1894–97), he returned to Washington to become head curator of the department of anthropology at the U.S. National Museum (1897–1902). After serving as chief of the Bureau of American Ethnology from 1902 to 1910, he again returned to his position as head curator at the National Museum, which he held until 1920. During 1908–20 he also served as curator for the National Gallery of Art, and in 1920 gave up his archaeological work to become director of that institution. Holmes was one of the pioneers in archaeological investigation in the South-west. His researches in aboriginal pottery have greatly contributed to knowledge on the subject of the habitat and relationships of Indian groups and cultures.

His books include *Art in Shell of the Ancient Americans* (1883); *Ancient Pottery of the Mississippi Valley* (1886); *Pottery of the Ancient Pueblos* (1886); *Ancient Art of the Province of Chirique, Colombia* (1888); *Archaeological Studies among the Ancient Cities of Mexico* (1895–97); *Aboriginal Pottery of the Eastern United States* (1903). A complete bibliography of his writings to 1916 is found in *Holmes Anniversary Volume*, Anthropological Studies (1916).

HOLMFIRTH, an urban district of the West Riding of Yorkshire, England, 6 m. S. of Huddersfield, on the L.M.S. railway. Pop. (1921), 10,439. It is situated in the narrow, steep-sided valley of the river Holme, a tributary of the Colne, and is walled in by moorland country. The people are employed in woollen manufactories and in the neighbouring stone quarries.

HOLMIUM, a metallic element, belonging to the rare-earth group, was discovered by Soret in 1878 and independently by Cleve in 1879. In 1912 the oxide was obtained in an almost pure form by Holmberg. Holmium occurs along with erbium, etc., in the minerals gadolinite, euxenite, xenotime, samarskite. It has the symbol, Ho, atomic number 67, and atomic weight 163·5. It is best separated by the crystallisation of the bromates and is thereby obtained mixed with yttrium, which may be removed by the fractional crystallisation of the double sodium sulphates in a vacuum at 25°–30° C. Holmium oxide is yellowish, soluble in many acids to form salts possessing an orange-yellow colour and of a high magnetic susceptibility. Solutions show a strong characteristic absorption spectrum. *See* RARE EARTHS. (C. J.)

HOLOCAUST, strictly a sacrifice wholly destroyed by fire. The word appears in Greek only in the Septuagint (Lev. 6. 23, in the form ὁλόκαυτον "the wholly-burnt thing"). Such are the sacrifices of the Jews, described in the Pentateuch as "whole burnt offerings" (*see* SACRIFICE). The term is now often loosely applied to a catastrophe on a large scale, whether by fire or not, or to a massacre or slaughter.

HOLROYD, SIR CHARLES (1861–1917), British artist, was born in Leeds on April 9, 1861. He received his art education under Professor Legros at the Slade School, University college, London. After passing six months at Newlyn, where he painted his first picture exhibited in the Royal Academy, "Fishermen Mending a Sail" (1885), he obtained a travelling scholarship and studied for two years in Italy. At his return, on the invitation of Legros, he became for two years assistant-master at the Slade School, and there devoted himself to painting and etching. For the church of Aveley, Essex, he painted a triptych altarpiece, "The Adoration of the Shepherds," with wings representing "St. Michael" and "St. Gabriel," and designed as well the window, "The Resurrection."

Sir Charles Holroyd was as an etcher possessed of profound technical knowledge of the art. Among the best known are the "Monte Oliveto" series, the "Icarus" series, the "Monte Subasio" series, and the "Eve" series, together with the plates, "The Flight into Egypt," "The Prodigal Son," "A Barn on Tadworth Common" (etched in the open air), and "The Storm." In all his work Holroyd displays sincerity, with a fine sense of composition, and of style. He was appointed the first keeper of the National Gallery of British Art (Tate gallery), and on the retirement of Sir Edward Poynter in 1906 director of the National Gallery. He died at Weybridge on Nov. 17, 1917.

HOLST, GUSTAV (1874–), English composer, was born at Cheltenham on Sept. 21, 1874. His father came of a Swedish family, one branch of which had settled in England early in the century. Holst entered the Royal College of Music, London, in 1893, and was a pupil of Stanford for composition, in which branch he gained a scholarship after two years. He also studied piano, organ and trombone. In 1898 he left the College and for some years played trombone in an orchestra. As a teacher he became associated with the Passmore Edwards Settlement (1904), Morley College (1907), Reading College (1909) and St. Paul's Girls' School, London (1905), and since 1919 has taught composition at the Royal College. In 1918 he worked among the troops in Salonika, organizing music under the Young Men's Christian Association. He visited Michigan university in 1923 for the purpose of conducting a concert of his own works. Holst's international reputation as a composer dates from the appearance of his largest symphonic work, *The Planets* (op. 32), in 1919.

Next in importance are the *Hymn of Jesus*, op. 37, No. 1 (1917), for chorus and orchestra; the Choral Symphony, op. 41 (1923); the Vedic Hymns for voice and piano, op. 24 and for chorus and orchestra, op. 26, which, with the opera *Savitri*, op. 28, represent the Eastern period in Holst's music; the opera: *The Perfect*

Fool (produced at Covent Garden, London, 1923); and the very charming examples of his lighter style—St. Paul's Suite for string orchestra (written for St. Paul's Girls' School), and the mediaeval Songs for voice and violin. Holst produces his choral effects with a sureness and ease that tell of long experience. He is particularly successful in writing for female voices. As an instance of the thoroughness of his methods it may be noted that he studied Sanskrit for the purpose of making his own translations for his songs, and himself wrote the libretto for *Savitri*. Characteristic of his idiom is the folk-song strain in his melody and the frequent use of unusual time-signatures. His other works include *Beni Mora*, op. 29, No. 1, oriental suite for orchestra; Suites for military band, op. 28, a, b; Japanese Suite for orch. op. 33; part-songs for mixed voices, op. 34; choral folk-songs, op. 36, No. 2; *Ode to Death* (Whitman) for chorus and orch.; Fugal overture for orch. op 40, No. 1; Fugal concerto for flute, oboe and string accpt. op. 40, No. 2.

HOLST, HERMANN EDUARD VON (1841–1904), German-American historian, was born at Fellin in the province of Livonia on June 19, 1841. Barred from his tutorship in Russia because of a political article, he emigrated to America in 1867, remaining there until 1872. He was professor of history in the University of Strasbourg (1872–74) and at Freiburg in Baden (1874–92) and was also a member of the Baden *Herrenhaus*. In 1892–1902 he was head of the department of history at the University of Chicago. He died in Freiburg on Jan. 20, 1904. His principal work is his *Constitutional and Political History of the United States* (German ed., 1873–91); English trans., 1877–92), based on source materials and written from a strongly anti-slavery point of view.

HOLSTEIN, FRIEDRICH VON (1837–1909) from 1878–1906 counsellor (*Vortragender Rat*) in the political department of the German Foreign Office, was the most important personality, after Bismarck, and equally with William II., in the political history of the German Empire. The following account will give first the chief events in his official career, then a picture of his personality, as reconstructed from documents, recollections and oral tradition, and finally an appreciation of the most important of his political decisions.

Life.—Friedrich August von Holstein was born on April 21, 1837, of an old and noble, but untitled, Mecklenburg family. He attended the gymnasium and the university in Berlin, and after passing his examinations in law entered the foreign office in 1860 as attaché. His first post was in Petersburg, under Bismarck, who was at that time Prussian Ambassador. His most important secretarial post was in Paris after the war of 1870–1871, first under Generals von Fabrice and von Waldersee, and later, after the re-establishment of the embassy, under the ambassador Count Arnim. He became secretary of legation in 1872, and in 1876, after Arnim's fall, was recalled to the foreign office, where the rest of his career was passed. At the Congress of Berlin in 1878 he accomplished excellent work, which was recognised by Bismarck, and was promoted *Vortragender Rat* This was the end of his actual promotions, but his unseen rise to the highest position of real power was only now to begin. The steps by which he rose cannot be measured by exact events.

After Bismarck's fall he appears at once as the "wirepuller in chief," whose extraordinary influence is known to all the initiated. Henceforward no secretary of state or chancellor might draw up any important document unapproved by him. Neither the changes in the Chancellor's Office (Caprivi, Hohenlohe, Bülow), nor at the head of the Foreign Office (Marschall, Bülow, Richthofen) in any way changed the fact that Holstein was the only man in the foreign office who mastered the complicated principles of German foreign policy, and was able to lay down its course with an assurance which may have been real and in any case was apparent. This situation continued, contrary to expectation, even during Bülow's long years of office. The first time that Bülow acted independently was during the Moroccan crisis of 1905–06. Holstein thereupon tendered his resignation, as the most effective way of gaining his point; it happened, however, that both chancellor and the secretary of state succumbed to strokes in quick succession and the secretary of state's deputy, von Tschirschky, submitted Holstein's proffered resignation to the emperor, who accepted it. There is good reason to suppose that Bülow knew what was happening, although he was able afterwards to persuade Holstein to the contrary, and it is certain that the Secretary of State, Freiherr von Richthofen whose illness proved fatal, had declared for Holstein's dismissal. Holstein himself believed the real author of his fall to be the Emperor's friend, Prince Philip Eulenburg, with whom he had quarrelled after an intimacy lasting many years. Even after Holstein's dismissal, Bülow did not despise his advice in later difficulties. A long memorandum by Holstein exerted a decisive influence on the attitude of the German Government in the Bosnian crisis of 1908–09. The promotion of his friend Kiderlen-Wächter to the position of Secretary of State came too late to benefit him. He died in Berlin in the same year, May 8, 1909.

Relations with Bismarck.—Bismarck, on whose staff Holstein had served as attaché in Petersburg, used his attachés principally to write from his dictation, requiring them not only to take down his ideas but to aid expression It is quite possible that Bismarck was struck here, not only by Holstein's notable eccentricity, but also by his literary and intellectual powers, which were presently to show themselves in the "Notes" with which Holstein afterwards ruled German policy. In any case, Bismarck kept in personal touch with his former attaché, whom he took with him ten years later to headquarters at Versailles, afterwards appointing him to the embassy under Freiherr von Arnim. It was here that the first great scandal arose, which is characteristic of Holstein's mentality. Soon after Arnim's appointment to the embassy, Bismarck quarrelled with him, and employed Holstein to spy on his chief. In the trial in which Bismarck broke the Ambassador, Holstein was obliged to come forward as a witness and to admit that he had written letters to the chancellor about his chief, Count Arnim. Bismarck had unmasked the secretary of legation before all the world as an intriguant; and this earned Holstein's undying hatred. He believed that Bismarck had shamed him as a traitor in order to make him a degraded and unresisting tool The passion of injured pride and vanity with which he reacted against this, the force of hatred which was to endure nearly twenty years, are no less characteristic of Holstein than his secret collaboration with Bismarck against Arnim. Various remarks on Holstein are attributed to Prince Bismarck and his son Herbert: "only useful for underground work"; "the blind spot" and "the man with the hyena eyes, of whom one must beware" (This the chancellor is alleged to have said to Prince William when giving him an account of affairs and personalities in the Foreign Office.) There is no reason to doubt the authenticity of these remarks.

The very bitterness of them betrays how clearly Bismarck must have realised the hatred burning in Holstein's heart against him They mean, too, that the Bismarcks, father and son, besides respecting Holstein's ability, had also formed a clear idea of the limits of his capacities. The "blind spot" had a symbolical meaning for Bismarck. He felt that Holstein was myoptic in dealing with matters that lay under his eyes. Prince Philip Eulenburg is the chief authority for the statement that Holstein was mainly instrumental in bringing about Bismarck's fall. But, he says, Holstein's tread was so soft and so hidden his ways, that he himself failed to detect the secret method of this enemy. It is impossible to say how far Holstein was influenced by his old hatred, how far by boundless ambition, which could not bear even a Bismarck in its path, and how far by political conviction that Bismarck's policy had ceased to be sound. But any of these three motives may have been present, and they show the composition of a character which was now to develop fully for the first time.

Character.—The chief trait of his character, the essential force in the exercise of which his soul resided, was political genius. Difficult as it may be to define more closely the character of this genius, it was beyond question the dominant feature in Holstein's nature. An attempt to reduce it to its basic psychological forces raises the main question whether intellect or will

was the stronger. The verdicts of most of his colleagues and acquaintances point to an unhealthy preponderance of the intellect. Holstein, it is said, was unsurpassed in the art of analysing situations and questions. But he failed to translate thought into action. Dogmatism and failure of will are said to have been characteristic of him; his most important decisions, it is said, were non-decisions. Historians in general have hitherto shared this view. The author of the present essay cannot agree with them. Holstein's reactions were often over-complicated and mixed with error, but always constructive. They never lacked the practical element. How could Holstein have reached and held the position of the absolutely indispensable adviser, had his advice lacked real power? It is true that he believed the human machine to be almost exclusively ruled by the intellect. He did not think it possible that passion and the blindness which passion involved could prove decisive in high places. In his mind the world of politics was composed of a system of interests, and it was only necessary to know their nature and strength in order to calculate events from moment to moment, as in a meteorological institute, and adapt oneself to them.

It is hardly possible to overestimate the power of this systematic thinking, and as this equation of forces, balanced in Holstein's super-refined brain, was upset by the personal factor: as foreign statesmen, Germany's own ministers, and not last the Emperor himself, failed to act according to the system, this resistance ended by engendering in the central brain that irritability which seemed to all observers unnatural and unhealthy. Holstein's proverbial mistrustfulness was the destiny and the curse of his over-systematic spirit. But this curse went so far as to create the illusion that it was unnecessary to treat the personal factor with any consideration. If interests ruled the progress of the world, semi-automatically, then it was possible to pay out Golushowski, when he was minister, for insolence of which he had been guilty when Secretary of Legation in Paris, or to let Salisbury feel the personal dislike conceived against him, even when his Government was making Germany favourable offers. Holstein shunned every official or social contact in which he was not able to balance and dispose as he wished. The emperor saw him only once; but even the simple social duties which would have been required of him as secretary of state, under Bülow's chancellorship seemed impossible for him. Yet he is said to have been capable of exerting great personal charm when he wished, and it was his habit to elaborate his policy with his intimate friends in a wine cellar of western Berlin as discreet as it was luxurious. The best proof of this ability to charm his enemies, and incidentally, to overcome his own nature, was given by his reconciliation with Maximilian Harden, his most embittered adversary in the journalistic world, after his dismissal.

He also saw many journalists while still in office. His name, however, was never mentioned. Only once was this rule broken. The humorous paper "Kladderadatsch" denounced him, Kiderlen and Philip Eulenburg under transparent pseudonyms as the secret tyrants of the foreign office and wirepuller of the Emperor. Holstein challenged the editor of "Kladderadatsch" to a duel with pistols and wounded his man. But this was not the only quarrel which he tried to settle by the pistol, and although in other cases he was at least dissuaded from a duel, yet his fondness for this means is characteristic of the hermit-like, sensitive but violent man, devoured by his own passion.

In the foreign office, he clung to his commanding position with ruthless jealousy. When an ambassador or minister came to Berlin, the first person to whom he had to report was not the secretary of state or the chancellor, it had to be Councillor von Holstein, who insisted on being called "Baron." Telegrams and reports went through his hands first, and it sometimes happened that urgently necessary papers were not available to the secretary of state because Herr von Holstein had gone on leave and locked them away. A large part of the official correspondence was marked "private for Baron Holstein." On the other hand, he sent private telegrams, letters and notes to the ministers, laying down their attitude, and often the way in which he desired them to report. The most surprising detail recorded of Holstein is his habit, continued almost daily for years, of speculating on the exchange. The correspondence between him and his intermediary, published by the *Berliner Tageblatt* is undoubtedly genuine. It is doubtful what the real aim of Holstein's speculation was. Money for money's sake, money in order to secure himself certain enjoyments, money for political purposes? Or was it the irresistible need to be in touch, to gamble, not merely with the State, but also with the other mighty force—Capital? The laconic notes to the banker give no answer to this question. It is also impossible to say with certainty whether Holstein let himself be led by financial considerations, into political actions contrary to the interests of the Empire. The correspondence as published gives no ground for the supposition that Holstein the speculator ruled Holstein the Statesman.

Diplomatic Decisions.—Whether Bismarck, after the Congress of Berlin, did or did not utter the proud saying, "From now onward I will drive Europe four-in-hand in harness," the foreign office in Berlin was fully convinced that this was Germany's position in Europe, at least up to the Conference of Algeciras, and Holstein developed this conviction into a system. As England would never be able to reconcile her differences either with France or Russia, the Triple Alliance would always remain the dominating combination, even in the case, which hardly needed to be considered seriously, of Russia's joining France in the war against Germany. That was Holstein's basic idea. He therefore held the task of German statesmanship to be to play off England and Russia against each other, either placing them under an obligation by some service, or coercing them by threats if the counter-service was not rendered. He did not in any case want to start a war. That was to be left to the two world powers which were described as the bear and the whale, and which, it was thought, must inevitably clash. This clash would then give Germany her great opportunity.

This was the system on which Holstein based his policy. It began with the non-renewal in March 1890 of the German-Russian Treaty of 1887. It would have been consistent with Holstein's policy to keep the treaty, but the system also allowed him to ignore it. For Holstein did not believe that Russia could form an alliance with France which would stand the test of Mediterranean policy. The suggestion that a treaty with Russia, added to one with Austria, was an act of dishonesty towards the latter power, was incorrect. Both treaties were defensive in their terms, and the aim of the double arrangement was not to let either of the two rivals in the Balkans act against the other and thereby against the peace of Europe. It is true, as Caprivi and others maintained, that this policy was more difficult to conduct than one which dealt with Austria alone. But Holstein shunned simplicity rather than sought it; the only explanation of his decision is therefore his hostility to Bismarck. Bismarck's fall was to be final, his return made impossible. Up to Bismarck's death, Holstein was always tortured by the nightmare of the possible return of the "Bismarcks." The danger of return would, however, have been greater on the renewal of the Russian treaty than at any other time. The following year saw Russia's political understanding with France, and 1892 the drafting of that military convention which was still in force in 1914. If it is remembered that at least up to 1908 Russia did not come into any sort of conflict, even with Austria, much less with Germany, it is clear that the one circumstance which drove the Tsar into the arms of France was the non-renewal of the Treaty, which was accompanied by ostentatious advances by the Emperor William to England, causing the Tsar to fear an attack. Thus two days after Bismarck's dismissal, the superiority of the Triple Alliance, which had hitherto been indubitable, vanished, France emerged from her isolation, and a danger of war between the two European systems of alliance arose. The chief responsibility for this must rest on two men: the Emperor and Holstein.

In the succeeding period Holstein's political path always led him nearer to Russia than to England. This attitude was largely due to his dislike of Lord Salisbury. The rebuffs experienced by Bismarck in 1887 and 1889 from the British foreign minister seem to have had a strong after-effect on Holstein. Between 1893

and 1895 came England's refusal to agree to the Italian plan of redrafting the Mediterranean agreement of 1887 more closely and more favourably for Italy. Holstein had supported Italy's wishes, and felt the refusal as a personal rebuff. Again, after the Chinese-Japanese war, Germany joined the Russo-French Note, while England refused at the last moment, making Germany's attitude conspicuous. Holstein believed that England had manoeuvred him into a false position. Then, in 1895, the British prime minister sounded the Powers regarding the partition of Turkey. Here Holstein conceived a fixed idea that British policy was aiming at bringing Germany into opposition with Russia and getting her to pull the chestnuts out of the fire for Great Britain. For Holstein assumed that Salisbury had conceived the whole plan in order to keep Russia quiet in the Far East. Later, after the emperor had met Salisbury's suggestions with a sharp refusal, Holstein saw that the plan had accorded with Russia's interests, and altered the foreign office's recommendation, but too late.

There is, so far, no documentary proof that Holstein had a share in the congratulatory telegram to President Krüger. But the statement made by Prince Bülow, the Chancellor, in 1904 that Holstein's advice had hitherto been followed in all important decisions, with the express reference to "the anti-English trend in 1896," can hardly mean anything except that Holstein was partly responsible for the Krüger telegram The author of this telegram, Privy Councillor Kayser, was one of Holstein's intimates.

Holstein is quite certainly the spiritual father of Germany's attitude towards the advances made by Chamberlain and Lansdowne in 1899–1901. In England itself, Salisbury consented only with reluctance to negotiations for a general understanding between England and Germany; and the idea immediately encountered the strongest opposition from Holstein. He feared that Germany was to be driven into a war with Russia and France and dropped at the decisive moment He rightly saw that England would be unable to allow a fresh victory by Germany over France. But he failed to see that if England were bound to Germany by a general understanding, and America and Japan also joined this combination, as seemed possible, then Russia and France would never have dared risk a war with Germany, Austria and Italy On the other hand, Holstein committed the error of considering England's differences with France and Russia to be insuperable, although Chamberlain made it absolutely clear that England, if rebuffed by Germany, would seek and find a settlement of her differences with Russia and France, which must then necessarily bring her into opposition to Germany. The negotiations were dragged out so long at Holstein's orders, and made so difficult that at last the British Government broke them off in December 1901 after concluding the Treaty with Japan.

When war threatened to break out between Russia and Japan in 1904, Holstein remained so conspicuously deaf to all warnings, particularly from Freiherr von Eckardstein, the well-informed councillor of embassy in London, that at this point the suspicion arises that financial motives influenced his attitude. During the war he adhered to his former policy of contact with Russia and strained relations dangerously with England by allowing Russian ships of war to take in German coal in the Baltic. If England had now joined Japan in her fight with Russia, and if France had supported her ally Russia against England and Japan, the Continental Alliance between Russia, France and Germany would have been formed. Without wishing for a war with England, which would have entailed the sacrifice of Germany's mercantile marine, Holstein envisaged the possibility of this alliance; and there is proof that one of the motives behind the German naval programme was the wish to enhance Germany's value to Russia as a potential ally. The Emperor, indeed, when he afterwards concluded the desired alliance with the downcast Tsar at Björkoe on July 24, 1905, privately altered the Foreign Office draft and limited the obligation of active mutual assistance to Europe, evoking thereby Bülow's offer of resignation, which was as unexpected as it was unwelcome to him. Bülow could have nullified the effect of the treaty of Björkoe, which the Russian Foreign Minister, Count Lamsdorff saw to be impracticable, without resigning; his threat of resignation must be therefore looked on as a successful attempt to curb the Emperor's power—a typical Holstein manoeuvre. Holstein himself attempted to have the Emperor placed under control as insane only a few years after his accession.

The last time that Holstein determined German policy was over the first Morocco bargain with France. The Anglo-French Entente had just been concluded and England had promised to support France in her action, which was irreconcilable with the 1880 Morocco Convention of Madrid. Holstein had always declared the Anglo-French entente to be a dream, and wished to seize the opportunity to shatter it. If this artificial web were only held to the light of the sun, he thought, the natural opposition of the two Powers in Morocco must pulverize it The Emperor wanted Germany to remain disinterested in Morocco; but Bulow and Holstein sent him to Tangier against his will. There by a speech, not that drawn up for him by the foreign office, but one of his own—which gave Holstein a nervous shock—he drew on himself public disapproval of his personal interference. The French and British Governments would have been glad to find a diplomatic settlement for the matter, but Holstein insisted on a conference and was not even satisfied by Delcassé's leaving the French Cabinet. He wanted to put forward and enforce such unmistakable and decisive demands as to compromise the Anglo-French entente. As Russia was absolutely out of action at the moment, and the French Government was consequently unable to risk an armed conflict; and as Germany also had international law on her side, which must place the British Government in an embarrassing light, Holstein's campaign, which he planned with great energy, had every prospect of success. But here for the first time Bülow failed to follow his tyrannical advisor. Fear of possible war with Great Britain, which would annihilate Germany's trade, seems to have been his decisive motive Holstein in consternation tendered his resignation for the fourteenth time, and this time, as said above, it was, contrary to expectation, accepted. Thus he relinquished the reins of policy, after holding them since Bismarck's resignation Only once again, during the Bosnian crisis, had he an opportunity of affecting a great decision by his advice. Holstein believed that the issue of the crisis had been a victory for Germany, which repaired the defeat of 1906. This was a grave error. Far from loosening the Entente, Russia's defeat over the Bosnian question in 1908–1909 was the occasion for a re-construction of the Entente on lines of closer diplomatic co-operation, and of a definite determination to arm.

This brings us to the final appreciation of Holstein's policy. It was Holstein who by his share in the non-renewal of the German Treaty with Russia, took the decisive step in making Germany dependent on Austria-Hungary. In trying to repair this fault by a rapprochement with Russia, he missed the hour in which Great Britain could have been won for the Triple Alliance, without being able to overcome the hostility of Russia, which dated from 1878 and had its roots in her rivalry with Austria in the Balkans. Finally, when England had composed her difficulties with France and Russia, consequent on which Italy also joined this group, Germany was left alone with Austria-Hungary. Possibly Holstein's Morocco policy would have been a more effective way of breaking the increasing menace of encirclement than Austria's war with Serbia in 1914 But it was due to Holstein's policy that the two central Powers were ever isolated at all.

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HOLSTEIN, formerly a duchy of Germany, now incorporated in Prussia. Until about 1110 the county of Holstein formed part of the duchy of Saxony, and it was made a duchy in 1472. From 1460 to 1864 it was ruled by members of the house of Oldenburg, some of whom were also kings of Denmark. By the Treaty of Vienna (Aug. 1864) which concluded the Danish War, Holstein

was ceded to Prussia and Austria jointly, but placed under the administration of Austria, which, however, was forced to deliver it over to Prussia after the Austro-Prussian War of 1866. (*See* SCHLESWIG-HOLSTEIN; SCHLESWIG-HOLSTEIN QUESTION.)

HOLSTENIUS, LUCAS, the Latinized name of Luc Holste (1596–1661), German humanist, geographer and theological writer, was born at Hamburg. He studied at Leyden university, where he became intimate with the most famous scholars of the age—J. Meursius, D. Heinsius and P. Cluverius, whom he accompanied on travels in Italy and Sicily. Eventually he went to Paris, and was recommended to Cardinal Francesco Barberini, papal nuncio and the possessor of the most important private library in Rome. On the cardinal's return in 1627 he took Holstenius with him as his librarian. He was appointed librarian of the Vatican by Innocent X., and was sent to Innsbruck by Alexander VII. to receive Queen Christina's abjuration of Protestantism. He died in Rome on Feb. 2, 1661. Holstenius was a man of unwearied industry and immense learning, but he lacked the persistency to carry out the vast literary schemes he had planned. He was the author of notes on Cluvier's *Italia antiqua* (1624); an edition of portions of Porphyrius (1630); notes on Eusebius *Against Hierocles* (1628), on the Sayings of the later Pythagoreans (1638), and the *De diis et mundo* of the neo-Platonist Sallustius (1638); *Notae et castigationes in Stephani Byzantini ethnica* (first published in 1684); and *Codex regularum, Collection of the Early Rules of the Monastic Orders* (1661). His correspondence (*Epistolae ad diversos*, ed. J. F. Boissonade, 1817) is a valuable source of information on the literary history of his time.

See N. Wilckens, *Leben des gelehrten Lucae Holstenii* (Hamburg, 1723); Johann Moller, *Cimbria literata*, iii. (1744).

HOLSTER, a leather case to hold a pistol, used by a horseman and properly fastened to the saddle-bow, but sometimes worn in the belt. More loosely it is applied to any pistol or revolver case worn on the person.

HOLT, SIR JOHN (1642–1710), lord chief justice of England, son of a small landowner, Sir Thomas Holt, was born at Thame, Oxfordshire, on Dec. 30, 1642. He studied at Oriel college, Oxford and at Gray's Inn, London. He was called to the bar in 1663. An ardent supporter of civil and religious liberty, he defended accused persons in many state trials. In 1685–86 he was appointed recorder of London, and about the same time he was made king's sergeant and was knighted. His giving a decision adverse to the pretensions of the king to exercise martial law in time of peace led to his dismissal from the office of recorder, but he was continued in the office of king's sergeant in order to prevent him from becoming counsel for accused persons. As a legal assessor to the peers in the Convention he took a leading part in the Revolution, and after the accession of William III. was appointed lord chief justice of the King's Bench. In judicial fairness, legal knowledge and ability, clearness of statement and unbending integrity he has had few superiors on the English bench. He is best known for the firmness with which he upheld his own prerogatives in opposition to the authority of the houses of parliament. Having been requested to supply police to help the soldiery in quelling a riot, he assured the messenger that if any of the people were shot he would have the soldiers hanged, and went himself to the scene of riot to prevent bloodshed. On the retirement of Somers from the chancellorship in 1700 he was offered the great seal, but declined it. He died in London on March 5, 1710. He was buried in the chancel of Redgrave church.

See *Reports of Cases determined by Sir John Holt* (1681–1710) published at London in 1738; and *The Judgments delivered in the case of Ashby* v. *White and others, and in the case of John Raty and others, printed from original mss.*, at London (1837). Burnet's *Own Times; Tatler*, No. xiv.; a *Life*, pubd., 1764; Welsby, *Lives of Eminent English Judges of the 17th and 18th Centuries* (1846); Campbell's *Lives of the Lord Chief Justices;* and Foss, *Lives of the Judges.*

HOLTEI, KARL EDUARD VON (1798–1880), German poet and actor, was born at Breslau on Jan. 24, 1798, the son of an officer of Hussars. After serving in the Prussian army as a volunteer in 1815, he began to study law at Breslau, but abandoned his studies for the stage. In 1821 he married the actress Luise Rogée (1800–1825), and was appointed theatre-poet to the Breslau stage. He next removed to Berlin, where he produced the popular vaudevilles *Die Wiener in Berlin* (1824), and *Die Berliner in Wien* (1825). After his wife's death he wrote a number of plays for the Königsstädter theatre in Berlin, notably *Lenore* (1829) and *Der alte Feldherr* (1829). In 1830 he married Julie Holzbecher (1809–1839), an actress engaged at the same theatre, and with her played in Darmstadt. Returning to Berlin in 1831 he wrote for the composer Franz Gläser (1798–1861) the text of the opera *Des Adlers Horst* (1835), and for Ludwig Devrient (*q.v.*) the drama, *Der dumme Peter* (1837). In 1833 Holtei toured with his wife in Hamburg, Leipzig, Dresden, Munich and Vienna. At Vienna the poet-actor created a sensation by his brilliant recitations, especially of Shakespeare, and was appointed manager of the Josefstädter theatre. Holtei left Vienna in 1836, and from 1837 to 1839 conducted the theatre in Riga. Here his second wife died, and he wandered from place to place, eventually settling in 1847 at Graz, where he wrote the novels *Die Vagabunden* (1851), *Christian Lammfell* (1853) and *Der letzte Komödiant* (1863). The last years of his life were spent at Breslau, where he found a home in the *Kloster der barmherzigen Brüder,* and here he died on Feb. 12, 1880.

As a dramatist Holtei may be said to have introduced the "vaudeville" into Germany; as a reciter, especially of Shakespeare, he knew no rival.

See his interesting autobiography, *Vierzig Jahre* (8 vols., 1843–50; 3rd ed., 1862) with the supplementary volume *Noch ein Jahr in Schlesien* (1864); Holtei's *Theater* appeared in 6 vols. (1867); his *Erzählende Schriften*, 39 vols. (1861–66); M. Kurnick, *Karl von Holtei, ein Lebensbild* (1880); F. Wehl, *Zeit und Menschen* (1889); O. Storch, *K. von Holtei* (1898); Moschner, *Holtei als Dramatiker* (1911).

HÖLTY, LUDWIG HEINRICH CHRISTOPH (1748–1776), German poet, was born on Dec. 21, 1748, at the village of Mariensee, Hanover, where his father was pastor. In 1769 he went to study theology at Göttingen. Here he formed a close friendship with J. M. Miller, J. H. Voss, H. Boie, the brothers Stolberg and others, and became one of the founders of the famous society of young poets known as the *Göttinger Dichterbund* or *Hain.* He died of consumption on Sept. 1, 1776, at Hanover. Hölty was the most gifted lyric poet of the Göttingen circle. He was influenced both by Uz and Klopstock, but his love for the Volkslied and his delight in nature preserved him from the artificiality of the one poet and the unworldliness of the other. A strain of melancholy runs through all his lyrics. His ballads are the pioneers of the rich ballad literature on English models, which sprang up in Germany during the next few years. Among his most familiar poems may be mentioned "Üb' immer Treu' und Redlichkeit," "Tanzt dem schönen Mai entgegen," "Rosen auf dem Weg gestreut," and "Wer wollte sich mit Grillen plagen?"

Hölty's *Gedichte* were published by his friends Count Friedrich Leopold zu Stolberg and J. H. Voss (Hamburg, 1783); new ed. enlarged by Voss, with a biography (1804); critical edition by W. Michael (2 vols., 1914–18). *See* H. Ruete, *Hölty, sein Leben und Dichten* (Guben, 1883); A. Sauer, *Der Göttinger Dichterbund*, vol. ii. (Stuttgart, 1894), where an excellent selection of Hölty's poetry will be found.

HOLTZENDORFF, FRANZ VON (1829–1889), German jurist, born at Vietmannsdorf, Brandenburg, on Oct. 14, 1829, studied law at Bonn, Heidelberg and Berlin. In 1860 he was nominated a professor extraordinary at Berlin. The predominant party in Prussia regarded his political opinions with mistrust, and he did not become full professor until February 1873, after he had decided to accept a chair at the university of Munich. At Munich he passed the last nineteen years of his life. Holtzendorff was an authority on criminal and international law. He edited the *Encyclopädie der Rechtswissenschaft* (Leipzig, 1870–71) and other works.

HOLTZMANN, HEINRICH JULIUS (1832–1910), German Protestant theologian, was born on May 17, 1832 at Karlsruhe, where his father, K. J. Holtzmann, ultimately became prelate and counsellor to the supreme consistory. Julius studied at Berlin, and became (1874) professor at Strasbourg. He wrote commentaries on the Synoptics (1889; 3rd ed., 1901), the Johannine books (1890; 3rd ed., 1908), and the Acts of the Apostles (1901), in the series *Handkommentar zum Neuen Testament.*

Other noteworthy works are the *Lehrbuch der histor.-kritischen Einleitung in das Neue Testament* (1885, 3rd ed. 1892), and the *Lehrbuch der neutestamentlichen Theologie* (2 vols., 1896–97; 2nd ed., 1911).

HOLUB, EMIL (1847–1902), Bohemian traveller in south-central Africa, was born at Holitz, eastern Bohemia, on Oct. 7, 1847. In 1872 he went to the Kimberley diamond-fields, and practised as a surgeon. He undertook expeditions to the northern Transvaal, Mashonaland and through Bechuanaland to the Victoria Falls, making extensive natural history collections. In June 1886 he crossed the Zambezi west of the Victoria Falls, and explored the then almost unknown region between that river and its tributary the Kafue. When beyond the Kafue the camp was attacked by the Mashukulumbwe, and Holub had to retreat. He returned to Austria in 1887 with a collection of great scientific interest, of over 13,000 objects, now in various museums. Holub died at Vienna on Feb. 21, 1902.

His principal works are: *Eine Culturskizze des Marutse-Mambunda-reichs* (Vienna, 1879); *Sieben Jahre in Sudafrika*, etc. (2 vols, Vienna, 1880–81), of which an English translation appeared; *Die Colonisation Afrikas* (Vienna, 1882); and *Von der Kapstadt ins Land der Maschukulumbe* (2 vols., Vienna, 1818–1890).

HOLY, sacred, devoted or set apart for religious worship or observance. It is a term characteristic of the sublimity and perfection of God, as the object of human reverence, awe and worship; and it is applicable to all that is held sacred or that excites awe, particularly, though not exclusively, to what is worthy of veneration or reverence on the ground of its moral worth; hence the term is transferred to those human persons, who, either because of their devotion to a spiritual life, or because of their moral perfection, are considered worthy of reverence. *See* RELIGION.

HOLY ALLIANCE, THE. The famous declaration known by this name was signed in the first instance by Alexander I., emperor of Russia, Francis I., emperor of Austria, and Frederick William III., king of Prussia, on Sept. 26, 1815

This document, the text of which was not published till 1816, laid down that the reciprocal relations of the Powers were henceforth to be based "on the sublime truths which the Holy Religion of our Saviour teaches"; that "the precepts of Justice, Christian Charity and Peace . . . must have an immediate influence on the councils of Princes, and guide all their steps"; that the three monarchs would, accordingly, "remain united by the bonds of a true and indissoluble fraternity" and "on all occasions and in all places, lend each other aid and assistance," while "regarding themselves towards their subjects and armies as fathers of families" (Art. I.); that the said Governments and their subjects would consider themselves as "members of one and the same Christian nation" (Art. II.). In the last article (III.) all the Powers who should "choose solemnly to avow the sacred principles which have dictated this act" were invited to join "this Holy Alliance."

The credit for inspiring this singular document was claimed by the Baroness von Krüdener (*q.v.*); in any case it was the outcome of the tsar's mood of evangelical exaltation, and was in its inception perfectly sincere. Neither Frederick William nor Francis signed willingly, the latter remarking that "if it was a question of politics, he must refer it to his chancellor, if of religion, to his confessor." Metternich called it a "loud-sounding nothing," Castlereagh, "a piece of sublime mysticism and nonsense." None the less, all the European sovereigns appended their signatures to it, except the prince regent of Great Britain, the Pope and the Sultan. The prince regent courteously declined to sign, on the constitutional ground that all acts of the British Crown required the counter-signature of a minister, but he sent a letter expressing his "entire concurrence with the principles laid down by the 'august sovereigns' and stating that it would always be his endeavour to regulate his conduct by their 'sacred maxims.' " The Pope could not sign a religious manifesto in common with schismatics and heretics, while the exclusion of the caliph of Islam was so obvious as to lead to sinister suspicions of the Emperor Alexander's motives.

In popular parlance the "Holy Alliance" soon became synonymous with the combination of the Great Powers by whom Europe was ruled for some years after 1815, and associated with the policy of reaction which gradually dominated their counsels. For the understanding of the history of this period, however, a clear distinction must be drawn between the Holy Alliance and the Grand or Quadruple (Quintuple) Alliance. The Grand Alliance was established on definite treaties concluded for definite purposes, of which the chief was the preservation of peace on the basis of the settlement of 1815. The Holy Alliance was a general treaty—hardly indeed a treaty at all—which bound its signatories to act on certain vague principles for no well-defined end.

As a diplomatic instrument the Holy Alliance never became effective. None the less, its principles and the fact of its signature had a powerful effect during the 19th century. It strongly influenced Nicholas I. of Russia, to whom the brotherhood of sovereigns by divine right was an article of faith, inspiring the principles of the Convention of Berlin (between Russia, Austria and Prussia) in 1833, and the tsar's intervention in 1849 to crush the Hungarian insurrection on behalf of his brother of Austria. That it had become synonymous with a conspiracy against popular liberties was, however, a mere accident of the point of view of those who interpreted its principles It was capable of other and more noble interpretations, and it was avowedly the inspiration of the famous rescript of the emperor Nicholas II. which resulted in the first international peace conference at The Hague in 1899. (W. A. P.)

HOLY GHOST: *see* HOLY, SPIRIT.

HOLYHEAD (Caer Gybi, the fort of Cybi), a seaport and town of Anglesey, North Wales, on Holy Island, at the western end of the county. Pop. (1921) 11,761. It is a terminus of the L.M.S.R. 264 m. from London by rail The church may occupy the site of the old monastery of St Cybi (6th or 7th century). There are traces (camps, etc.) of earlier occupation on the high ground near the town Once a fishing village the town has since the reign of William IV. acquired importance as a packet station for Dublin. It was selected for this purpose in 1801 and in 1815–19 was made the terminus of the great Telford road from England. The harbour protected by a breakwater (1½ m.) was opened in 1873. Additions were made in 1880. There is passenger traffic to Dublin and Greenore and mails are carried to Dun Laoghaire (Kingstown).

HOLY ISLAND or **LINDISFARNE,** an irregularly shaped island in the North Sea, 2 m. from the coast of Northumberland, in which county it is included. Pop. (1921) 586. It is joined to the mainland at low water by flat sands, over which a track, marked by wooden posts and practicable for vehicles, leads to the island. There is a station on the N.E. railway at Beal, 9 m. south-east of Berwick, opposite the island, but 1¼ m. inland. Its total area is 1,051 acres. On the N. it is sandy and barren, but on the S. very fertile and under cultivation. Large numbers of rabbits have their warrens among the sands, and, with fish, oysters and agricultural produce, are exported. There are several fresh springs on the island, and in the north-east is a lake of 6 acres. At the south-west angle is the little fishing village (formerly much larger) which is now a favourite summer watering-place. Here is the harbour, offering good shelter to small vessels. Its ruins, still extensive and carefully preserved, justify Scott's description of it as a "solemn, huge and dark-red pile." An islet, lying off the S.W. angle, has traces of a chapel upon it, and is believed to have offered a retreat to St. Cuthbert and his successors. The castle, situated east of the village, on a basaltic rock about 90 ft. high, dates from *c.* 1500

When St. Aidan came at the request of King Oswald to preach to the Northumbrians he chose the island of Lindisfarne as the site of his church and monastery, and made it the head of the diocese which he founded in 635; hence its name. For some years the see continued in peace, numbering among its bishops St. Cuthbert, but in 793 the Danes landed on the island and burnt the settlement, killing many of the monks. The survivors, however, rebuilt the church and continued to live there untill 883, when, through fear of a second invasion of the Danes, they fled inland,

taking with them the body of St. Cuthbert and other holy relics. The church and monastery were again destroyed and the bishop and monks, on account of the exposed situation of the island, determined not to return to it, and settled first at Chester-le-Street and finally at Durham. With the fall of the monastery the island appears to have become again untenanted, and probably continued so until in 1082 the prior and convent of Durham established there a cell of monks from their own house. The inhabitants of Holy Island were governed by two bailiffs at least as early as the 14th century, and, according to J. Raine in his *History of North Durham* (1852), are called "burgesses or freemen" in a private paper dated 1728. Towards the end of the 16th century the fort on Holy Island was garrisoned for fear of foreign invasion. During the Civil Wars the castle was held for the king until 1646, when it was taken and garrisoned by the parliamentarians. The only other historical event connected with the island is the attempt made by two Jacobites in 1715 to hold it for the Pretender. The island has two life-boat stations.

HOLYOAKE, GEORGE JACOB (1817–1906), English secularist and co-operator, was born at Birmingham on April 13, 1817. At an early age he became an Owenite lecturer, and in 1841 was the last person convicted for blasphemy in a public lecture, though this had no theological character and the incriminating words were merely a reply to a question addressed to him from the body of the meeting. He nevertheless underwent six months' imprisonment, and upon his release invented the inoffensive term "secularism" as descriptive of his opinions, and established the *Reasoner* in their support. He was also the last person indicted for publishing an unstamped newspaper, but the prosecution dropped upon the repeal of the tax. His later years were chiefly devoted to the promotion of the co-operative movement among the working classes. He wrote the history of the Rochdale Pioneers (1857), *The History of Co-operation in England* (1875; revised ed., 1906), and *The Co-operative Movement of To-day* (1891). He also published (1892) his autobiography, under the title of *Sixty Years of an Agitator's Life*, and in 1905 two volumes of reminiscences, *Bygones worth Remembering*. He died at Brighton on Jan. 22, 1906.

See J. McCabe, *Life and Letters of G. J. Holyoake* (2 vols., 1908); C. W. F. Goss, *Descriptive Bibliography of the Writings of G. J. Holyoake* (1908).

HOLYOKE, a city, Hampden county, Mass., U.S.A., on the Connecticut river, 8m. N. of Springfield. It is served by the Boston and Maine and the New York, New Haven and Hartford railways. The population was 60,203 in 1920 (33·6% foreign-born white) and was estimated locally at 63,000 in 1928. The city occupies 17 sq.m. in a bend of the river, on the west bank, at the foot of Mount Tom. It is a busy industrial and commercial centre, with a factory output in 1925 valued at $88,325,281 and bank debits in 1926 amounting to $196,335,000. The outstanding products are fine writing and envelope papers, in which it leads all the cities of the United States. Cotton, silk, alpaca and woollen goods also are extensively manufactured, and among the many other products are steam pumps, water wheels and machinery. The assessed valuation of property in 1926 was $117,057,360. The immense water-power from the Connecticut river (which falls 60ft. in 1·5m. just above the city) was not utilized until 1849, when a great dam (1,017ft. long) was completed, a colossal undertaking for the time. Before that Holyoke had been a farming village, originally part of Springfield, and after 1774 of West Springfield; and the population in 1850, when the town was incorporated, was only 3,245. By 1870 it had increased to 10,733, and in 1873 the town was chartered as a city. Between 1870 and 1880 the population doubled, and it continued to grow rapidly until 1910.

HOLY ROMAN EMPIRE: *see* EMPIRE; EUROPE; HABSBURGS; HOHENSTAUFEN, etc., and under the names of the various emperors. *See* also PAPACY.

HOLY SPIRIT, THE, a term which developed from the use of the word "spirit" (*spiritus* in the Vulgate), to translate the Hebrew *ruach,* Greek πνεῦμα. Etymology and usage suggest that the common meaning of the three terms is the "blowing" of the wind and the "breathing" of man. This is the physical basis of the remarkable and influential duality of meaning in the three terms—their inclusion of both supernatural and natural aspects of human life and experience. (Primitive thought knows no natural explanation of the wind, and the power or mystery of the wind made it a typical example of the supernatural, lending its name to similar phenomena or agencies.) The usage of the three terms, however, also shows characteristic differences, due to those of the Hebrew, Greek and Roman peoples. *Ruach* becomes a theological term denoting the personal energy of God; *pneuma,* in philosophy or medical science, a permeating principle; *spiritus,* at any rate in its modern equivalents, has tended more and more to denote personal, especially religious, experience—a development which makes the English equivalent one of our most subtle and interesting words (more than a score of different meanings may be found in the *New English Dictionary, s.v.*).

The Old Testament.—The Hebrew word, *ruach,* began its long history not by denoting an element of human personality, afterwards transferred to God, but as a divine activity, subsequently transferred to man. Critical study of the Old Testament shows that *ruach* is not used of the human breathing or with psychical predicates before the exile, whereas from the earliest period it does denote the wind, conceived as a superhuman activity. It was natural, therefore, to use the term of any powerful and mysterious agency, acting on man from without, and of any abnormal display of energy by man himself. At this stage the use is non-moral and comprehensive as to source, not being confined to energies controlled by Yahweh. Only as Israel came to conceive Him as omnipotent and as acting according to ethical standards did *ruach,* the characteristic expression of His energy, move towards the conception of "the Holy Spirit." This full term occurs three times only (Ps li. 11, Is lxiii. 10, 11), but the noun alone develops the conception of ethical majesty *pari passu* with the conception of Yahweh Himself (the adjective "Holy" originally denoted not moral character but the "numinous," that aspect of the divine which separates it from the human).

The divine activity expressed by *ruach* is the source of the most varied phenomena, ranging from Samson's outbursts of physical energy without moral purpose (Jud. xiv. 6, 19, xv. 14) to Ezekiel's conception of the changed heart as the spring of moral obedience (xxxvi. 26, 27). In the earlier "prophesying" (*e.g.,* I Sam. xix. 18–24), prominence is given to the physical phenomena ascribed to the Spirit; in the later development of ethical prophecy these sink into the background, without being wholly lost, as we may see from Ezekiel. The outpouring of the prophetic Spirit upon all without distinction is a sign of the "Messianic" age (Joel ii. 28, 29); this is a more external parallel to the inwardness of the "New Covenant" of Jeremiah (xxxi. 31–34), when all shall know Yahweh. Through the whole development of a thousand years *ruach* denotes the transcendent, not the immanent, energy of God. The nearest approach to immanence is that from the exile onwards the term *ruach* denotes the breath or breath-soul or inner life of man, naturally with the suggestion of its divine origin. This is an important fact for the Pauline usage of *pneuma;* the use of the same term to denote the super-normal energy of God and the normal life in man was an implicit assertion of kinship between the human and the divine. Yet we must not press this too far within the Old Testament, because of the sharp antithesis there made between God and man (as in the contrast of Spirit and flesh in Is. xxxi. 3). Even when God is said to be omnipresent by His Spirit (Ps. cxxxix. 7) there is no suggestion of an immanent permeating principle such as is developed in the Greek use of *pneuma.* The Holy Spirit in the Old Testament is a personal, yet unhypostasized, activity of God, almost always concerned with human life.

LIMITATIONS OF THE TERM

Between the Testaments.—The subsequent Palestinian Judaism made no fresh contribution to the doctrine of the Holy Spirit, but tended to limit the activity to prophecy and to regard the Torah (Pentateuch) as the Spirit's characteristic work. Thus the Spirit belonged to the past or to the future (Ps. Sol. xvii. 42), rather than to the present, which was conscious of the lack of the

prophetic impulse (Ps. lxxiv. 9, I. Macc. iv. 46, ix. 27, xiv. 41; the Second Temple was said to lack the ark, the fire, the Shechinah, the Spirit, the Urim and Thummim). A new influence, however, came into Alexandrian Judaism through its use of the Greek term *pneuma* (used by the Septuagint to translate *ruach*). The Stoic Posidonius had described God as *pneuma*, with the qualities of both intelligence and fire, formless yet capable of unlimited transformation; the Stoics generally explained the bodily senses as due to the immanent activity of *pneuma*, which might be described as the "material" out of which the *psyche* or soul is composed. The *Wisdom of Solomon* continues this Stoic doctrine of immanence, and blends the idea of the Spirit of God with that of "Wisdom" (vii. 22, *cf.* i. 4–7, ix. 17); here, perhaps, we may first speak of a "hypostasis" of the Holy Spirit, *i.e.*, of a divine attribute endowed with separate existence. Philo has largely absorbed the content of "Wisdom" and "Spirit" into his characteristic term, "Logos"—a fact which should remind us how elastic were these mediatorial ideas in New Testament times. It is clear that the doctrine of the Spirit did not take anything like so distinctive a place in contemporary Judaism, Palestinian or even Alexandrian, as in the Christian life of the New Testament. It is also clear that the suggestion of immanence in the Greek term *pneuma* might deeply affect its connotation when used to render *ruach*, though this Hellenistic influence can easily be exaggerated (as by Leisegang). The Hebrew connotation of *ruach* remains fundamental in regard to transcendent personal activity and to ethical content.

The New Testament.—Jewish faith expected the Messiah to be endowed with the Holy Spirit (Is. xi. 1 *seq.*; Ps. Sol. xvii. 39 *seq.*), and this faith is reflected in the Synoptic account of Jesus, whose birth, baptism and ministry of power are directly linked to the Spirit's activity. He wages war with the demonic world in the power of the Spirit (Mt. xii. 28), and at "Pentecost" this power is consciously realized as resting upon His disciples (Acts ii. 4, 17 *seq*.). The abnormal physical and psychical phenomena which seem to have accompanied baptism in primitive Christianity were ascribed to the Holy Spirit, and corresponded in some degree with those of early "prophecy" in the Old Testament. It was the Apostle Paul who ethicized this conception and transformed it in a way comparable with that of the eighth century prophets; to him, intelligible and "edifying" prophecy was worth infinitely more than the unintelligible gift of "tongues," which needed an interpreter (I Cor. xiv.) (*see* TONGUES, SPEAKING WITH). The *charismata* or gifts of the Spirit (I Cor. xii. 4 *seq.*) were bestowed within, and for, the community; hence "love" was the highest of them all. The fruit of the Spirit was that of the Christlike character (Gal. v. 22, 23). To be "in Christ" was to be a new creation of the Spirit of Christ. Paul drew no clear distinction between the activity of the risen Christ and that of the Holy Spirit, as we may see from the alternations of Rom. viii. 9–11 ("Spirit of God, of Christ, Christ in you, indwelling Spirit"—all with the same connotation of experience). The whole of the Christian experience, as Paul conceived it, can be gathered within the formula of Eph. ii. 18: "*through* Christ, we have our access *in* one Spirit *unto* the Father." The supreme work of the Holy Spirit is to create the Christian fellowship. The Fourth Gospel develops this conception in the light of the experience of the Church during the first century. The Holy Spirit is represented as continuing the work of Christ in and through the Church, as another "Paraclete" or "Helper." The world will be convinced of sin, righteousness and judgment (xvi. 8–11) through the presence of the Spirit with the community of disciples.

So far, nothing has been said of the metaphysical basis of this experience, *i.e.*, what it implies as to the Godhead. We shall find in the New Testament no explicit teaching as to the Trinity, but simply such data of thought and experience as may be held to require such a doctrine to explain them. The two clearest references are those of the benediction (II. Cor. xiii. 14) and the baptismal formula (Matt. xxviii. 19). But the former gives us no more in reality than the reversed line of approach of Eph. ii. 18; the grace of Christ springs from the love of God and operates through the fellowship (of man with God and man with man) created by the Holy Spirit; the baptismal sentence does not carry us further than this "intensive" line of God's approach to man and man's approach to God. We are hardly warranted in saying more of St. Paul's doctrine of the Godhead than that, for him, the real presence of God, as known through Christ, "the Lord the Spirit" (II. Cor. iii. 18), was inwardly experienced by the believer who had been baptized in the Spirit (I. Cor. xii. 13) and had thus entered the fellowship (Phil. ii. 1). This real presence of God is personally experienced and conceived, and the New Testament data warrant us in asking whether God as Spirit can be conceived as other than personal. But the metaphysical questions were not faced by the New Testament believers; they belong to the next period of the history of the doctrine.

The Dogmatic Development.—The early uncertainties as to the extension of monotheism are illustrated by the *Shepherd* of Hermas, who does not distinguish the pre-existent Son of God from the Holy Spirit, and no trinitarian formula was reached by the Apologists. Meanwhile, the growing emphasis on the more external aspects of the Church, the ministry, and the sacraments provoked the interesting Montanist reaction—an attempt to revive the New Testament "life in the Spirit." Sabellius (*fl.* 215) regarded the Holy Spirit as a "mode" of the one God (Monarchianism). Origen (185–254) held the Holy Spirit to be the highest of the spiritual beings brought into existence through the Son, though he refrains from using the term *ktisma* (creature); the work of the Spirit is essentially the sanctification of believers. Tertullian—a Montanist—was the first to deal at all adequately with the doctrine of the Trinity. But during the ante-Nicene period there is no settled "Doctrine of the Holy Spirit": thought on the subject is fluid and unformed. At the Council of Nicaea (325) it is significant that whilst the Father and the Son receive careful and elaborate definition, there is but the bare mention of the Holy Spirit in the third place, without any definition at all. But when the *homoousia* (identity of nature with the Father) of the Son had been successfully asserted in the Arian Controversy, the result was transferred, without any corresponding discussion, to the Holy Spirit, as the third *hypostasis* of the Godhead (Synod of Alexandria, 362). Moreover, as the interpretation of Christ in terms of the divine *Logos* (creative reason or word in the world) tended to fall into the background, that of Christ as Son taking its place, functions hitherto often ascribed to the *Logos*, came to be ascribed to the Spirit; the conception of the Spirit therefore became more prominent. The only controversy dealing directly with the doctrine of the Holy Spirit was that known as the "Macedonian," which was hardly more than the closing phase of the Arian Controversy. The orthodox doctrine of the Church was due to the three "Cappadocians" (Basil of Caesarea, Gregory of Nazianzum and Gregory of Nyssa); the three *hypostases* were distinguished by the conception of the Father as "ingenerate," the Son as "generate," and the Spirit as proceeding from the Father through the Son. The Council of Constantinople (381), which repudiated Macedonianism, described the Holy Spirit as "Sovereign and Lifegiving, Who proceedeth from the Father, Who with the Father and the Son is together worshipped and glorified: Who spake by the prophets." Its decisions were confirmed at the Council of Chalcedon (451).

The Western Church, at least from Tertullian's time, had asserted that the Holy Spirit proceeded from the Father *and the Son*, as Augustine definitely argued in the interest of the unity of the Godhead. The Eastern Church, which regarded the Son and the Spirit as in some sense subordinate to the Father, taught that He was the only source of the Spirit. Consequently, the insertion of *filioque* in the Creed, for the first time at the third Council of Toledo (589), created a formal issue between the West and the East which has contributed to their lasting separation. The Eastern position is expressed by John of Damascus (700–754)—"proceeding from the Father and communicated through the Son . . . we do not speak of the Spirit as from the Son."

Scholasticism, concerned with the philosophic defence and elaboration of the faith, contributed no really new feature to the doctrine of the Holy Spirit. The Council of Trent (1545–1563) claimed the direct inspiration of the Holy Spirit for the traditions of the Church as equal in authority to that of the Scriptures

(including the Apocrypha). Justification was regarded as the infusion of righteousness through the Holy Spirit, mediated through the whole system of the Church. On the other hand, the mysticism of the Middle Ages, by its endeavour after a more direct fellowship with God, paved the way for that re-discovery of the activity of the Spirit in Christian experience which characterized the Reformation. The *Theologia Germanica,* for example, forming a direct and important link with Luther, brings us back to the realization of the indwelling presence of God through the surrender of the will to Him.

Augustine had laid the foundation of the Western doctrine of grace, which he held to be the activity of the Holy Spirit, inspiring faith, love and the whole experience of regeneration; but this was bound up with his doctrine of the Church and the sacraments. Luther also made faith and all its sequel to be the gift of the Holy Spirit, but for him the "Word" was the essential link in the chain of divine causality. Melanchthon linked with the Word and the Spirit the co-operation of the human will Calvin emphasized the internal testimony of the Holy Spirit as confirming the authority of the Spirit's utterance in Scripture. It is this emphasis on the Scriptural, in contrast with the predominantly "sacramental," conception of grace—*i e.,* the mediation of the Spirit through the "Word" of God—which gives to the Protestant doctrine its characteristic features. Quietism (Molinos) and Pietism (Spener and Francke) on the continent, Quakerism and Methodism in England, may all be viewed as a return to the emphasis on Christian experience and on the Holy Spirit as its direct interpretation, as against contemporary intellectualism. The modern appeal to Christian experience as the basis of theological reconstruction began with Schleiermacher, who, in accordance with his Sabellianizing doctrine of God, identified the Holy Spirit with the spirit of the Christian community.

The Modern Approach.—This brief summary of the history has shown that the orthodox doctrine of the nature of the Holy Spirit was substantially reached in the fourth century, as the result of the transference of the *hypostasis* doctrine of the Logos to the third "Person" of the Holy Trinity. On the other hand, the doctrine of the work of the Holy Spirit largely fell into the background till the Reformation. The Protestant emphasis on Christian experience as of "supernatural" origin was accompanied by such a contemporary development of philosophic thought as has made possible a new conception of the nature of Spirit. The static conception of "substance" gave place to the dynamic conception of "subject"; the experience of the (personal) "subject" reveals a unity of objective-subjective factors which may be held to imply both the transcendence and immanence of God. The larger outlook of the modern world on nature and history has given a new background to the activity of the Holy Spirit, and theologians are coming to realize that the special activity within Christian experience must be related to the whole working of the Spirit of God in the universe. The endeavour to recover the New Testament consciousness of a direct fellowship with God through Christ, in reaction from a too external emphasis on the authority of Bible or Church, is leading to doctrinal re-statement in the light of these new categories and data.

It may be argued that the real presence of God (as known through Christ) in the heart of the believer or the Christian community, implies the "personality" of Spirit (God as Spirit). Moral and religious surrender to God has this significant feature—the individuality of the believer is not absorbed, but raised to new powers when he is brought to say, "My life is hid with Christ in God." This suggests that at higher levels of personality or "Spirit" there may be inclusion without absorption, and that the individuality of the "Jesus of history" is not lost but raised to fulness of being in the exalted "Christ of experience." The Spirithood of God becomes the primary category for a doctrine of the Godhead, unifying the divine purposes of creation, redemption and sanctification and the divine activities to these ends. We have no experience of triple-centred personality; but our own partial achievement of personality, marked by sociality as well as individuality, points forward to more inclusive and complex conceptions of Spirit which would safeguard the Christian "values" and justify them ontologically—the values which were safeguarded by the ancient *hypostasis* doctrine. The formulation of such a conception is interwoven with the theological doctrine of mediation and the philosophical problem *par excellence, i.e.,* the relation of time and eternity.

The doctrine of the Holy Spirit, therefore, is of the greatest importance to the Christian Church. It is the guarantee that Christian experience originates *ab extra* whilst involving the moral response of the believer. It links that experience with its historical origin in the Person and Work of Christ whilst guaranteeing the continuity of Christian experience and the progressive and continuous character of revelation; it points to the ultimate nature of God. The transforming activity of spirit in man, by which new meanings and therefore new facts are created, suggests that some of the great problems of theology, such as those connected with the doctrine of Atonement, may find their solution in a more comprehensive and adequate doctrine of the Holy Spirit.

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(H. W. R.)

HOLYSTONE, a soft kind of sandstone used by sailors for scrubbing and cleaning the decks of ships. The origin of the word is doubtful. Some authorities hold that it arose from the general practice of scrubbing the decks for Sunday service; while others think the name arises from the fact that the stone so employed is naturally porous and full of holes. A small flint or stone having a natural hole in it, and worn as a charm, is also called a holystone.

HOLY WATER, technically the water with which Christian believers sign the cross on their foreheads on entering or leaving church. The decretum of Gratian enjoins that it should be exorcized and blessed by the priest and sprinkled with exorcized salt. This rite is found in the Gelasian, Gregorian and other sacramentaries. In the East the water was blessed once a month; in the Latin Church it is now blessed every Sunday. In the 4th century in the East it was usual to wash the hands on entering the church (*see* ABLUTION). In the early church water was not expressly consecrated for baptisms and other lustrations.

HOLY WEEK, in the Christian ecclesiastical year the week immediately preceding Easter. The earliest allusion to the custom of marking this week as a whole with special observances is to be found in the *Apostolical Constitutions* (v. 18, 19), dating from the latter half of the 3rd century A.D. Abstinence from wine and flesh is there commanded for all the days, while for the Friday and Saturday an absolute fast is enjoined. Of the particular days of the "great week" the earliest to emerge into special prominence was naturally Good Friday. Next came the Sabbatum Magnum (Holy Saturday or Easter Eve) with its vigil, which in the early church was associated with an expectation that the second advent would occur on an Easter Sunday.

For details of the ceremonial observed in the Roman Catholic Church during this week, reference must be made to the *Missal* and *Breviary.* In the Eastern Church the week is marked by similar practices, but with less elaboration and differentiation of rite. *See* also EASTER, GOOD FRIDAY, MAUNDY THURSDAY, PALM SUNDAY and PASSION WEEK, and article "Holy Week" in the *Catholic Encyclopaedia.*

HOLYWELL (*Tre'ffynnon,* well-town), a small town of Flintshire, north Wales, situated on a height near the left bank of the Dee estuary. Pop. of urban district (1921) 2,908. The

parish church (1769) has some columns of an earlier building, and a strong embattled tower. The remains of Basingwerk abbey (*Maes glas*, green field), partly Saxon and partly Early English, are near the L.M.S. station about 2 m. from the town. It was used as a monastery before 1119, and in 1131 Ranulph, earl of Chester, introduced the Cistercians. It was dissolved in 1535, but used in after years as a Roman Catholic burial place. Scarcely any traces remain of Basingwerk castle, an old fort. St. Winifred's well is a place of pilgrimage for Roman Catholics. The well itself is covered by a fine Gothic building, said to have been erected by Margaret, mother of Henry VII., with some portions of earlier date. In 1870 a hospice for poorer pilgrims was erected. There was some metalliferous mining in the region in the 19th century, though this has become relatively unimportant.

HOLYWOOD, a seaport of Co. Down, Ireland, on the east shore of Belfast Lough, 4½ m. N.E. of Belfast by rail. Pop. (1921) 4,035. A religious settlement, founded in the 7th century, later became a Franciscan monastery. Its site is marked by a church dating from the late 12th or early 13th century. A solemn league and covenant was signed here in 1644, and the document is preserved at Belfast. Holywood is now a residential area of Belfast.

HOLZ, ARNO (1863–), German writer, was born on April 26, 1863, at Rastenburg, East Prussia, son of a chemist. At the age of 12 he went to Berlin. His early lyric poetry attracted considerable attention, but his principal work, undertaken often in collaboration with J. Schaf, has been critical. In *Die Kunst, ihr Wesen und ihre Gesetze* (1890–92) Holz really inaugurated the German impressionist school. In his *Revolution der Lyrik* (1899) he rejected rhyme, strophe and rhythm and all verbal music, maintaining that poetry must live by its meaning alone. His two volumes *Phantasus* (1898–99) were written on this theory. Holz's original work, which includes verse, fiction and numerous dramas, fell short of greatness, but he exercised a notable influence on the entire current of German literature. His collected works were published in 10 vols. (1924–25) and in 12 vols. (1926).

HOLZMINDEN, a town of Germany, in the republic of Brunswick, on the Weser, at the foot of the Solinger Mountains, 56 m. S.W. of Brunswick. Pop. (1925) 12,192. It obtained municipal rights from Count Otto of Eberstein in 1245, and in 1410 it came into the possession of Brunswick. The town depends on agriculture, the manufacture of iron and steel wares, and of chemicals and artificial manures. There are also polishing-mills for sandstone. It has river trade on the Weser.

HOLZTROMPETE (Wooden Trumpet), an instrument somewhat resembling the Alpenhorn (*q.v.*) in tone-quality, designed by Richard Wagner to represent the natural pipe of the peasant in the performances of *Tristan und Isolde* at Bayreuth, but since 1891 superseded by W. Heckel's clarina, an instrument partaking of the nature of both oboe and clarinet.

HOMAGE, one of the ceremonies used in the granting of a fief, and indicating the submission of a vassal to his lord. It could be received only by the suzerain in person. With head uncovered the vassal humbly requested to be allowed to enter into the feudal relation; he then laid aside his sword and spurs, ungirt his belt, and kneeling before his lord, and holding his hands extended and joined between the hands of his lord, uttered words to this effect: "I become your man from this day forth, of life and limb, and will hold faith to you for the lands I claim to hold of you." The oath of fealty, which could be received by proxy, followed the act of homage; then came the ceremony of investiture, either directly on the ground or by the delivery of a turf, a handful of earth, a stone, or some other symbolic object. Homage was done not only by the vassal to whom feudal lands were first granted but by every one in turn by whom they were inherited, since they were not granted absolutely but only on condition of military and other service. An infant might do homage, but he did not thus enter into full possession of his lands. The ceremony was of a preliminary nature, securing that the fief would not be alienated; but the vassal had to take the oath of fealty, and to be formally invested, when he reached his majority. The obligations involved in the act of homage were more general than those associated with the oath of fealty, but they provided a strong moral sanction for more specific engagements. They essentially resembled the obligations undertaken towards a Teutonic chief by the members of his *comitatus* or *gefolge*, one of the institutions from which feudalism directly sprang. Besides *homagium ligeum*, there was a kind of homage which imposed no feudal duty; this was *homagium per paragium*, such as the dukes of Normandy rendered to the kings of France, and as the dukes of Normandy received from the dukes of Brittany. The act of liege homage to a particular lord did not interfere with the vassal's allegiance as a subject to his sovereign, or with his duty to any other suzerain of whom he might hold lands. (*See* FEUDAL LAWS.)

The word was formerly used of the body of tenants attending a manorial court, or of the court in a court baron (consisting of the tenants that do homage and make enquiries and presentments, termed a *homage jury*).

HOMBERG, WILHELM (1652–1715), Dutch natural philosopher, was born at Batavia (Java) on Jan. 8, 1652. He went to Europe in 1670, to study law at Jena and Leipzig, and in 1674 he became an advocate at Magdeburg. In that town he made the acquaintance of Otto von Guericke. He graduated in medicine at Wittenberg and settled in Paris in 1682. From 1685 to 1690 he practised as a physician at Rome; returning to Paris in 1691, he was elected a member of the Academy of Sciences and appointed director of its chemical laboratory. Subsequently he became teacher of physics and chemistry (1702), and private physician (1705) to the duke of Orleans. He died at Paris on Sept. 24, 1715. Homberg was not free from alchemistical tendencies, but he made many solid contributions to chemical and physical knowledge, recording observations on the green colour produced in flames by copper, on the crystallization of common salt, on the salts of plants, on the saturation of bases by acids, on the freezing of water and its evaporation *in vacus*, etc. Much of his work was published in the *Recueil de l'Académie des Sciences* from 1692 to 1714. The *Sal Sedativum Hombergi* is boracic acid, which he discovered in 1702, and "Homberg's phosphorus" (fused calcium chloride) is prepared by heating sal-ammoniac with quick lime.

HOMBURG-VOR-DER-HÖHE, a town in the Prussian province of Hesse-Nassau, situated at the foot of the Taunus Mountains, 12 m. N. of Frankfort-on-Main, by rail. Pop. (1925) 16,287. Homburg consists of an old and a new town; the latter was founded by the landgrave of Hesse-Homburg Frederick II. (d. 1708), and came into repute as a watering-place in 1834. On a neighbouring hill stands the palace of the former landgraves, built in 1680. The White Tower is said to date from Roman times, and certainly existed under the lords of Eppstein, who held the district in the 12th century. There are eight mineral springs. The industries embrace iron founding and the manufacture of leather, sugar, biscuits and hats. The prosperity of the town is largely due to the annual influx of visitors. In the neighbourhood lies the ancient Roman castle of Saalburg.

Homburg is also the name of a town in the Saar territory of Bavaria. Pop. (1925) 10,054. It manufactures iron goods. In the neighbourhood are the ruins of the castles of Karlsberg and of Hohenburg. The town came into the possession of Zweibrücken in 1755 and later into that of Bavaria.

HOME, EARLS OF. Alexander Home or Hume, 1st earl of Home (*c.* 1566–1619), was the son of Alexander, 5th Lord Home (d. 1575), who fought against Mary, queen of Scots, at Carberry Hill and at Langside, but was afterwards one of her most stalwart supporters, being taken prisoner when defending Edinburgh castle in her interests in 1573 and probably dying in captivity. He belonged to an old and famous border family, an early member of which, Sir Alexander Home, was killed at the battle of Verneuil in 1424. Sir Alexander (d. 1491) was created a lord of parliament as Lord Home in 1473, being one of the band of nobles who defeated the forces of King James III. at the battle of Sauchieburn in 1488.

Alexander 6th Lord Home (d. 1619) was warden of the east marches, and was often at variance with the Hepburns, a rival

border family whose head was the earl of Bothwell. Home accompanied James to England in 1603 and was created earl of Home in 1605; he died in April 1619.

His son James, the 2nd earl, died childless in 1633 when his titles passed to a distant kinsman, Sir James Home of Coldingknows (d. 1666), a descendant of the 1st Lord Home. This earl was in the Scottish ranks at the battle of Preston and lost his estates under the Commonwealth, but these were restored to him in 1661. His descendant, William, the 8th earl (d. 1761) fought on the English side at Prestonpans, and from his brother Alexander, the 9th earl (d. 1786), the present earl of Home is descended. In 1875 Cospatrick Alexander, the 11th earl (1799–1881), was created a peer of the United Kingdom as Baron Douglas, and his son Charles Alexander, the 12th earl (1834–1918), took the additional name of Douglas. The principal strongholds of the Homes were Douglas castle in Haddington and Home castle in Berwickshire.

See H. Drummond, *Histories of Noble British Families* (1846).

HOME, DANIEL DUNGLAS (1833–1886), Scottish medium, was born near Edinburgh, March 20, 1833, his father was said to be a natural son of the 10th earl of Home. He went with his mother to America, and on her death was adopted by an aunt. In the United States he came out as a spiritualistic medium, though he never sought to make money out of his exhibitions. In 1855 he came to England and gave numerous séances, which were attended by many well-known people. Robert Browning gave his impression of Home in the unflattering poem of "Sludge the Medium" (1864) Home had many disciples, and gave séances at several European courts. He became a Roman Catholic, but was expelled from Rome as a sorcerer. Home published two volumes of *Incidents of my Life* and *Lights and Shadows of Spiritualism*. He died at Auteuil, France, on June 21, 1886.

HOME, JOHN (1722–1808), Scottish dramatic poet, was born at Leith. Graduating M.A. at Edinburgh university he was licensed to preach by the presbytery of Edinburgh in 1745. In July 1746 Home was presented to the parish of Athelstaneford, Haddingtonshire. His first play, *Agis: a tragedy*, founded on Plutarch, was rejected by Garrick. The ballad of *Gil Morrice* or *Child Maurice* (F. J. Child, *Popular Ballads*, ii. 263) supplied him with the outline of the simple and striking plot of *Douglas*, on which he spent five years' labour. The play was rejected by Garrick, but was produced in Edinburgh on Dec. 14, 1756 with overwhelming success, in spite of the opposition of the presbytery, who summoned Alexander Carlyle to answer for having attended its representation. Home wisely resigned his charge in 1757, after a visit to London, where *Douglas* was brought out at Covent Garden on March 14. Peg Woffington played Lady Randolph, a part which found a later exponent in Mrs. Siddons. Gray said that the author "seemed to have retrieved the true language of the stage," but Samuel Johnson held aloof from the general enthusiasm. Home died at Merchiston Bank, near Edinburgh, on Sept. 5, 1808

The Works of John Home were collected and published by Henry Mackenzie in 1822 with "An Account of the Life and Writings of Mr. John Home." Poems omitted from this edition are printed in vol ii. of *Original Poems by Scottish Gentlemen* (1762). *See* also Sir W. Scott, "The Life and Works of John Home" in the *Quarterly Review* (June, 1827). *Douglas* is included in numerous collections of British drama.

HOME ECONOMICS. This is a phrase now widely used in the United States to describe a subject of study which would in the past have been called "domestic economy." The range of types of the teaching of home economies is wide, as the subject is taught in elementary schools, high schools, vocational schools, private schools for girls, technical schools, colleges, universities and schools or colleges for teacher training. A further type of teaching is offered by the extension service of the U.S. department of agriculture, the home economics staff (women) doing their work through lectures, demonstrations, printed matter and the training of local leaders. This extension work is done chiefly in rural districts, but in some States there is similar work in cities. The vocational work is under the direction of the Federal board of vocational education.

In the institutional field the opportunities are many. Hospitals, sanitoriums, homes for the aged or for children, homes for the handicapped, such as the blind and crippled, employ "dietitians," "dietitian"-housekeepers or housekeepers trained in home economics. Private schools employ "dietitians," housekeepers and matrons so trained. All these positions are usually resident. Tearooms, cafeterias and restaurants employ many trained women in different capacities and are frequently owned by women. Many social welfare organizations, such as charity organization societies, have home economics departments, and these, as well as some hospitals, employ trained women as "visiting housekeepers." They are employed also in health centres, social settlements and other welfare enterprises.

Training for work as budget consultant is part of home economics, and such specialists are employed by banks, welfare organizations and a few department stores. A few are established privately as budget consultants. Women's magazines and some newspapers have home economics workers, often specialists in one or another part of the field.

Those who have done advanced work in physiological chemistry, textile chemistry or some other branch of science with applications to home economics, may do laboratory or research work. Manufacturing and distributing firms whose product is food or household equipment employ trained home economics women as an adjunct to the advertising department. This staff plans the educational work of the firm, plans and prepares leaflets and matter for advertising pages, and co-operates with the advertising department to make sure that all information given to the public is accurate and helpful. Advertising firms sometimes employ a home economics woman for service to their clients, and this may include speaking over the radio, which is popular as a means of advertising foods and household equipment

For the work described, professional training is necessary. Some women not so trained are now employed in some of the fields other than teaching, but the necessity for training is recognized more each year, so that it is increasingly difficult for a woman with inadequate or no training to secure and hold such positions.

(I. E. L.)

HOME OFFICE: *see* GOVERNMENT DEPARTMENTS.

HOMER (Ὅμηρος), the traditional epic poet of Greece. The name is especially applied to the author of the two great epic poems, the *Iliad* and *Odyssey* (ἡ Ἰλιὰς πόησις, ἡ Ὀδυσσεία πόησις), which were recited or performed by rhapsodes at the Panathenaea at Athens, every four years during the classical period. An analysis of their contents will be found under the title HOMERIC POEMS, together with an account of the rest of the Homeric cycle.

The great books which come from an age before literary record are sometimes anonymous, like the Eddas, sometimes attributed to famous figures in the tradition, as the Psalms in mass to David and the Pentateuch to Moses, sometimes to a definite but unknown person, as the *Chanson de Roland* to Thorold, sometimes to gods or mythical characters, like the poems in Book X. of the *Rigveda*. The special difficulty about Homer is that, whereas David and Moses have an independent existence, whether or no they wrote the works ascribed to them, Homer has not: he is nothing but the author of the Homeric Poems. The poems are facts and "Homer" a hypothesis to account for them.

Lives of "Homer."—There are indeed certain traditional "Lives of Homer." Eight are published in the Oxford text of Homer, vol. 5, together with the *Contest of Homer and Hesiod*. The longest and best is composed in Ionic Greek under the name of Herodotus. The dates of these lives are hard to determine, particularly since the latest may contain nuclei of ancient tradition. But it seems likely that the demand for a life of Homer arose at least as early as the general interest in literary biography in Greece, *i.e.*, about the time of Aristotle; and that, when it arose, there was no material for satisfying it beyond romance and conjecture. The existing lives seem to be made up out of deductions from certain passages in the Homeric poems and from proverbs and popular verses. The Lives quote many of these; sometimes lines about particular places—Smyrna and Kyme (Epigr. iv.), Erythrae (Epigr. vi., vii.), Mt. Ida (x.), Neon Teichos

(i.), sometimes about particular trades or occupations—potters, sailors, fishermen, goatherds, etc. The verses are attributed to Homer, and occasions are invented for his uttering them. Similarly various characters in the epics, Mentes, Mentor, Tychius etc., are explained as real persons whom he rewarded or punished by putting them into his books. There is romance in the conception of the divine poet, blind, old and poor, wandering from city to city; and it may well be real history which, amid the many varying stories, always brings Homer from Ionia, and almost always from that part of Ionia which was originally Aeolic.

Seven cities are recorded as claiming to be Homer's birthplace: "Smyrna, Chios, Colophon, Salamis, Rhodos, Argos, Athenae," but it is not always the same seven. Kyme, Ithaca, Ios, Pylos come in some lists, while Sparta, Egypt and Babylon also compete. Many of these fall away as obvious inventions; Sparta comes from the Lycurgus romance; Egypt and Babylon belong to the conception of Homer as "all-wise," full of the learning of the east. Smyrna and Chios have the most support, followed by Kyme and Colophon.

As to Homer's date, the pseudo-Herodotean *Life* puts his birth at 1102 B.C. Elsewhere the estimates vary from 685 B.C. (the historian Theopompus) to 1159 B.C. (certain authorities in Philostratus). Herodotus considers that "Homer and Hesiod" made the Greek pantheon "not more than 400 years before me": *i.e.*, about 830. Aristarchus puts his floruit at 1044 B.C. These dates seem to be based on the date of the Trojan War and a conjecture of Homer's relation to it.

Sometimes one can place a poet's date and nationality by his dialect. But the Homeric dialect has no contemporary parallel by which it can be judged, and as it comes to us in the poems is clearly not a dialect that was ever spoken, but one created by the epic tradition, and even by the hexameter metre, for its own purposes. In the main it is an Ionic dialect, like an early stage of that written by Herodotus; but the surface of the poems has been unconsciously Atticized, an inevitable result of the Panathenaic recitation and the Athenian book trade. When this surface corruption is removed we find many non-Ionic forms which have all the appearance of being Aeolic—the dialect of Thessaly, Lesbos and Aeolis. It is also clear that, where two forms are metrically equal, the Ionic form is generally preferred.

This would seem, by all analogy, to show that either the poem itself or at any rate the poetry which created the Epic dialect, had once been Aeolic, just as the people of Smyrna, Chios and the neighbourhood had. (The phenomenon is not uncommon in traditional poetry. Thus the English poem, Sir Degrevant, is shown to be taken over from a Norman original by the fact that, while the hero is normally called Degrevaunt, and of course remains so when required to rhyme with "avenaunt," "recreaunt," he becomes "Degrivauns" when he has to rhyme with "countenauns" and "Frauns." In Norman, "Degrevans" was nominative and "Degrevant" accusative.)

But beneath both the Ionic main stream and the Aeolic incidents there is an element of very old Greek, comprising many expressions which were not understood in classical or Alexandrian times, and many more which needed a commentary (*ἀμενηνὰ κάρηνα, διάκτορος ἀργειφόντης*). What is more remarkable, there are some forms (such as *ῥάναξ, πτόλις, κέραμος*) which are found in Cyprian and Arcadian, and nowhere else. That is, they belong to the ancient undivided language which survived in these two isolated and mutually remote dialects. The problem may be raised whether the Homeric dialect does not contain an element of the pre-Greek language of the Aegean, derived perhaps from pre-Homeric Minoan poetry. Doubtless there is such an element but it does not seem noticeably stronger in Homeric than in classical Greek (*cf.* Haber, *De Lingua antiquissimorum Graeciae Incolarum*, 1921.)

The Text of the Poems.—These observations, which seem at first sight so confusing, nevertheless yield a result. The man "Homer" cannot have lived in six different centuries nor been born in seven different cities; but Homeric poetry may well have done so. The man cannot have spoken this strange composite epic language, but the poetry could and did. Let us turn back therefore from the unknown man to the known book.

The works of Homer "and no other poet" (Lycurg. in Leocr. p. 209) were recited at the Panathenaea in accordance with a law attributed variously to "our ancestors," Solon, Hipparchus or Peisistratus. The "works" were the *Iliad* and *Odyssey*. They had to be recited *ἐξ ὑποβολῆς* or *ἐξ ὑπολήψεως*, *i.e.*, by giving or taking a cue; there was a fixed order, so that where one man left off another began. The custom continued at least to the times of the author of the pseudo-Platonic dialogue *Hipparchus*, and seems to have started with the foundation or re-foundation of the Panathenaea by Peisistratus.

If there was a fixed order, there must have been something like a written text; and as a matter of fact we find in the scholia an accepted tradition, supported by certain corruptions in the text, that the poems were once written in the old Attic alphabet, an archaic and awkward script with no double letters or long vowels. This tradition has been considered incredible on the grounds that the new, or Ionic, alphabet was used in Athens for literary purposes from very early times, the old script being purely for official documents; that Homer must have come to Athens in Ionic script; and finally that several passages in tragedy which describe the writing of heroic times always take the Ionic script for granted. (Eurip. *Theseus*, fr. 382 N.; Agatho fr. 4, Achaeus fr. 33, Theodectes fr. 6.) The conclusion seems to be that, if the Panathenaic text of the *Iliad* and *Odyssey* was ever written in the old Attic script, it must have been an official document, drawn up by order of the state.

There is some evidence that this was so. A tradition which Wolf described as *vox totius antiquitatis* speaks of a text or an arrangement, or recension, of the works of Homer by Peisistratus, tyrant of Athens between 560 and 527 B.C. The oldest witness is one Dieuchidas of Megara in the fourth century B.C., to whom may perhaps be added the Aristotelian Dicaearchus and the grammarian Crates, who founded the art of *grammatike* in Rome. (He was detained there by breaking his leg when on an embassy from Attalus II. to the Senate.) The clearest are writers of the early Roman period and various scholia and lexica. Cicero puts it that Peisistratus *primus Homeri libros, confusos antea, sic disposuisse dicitur ut nunc habemus* (is reported to have been the first to arrange in their present order the books of Homer, which were previously in confusion); Josephus says that Homer left nothing in writing; the poems were afterwards put together from the varying memory of different places; Suidas, the Lives, Eustathius and the Townley Scholia explain that Homer sang his poems *σποράδην*, "in a scattered way," as he travelled about, and that Peisistratus afterwards collected them. Pausanias, Aelian, Diogenes Laertius, mention or assume the tradition; indeed one may say that it is the accepted view of the grammarians with the exception of Aristarchus, who held that Homer himself was an Athenian.

Such authority is of course not conclusive. But there is very little of our grammatical record that has more ancient credentials, and even if there were no tradition at all, it is hard to conceive how the Panathenaic recitation could have been established without some editing of the poems, under the orders, presumably, of Peisistratus or his artistic son, Hipparchus.

There must then have been an authoritative Athenian text in the second half of the sixth century B.C. That is the earliest solid fact in the record of the Homeric poems. The curious thing is that this text did not maintain itself. There is little evidence affecting the text of Homer in the fifth century, after the fall of the Peisistratidae, but as soon as quotation becomes common, in the fourth and third centuries, it is clear that the current texts varied considerably both from one another and from our vulgate. Still more striking is the evidence of the early papyri, numbering about 200 which have been discovered since 1890. Eleven of these are earlier than 150 B.C.; the rest later. Roughly speaking those later than 150 B.C. generally agree with our present vulgate texts; of the eleven supposed to be earlier ten differ "wildly" from our vulgate and one (Pap. Ox. 1388), has proved to be later.

The Establishment of the Text.—Evidently something happened about 150 B.C. which reduced the current texts of Homer from disorder into order, and the grammatical tradition enables us to see what it was. It was about 150 B.C. that the famous Aristarchus of Samothrace, then head of the Alexandrian library, published the edition, or rather the two successive editions, of the text of Homer which were afterwards recognized as authoritative. This fact was for long obscured by the language of the scholia, which dwell on Aristarchus's extreme "caution" (εὐλάβεια) in treating the text and often seem to be in doubt what his reading really was. When he does not "condemn" a spurious line, that normally means that it had not yet made its way into the text. But it is clear that his caution did not prevent conjectures and large condemnations; and the occasional uncertainty as to his reading only shows that the current texts a few generations afterwards were not infallible and could not be trusted without further question. It seems probable, especially after the recent work of Cauer, Wecklein and Bolling, that the present vulgate text was approximately, at any rate, the text of Aristarchus. It is still disputed how far he created that text, and whether it is really some old text—that of Peisistratus, or even of Homer himself—re-established by the great critic out of the mss. which he collected.

It seems clear that from the time of Aristotle and Aeschines on to that of the earliest papyri the texts of Homer were in an extremely fluid state. (Aristotle for example cites from Homer five completely unknown phrases or passages; he quotes many passages in a strange shape; he found several passages not where we have them but in another context; and in order to show how short a *resumé* can be he remarks that Odysseus' story to Penelope in *Od.* xxiii. "occupies only 60 lines," while in our texts it only occupies thirty-three.) The first great Alexandrian scholar, Zenodotus of Ephesus (b. 325) set himself vigorously to cope with this confusion. He rejected freely passages which he thought spurious, and probably he found mss. which were considerably shorter than ours. He had not reached the wonderful knowledge of Homeric idiom which was the distinction of Aristarchus; but he had the advantage of catching the text at an earlier stage, and thus was spared some interpolations which had not yet been made, while he preserved many ancient readings and forms (*φὴ κύματα* B 144, *δαῖτα* A 5, *κυνύλαγμον* Φ 575, *ἀψ ἀπὸ Φωκήων* γ 307). His text must have been at least a thousand lines shorter than that of Aristarchus, and it was his vigorous pioneer work which made the "caution" of Aristarchus possible (see *infra*, "Study of Homer in Antiquity").

The Poems Before Aristarchus.—We find thus two stages of something like *terra firma* in the history of the Homeric text: the present vulgate, established (approximately) by a process which set in about 150 B.C. and was probably due to Aristarchus. Before that a long period of uncertainty, and then earlier, about 550 B.C., the so-called "Peisistratean recension," by which we can only mean the text in the old Attic script which was composed or used for the purposes of the Panathenaic recitation. This is the earliest stage of which we have any record; any suggestion about the previous history of the poems must rest on conjecture, and conjecture supported by little external evidence. Yet it is clear that the year 550 B.C. is an extremely late stage in the history of the Homeric poems, or at least of Homeric poetry. As in almost all departments of Greek literature only the latest growth was preserved; the last stage of the epic like the last of choric poetry, and the last of tragedy. We can at best try by different roads to pierce into this darkness.

1. Were the poems recited elsewhere before they came to Athens? It would seem at first sight probable. There certainly was a good deal of epic recitation; but of the *Iliad* and *Odyssey* no public recitation is recorded, and it is noteworthy that when Zenodotus and Aristarchus ransacked the Greek world for mss. they seem never to have lit on any fragment of a pre-Peisistratean ms. No Ionic *Iliad* or *Odyssey* seems to have been in existence in the third century B.C. This seems to show either that the poems had not been committed to writing before they came to Athens, or else that the poems written in Ionic, and recited for many generations at Ionian gatherings, were in some way completely outshone and driven out of the market by the Attic poems. At any rate there is no trace of an earlier written text of the *Iliad* or *Odyssey* as we know them.

2. For what occasion can the poems have been intended? As epics for reading they are wonderful, yet it seems certain that there was no large reading public in Greece in the sixth century B.C., much less in that far more remote period when Homeric poetry first took shape. As lays for ordinary recitation they are not suitable. A recitation ought not to last more than an hour or two, but the *Iliad* would last about twenty hours. And the poems are decidedly unities; they are not strings of separate lays or cantos. They absolutely refuse to fall apart into separate lays, as is proved by the subsequent history of Lachmann's famous attempt to make them do so. There were rhapsodes reciting Homeric poetry all over Greece in the sixth century; we hear of them at Sicyon, Sparta and Syracuse. But they can hardly have been reciting the *Iliad* and *Odyssey*. Those gigantic wholes must have been meant for some very great and rare occasion, such, for example, as the Panathenaea—the solemn gathering of all the Ionian cities to their Metropolis once every four years. If the poems were first written down in the time of Peisistratus it may well be that they first received their present form at that time. Indeed such would be the natural conclusion. For the rhapsode, at each performance that he gave, regularly drew both upon his memory and his invention. He knew the style, the language and the facts, and could begin his recitation from any point he chose, as bards in the *Odyssey* do. (*τῶν ἀμόθεν γε*, *Od.* i. 10. *ἔνθεν ἐλών*, *Od.* viii. 500.) For the new Pan-Athenian festival which he was founding Peisistratus would naturally have a special version or arrangement made.

3. Thus we cannot be certain that the poems in their present form existed before the sixth century, but we can be quite certain that everything but the form is vastly older. By form is here meant the selection and arrangement of the incidents. The subject matter, the language used in describing it, the poetical style, and above all the manners and customs of the society depicted belong to an age which can in part be dated and in part reaches back to the dimmest antiquity.

Internal Evidence.—In facing this problem the first thing to realise is that the poet is not naïvely describing the world as he himself knew it, but, like almost all narrative poets after him, describing with deliberate artistic purpose a long past age which he knew from earlier poets and from tradition. This is shown not merely by the occasional contrast between the heroes and "men as they now are" (*οἷοι νῦν βροτοί εἰσι*, cf *Il.* xii., 14 *sqq.* xx., 302 *sqq.*), but much more by the fact that a number of customs are mentioned in metaphors and similes which are carefully excluded from the narrative itself.

Thus in the narrative there are no trumpets, no garlands, no eating of fish (except by starving men, *Od.* xii. 331, iv. 368), fowl, vegetables, milk or boiled meat; but most of these things were evidently known to the poet and occur in similes or descriptions. Paintings are not mentioned, nor yet coins; a statue, and a sitting statue, is once implied but not directly mentioned (*Il.* vi. 303); the art of writing is left doubtful, but any direct mention of it is skilfully avoided and the scholiasts left to take divergent views (*Il.* vi. 168, vii. 175 with schol.). Cavalry is never mentioned (*Od.* xviii. 263) though riding is known: the use of cavalry was extremely old, but the chariot was more "heroic." In a similar archaizing spirit there is no mention of colonies, nor of the great "modern" Ionian trading cities like Miletus, just as there are no Dorians; yet the mask slips, for we hear of an old Sicilian woman (*Od.* xxiv. 211, 366, 389) possibly of a colony (*Od.* x.108 ?Artakia), and a good deal about certain Heracleidae, who were the Dorian chieftains (*Il.* v., 628, ii. 653) and still more about their ancestor Heracles.

There are abundant "arts and crafts": a famous cup, brooches, belts, necklaces of amber and gold, stained ivory, ivory reins, and a shield from the divine smithy which surpasses the handi-

work of man, but is doubtless modelled on it. As to food, the scholiasts remark that "the heroes" took three meals a day, and each meal consisted of the roast flesh of the larger quadrupeds. The recurrent phrase "unspeakable flesh and sweet strong wine" (*κρέα ἄσπετα καὶ μέθυ ἡδύ*) betrays the admiration felt by a later generation for such heroic tastes. The dead are burned. The bale-fires make a vivid stain in the scenery of the epic. The Greeks had always the custom of burial, and had mostly not enough wood for pyres. The weapons are made of bronze (*χαλκός*).

Homer like Hesiod knows of a time when "black iron was not," except indeed as a material for tools, clubs, arrowheads and other easily workable objects. He knows, as Aristotle knew, that the classical Greek custom of the marriage-dowry was recent, and that in the old days "they bought their women" by giving bride-gifts (*ἕδνα*). It is wonderful how clearly these last three customs are realized, and how carefully the illusion is kept up. There is a slip in the use of a late proverb "iron of itself draws a man on" (*Od.* xvi. 294, xix. 13) where "iron" is used for "a weapon"; and once or twice the word *ἕδνα* is used as if it meant "dowry" (*Od.* i. 277, ii. 53,196). But in the main the picture of the heroic age is wonderfully well maintained. The schools of bards must have had a fine training in the tradition, though we must remember also that our present text has passed under the eyes of many jealous critics before its final revision by Aristarchus.

For the fact is that the Scholia, or remains of ancient commentaries, with which the *Iliad* is richly provided and the *Odyssey* not deficient, are more occupied with the distinction of the Homeric from the non-Homeric (or "more recent") than with any other problem. Aristarchus and his disciples have lynx eyes for subtle points of language, belief and custom. It is no exaggeration to say that modern scholarship had no conception of many subtle uses of words in Homer until the Scholia to the ms. called Venetus A were published by Villoison in 1788. (*E.g.*, that *φόβος* is "flight," *δέος* "fear," *τρεῖν* is "retire," not "to tremble," *θῦσαι* "to cense," not "to slaughter"; that *φράζω* is "to point out," not "to say," *σῶμα* is "a dead body"; *σχέδον* "near," not "almost," *πάλιν* "backwards," not "again," *τάχα* "quickly," not "perhaps," *γράφειν* "to scratch," not "write".) And the observation of customs was almost equally acute. The explanation seems to be clear. It is not to be supposed that either Peisistratus or Aristarchus had access to a flawless ms. many centuries old by which variations could be checked; but there were traditional texts and a traditional knowledge, both in the schools of bards and to a less extent among the critical public, by which all variations or new compositions could be tested and kept true to standard. It is most instructive to see how those remains of ancient epic which were not selected for the great recitation and thus fell into neglect break all the Homeric rules in language, verse and custom alike, while on the other hand they never approach, as many passages in Homer do, to the lyrical hexameters characteristic of the fifth century.

Study of Homer in Antiquity.—The critical study of Homer, that is, of the mass of epic literature concerned with the heroic saga, began in Greece, as Monro says, "almost with the beginning of prose writing." The first names recorded are those of Theagenes of Rhegium (6th century B.C.) and his pupil Metrodorus of Lampsacus. In the fifth century educated men from the impoverished islands and cities of Ionia sought a living in Athens by teaching literature and especially Homer. A typical instance is the adventurer Stesimbrotus of Thasos. From this time onward the study of Homer was a regular feature of Greek *mousike*.

It is noteworthy that, from the very first, exegesis took two forms: explanation of the *glossae*, or hard words, and allegorical interpretation and justification of the subject matter. The principle set out in the *Homerica Problemata* of Heracleitus (1st century A.D.) "If Homer used no allegory he committed all impieties" (*εἰ μηδὲν ἠλληγόρησεν πάντα ἠσέβησεν*) was, as one can see from Plato, accepted early, and regarded as a natural thing. On this system Hera was the Air (*ηρ-α = α-ηρ*), the adultery of Ares and Aphrodite was the combination in the world of Strife and Love, and so on.

The interpretation of glosses is mentioned in Aristophanes, *Daitales* frag. 222, where a father asks his son the meaning of *κόρυμβα* and *ἀμένηνα κάρηνα*. Many strange interpretations, recorded in the Scholia as coming from "the glossographi" serve to illustrate these painful beginnings of the science of *grammatike*. The phrase *νέκρους κατατεθνηώτας* ("the dead corpses") was objected to as tautologous. "No," said the glossographi, *Νεκροι = νέρι*, "young men," with *κρ* "added for euphony." *Τοῖος* was interpreted as *ἀγαθός*, a meaning of course which it sometimes implies (*τοίου γὰρ καὶ πατρός Od.* iv. 206, and even *τοῖο γέροντος* as *ἀγαθοῦ γέροντος Il.* xxiv. 164). It is noteworthy that Aeschylus actually uses *τοῖος* as "good" (Suppl. 400), and so, it is said, did Callimachus.

Many individuals are recorded as having made a text of Homer. Probably it was a common thing for students and poets, such as Antimachus and Philetas, instead of buying a book from a shop, to write out their own text. We hear that Plato's library passed on eventually to the library at Alexandria, which may account for the close resemblance of the Homeric quotations in Plato to our vulgate. Aristotle makes many interesting criticisms on the poems from the aesthetic point of view, but seems to have had a text widely differing from ours. Among fourth-century critics was Zoilus *Ὁμηρομάστιξ*, who shocked public opinion by his attacks on Homer.

The first approach to a really scientific treatment of the poems was made by the great scholars of Alexandria, Zenodotus (d. 260? B.C.), Aristophanes of Byzantium (about 262–185) and Aristarchus of Samothrace, who resigned his post as head of the Alexandrian library in 137 B.C. The work of Zenodotus is still something hard to appreciate. We can see that the texts of Homer in his time fluctuated wildly and in order to establish a fairly "correct" text he had to cut his way boldly through a jungle. His rejections, as recorded in the scholia, are very extensive; his Iliad must have been very much shorter than the present vulgate. He frequently rejected passages for "unseemliness," *διὰ τὸ ἀπρεπές* (*see* below, "Expurgation"). We often hear of lines which Aristarchus or some later scholar doubted, but Zenodotus *οὐδὲ ἔγραφεν*. This used to be explained as a sign of his recklessness; but, as Professor Bolling of Ohio has pointed out, there has been, as far as our record reaches, a constant tendency to add lines to the Homeric text, and probably the statement that Zenodotus "did not even write" a line means that it did not exist in his day.

Zenodotus had nothing like Aristarchus's delicate and intimate knowledge of Homeric idiom: he thought that the dual (which had disappeared by his day) was merely another form of the plural; he was capable of such a metrical solecism as *προφανείσας ἰδών* (*Il.* viii. 378). On the other hand he seems often to have preserved ancient forms and readings which were rejected afterwards by Aristarchus (*ἄψ ἀπὸ Φωκήων Od.* iii. 307; *φὴ = ὣς Il.* ii. 144, xiv. 499; *ἐπεὶ κυνυλαγμὸν ἀκούσῃ Il.* xxi. 575).

Our knowledge of Aristarchus comes chiefly from the rich scholia to the Venetus A, first published by Villoison in 1788. They quote largely from four scholars Aristonicus (Augustan era), Didymus (who wrote against Cicero De Republica), Herodian and Nicanor (2nd century A.D.). They are sometimes in doubt about Aristarchus's views, and evidently possessed no ms. which could be held as authoritative. We learn from them of his *σημεῖα* or signs, which frequently occur in the Venetus A itself. One would have expected, considering the very imperfect state of Greek *γράμματα* at the time, with no system of punctuation or even of dividing word from word, that any new "signs" would have been devoted to supplying this want; but Aristarchus's signs deal chiefly with the genuineness or spuriousness of particular lines. There was also a sign (*diple*, like a V on its side) to give the reference to a note; and another to call attention to mistakes of Zenodotus (*diple* with dots).

His critical material comprised many mss. *κατὰ πόλεις* and several *κατ' ἄνδρα*. The latter were the work of individual scholars, the former apparently those used by certain cities for the public official recitations. He never mentions the Athenian

recension, evidently because he assumes it as his basic text. He speaks of the "better" or "more careful" texts, and the "common," "ordinary," and of one as ἡ πολυστίχος ("of many lines"). He evidently had no access to any text or fragment of text earlier than the Athenian recension, and shows no sign of having any which went back to the sixth or even the fifth century. With this imperfect material and the help of Zenodotus' pioneer work Aristarchus produced a text which immediately won recognition as the classical recension of Homer in antiquity and was probably, though the point is still disputed, the foundation of our present vulgate. Certainly, of our existing papyri, those written before the time of Aristarchus (150 B.C.) differ widely, while those later are almost uniform.

Aristarchus did even more remarkable work in exegesis. He not only corrected the errors of the glossographi in explaining the obsolete words, he observed with great acuteness the peculiar Homeric uses of common words (*see* above). He distinguished dual and plural; he saw that in Homer ὁ ἡ τό was a pronoun, and he rejected the theories of Homer's allegory of universal knowledge. On the other hand his grammatical explanations often betray the infancy of the science (the first Greek grammar was the work of his disciple Dionysius Thrax). For example he uses freely the theory of "enallage" or "change of case": Ἵπποτα is "the vocative instead of the nominative"; in τὸν δὲ σκότος ὅσσε κάλυψεν, τὸν is "instead of τοῦ."

The Heroic Age.—The poems, even as they stand now, approximately in the form fixed for them by Aristarchus, nearly a thousand years later than the events they profess to describe, have an almost entirely consistent style and phraseology and give an almost entirely consistent description of the age about which they write. Of course "consistent" is by no means the same as "true." Yet, though we have practically no direct information about the Homeric age, we can, by analogy from other literatures better supplied with contemporary history, understand its general character and see that the description seems to be based on fact. The poets described a society which they did not themselves know and could not well have invented, but which corresponds closely to a type known to have existed elsewhere under given conditions. It was easy, of course, for a romantic Greek bard to make his ancient heroes ignorant of iron weapons and the art of writing, or to imagine an idyllic princess washing the royal clothes in the river.

But there are other characteristics of the age which can hardly be inventions. The heroes of Homer belong to a *Wanderzeit*. The kings had, in general, no national territories and no strong ties of kindred; they depended on their "companions" (ἑταῖροι, *comites*) or personal followers, who were largely adventurers like themselves. They are untroubled by the sanctities and duties attaching to the tribe or to the buried tribal ancestors. They practise no arts but song and war. They carry their wealth about with them in the form of brooches, belts, rich armour, necklets and caparisons. They burn their dead, they build no temples but worship at altars in the open air: and they worship a collection of gods who are just like themselves, gods who feast and sing and conquer and utter judgments, but who never work, have never created a world—only conquered and divided it—and who are to an extraordinary degree rootless and international. They stand or fall by their personal qualities; their strength and courage, their faithfulness and military honour, and the fact that since they fear no one they never tell a lie.

The above picture needs qualification if we take account of details; *e.g.* the *Odyssey* is a romance of the return of the wanderer, and implies the existence of a real home; the catalogue of ships in *Iliad* ii. gives geographical kingdoms to all the heroes. But in the main it is true, and it corresponds to the type of society that we find in many parts of the world under particular historical conditions. It occurs where an old and rich civilization is in process of being broken up by barbarian conquerors. It is the type called by Professor Chadwick a "heroic age," and can be traced in northern Europe during the break-up of the Roman empire, in the Balkans during that of the Greek empire, and in other parts of the world that have produced heroic poetry. The description of Attila's camp by the Byzantine historian Priscus is curiously Homeric in its details. (*See* Gibbon, ch. xxxiv.)

Discoveries.—This discovery has changed the character of the problem of the Homeric age. We saw above that the poets were consciously describing an age long past and notably different from their own. We now see that they were not merely describing a sort of "youth of the world," remarkable chiefly for a rude idyllic simplicity in which the contrast is between "Homer" and οἱ νεώτεροι. Nor yet were they, as Schliemann's great discoveries first suggested, depicting the great age of Troy, Mycenae and Cnossus. It was a particular period in history, to be contrasted both with the rich decadent civilization that went before and the peculiar classic Hellenism which came after.

The first palaces of Crete must have been built about 2000 B.C., and not long after there are signs of that movement of the Aryan tribes which was to have such incalculable effects on human history. The second town of Troy was laid under seven feet of ashes; at Orchomenos, Corinth and Argos citadels were destroyed and rebuilt, apparently by Northern conquerors. The northern "*megaron*," or hall with a porch and central hearth, begins to be found in Greece. Hitherto the "Kefti" or Men of the Isles have been in close connection with Egypt, but about 1700, when the Hyksos dynasty largely cut that country off from civilized commerce, the Cretan cities begin to turn more to Greece. Argos learns to grow the vine and olive; it adopts the Cretan woman's dress and the Cretan frescoes, while it still keeps its northern beard and tunic and *megaron*. A century or so later perhaps the Aryan invaders, or Achaioi(?), take to the sea. They had first called the sea by an "Aegean" or pre-Hellenic word, θάλασσα; then they called it ἅλς, "the salt"; it may be significant that at last they used the name πόντος, a good Greek word meaning "path." It was a path that led both to Crete and to Egypt. About 1450, Phaestus and other Cretan palaces were destroyed. For some 50 years Cnossus ruled alone: then comes the destruction of Cnossus itself—a sudden attack, it would seem, in the midst of some great court ceremony—and the end of the Minoan empires. After about 1400 B.C. only Mycenean work is found in Egypt, not Cretan.

Achaioi from Mycenae seem to take the vacant place. In Crete the royal tomb becomes a common pit; portraits of chieftains wear the northern beard and moustache. New towns are called by Achaean names; there is a decline in art and a cessation of wall-painting. It is significant, too, that after this date there is no further mention of the Kefti in Egyptian records.

Civilization has gone back but is by no means destroyed. Writing remains and there are signs of abundant wealth and mass production for commercial purposes. Speculative historians have fancied that in the Tell-el-Amarna letters and other records of this period they find some of the great names of Greek saga, an Alaksandus of Uilusa who reminds them of Alexandros of Ilion, an Attarissyas of Ahhia or Ahhijava who sounds remotely like Atreus the Achaean. With much more probability we begin now to identify names of various peoples, or at least hordes of men, who are known to Greek tradition.

At the battle of Kadesh in 1290 the Hittites had in their motley host Iliouna, Dardanoui, Masa, Pedasa, Kerkisha, Loukki and Danaouna. If the terminations -na and -sha denote "peoples" or "hosts," as Egyptologists suggest, we can hardly be wrong in recognising at least the people of Ilion, the Dardanoi, Lukioi and Danaoi. About 1230 and 1225 Merneptah of Egypt defeats in the Delta "uncircumcised Akhaiusha" "from the sea-lands," "who fight to fill their belly daily." With them are Toursha, Shardina, Loukki and Shakalasha, wanderers who may have given their names afterwards to the Tyrseni, the Sardinians, Lycia and Sagalassus. About 1194 Rameses defeated a similar locust-like multitude advancing "by sea and land, with women and children in ox-carts." They had destroyed the Hittite empire and "no people had stood before them."

Troy.—Most of the cities they destroyed have perished without

record, but Greek tradition tells us that the great sixth city of Troy, Homer's Troy, was sacked about this date. It was sacked, after a long siege perhaps, by a host that may be called indifferently Akhaiu-sha or Danaou-na—Homer has also a third name, Argeioi—and who are led by a "king of men" who is "lord of many islands" and has doubtless gathered in his thousand or twelve-hundred ships a great force of "the peoples of the sea." (Greek legend also makes Agamemnon and Menelaus joint kings of Sparta, or one of Mycenae and one of Sparta; it also involves them in some ritual king myths; but it is perhaps not rash to detect an element of real history in the Homeric picture.) The fall of Troy seems to be the sign or cause of the final crash. About 1200 the infiltration of further West-Greek tribes becomes a regular invasion. The pirates, or "peoples of the sea" receive an increase both from new "Dorian" invaders and from the broken men of the old Minoan or Achaian kingdoms, but by now there is little rich plunder left. It is a time of συνεχεῖς στρατεῖαι καὶ μεταναστάσεις, "constant warfarings and uprootings" (Diodorus v. 80: *cf.* Thuc. i., 2).

Homer's narrative of the siege of Troy is doubtless related to the real siege much as the Norse or German or French poems are related to the actual brutalities of the age they describe. The facts have been idealised and transfigured by memory, and confused with abundant myth, folklore and fiction; but some of the truth can be descried, as in a palimpsest, beneath the poetry. We can see in the first book of the *Iliad* a plague-stricken army, or mob of mixed peoples under diverse leaders, pinned to the barren sea shore, the narrow space choked with dead dogs and mules, the piles of burning corpses, the best fighting force in mutiny because of a quarrel about a captured woman; and the various bands "fighting to fill their bellies daily" by raids on the exhausted neighbourhood. At the end of Book VII., on the arrival of a wine-ship, we see the soldiers selling all they have, bronze, iron, shields, cattle and captives, for liquor and lying all night long on the beach under a thunderous sky.

We can also see, not from direct statements in the Homeric poems, but from implications there and direct statements in the rest of the poetic tradition, that the fall of Troy was the beginning of a dark age. If Troy fell the rest of Achaian Greece fell with it, including Thebes, Argos and Mycenae. The great kingly houses disappear. The *epos* knows little of the after history of the Homeric heroes except a disastrous series of so-called "returns"; the conception belongs to a later age which conceived these wandering hordes as the armies of regular Greek cities. The sons of Agamemnon, Achilles and Ajax and Odysseus are just remembered, but after them there is darkness.

We are justified therefore in recognising the siege and destruction of the sixth city of Troy, about the year 1200 B.C., as forming the historical nucleus of the poems, just as the defeat of Charlemagne's rearguard by the Basques in the valley of Roncesveaux is the historical nucleus of the Chanson de Roland. The real Hrodland, count of the march of Britanny was killed in that battle on Aug. 15, 778; our existing *Chanson de Roland* was written soon after 1066, three hundred years later. But we know that songs or lays on the subject were soon composed: they are mentioned as widely known (*vulgata*) in a book written less than 60 years after the battle (Life of Louis I., in Pertz SS. ii. 608). And an analysis of the existing *Chanson* shows, beyond question, that it is a re-treatment (*remaniement*) in large part built up out of previous poetic treatments of the same subject.

Using this comparison as it stands, we may observe that the gap between the fall of Troy and the earliest text of Homer known to us is much greater than 300 years: our present text probably dates from Aristarchus about 150 B.C., and even if we assume that that is in the main identical with the text of Peisistratus we only get back to the latter part of the sixth century B.C. and Troy fell at the beginning of the twelfth. There must have been, during those centuries of oral transmission, uncontrolled by any fixed record or any learned class, much reshaping of the poetry and much transformation of the historical facts.

Date of Composition.—Innumerable attempts have been made to fix some time and place at which "Homer" may have lived, or at which the *Iliad* or the *Odyssey* or both, in more or less their present form, may have been composed. All have failed, and it is well to consider the reasons for their failure.

In the first place, we do not yet know what question to ask, and until we do we can hardly expect the right answer. Yet, from the nature of the case, to know the right question implies an understanding of the whole problem which is at present beyond us.

Next, we have no contemporary record to guide us. Even the political history of Greece between 1200 and 600 B.C. is extremely scanty and unreliable; and the history of literature before the time of Peisistratus is practically non-existent. Callinus in the early seventh century is said to have mentioned the *Thebais*, an epic now lost, as the work of Homer. Herodotus (v. 67) tells us that, in the early sixth century, Cleisthenes the tyrant of Sicyon put a stop to the contests of rhapsodes because the Homeric poems "glorified Argos and the Argives."

This shows that there were recitations of Homeric poetry in Sicyon before the time of Peisistratus, but nothing of what that poetry was. Our extant *Iliad* and *Odyssey* do not glorify the Argives in any special sense, but they do use the word "Argives" for the Greeks as a whole, which may have been enough to disturb Cleisthenes. There is a general reference by Xenophanes, an early contemporary of Peisistratus, to the immoral stories about the gods in Homer and Hesiod. There is no other pre-Peisistratean evidence. It is indeed conjectured that the Simonides who quotes a line of the *Iliad* (vi. 126) as the work of "a man of Chios" was perhaps the old seventh-century poet from Amorgos; but both Plutarch and Stobaeus, who are our sources for the information, clearly meant the famous Simonides of Ceos, who belongs to the fifth century. One would like to know whether by "a man of Chios" he really meant the traditional Homer or was merely referring to some contemporary Homeric rhapsode, such as Cynaethus of Chios.

The Homeric Tradition.—The other early references chiefly use the name "Homer" as covering the whole heroic or epic tradition. Aeschylus is reported to have described his plays as "slices from the great banquets of Homer"—which is true if "Homer" means the heroic tradition, markedly untrue if it means the *Iliad* and *Odyssey*. Simonides refers to Homer as telling how "Meleager surpassed all the youths in spear-throwing across the wild Anauros"—which is not in our Homer: Pindar (Nem. vii.) says that Homer praised Odysseus—which may mean, but does not by any means prove, that Pindar read the *Odyssey* as we have it. He makes two other references to Homer, neither of them quite irreconcilable with our poems but certainly not sufficing to prove that he knew them. A late schoolmaster, Theodorus (see *infra*), made a sort of wall-picture which he called τάξιν Ὁμήρου —an arrangement of the events of the whole early heroic tradition, in which the *Iliad* and *Odyssey* form only a fragment. An "arrangement of Homer" of a different kind was needed for the great Panathenaic recitation, and took the form—so we have definite evidence—of our present *Iliad* and *Odyssey*.

The effect of the recitation and the published text which seems to have accompanied it was quickly seen. By the latter part of the fifth century, especially among Attic writers, the *Iliad* and *Odyssey* are well-known and often mentioned: they are accepted as the only canonical works of Homer, though other poems—epics, hymns, epigrams and the like—are occasionally mentioned. Herodotus for instance is doubtful about the *Epigoni* and is against the authenticity of the *Cypria* because in his time it differed from the *Iliad* in its account of the travels of Paris. (It was altered later and made to agree: *see* Proclus' epitome.) Aristotle treated the comic *Margites* as genuine. It may be noted, also, that Attic tragedy, which drew its material from the heroic saga, *i.e.*, from "Homer" in the old sense, carefully avoided the "Homer" that was recited at the Panathenaea. It never trespassed on the *Iliad* and *Odyssey*.

Lastly it is worth remarking that, while all early quotations from Homer are apt to vary considerably from our texts, the

non-Attic writers vary much more than the Attic. Hippocrates, the Coan physician, who lived chiefly in Ionia, has many quotations which do not occur at all in our Homer, including one which he says is "frequent"; the same is true of Aristotle, born in Stageira and trained in the Ionic tradition. And it is noteworthy that a speech of Syagrus the Spartan in Hdt. (vii. 159) not only quotes a hexameter line which is not in our Homer, but seems to quote a Homer who made Agamemnon a king of Sparta. In our Homer he is king of Mycenae, though traces of Sparta seem occasionally to cling to him (*e.g.*, *Od.* iv., 514ff). The "Homer" that was "sung in scattered bits" about Greece before the time of Peisistratus may well have been very different from the *Iliad* and *Odyssey*.

Thus one may be fairly sure from the external record that there existed before the time of Peisistratus masses of heroic poetry, reputed to be very old and to be in general the work of "Homer." As to its form we can say little. It probably consisted normally of lays, of a length suitable for recitation; the length perhaps of the Catalogue or the Doloneia (400–600 lines). Whether there were already any great epics, too long for ordinary recitation but suitable for some great "panegyris" such as the Panionia or the four-yearly gathering of the Ionians at Delos, we have no evidence. Many scholars have concluded that the Peisistratean recension provided the first written text of the Homeric poems. Certainly there is no record of any written text of the *Iliad* and *Odyssey* previous to that; yet it seems almost impossible that no lays at all should have beeen written down, and the composition of the two great poems does at times seem to suggest the use of written sources.

A Crystallization of Tradition.—Thus while it seems probable that songs or lays about the siege of Troy and other achievements of the heroic age came into existence very soon after the events themselves, the first long epics in written form of which we have any knowledge appear in Athens in the sixth century, some 600 years later. The poems that we possess represent the last stage of epic creation, though, as far as we know, the most perfect. The history of epic poetry between 1200 and 550 is entirely obscure, and conjecturable only by indirect internal evidence. Some conclusions, however, can be drawn from the language, metre, subject matter and composition of the two poems. For example (1) it is clear from the composition that each poem is a unity, but a unity imposed on a variety of sources. The unity is made up by combining different lays or parts of lays and smoothing away the discrepancies. It is clear also that in the last shaping of the poems Athenian influence counted for much.

(2) The subject matter shows that the poems cannot be explained as creations of some one age midway between Troy and Athens. Some elements of custom, story and diction go back to remote antiquity, and some again are not earlier than Athens of the sixth century.

(3) The language shows traces of Attic, not only on the surface but also a little below; a great body of Ionic; traces of a definitely Aeolic dialect; and remains also of some very ancient Greek, not definitely assignable to any particular dialect and already unintelligible in classical Athens.

(4) The metre shows signs of long development, and has, to a degree perhaps unexampled in the history of literature, conditioned and almost created the Epic dialect. Many centuries of hexametric or at least dactylic composition must have preceded the present form of Homeric verse.

To take these points in detail: the old explanation of the poems (Hermann and Grote) as an original nucleus *plus* interpolations or late additions, and of the occasional discrepancies as due to the interpolators, must by now be given up. For example, there is the discrepancy between books ix. and xvi. of the *Iliad*, the Embassy and the Patrocleia. In xvi. Achilles, seeing the defeat of the Greeks, breaks into a splendid complaint that if only Agamemnon would seek his friendship and offer atonement, the Trojans would soon fly and choke the trenches with their dead. Yet the whole of book ix. has been occupied by Agamemnon's offers of princely atonement and Achilles' rejection of them. The discrepancy is manifest; but it is not well explained by supposing that a late poet invented Bk. ix. and interpolated it.

Why should he so upset the story? It is explained at once if we suppose that a poet engaged in building up the great epic out of old material found both the Embassy and the Patrocleia in existence, and, not liking to sacrifice either, wove them both in and smoothed out the more alarming difficulties. Similarly he found—so the Scholia tell us—Bk. x., the Doloneia, as a separate lay. It is somewhat foreign in style and it makes some little trouble, but it was too good to throw away. So again some parts of the *Iliad* imply the existence of a wall round the ships while others ignore it. It is much easier to suppose that the poet-editor found some lays with a wall and some without, and chose to combine them, than to imagine an "interpolator" who made gratuitous trouble by putting in a wall here and there.

Just so in the *Odyssey*, there is much confusion as to Odysseus' disguise: he is sometimes disguised and sometimes not. Also there are three incidents in which something is thrown at the disguised Odysseus by one of the suitors. The three do not form a climax or show any relation to one another (ρ 462, σ 394, υ 299). He is twice insulted by one of his own servants. In one place the offender is Melantho, daughter of Dolios (σ, τ), in the other it is Melanthios, son of Dolios (ρ, υ, φ, χ). The Melantho part never mentions Melanthios, nor the other part Melantho—though it speaks of other wicked maidservants. Again, in the long story of adventure which Odysseus relates in the first person we find one interruption of third-person verbs (ι, 54, 55), and some passages which perhaps show traces of having been once written in the third person. In all such cases the hypothesis of "interpolations" or "late additions" is of little help. The probable explanation is that two or more different sources have been combined by the—shall we call him poet or editor? He is both; but the Greeks called him ῥαψῳδός, or "a stitcher of songs."

So far the divergent sources that we have considered have been merely different versions of the same body of saga. The Embassy was always an incident in the Wrath of Achilles—or some similar Wrath; both Melantho and Melanthios had a part in the adventures of Odysseus, or somebody very like Odysseus. But we also find in both poems lays or long passages of quite extraneous origin.

For example, the Catalogue of Snips in *Iliad* ii. is, by general agreement, an old document originally composed for a different context. It describes the mustering of the ships at Aulis, not their stations on the coast of Troy, and in various ways it shows signs of adaptation, and imperfect adaptation, to its present place. Further there are passages in *Odyssey* iii. and iv. which give abbreviated accounts of the Homecomings, or *Nostoi*, of various Greek heroes. Presumably they are derived from the Epic (or collection of lays) called *The Nostoi*. There are fragments derived from some *Heracleia*, or poem on Heracles, and it seems likely that some of the *Androktasiai* or "slayings of men" by various heroes may contain faded memories of real fighting in different parts of the Aegean world. If this is so, we must not reject the possibility of further "liftings"; notably a strong case has been made out for the suggestion that the exploits of Diomedes in the *Iliad* are in part taken from those of his father Tydeus in the *Thebais*, and that Hector himself, whose grave was shown in Thebes, was originally the defender of Thebes, not of Troy. The business of the song-stitcher was to make a great epic for the Panathenaea or some similar great occasion, and he had all the riches of "Homer" to draw upon.

Subject Matter.—Most of the typical Minoan or Mycenaean objects seem to have disappeared from the mainland of Greece by 1400 B.C., some 200 years before the fall of Troy. Some of these Homer does not mention (*e.g.*, figure-of-eight shields, inlaid sword-blades, long rapiers), but he mentions elaborate palaces with bath-rooms (ἀσάμινθος, a pre-Greek word), Nestor's cup with the doves drinking (*Il.* xi. 633), a helmet with boar's tusks (x. 261–5) and the inlaid metal-work on the shield of Achilles. These are very ancient indeed but may be explained by traditional knowl-

edge helped out by actual relics. If we ourselves have seen a Mycenaean cup like Nestor's presumably a classical Greek may have done so. Even Euripides describes a Mycenaean inlaid swordblade (*Electra* 476, cf. *Heracles* 418). The big shield which took the place of body armour and is often called Mycenaean remained in use, as Herodotus tells us, till about 650. It is found in Tyrtaeus and in a relief representing Ionian or Carian mercenaries approaching Sennacherib (705–680). A rather similar problem is presented by the discovery among Minoan remains of thirteen rings from Thisbe; the genuineness is avouched by Sir Arthur Evans. These are engraved with scenes or motives which are prominent in the poems or in later Greek saga: a man clinging under the body of a woolly ram, like Odysseus in *Od.* ix., a young prince slaying a king in a chariot in a narrow defile, as Oedipus slew Laius; a creature like Scylla with many heads attacking a ship, as in *Od.* xii. 245; a young prince, like Orestes, killing two guilty lovers. In Cnossus itself we find repeatedly the motive of a siege of a city, the hardest work of ancient warfare, which took poetic shape in the *Thebais* and the *Iliad*.

The existence of such motives in very early pre-Homeric times gives no evidence as to the date of any particular treatment of them in poetry. On the other hand the *Iliad*, though not the *Odyssey*, also clothes the heroes in the bronze panoply which came in not long before the time of Peisistratus, and often refers to the hoplite tactics which go with the panoply. More than that, Homer dresses both men and women, not in Mycenaean bathing drawers nor flounces, but in the "old-fashioned Attic style." He describes—in a book remarkable both for "lateness" and for beauty—a procession taking a peplus to Athena in exactly the manner of the Panathenaean peplus; he makes Athena leave Odysseus and go home to the "strong house of Erechtheus," or Erechtheum, on the Athenian acropolis. It also seems significant that the adventures of Odysseus in the *Odyssey* are turned into a contest between Poseidon and Athena, with the latter victorious, one of the most characteristic local Athenian myths, while a sympathetic character who protects and helps Telemachus is called "Peisistratus" and made the son of Nestor, from whom Peisistratus of Athens claimed descent. One need not dwell on the supposed "Athenian interpolations" which were noted in antiquity. The omissions are equally significant. In the Catalogue, for instance, Thebes, Aegina, Megara are omitted entirely; Salamis is suppressed and Corinth belittled. Athens, and no other city but Athens, has reasons for just these suppressions. Of course, the symptoms are never gross. The poems are as far removed from flattery or boastfulness as the rest of classical Greek literature.

Language.—Apart from problems of local dialect, the dialect of Homer is an early or "primitive" form of the language which we know as Greek in the classical age. This can be shown by comparing the grammatical formation and syntax of Homer with those of Attic. (The comparison of the vocabulary is in the nature of things less conclusive.)

1. The first aorist in Greek being a "weak" tense, *i.e.*, formed by a suffix (*-σα*), whereas the second aorist is a "strong" tense, distinguished by the form of the root-syllable, we expect to find a constant tendency to diminish the number of second aorists in use. No new second aorists, we may be sure, were formed any more than new "strong" tenses, such as *came* or *sang*, can be formed in English. Now in Homer there are upwards of 80 second aorists (not reckoning aorists of "verbs in *μι*," such as *ἔστην*, *ἔβην*), whereas in all Attic prose not more than 30 are found. In this point therefore the Homeric language is manifestly older.

2. While the whole class of "strong" aorists diminished, certain smaller groups in the class disappeared altogether. Thus we find in Homer, but not in the later language:

(a) The second aorist middle without the "thematic" **ε or ο**: as *ἔβλη-το*, was struck; *ἔφθι-το*, perished; *ἄλ-το*, leaped.

(b) The aorist formed by reduplication: as *δέδαεν*, taught; *λελαβέσθαι*, to seize. These constitute a distinct formation, generally with a "causative" meaning; the solitary Attic specimen is *ἤγαγον*.

3. It had long been known that the subjunctive in Homer often takes a short vowel (*e.g.*, in the plural, *-ομεν*, *-ετε* instead of *-ωμεν*, *-ητε*, and in the Mid. *-ομαι*, etc. instead of *-ωμαι*, etc.). This was generally said to be done by "poetic licence," or *metri gratia*. In fact, however, the Homeric subjunctive is almost quite "regular," though the rule which it obeys is a different one from the Attic. It may be summed up by saying that the subjunctive takes *ω* or *η* when the indicative has *ο* or *ε*, and not otherwise. Thus Homer has *ἴ-μεν*, we go, *ἴ-ο-μεν*, let us go. The later *ἴ-ω-μεν* was at first a solecism, an attempt to conjugate a "verb in *μι*" like the "verbs in *ω*." It will be evident that under this rule the perfect and first aorist subjunctive should always take a short vowel; and this is the case, with very few exceptions.

4. The article (*ὁ, ἡ, τό*) in Homer is chiefly used as an independent pronoun (he, she, it), a use which in Attic appears only in a few combinations (such as *ὁ μέν . . . ὁ δέ*, the one . . . the other). This difference is parallel to the relation between the Latin *ille* and the article of the Romance languages.

5. The prepositions offer several points of comparison. What the grammarians called "tmesis," the separation of the preposition from the verb with which it is compounded, is peculiar to Homer. The true account of the matter is that in Homer the place of the preposition is not rigidly fixed, as it was afterwards. Again, "with" is in Homer *σύν* (with the dative), in Attic prose *μετά* with the genitive. Here Attic poetry is intermediate; the use of *σύν* is retained as a piece of poetical tradition.

6. In addition to the particle *ἄν*, Homer has another, *κεν*, hardly distinguishable in meaning. The Homeric uses of *ἄν* and *κεν* are different in several respects from the Attic, the general result being that the Homeric syntax is more elastic, and that the less common combinations of the earlier period were disused altogether in the later.

7. In the vocabulary the most striking difference is that many words appear from the metre to have contained a sound which they afterwards lost, viz., English *W*, written in some Greek alphabets by the "digamma." This letter, however, died out earlier in Ionic than in most dialects, and there is no proof that the Homeric poems were ever written with it.

In many epics the nationality of the author, or of both author and scribe, can be fixed by the dialect. Thus the author of the *Chanson de Roland* was probably a native of the Ile de France, while the scribe was an Anglo-Norman. Similar conclusions may be drawn about many of the medieval German poems. But Homer's is no definite spoken dialect—it is a traditional dialect, regularly used for epic, shaped and twisted to an extent probably without parallel in literature by the needs and conveniences of the epic hexameter. In the main the poems are Ionic, with an Aeolic under-current. That suits the tradition, almost universal in antiquity, that the poems came from Ionia, and that "Homer was born" in Smyrna, Chios or Colophon, in regions where an Ionic population had superseded an Aeolic. We cannot however answer simply that the dialect is that of Smyrna or Chios at a given date; for it is clear that some process of transmutation has taken place. In general, Aeolic forms are left (*Ἀτρείδαο, κεν, ῥοάων, Μυρμιδόνεσσι*) where the Ionic form was not metrically equivalent; wherever the two are metrically equivalent, the Ionic is preferred. An exception like *θεά* is left because there was no Ionic *θεή*; *θεός* was the form used. *Νηός* has always its Ionic form because the older poetry did not, apparently, mention temples, but only altars. Other exceptions are due to various accidental causes. The attempt has been made to argue that these "aeolic" forms were not really dialectic at all, but merely belonged to an older form of the Greek language from which both Aeolic and Ionic afterwards developed. The digamma, for instance, *ϝ*, a w-sound which gradually disappeared from the Greek language like h in French or w in *whom*, *wrong*, in English, is practically a living letter in Homer. (Roughly 3,354 places imply the *ϝ* while 617 ignore it.) By the sixth century *ϝ* was dead in Ionic though alive in both Doric and Aeolic, and the ancients actually called it "the Aeolic letter"; but two centuries earlier it may well have been current in all forms of Greek.

This view however is disproved by the presence of new formations, which occur in Aeolic and in Homer, but are certainly not "Old Greek." There seems to have been some definitely Aeolic period in the development of the epic. On the other hand there is abundant evidence of "Old Greek," dating from a time prior to any Aeolic or Ionic of which we have written record. There are many phrases which were not understood in classical times, or at least had to be taught in school: *ἀμένηνα κάρηνα, διάκτορος ἀργειφόντης, νήδυμος, τοῖος* (*cf.* Ar. Fr. 222 *Daitales*). And, equally significant, there are words which, in ordinary speech, only occur in Cyprian and Arcadian, such as *ϝάναξ, πτόλις, κέραμος* (a prison). Arcadia, isolated in the mountains of the Peloponnese, and Cyprus, isolated among the Semites of the eastern Aegean, preserved in common fragments of the very oldest Greek, which had perished elsewhere.

We have here phenomena corresponding to the Mycenaean cups and primaeval motives; while on the other hand the Attic influence on the language is equally conspicuous. It occurs in two forms. First, there are numerous Atticisms which are shown to be wrong by the metre, and must therefore be simply mistakes by the Attic scribe. Some are unmistakable like *Ἕως ὁ ταῦθ' ὥρμαινε*, where *ἕως* must be a mistake for *ἦος*. Others are almost certain but not quite: *Τοῖς δ' Ἀγελέως μετέειπεν* offends against Homeric idiom and has probably supplanted *τοῖσ' Ἀγέλαος ἔειπεν*; *ἦν που ἐφεύρῃ* is pure Attic and is more likely to be the mistake of an Attic copyist or reciter for *αἴ κεν ἐφεύρῃ* than an original un-Homeric effort of a poet. But beyond a few clear cases we cannot be sure. If we remove drastically all the obvious "surface corruption" there remains a more deep-seated Attic element: *ἥλιος, ἀμοθεν γε, βεβῶσα, ἧντο, εὔσφορος* (as a dactyl *Il.* xxiii.) are isolated, but *ὅπως* (for Aeolic *ὄππως*, Ionic *ὅκως*), *ἕπεσθαι* (for *ὀπάζειν*) are common; and one has to remember that these Atticisms represent merely what has been left after generations of grammarians have gone over the text carefully to remove all that was not "Homeric."

Metre.—Lastly, this dialect has been re-shaped by the needs of the metre. To mention only a few of the instances: wherever three or more short syllables came together, or where a short came between two long, the word had to be changed before it could get into the hexameter; hence forms like *γεινόμενος, Τειρεσίας, εἰν ἀγροῖι, εἰνὶ θύρηισι*, with *ει* for *ε*; *ἀπειρέσιος* or else *ἀπερείσιος*; *ἰστὶη, προθυμίησι, Ἀππόλλωνα, εἰλήλουθα*. Analogy of course plays a part in these changes, *e.g. τιθήμενος* in place of *τιθέμενος* because of *τίθημι, μαχειόμενος* from the rhythm of *μαχησόμενος*, contrasted with *ἠὲ περὶ πτόλιος μαχεούμενος ἠδὲ γυναικῶν* (ω 113, λ 403) because of Σ 265 *ἀλλὰ περὶ πτόλιος τε μαχήσεται ἠδὲ γυναικῶν*. Liberties are taken both with accidence and with syntax in order to obtain forms that are metrically convenient; especially conspicuous is the effort to obtain words or phrases which fill the final dactyl-spondee after the Bucolic diaeresis: *ἡνιοχῆα* acc. of *ἡνιόχος, Αἰθιοπῆας* of *Αἰθίοπες, Σαρπήδοντος* for *Σαρπήδονος, εὐρέα πόντον* (from *εὐρέι πόντῳ*); the alternation of singular and plural in such words as *ἱπποσύνης ἱπποσυνάων, νηπιέη νηπίῃσι, κονίῃ κονίῃσι*, that of active and middle in *εἰσορόωντες εἰσορόωνται, μητιόωντες μητιάασθαι* are to be explained thus. Similarly the gen. in *οιο* is prevalent in choriambic words *Ἀντιμάχοιο, ἡνιόχοιο, ἀτρυγέτοιο*, whereas for obvious reasons we always have *Ἀξίου, εὐξόου, ἑταίρου, κελεύθου*, and also *Μενελάου, ἐνιαυτοῦ, μεγαθύμου*. In spondaic words (*ἀγροῦ, οἴκου, σίτου*) *-ου* is much commoner than *οιο*.

Thus the metre both preserves ancient forms and invents new forms. As to contraction of vowels, Epic prefers the old uncontracted forms but admits the shorter forms, usual no doubt in contemporary speech, for special reasons. Metrical necessity produces *πελάγει, ἐφίλει* (and *φίλει*), *ἀγαπᾶς, φοβεῖται, πειρώμενος*, etc.: the convenience of having all the cases of a noun metrically identical has some effect (*Τυδείδεω, ἀπασεῶν, ἡμέας, ὑμέας*); while analogy also plays its part (*ἀναβῆι* for *ἀναβήηι* from *ἀναβάς, ὑπέρθυμον Διομήδεα* from *ὑπέρθυμος Διομήδης*), sometimes assisted by an actual mistake: *πῶυ μέγ' οἰῶν* must have come from some rhapsode who pronounced Γ 198 *ὅς τ' οἰῶν μέγα πῶυ* wrong. Similarly a bard who said *τρεῖτ' in νίκην ἀλλ' αὐτοὶ τρέετ' ἄσπετον* (*Il.* xvii. 332) proceeded to say *τρεῖν μ' οὐκ ἐᾶ Παλλὰς Ἀθήνη* (*Il.* v. 256). The fact that the Greek language had thus to be stretched and twisted in order to satisfy the needs of the hexameter has led to the suggestion that the hexameter must be a foreign metre, made to suit a language other than Greek (Meillet, *Origines Indo-Européennes des Mètres Grecs*, 1923). The conclusion is not probable. After all no known language suits the hexameter half as well as Greek, and the variety of forms of words was satisfactorily explained by the ancients as due to the "singing" of early epic verse (Athenaeus xiv. p. 632d.), and Greek was spoken in the Aegean by 1400 B.C. (Buck, in *Class Phil.* xxi.).

The misuses of the old language by rhapsodes who were accustomed to something much later may be compared with *στεῦτο* for "stood" in *Od.* xi., 584 of *δεδουπότος Οἰδιποδαο* for "having died" (*Il.* xxiii. 679), of the misunderstanding of *ἕδνα* "bride-price" as if it meant "dowry" in *Od.* i. 278, ii. 194, or the introduction of the proverb "iron itself draws a man on" (*Od.* xvi. 294, xix. 13).

The Homeric Style.—These considerations may be thought to lead to a rather chaotic result, if not a purely negative one. Yet, though they do not encourage attempts to discover the age or birthplace of "Homer," they do help us to understand the great qualities of the Homeric style. If we compare the Homeric poems with the *Aeneid* or *Paradise Lost* we feel in them much more directness and vital force. They have the quality of the heroic age, of the Volsunga saga or of Beowulf. If we compare them with these latter, we feel them to be far richer in language, larger and closer in construction, nobler in artistic form. They unite, to a degree that is perhaps unique in literature, primitive force with artistic dignity and accomplishment. Poems like *Iliad* vi. and xxiv., for example, are hardly conceivable except as the work of minds as civilized as that of Aeschylus on material as rude and fierce as the End of the Niblungs.

The same considerations throw light on another quality of Homer, which persists all through the higher Greek poetry. The grand style concentrates on the main subject, not on detail. It is not precise or realistic. It deals in types more than individuals. The main characteristics of the main characters, the main interest of the main story, are intensely clear, but the mass of not strictly relevant detail which contributes so much to the lifelikeness of modern fiction is mostly omitted. There are many ships described in Homer, and described vividly, but no one is ever distinguished from another. They are merely "black," "hollow," "swift," "well-balanced," "red-cheeked" or the like.

There are two quite distinct styles of fighting and of armour: first the classical battle of hoplites in phalanx with small bronze shield, breastplate and backplate, which has been introduced into many parts of the *Iliad;* and second, below this, the fighting of particular champions (*πρόμαχοι*) in Mycenaean style with the great leather shield, reaching from neck to ankles and making body armour unnecessary, while an ill-armed mob behind, with little protection beyond goat-skins (*λαισήια*) help with stones, darts and arrows. Yet the epithets seldom make clear what sort of shield is meant; the general descriptions often leave obscure what style of fighting. The same with the topography.

This quality enabled the bards freely to compose poetry about times and places of which they had no personal knowledge, provided only that they observed the traditional epic manner and were permeated by its spirit. A modern artist, especially a novelist, generally has two aims which seem to us normal, but which are entirely alien to the spirit of Homeric poetry. First, he aims at detailed descriptions of phenomena; while "Homer" aims straight at the emotional effect with a minimum of detail. For example, the similes taken from lions in the *Iliad* might always have been written by one who had never seen a lion, but never by one who had not been imaginatively thrilled by poetry about lions. Secondly, the modern artist is generally conscious of himself as opposed to his audience, and aims at producing something "original." The book he writes is printed

and preserves its sharp edges, whatever the taste of the reader may be.

But the ancient bard was, in the main, performing things already well known, the common possession of himself and his audience. An ancient bard could not be eccentric or go against the prevailing taste. A poem so written would simply not live. It would not fit its environment, and the next reciter would alter it. It is essential, in trying to understand ancient oral poetry, to realize this fact: the successful oral poem, like the speech of a popular orator nowadays, must be the joint product of the artist and his public. Thus a rhapsode describing Ithaca or Troy or Achilles must avoid any sharp clash with the public conception of those subjects. He must not contradict people's expectations and memories. The real facts, as they would appear in a modern book of reference, do not much matter, though, in order no doubt to avoid awkward clashes, he does generally abstain from precise detail. When there is detail it is still generic.

There is an oak on the plain of Troy; oaks are common on plains. There is a fig-tree growing in or beside the wall, making a place where the wall is climbable (*Il.* vi. 433). That may well be evidence for the existence of a poem describing the scaling of the wall by help of the fig-tree; it is no evidence that there was actually a fig-tree in the wall of historical Troy. The one detailed statement about the rivers of the plain of Troy, viz. that they meet (*Il.* v. 774), is rejected as geographically impossible even by those scholars, like Leaf and Robert, who try to identify the local details. In the descriptions of Ithaca, some points can be found on the island, and doubtless could on other islands also; some seem to suit Leucas but not Ithaca, while in some again the detail seems to be the remnant of a myth. The isle of Odysseus is described as "low down, farthest away in the sea toward the darkness: the others are separate, toward the dawn and the sunlight." That description is utterly unsuitable to the real geography, but sounds like a description of a mythical Isle of the Setting Sun, in the far west, which possibly lingered in the minds of poets and audiences from an older poem.

It is worth observing that this vagueness of detail, this use of the generic and typical rather than the hard particular, is characteristic of the higher Greek poetry in general, and is probably due to the same cause—the dependence of the poet on the tradition as known to, or accepted by, his audience. Thus Aeschylus in the *Agamemnon* makes his beacon-signals start from Mt. Ida, though in fact the top of Mt. Ida is some 30 miles in the wrong direction. He does so because Mt. Ida is always in tradition the mountain of Troy. Both audience and poet take it for granted. For somewhat similar reasons, the tragedians give no names to their subordinate characters: they are merely Servant, Messenger, or Nurse.

Historicity.—Far more precarious than the geographical identifications are attempts to extract history from the Homeric narrative. It is quite likely that there are hard nuggets of history preserved unchanged in the poems, but it is impossible to distinguish history from myth, folk-lore and fiction in such a slowly grown and beautifully welded whole. If Odysseus burns out the eye of a one-eyed giant, if he escapes from the cave by clinging under the belly of a ram while the Cyclops stops and feels the ram's back, one cannot say that such things never happened, but one should not forget that they occur in dozens of folk-tales. If Odysseus had 360 boars, one of whom died every night, one cannot but think of the sun or the year, as described in ancient riddles: one cannot help noticing with interest that the day on which Odysseus and Penelope met was the exact day in which ancient astronomers considered that the sun cycle and moon cycle coincided: the day called "the meeting of sun and moon" in Meton's *Eikosieteris* or 20 year cycle. Such solar material may quite well be blended with a story of real life. One must simply wait for the evidence.

Again, there is nothing at all impossible in the story that the cause or pretext of the Trojan War was the rape of a princess. Yet the fact that a statement is possible is no proof that it is true; and one must remember that Helen was, in historical times a marriage goddess in Sparta, and as such must herself go through the marriage ceremony, which comprised in Sparta the carrying off of the bride. Hence Helen in saga is constantly "carried off"—to Sidon or Troy by Paris, to Egypt by Hermes, to Deceleia by Theseus or the Apharetidae, to Parmon by "a robber." There is ritual significance also in the fact that she is generally restored by twins, either her brothers, the Dioscuri, or the *gemini Atridae;* and that, as with other marriage-goddesses, the story sometimes explains that it was not the true goddess but only an "image" that the ravisher seized.

There will be little difference of opinion as to the existence in Homer of real history, mixed up with fiction, folk-lore and myth; it is also clear that we have not at present any body of evidence by which to sift out the history. It would moreover be a great error of method to suppose that in such a combination there is always, or usually, a true nucleus and a fictional or mythical penumbra. In the Niebelunglied, for example, the myth seems to be the nucleus, which has attracted into it some historical figures like Atli and Dieterich of Berne (Attila and Theodoric). The same would hold of most historical novels.

Nor should much weight be attached to the fact that the incidents of the *Iliad* are generally of the possible sort; marvels and monsters are kept outside the story. That is purely a question of style. The *Iliad* is tragic, and serious. The *Odyssey* veers towards the fairy-tale in the Story of Odysseus (ix. to xii.) and comes back to reality in the later books. The *Argonautica* was τερατώδης, "full of marvels," throughout. On the other hand the actual names borne by the chief heroes may well be historical or at least derived from history. Atreus, Paris, Helene, Odysseus (or Olytteus) do not seem to be Greek words; Achilleus, Agamemnon, Menelaus look like non-Greek words twisted into a semblance of Greek. If so, they are probably not invented but derived from real persons who bore names more or less like them, while Diomedes (Zeus-counsel), Neoptolemus (War-new), Hector (Holder) and perhaps Priam (King) seem like pure Greek names which anyone could invent.

HOMERIC MORALITY

It is strange to read in old books that Homer has "no law and no morality." It seems so very contrary to the truth. Homeric law is the law of the heroic age: there is no code, but the king delivers judgments (θέμιστες), based no doubt on custom and public opinion. If they are unjust there is a general Nemesis, or Indignation, of men, and probably a punishment of all the land by the gods. In times of peace, as in the *Odyssey*, there is praise for "some blameless king, who in the fear of God rules among men many and strong, and upholds righteous judgments; to him the black soil bears wheat and barley, the trees are heavy with fruit, the flocks bring forth unfailingly and the sea provides its fish, because of his good leading; and the peoples prosper under him." (*Od.* xix. 111.) So Odysseus "had no evil thoughts, but was kind as a father to his people" (*Od.* ii. 230 *sqq.*, v. 8 *sqq.*, etc.) In war, of course, such as we have in the *Iliad*, there is not so much question of law or justice, though it is noteworthy that the *gerontes*, or elders, have some influence beside the king. In Troy this is natural, since the Trojans are still living at home among their native sanctities. But even in the Achaean camp Nestor carries weight in the council of chieftains on the ground of his age and experience.

In the main, as in other heroic ages, morality has gone back to first principles, to what Homer calls *aidôs* and *nemesis*. *Aidôs* is generally interpreted as "shame" or "sense of honour," *nemesis* as "righteous indignation." *Aidôs* is what you feel about your own actions: the honour that compels you, the shame that deters you, the ruth or remorse that haunts you. *Nemesis*, or "the *nemesis* of men," is what is felt by the onlooker about the act of another, done or contemplated. If you feel disposed to run away in battle, or if you continue to be angry after receiving atonement, think of the "*nemesis* of men"! When Helen is asked to go and let Paris make love to her when he has emerged with doubtful honour from a battle with Menelaus, she says roundly: "I will

not go. Νεμεσσητὸν δέ κεν εἴη; it would be a thing to feel *nemesis* at." The word *nemesis* soon passes away from the sphere of ordinary human blame. It becomes the haunting impalpable wrath of the earth and sun, the "innumerable *Keres*," the gods and the dead. The deeds that rouse it fall mainly into three categories; first, actions that imply cowardice. "*Aidôs*, ye Argives . . will ye not stand? . . . I have *nemesis* against you in my heart." Secondly, perjury and lying. This never occurs in Homer, because the heroes never commit the action, except perhaps Pandarus, who is killed. But it is the most typical source of shame in the rest of the heroic tradition.

Thirdly, and much the most important, any wrong or treachery towards the helpless, the stranger, the suppliant, and the aged. The feeling often occurs in Homer, but the doctrine is most clearly expressed by a passage in Hesiod (*Works and Days* 327 *sqq.*). "It is all as one thing—the man who wrongs a suppliant or a stranger, the man who violates his brother's bed; the man who in heartlessness sins against orphan children; the man who reviles his old father on the bitter threshold of age: with that man Zeus himself is wroth." The parable of the prayers, Daughters of Zeus, in *Il.* ix. 502 illustrates the same feeling. They are prayers for mercy or forgiveness. Lame, and wrinkled and half-blind, they stagger after the footsteps of Ate (Blindness, or Evil) trying to heal the harm she has done. . . . And woe to the man who rejects them, for the daughters of God speak to their Father. Such a man would be Ἀναιδής.

Expurgations.—A saga, or a body of poetry, which lasts on in tradition from one age to another is almost certain to be altered to suit changes of taste, particularly if the standard is rising. The Northern epics were modified as their people became Christian. The books of the primitive polytheistic Hebrews were modified as the religion of Jehovah prevailed. The acting texts of Shakespeare changed most sensitively in the 18th and 19th century. In Homer, as Plato explains in the *Republic*, there are occasional passages which hurt the moral sense of a later age, and "we must beg Homer not to be angry if we delete them" (*Rep.* iii. p. 387b). Zenodotus and Aristarchus are recorded as having acted in this spirit after Plato, and other critics and poets had evidently done so before. Zenodotus mostly deleted what was ἀπρεπές, "unseemly"—abusive language, attribution of fear to the Gods or heroes, of a mean motive to Achilles or Agamemnon, of a list of amours to Zeus, and the like. These expurgations are recorded in the Scholia. So is the meditated parricide of Phoenix and a suggestion, by Ajax, of all people, that the Achaeans should "pray silently, so that Trojans should not hear."

There has been a complete expurgation of certain primitive vices, which were current in most parts of later Greece (Schol. on *Il.* xvi. 97 *sqq.*, xx. 231 *sqq.* v. 266). The brother-and-sister marriage of Alcinous and Arete is turned into one between uncle and niece. (Schol. *Od.* vii. 55 *sqq.*) The torture of Hector before death has been turned into an insult to his body after death. In general, mutilation, stripping of the dead, torture and beheading have been either removed or softened down. Poisoned arrows are condemned, though it is clear that Homer's arrows, like those of Heracles in Hesiod, originally "had death on the tip and wept in drops" (*Aspis* 132). There has also been a vigorous and almost complete excision of human sacrifice. Homer says nothing of the sacrifice of Iphigeneia or Polyxena; "rightly," says Pausanias, "he omitted such a cruel and unlawful deed." The one human sacrifice which seems to have been too firmly fixed in the legend to admit of expurgation, viz., the sacrifice of twelve noble Trojans by Achilles at the pyre of Patroclus, is hurried over in a shamefaced line and a half, without even a principal verb, and is followed by the words: "Yea, he devised evil things in his heart." The *Odyssey*, which is in many ways less a mirror of chivalry than the *Iliad*, admits something very like torture for Melanthios and the treacherous bondmaids. After all, they were only slaves!

Each case needs separate consideration, but the fact of expurgation can hardly be denied. The real Akhaiusha who took Troy were probably a horde of savages. We can see the unexpurgated account of their doings in the fragments of the Epics that were considered "non-Homeric," *i.e.*, which never passed through the furnace of the Panathenaic recitation. But the "godlike Achaioi" of Homer have been made into ideals of manly chivalry, held up to the imitation of the young, and must not be described as practising the "beastly devices of the heathen." The true spirit of Homeric chivalry comes out in the parting of Hector and Andromache in *Il.* vi., the reconciliation of Achilles and Priam in *Il.* xxiv., or the words of Odysseus over his dead enemies: "Unholy it is to vaunt over slain men."

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(6.) General:—Wolf, *Prolegomena ad Homerum* (1795, ed. Volkman 1844). Wolf was to some extent preceded by Wood, *Essay on the Original Genius of Homer* (1769); and the Abbé d'Aubignac, *Conjectures Académiques* (pub. 1715 but written about 1669). Compare also Vico, *Il vero Homero*, 1744. Hermann, *De Interpolationibus* and *De Iteratis apud Homerum*, in his *Opuscula* (5 vols.); Lachmann, *Betrachtungen über Homers Ilias* (1837–41, ed. Moritz Haupt 1865, 1874); Erhardt, *Entstehung der Hom. Gedichte* (1894); Jebb, *Introduction to Homeric Study* (1887), still useful; Browne, *Handbook of Homeric Study* (1908); Seymour, *Life in the Homeric Age* (1907); Cauer, *Grundprobleme der Homerischen Kritik* (3rd ed. 1921–23) gives the best conspectus of the whole problem. Chadwick, *The Heroic Age* (1912) brought new light on the Homeric question by a study of "heroic ages" as a type. Rothe, *Ilias als Dichtung* (1910), *Odyssee als Dichtung* (1924), a good restatement of the old "unitarian" point of view; *cf.* M. Stawell, *Homer and the Iliad* (1909). Drerup, *Homerische Poesie* (5 vols. 1921); the first gives a valuable conspectus, specially devoted to correcting Cauer, learning great, but standpoint somewhat uncritical. G. Murray, *Rise of the Greek Epic* (1907, 3rd ed. 1925); T. W. Allen, *The Homeric Catalogue of Ships* (1921) and *Origin and Transmission of the Homeric Poems* (1926); U. von Wilamowitz-Moellendorff, *Homerische Untersuchungen* (1884) and *Homer und die Ilias* (1920) and *Heimkehr des Odysseus* (1926); Eric Bethe, *Homer und die Heldensage* (1902), valuable on the nuclei of historical fact, transmuted, in the poems, and *Homer, Dichtung und Saga* (3 vols. 1914–27). Seeck, *Quellen der Odyssee* (1887), struck out a new line of inquiry; vigorously followed up by Mülder, *Ilias und ihre Quellen* (1910). J. A. K. Thomson, *Studies in the Odyssey* (1914), emphasizes tradition and attempts imaginative understanding; E. Schwartz, *Odyssee* (1924); Finsler, *Homer in der Neuzeit* (1912) and *Homer* (1908), very wide reading; Bédier, *Les Légendes Epiques* (1908–13). Ingenious are:—Butler, *The Authoress of the Odyssey* (identified as Nausicaa 1897); Shewan, *The Lay of Dolon* (1911); Smyth, *A Nu. ierical Law in the Homeric Poems* (1914). (7.) Among older books Welcker's *Epische Cyclus* (1835–49), is still valuable; also Sengebusch, Introductions to Dindorff's text of Homer (1855–56); Friedlaender, *Wolf bis Grote* (1853); Kirchhoff, *Homerische Odyssee* (1869); and Paley, articles cited in Sayce's Appendix to vol. i of Mahaffy's *Greek Literature*. Andrew Lang's books, though injured by their polemical tone, are still useful:—*Homer and his Age* (1906), *Homer and the Epic* (1895) and *The World of Homer* (1910). Gladstone's *Studies on Homer* (1858), *Juventus Mundi* (1869) contain some brilliant suggestions; Hayman's *Odyssey* (1866), has useful notes. Geddes, *Problem of Homeric Poems* (1878); *Nitzsch's* voluminous writings, *Erläuternde Anmerkungen zu*

Homers Odyssee (1826–40), etc., have lost most of their value; Nägelsbachs, *Anmerkungen zur Ilias* (first three books) much praised (1864).

(8.) Archaeology:—All books are dependent on the discoveries of Schliemann at Troy and Mycenae, between 1869 and 1896, summed up in Schuchhardt, *Schliemann's Excavations* (1891, Eng. tr. 1891), and later on those of Sir Arthur Evans and others in Crete, summed up in Evans, *The Palace of Minos at Knossus* (3 vols. 1921–28); *cf.* W. Leaf, *Troy* (1912), *Homer and History* (1915) and *Strabo on the Troad* (1923); Robert, *Studien zur Ilias* (1901); Helbig, *Das H. Epos durch die Denkmäler erklärt* (1884, 1887); Buchholtz, *H. Realien* (1871–73); Reichel, *H. Waffen* (epochmaking); V. Bérard, *Les Phéniciens et l'Odyssée* (1902–03), fascinating rather than convincing; Noack, *H. Palaste* (1903); *cf.* Dörpfeldt in *Mitth. Arch. Inst. Ath.* (1905); Ridgeway, *Early Age of Greece* (1901), first emphasized the northern invasions. Wace and Thompson, *Prehistoric Thessaly;* Sartiaux, *Troie* (1915); Macurdy, *Troy and Paeonia* (1925); Hall, *Oldest Civilization of Greece* (1901), and *Ancient History of Near East* (1913), and *Aegean Archaeology* (1915); Dussaud, *Les Civilisations Pre-helleniques* (2nd ed. 1914); Glotz, *Civilisation égéenne* (1924); Heusey, *Histoire du Costume antique* (1922).

(9.) Language:—Buttmann, *Lexilogus* (1818–25), still interesting; Monro, *Homeric Grammar* (2nd ed. 1891); van Leeuwen and Mendez da Costa, *Eucheiridion Dictionis Epicae* (2nd ed. 1918); Dieltz, *H. Formenlehre* (1908); Freund, *Formenlehre d. H. Mundart* (1906); Schulze, *Quaestiones Epicae* (1902); Delbruck, *Syntaktische Forschungen* (1871–72); Thumb, *Das Digamma* (1898) and *Die Gr. Dialekte* (3rd ed. 1928); Bekker, *Homerische Blätter* (1863–72); Cobet, *Miscellanea Critica* (1876); Bechtel, *Vokalkontraktion bei H.* (1908); Meillet, *Aperçu d'une Histoire de la Langue Grecque* (1920), very good; Wackernagel, *Sprachliche Untersuchungen zu Homer* (1916). (10) Metre:—Hartel, *Homerische Studien;* Solmsen, *Untersuchungen zur Gr. Laut- und Versiehre* (1901); Danielsson, *Zur Lehre vom H. Digamma,* Ind. Forsch XXV.; Witte in Pauly-Wissowa's *Realenzyklopedie,* "Homeros"; Drewitt, "Scansion in H. Verse," in *Class. Quarterly* (April 1908); Usener, *Altgriechischer Versbau* (1886); Schröder, *Vorgeschichte des H. Hexameters* (1908). (11.) Lexica, etc.:—*Concordance to Iliad* by Prendergast (1875) and *to Odyssey* by Dunbar; *Lexicon Homericum* by Ebeling (1880–85); Gehring, *Index Homericus* (1891); *Facsimile* of codex Venetus A, Sijthioff (1901), with introduction by Comparetti. The chief classical periodicals (such as, in England, *Journal of Hellenic Studies, Classical Quarterly, Classical Review,* Liverpool *Annals* of Archaeology, and in America *Classical Philology, American Journal of Archaeology*) contain *passim* articles on Homer, *e.g.,* many on mss. by T. W. Allen in the *Class. Review;* the literature is summarized from time to time in Bursian's *Jahresberichte:* esp. vols. CLXVI. (text), *CLXXXII.* (general and archaeological). The histories of Greece and of Greek Literature all treat of Homer.

For a summary of the plots of the *Odyssey* and *Iliad see* HOMERIC POEMS. (G. G. A. M.)

HOMER, WINSLOW (1836–1910), American painter, was born in Boston (Mass.), on Feb. 24, 1836. At the age of 19 he was apprenticed to a lithographer. Two years later he opened a studio in Boston, and devoted much of his time to making drawings for wood-engravers. In 1859 he removed to New York, where he studied in the night-school of the National academy of design. During the American Civil War he was with the troops at the front, and contributed sketches to *Harper's Weekly.* The war also furnished him with the subjects for the first two pictures which he exhibited (1863), one of which was "Home, Sweet Home." His "Prisoners from the Front"—perhaps his most generally popular picture—was exhibited in New York in 1865, and also in Paris in 1867, where he was spending the year in study. Among his other paintings in oil are "Snap the Whip," "Eating Water-melon," "The Cotton Pickers," "Visit from the Old Mistress, Sunday Morning," "The Life-Line" and "The Coming of the Gale."

His genius, however, has perhaps shown better in his works in water-colour, among which are his marine studies painted at Gloucester (Mass.), and his "Inside the Bar," "The Voice from the Cliffs" (pictures of English fisherwomen), "Tynemouth," "Wrecking of a Vessel," and "Lost on the Grand Banks." His work, which principally consists of *genre* pictures, is characterized by strength, rugged directness and unmistakable freshness and originality, rather than by technical excellence, grace of line or beauty of colour. He was little affected by European influences. His types and scenes, apart from his few English pictures, are distinctly American—soldiers in blue, New England children, negroes in the land of cotton, Gloucester fishermen and stormy Atlantic seas. Besides being a member of the Society of painters in water-colour, New York, he was elected in 1864 an associate and the following year a member of the National academy of design.

HOMERIC POEMS. This title is commonly given to the whole cycle of the early Greek epics, including the *Odyssey* and the *Iliad* as well as the rejected epics. In the article HOMER a full discussion is given of the "Homeric question." For bibliographical information also the reader is referred to the article HOMER. In the present article will be found merely (1) a discussion of the cyclic poems other than the *Iliad* and the *Odyssey,* (2) an analysis of the plots of the *Iliad* and the *Odyssey.*

The Rejected Epics.—As soon as the two great wholes, *Iliad* and *Odyssey,* were given exclusive rank as "Homer" at the Panathenaea the rest of the heroic *epos* fell, it would seem, quickly into neglect. The subject matter indeed was used freely by the tragedians, who carefully avoid the *Iliad* and *Odyssey,* but though the names of many epics or groups of story are preserved, the poems themselves have perished utterly except for a few meagre fragments (about 120 scattered lines altogether) and those in a very rough and unscholarly form. The Homeric rules of metre, language and subject matter are carelessly ignored, presumably because the attention of scholars was concentrated on the two great poems. We hear much in later times of various "cycles," "the Trojan cycle," "the Theban cycle," and "the Epic cycle" as a whole. The epic cycle is a "ring" or collection, covering the whole epic saga; the Trojan or Theban is that part of it which deals with Troy or Thebes. Thus a certain Proclus (presumably the Neo-Platonic philosopher, 5th century A.D.) in his *Chrestomatheia Grammatike,* or *Compendium of Literature,* included "an account of the so-called Epic cycle, beginning with the Marriage of Heaven and Earth, and . . . made complete out of various poets" till it ends with the death of Odysseus at the hands of his son Telegonus.

Among the *Tabulae Iliacae* in Jahn's *Bilderchroniken* (1873) there is a large relief (No. 1) illustrating scenes in the history of the Trojan War, drawn up for school use by the grammarian Theodorus, probably in the 1st century B.C. It is called τάξις Ὁμήρου, "an arrangement of Homer," and is duly "made up out of various poets." Thus the post-Homeric part of the "Trojan Cycle" is taken from "the *Aethiopis* according to Arctinus, the so-called *Little Iliad* according to Lesches of Pyrrha and the *Sack of Ilium* according to *Stesichorus.*" Elsewhere we hear of the *Sack of Ilium* by (or "according to") Arctinus of Miletus. Evidently the Sack of Ilium is a fixed mass of legend, a traditional subject, which the cycle-maker could tell "according to" the version of any one of its successive composers, even at times preferring a lyric poet like Stesichorus to any of the epic writers.

The *Tabulae Iliacae* refer to a large number of these ancient poems, more indeed than we can identify from the fragments (*cf.* Jahn, No. VI.). Those poems whose names are known are attributed by Athenaeus and Pausanias, our earliest authorities, to various authors. Athenaeus refers to "him who made the *Titanomachy,* whether Eumelus or Arctinus or whatever name he prefers"; "him who made the *Cypria,* Hegesias or Stasinus or Cyprias"; but he generally leaves the author anonymous: Ὁ τὴν Ἀλκμαωνίδα ποιήσας, ὁ τοὺς Νόστους ποιήσας. Occasionally we find a plural: οἱ τὴν Ἡρακλείαν ποιήσαντες, οἱ τῶν Κυπρίων ποιηταί (Eratosthenes *ap.* Strabo 688: Schol. v. on *Od.* xvi. 57). This means, not of course "the committee which composed the Heracleia," but "the various poets or 'makers' who made versions of the Heracleia."

An epitome of Proclus' account of the poems which formed the sources of his Epic cycle is given partly in Photius' *Bibliotheca* (*c* 850 A.D.), partly in the Venetian scholia. The epitome gives a definite list of poems each with a definite author: the *Iliad* by Homer, *Aethiopis* by Arctinus of Miletus, *Little Iliad* by Lesches of Mitylene, *Sack of Ilium* by Arctinus, *Nostoi* or *Homecomings* by Agias of Trozen, *Odyssey* by Homer and *Telegonia* by Eugammon of Cyrene. This definiteness is apparently the result of epitomizing the longer and more doubtful accounts given by earlier authorities; and references to these same poems elsewhere show that they were far from definite wholes. The same incidents are quoted now from the *Sack* and now from the *Little Iliad.* Simi-

larly an attempt to give definite dates to the separate poets breaks down on examination.

It is noteworthy that the poems about the *Sack of Troy* seem to be pro-Trojan or at least anti-Greek in sympathy. As in Euripides' *Trojan Women,* all possible cruelties and crimes are attributed to the conquerors. This may be due merely to the nature of the theme. Any poet telling of the sack of a town, whether he takes the romantic tone of the *Little Iliad* or the tragic tone of the *Sack of Ilium,* is fairly sure to make the most of the sufferings of the conquered women and children; but we may observe also that the alleged authors are mostly drawn from towns outside the traditional Homeric birthplaces; and that Miletus, for instance, the city of Ionian science and commerce, may have regarded with some feeling of opposition the barbarous glories of the old towns which it had outstripped.

It is not to be supposed that these poems of the Trojan cycle, in their late versions, were true representatives of the rejected epic literature. The true rock from which the *Iliad* was hewn is lost. The Theban epics, especially the *Thebais,* seem to have come nearest to the *Iliad* in general esteem, and to have been largely used in the final make-up of that poem; next to them in importance, perhaps, were Thessalian lays about the ship Argo (*πᾶσι μέλουσα, Od.* xii. 70) and Argive lays about Heracles. The *Titanomachies* and poems about the origin of the world belong to the Hesiodic group rather than the Homeric.

Plot of the Iliad.—I. (*Λοιμός. Μῆνις.*) Chryses, priest of Apollo, comes to the Greek camp with ransom, to buy back from Agamemnon his captive daughter, Chryseis. Scornfully refused, he prays to Apollo to avenge his daughter's wrong. Apollo sends pestilence on the host. After nine days Achilles calls an assembly, discovers the cause of the pestilence, and demands that Chryseis be restored to her father. Agamemnon consents, but takes instead Achilles' own prize, Briseis. Achilles renounces his allegiance. His mother Thetis persuades Zeus to make the Greeks rue the wrong done to her son.

II. (*Ὄνειρος. Βοιωτία, ἡ κατάλογος τῶν νεῶν.*) Zeus thereupon beguiles Agamemnon with a dream to begin a pitched battle. Agamemnon, to try the temper of his men, proposes to abandon the expedition; they, led by a demagogue, Thersites, are only too ready to do so; but Odysseus beats Thersites and rallies them. There follows a Catalogue of the Greek ships as they were marshalled at Aulis before starting to Troy (484–760), and of the Trojans and their allies (816–877).

III. (*Ὅρκοι. Τειχοσκοπία. Μενελάου καὶ Πάριδος μονομαχία.*) Paris challenges Menelaus to single combat for Helen; a truce is proclaimed. Helen and Priam watch the Greek army from the Walls of Troy. Paris is nearly slain, but saved by Aphrodite.

IV. (*Ὅρκιων σύγχυσις. Ἀγαμεμνονος ἐπιπώλησις.*) Athena, to injure the Trojans, persuades Pandarus, son of Lycaon, to break the truce by treacherously shooting Menelaus. Wrath of Agamemnon: he marshals the host and the armies join battle, the Trojans now involved in a curse.

V. (*Διομήδους ἀριστεία.*) Diomedes' day: he makes great slaughter of the Trojans, especially of the traitor Pandarus by a wound through the mouth (290–296). He wounds Aphrodite, who is protecting her son Aeneas, and sends her weeping to Olympus. He is beaten back from Troy by Apollo. Ares helps the Trojans; the Greeks are failing, when Athena mounts in Diomedes' chariot and they charge and wound Ares, who flies with a shout like ten thousand men.

VI. (*Ἕκτορος καὶ Ἀνδρομάχης ὁμιλία.*) Hector goes back to Troy to bid the women make a great procession and prayer to Athena. Meanwhile Diomedes and the Lycian Glaucus are about to fight, when they recognize one another as hereditary guest-friends, and part with gifts. Hector gives his message, says farewell to his wife Andromache and their child, who is frightened of his father's plume; he collects Paris and goes back to the battle never to return.

VII. (*Ἕκτορος καὶ Αἴαντος μονομαχία. Νεκρῶν ἀναίρεσις.*) Hector challenges all the Greeks; the lot falls on Ajax; the fight is indecisive and they part with gifts. In Troy Antenor urges that, since they now fight with a curse upon them, they give back Helen and her treasure and ask for peace. Paris will not give up Helen, but offers to restore the treasure and add more. This offer is sent next day to the Greeks and refused; a truce is made for the burial of the dead; the Greeks build a wall round the ships. A wine ship comes from Lemnos and the Greeks lie on the shore drinking.

VIII. (*Κόλος μάχη.*) Zeus, to fulfill his promise, commands the gods to keep away from the battle and himself comes to the top of Mt. Ida. He weighs the fates of Greeks and Trojans and drives the Greeks back with thunderbolts. Agamemnon and Teucer resist desperately; Poseidon, and then Hera and Athena, try again to help the Greeks, but are warned back. The Trojans bivouac on the field and their fires surround the Greek camp.

IX. (*Πρεσβεία πρὸς Ἀχιλλέα. Λιταί.*) At a secret meeting of the chiefs, Agamemnon again offers to abandon the expedition and set his followers free; Diomedes and Nestor insist on continuing. Watches are set lest the Trojans attack by night. Agamemnon next offers to make atonement to Achilles and implore his forgiveness, to return Briseis untouched, and splendid gifts with her. Odysseus, Ajax and Achilles' old tutor Phoenix go to beseech Achilles, who passionately refuses all their offers and declares he will sail for home on the morrow. Phoenix stays with him; the other envoys return.

X. (*Δολωνεία.*) Agamemnon and Menelaus call the chiefs to watch by the trench. Odysseus and Diomedes go out as spies. They capture and kill a Trojan spy, Dolon; by his information they surprise the camp of the Thracians, kill Rhesus, take his horses and escape.

XI. (*Ἀγαμέμνονος ἀριστεία.*) Agamemnon by desperate valour beats back the Trojans until he is wounded. Diomedes and Odysseus, rallying the Greeks, are both wounded; then Machaon and Eurypylus. Achilles, seeing the wounded Machaon pass, sends Patroclus to enquire. Nestor urges on Patroclus that Achilles should either return to the war or send Patroclus with the Myrmidons.

XII. (*Τειχομαχία.*) The Trojans assault the Greek wall. Asius' chariot charge is defeated; Sarpedon tears down a turret; at last Hector breaks through one of the gates, and the Trojans rush in.

XIII. (*Μάχη ἐπὶ ταῖς ναυσίν.*) Poseidon, hidden from Zeus, encourages the Greeks. The two Ajaces and, above all, the grey-haired Idomeneus uphold the battle. The Trojans waver but rally.

XIV. (*Διὸς ἀπάτη.*) Nestor and the wounded chiefs throw themselves again into the battle. Meantime Hera, having borrowed the magic girdle of Aphrodite and persuaded Sleep to help her, beguiles Zeus from his watch and sends him to sleep. Poseidon openly aids the Greeks; Hector is felled by a great stone and the Trojans driven back.

XV. (*Παλίωξις παρὰ τῶν νεῶν.*) Zeus awakes. At his bidding Poseidon retires, Apollo puts new strength into Hector and, bearing his aegis, leads the Trojans on past the wall and up to the ships. Patroclus returns to Achilles and implores him with tears to help the Greeks. Ajax with a great naval ramming-pole, leaping from ship to ship, is holding the Trojans back, when Hector brings fire to burn the ship of Protesilaus.

XVI. (*Πατροκλεία.*) At Patroclus' entreaty Achilles, though he will not himself fight till Agamemnon offers atonement, gives his chariot and armour to Patroclus and bids him drive the Trojans back but not go further, when once the camp is clear. Patroclus with the Myrmidons routs the Trojans, kills Sarpedon and many others, and pursues right up to the wall of Troy, where he is stopped by Apollo. He kills Hector's charioteer; then, dazed by Apollo, and wounded by Euphorbus, he is slain by Hector, while Automedon with the immortal horses of Peleus flies to the ships.

XVII. (*Μενελάου ἀριστεία.*) Hector strips Achilles' armour from the corpse of Patroclus. A desperate battle arises about the body. Antilochus is sent to bear the news to Achilles. The immortal horses stand weeping for Patroclus and then return to the battle. At last Menelaus recovers the body, and bears it back to the ships while the Ajaces cover his retreat.

XVIII. (*Ὁπλοποιία.*) Antilochus gives the news: despair of Achilles. His mother Thetis rises from the sea to help. "Give me armour that I may slay Hector." "My son, it is written, that when

Hector dies you die." "Would I were dead now, who failed to save my friend." So Thetis goes to beg Hephaestus to make her son new armour. The Trojans are pressing on to recover the body of Patroclus, when Achilles shouts his war cry from the trench and they stop. They encamp on the plain. The Greeks bring the body to Achilles' tent and prepare it for burial. The Shield of Achilles is described (356–617).

XIX. Achilles receives the arms. He calls an assembly, renounces his wrath and demands instant battle. Agamemnon confesses his fault and offers gifts of atonement. The army eat before battle, but Achilles will not eat till Hector is slain. He mounts his chariot and calls to the immortal horses: "Bear me safe through this battle; do not leave me dead as you left Patroclus." And the horse Xanthus speaks: "Yes, this one time; but never again. Your death is close." "I know it," he answers and drives with a shout into the battle.

XX. (*Θεομαχία.*) His promise fulfilled, Zeus now allows the gods to mix in the battle as they choose, while he watches from Olympus. Hera, Athena, Poseidon, Hermes, Hephaestus help the Greeks; Ares, Apollo, Artemis, Leto, Aphrodite and the river Xanthus the Trojans. Achilles on foot fights with Aeneas, who is saved by Poseidon to be hereafter king and father of kings to the Trojans; with Polydorus, whom he kills, and with Hector, who is saved by Apollo. He puts the Trojans to flight.

XXI. (*Μάχη παραποτάμιος.*) Achilles drives the Trojans, part into the city, part into the River Xanthus. He kills Lycaon, though a suppliant, and takes twelve youths to be sacrificed at the pyre of Patroclus. He kills Asteropaeus, and mocks at his River-ancestor. The river Xanthus, choked with dead, rises in flood against Achilles to beat down his shield and drown him. There is a battle of water and fire. The gods are again in strife on the plain. Then all vanish except Apollo who tempts Achilles away from the city till the fugitives are safe within the gates.

XXII. (*Ἕκτορος ἀναιρέσις.*) Hector alone stays outside, awaiting Achilles, while his parents implore him to come in. As Achilles comes he turns to fly, and is pursued three times round the city; then he stands. Zeus weighs the fates of the two men in his scales, and Hector's fate falls. Apollo deserts him, while Athena, taking the shape of his brother Deiphobus, betrays him. When both have thrown their spears she sends that of Achilles back to him. Achilles kills Hector and refuses his dying prayer for burial. He drags the dead body behind his chariot to the ships, while Hector's parents and wife make lamentation on the city wall.

XXIII. (*Ἆθλα ἐπὶ Πατρόκλῳ.*) The Myrmidons make a procession round the bier of Patroclus, and hold a funeral feast. That night the ghost of Patroclus appears to Achilles: "Bury me quickly that I may cross the river; and let your bones lie with mine in the golden jar." Next morning a great pyre is built and the body burnt, with many victims, among them the twelve Trojan youths, "an evil deed." Funeral games in honour of the dead (257–897).

XXIV. (*Ἕκτορος λύτρα.*) For many nights Achilles has neither sleep nor food. Each day he drags the dead Hector behind his chariot round Patroclus' grave, but Apollo preserves the body from decay. By command of Zeus Thetis warns Achilles of the wrath of the gods. "My son, take food and sleep. Remember your own death is close. Fear the gods, and give back Hector's body for burial." Iris sent from Zeus bids Priam rise from the dust, go to Achilles with ransom and ask for Hector's body. The old king starts by night with a chariot laden with gold, and guided by Hermes finds his way unseen to Achilles' tent. "Achilles, remember your own father; I am more wretched than he, and I have done what no man on earth has done before, lifted to my lips the hand that killed my son." Then the two enemies weep together in their common misery, and at dawn Priam takes back the dead Hector to Troy, where Andromache, Hecuba and Helen lament over him, and a very great funeral is made.

Plot of the Odyssey.—I. (*Θεῶν ἀγορά. Ἀθηνᾶς παραίνεσις πρὸς Τηλέμαχον.*) It is the tenth year after the fall of Troy. Athena reminds the Gods in council of Odysseus, whom Poseidon —now absent—has plagued so long. He is now detained in the Isle of Calypso, while suitors beset his wife and plunder his substance. Zeus agrees that Hermes shall be sent to Calypso, while Athena goes to Ithaca and, in the form of Mentor, stirs up Telemachus to call a gathering of the people in protest against the suitors and himself to go in search for his father. In the hall Phemius sings of the sad homecoming of the Greeks from Troy.

II. (*Ἰθακησίων ἀγορά. Τηλεμάχου ἀποδημία.*) In the gathering Telemachus demands the help of the people against the suitors. Antinous answers that as soon as Penelope gives her hand to one of them they will go. Telemachus demands a ship in which to search for his father, but Leiocritus, a suitor, dismisses the assembly. Athena, disguised as Mentor, gets him a ship. He collects provisions and, without Penelope's knowledge, starts at night.

III. (*Τὰ ἐν Πύλῳ.*) They come to Pylos and are welcomed by the aged Nestor. He knows nothing of Odysseus, but tells of the homecomings of various chiefs, and the death of Agamemnon. Menelaus, who has just returned from great wanderings, may know of Odysseus. At evening the disguised Mentor vanishes and is recognized as divine by Nestor. Telemachus spends the night with Nestor, and starts next day with Peisistratus, son of Nestor, for Sparta. The first night is spent at Pherae.

IV. (*Τὰ ἐν Λακεδαίμονι.*) They find Menelaus celebrating the double wedding of a son and a daughter, and are led to his splendid palace. A mention of Odysseus reveals Telemachus to Menelaus, while Helen recognizes him at sight. They talk of Odysseus and are filled with grief till Helen gives them a nepenthe from Egypt. Next day Menelaus relates how Proteus the sea-god told him of the fates of Agamemnon and Ajax the Locrian, and how Odysseus was in the isle of Calypso. Meantime the suitors have learned of Telemachus' expedition and send a ship to ambush him at the isle of Asteris. Penelope hears of her son's voyage and of the plot against him, and weeps till Athena comforts her with a dream.

V. (*Καλυψοῦς ἄντρον. Ὀδυσσέως σχεδία.*) Hermes arrives at the isle of Calypso and gives the message of the gods. Calypso weeps but obeys, and helps Odysseus to build a flat-bottomed boat. The parting of Odysseus and Calypso. On the 18th day he is in sight of Scheria, the land of the Phaeacians, when Poseidon, returning from the Aethiopians, sees him and wrecks his boat. The sea-goddess Ino gives him a veil which bears him up till, naked and half-dead, he reaches a river mouth and, covering himself with leaves, falls asleep.

VI. (*Ὀδυσσέως ἄφιξις εἰς Φαίακας.*) Nausicaa, daughter of King Alcinous, comes with her maidens to wash clothes at the river mouth. While the clothes are drying they play ball, and their voices wake Odysseus, who comes out and begs for protection. They all run away except Nausicaa, who receives him and gives him food and raiment, and tells him the way to her father's house. As she returns he follows at a distance and at evening comes to a grove of Athena outside the walls.

VII. (*Ὀδυσσέως εἴσοδος πρὸς Ἀλκίνουν.*) Athena, disguised as a girl, leads Odysseus unseen into Alcinous' splendid hall, where he supplicates the queen, Arêtê. The king and queen accept him, and promise him gifts and a ship to take him home. He tells of his voyage from Calypso's Isle.

VIII. (*Ὀδυσσέως σύστασις πρὸς Φαίακας.*) A feast is held and games, in which Odysseus, being taunted, wins the discus throwing, though he will not otherwise compete. The bard, Demodocus, sings the loves of Ares and Aphrodite. In the evening gifts are brought to Odysseus. Demodocus sings of the taking of Troy at which Odysseus silently sheds tears, but Alcinous marks him and asks his name and race.

IX. (*Ἀλκίνου ἀπόλογοι. Κυκλώπεια.*) "I am Odysseus, son of Laertes. From Troy we came first to the Cicones, where in raiding I lost 72 men; thence to the land of the Lotus-eaters; then to the isle of the Cyclops, who killed and ate six of my men, but we blinded his one eye as he lay drunk. So we escaped

X. (*Τὰ περὶ Αἰόλου καὶ Λαιστρυγόνων καὶ Κίρκης.*) "Thence to the isle of Aeolus, king of the winds, who gave me the winds, all tied up in bags, except the west-wind, which blew me homewards. But my men thought the bags held treasure, and opened them, so the winds rushed out and drove us away to the land of the Laestrygones, giants and cannibals, where I lost 11 ships out of 12. Thence to a beautiful wooded island, where we heard a

goddess singing in the forest. She was Circe, and she turned into swine the men I sent out; but Hermes gave me a magic root, and when she struck me with her wand I defied her, and she was subdued to me. There we stayed a year. She told me that before reaching home I must go to the land of the dead beyond the ocean and consult the spirit of the seer Teiresias"

XI. (Νέκυια.) "I came to the dark land of the Cimmerians and made sacrifice. The ghosts gathered about the blood, but I would suffer none to drink till Teiresias came. The first ghost I saw was my comrade Elpenor, who had been killed by an accident just as we started; then came my mother, Anticleia. Teiresias told me of my future fates; my mother, who had died of grief for me, told me of home. Then I saw the beautiful women of the past, and the heroes; Ajax would not speak to me. Then Minos and Orion, and those punished for sin, Tityus, Tantalus, Sisyphus and the shadow of Heracles."

XII. (Σειρῆνες, Σκύλλα, Χάρυβδις, βόες Ἡλίου.) "I returned to Circe, who told me of my future voyage, and warned me above all not to kill the oxen of the Sun. Thus I stopped my men's ears when we passed the sirens; though I listened myself, tied to the mast. Then we passed the Wandering Rocks and Charybdis the whirlpool, though Scylla took six of my men. Then a tempest held us on shore in Thrinacia for a month, and my companions, starving, at last killed the oxen of the Sun while I was asleep. Then, when we put to sea, came storm and thunderbolt; my ship and all my men were destroyed; I was driven back through Charybdis, and escaped clinging to the mast and keel to the isle of Calypso."

XIII. (Ὀδυσσέως ἀνάπλους παρὰ Φαιάκων καὶ ἄφιξις εἰς Ἰθάκην.) The story over, the Phaeacians give Odysseus their gifts, and the next evening the ship starts. It arrives before dawn at the harbour of Phorcys, near a cave of the Nymphs; and Odysseus is left asleep on the shore. The ship on its way back is turned by Poseidon into a rock. Odysseus wakes and does not know his own land, till Athena, disguised as a youth, explains to him. She disguises him as an old beggar.

XIV. (Ὀδυσσέως πρὸς Εὔμαιον Ὁμιλία.) He finds the hut of his old swineherd, Eumaeus, and is welcomed as a stranger. They talk of Odysseus. He tells false stories, how he is a Cretan, and how he has seen Odysseus, who will soon return. Eumaeus thinks both Odysseus and Telemachus are dead, but remains true to them. The night is very cold, and Odysseus borrows a cloak.

XV. (Τηλεμάχου πρὸς Εὔμαιον ἄφιξις.) Telemachus in Sparta is warned by Athena of the suitors' ambush. He returns with Peisistratus to Menelaus and to Nestor. There he leaves Peisistratus and takes with him Theoclymenus, an Argive seer now in exile. He escapes the ambush and lands in Ithaca far from the city. Meantime Eumaeus, the child of a prince, taken by slavers, has told Odysseus the story of his life, and discussed how Odysseus is to go to the city safely.

XVI. (Ἀναγνωρισμὸς Ὀδυσσέως ὑπὸ Τηλεμάχου.) Telemachus arrives at the hut, and sends Eumaeus to the city to tell his mother of his safe return. Alone with Telemachus, Odysseus —retransformed by Athena—reveals himself, and they discuss the battle against the suitors. The suitors' ambush-ship returns baffled. Eumaeus comes back to the hut.

XVII. (Τηλεμάχου ἐπάνοδος εἰς Ἰθάκην.) Telemachus returns to the palace and brings Theoclymenus as a guest. He tells Penelope what he has heard from Menelaus. Theoclymenus prophesies that Odysseus is alive. Odysseus arrives, disguised as a beggar; only the old dog Argus, lying neglected on the dunghill, recognizes him and dies. Odysseus is insulted by the goatherd Melanthius. At the feast he receives food from the suitors, though Antinous throws a stool at him. He promises to speak to Penelope at nightfall.

XVIII. (Ὀδυσσέως καὶ Ἴρου πυγμή.) The suitors incite another beggar, Irus, to drive Odysseus off the threshold. Odysseus almost kills him with a blow. Penelope rebukes the suitors for their unkindness to the beggar, and makes them bring her gifts, as suitors should. The handmaid Melantho insults Odysseus and Eurymachus throws a footstool at him.

XIX. (Ὀδυσσέως καὶ Πηνελόπης ὁμιλία. Τὰ νίπτρα.) Odysseus, with Telemachus, removes the weapons from the Hall. Melantho girds at him but Penelope calls him to her, and tells how she made the suitors agree to wait till she should have finished her web; but now they have found her undoing it during the night, and will wait no more. Odysseus tells her he is a Cretan: he says that Odysseus—whom he describes exactly—will return this very year on the day that ends one month and begins another (*i.e.*, on the morrow). The old nurse Eurycleia washes his feet and recognizes him by a scar on the knee; but he warns her to silence. Penelope arranges that she will agree to wed the suitor who can bend Odysseus' bow and shoot through the sockets of twelve axe-heads.

XX. (Τὰ πρὸ τῆς μνηστηροφονίας.) Odysseus lies sleepless, listening to the weeping of Penelope, till Athena comforts him. The palace is prepared for the feast of Apollo and the new moon (the winter solstice at the end of the 19th year). The suitors conspire in the agora against Telemachus, but are deterred by bad omens, and return to feast. One throws a cow's foot at Odysseus. Theoclymenus the seer feels that there is sudden darkness on the hall, and blood and a sound of weeping, and ghosts hurrying toward the darkness. The suitors mock him, but he goes from them.

XXI. (Τόξου θέσις.) Penelope brings out Odysseus' old bow, and proposes the trial to the suitors. Eumaeus and the cowherd Philoetius weep at the thought of their master. First Leiodes the bard tries the bow in vain; then many others. Antinous bids the goatherd grease and warm it. Meantime Odysseus outside reveals himself to the swineherd and cowherd. Eurymachus tries the bow. Antinous puts off further trial till after the feast. Then Odysseus begs to be allowed to try; the suitors refuse, but Penelope insists. Eumaeus gives him the bow; Eurycleia shuts the postern and Philoetius the other door of the hall. Odysseus bends the bow and shoots straight through the holes in twelve axe-heads. Telemachus, fully armed, leaps up beside him on the threshold.

XXII. (Μνηστηροφονία.) "Now for another target that none has ever struck!" He shoots Antinous through the throat, then Eurymachus, then others till he has no arrows left. Telemachus has brought spears and armour for four; and Odysseus, Telemachus, Eumaeus and Philoetius arm. Meantime the suitors have sent the goatherd, Melanthius, to bring arms for them; he has brought twelve sets, when the other herds catch him and tie him to a post. There is a great fight with spears, while Athena watches in the shape of a swallow, and all the suitors are slain except the bard and the herald, who were innocent. Odysseus has the corpses removed, twelve guilty bondmaids hanged, and Melanthius mutilated and slain. Then he burns sulphur and purifies the hall.

XXIII. (Ὀδυσσέως ὑπὸ Πηνελόπης ἀναγνωρισμός.) Penelope is awakened from sleep by Eurycleia with the news. She comes down to the hall, sees what has been done, but she cannot believe: "her eyes stay like horn or iron." Odysseus, much hurt, makes the men and the faithful handmaids dance and make merry, so that the slaying may not be known outside. When he comes back to Penelope she tests him by ordering that his bed be brought outside the chamber. "Now who has moved my bed, which I built on a stump of olive?" At that she knows him, and throws herself in tears into his arms. "Forgive me. All these years I have schooled myself not to be deceived by some stranger who should pretend to be you!" So they were rejoined, and came again to their ancient marriage-bed. Through the long night they lay and Odysseus told his story. In the morning he set off with his son and the herdsmen to see his father Laertes.

XXIV. (Νέκυια δευτέρα. Σπονδαί.) The souls of the suitors, guided by Hermes to the shades, meet Agamemnon and Achilles, and tell their story. Odysseus meantime finds Laertes working in his orchard, in much poverty, and reveals himself. In the city the news of the slaying is known, and the kindred of the suitors come out to Laertes' farm for vengeance, led by Eupeithes, father of Antinous. A battle begins and Laertes slays Eupeithes, but Athena stops the strife and makes an oath of peace between Odysseus and his enemies. (G. G. A. M.)

HOME SEWING. The sewing actually done in the home to-day centres in darning, repairing, remodelling, and making children's clothing and simple adult garments. To acquire skill in hand sewing, attention must be given to the correct position of

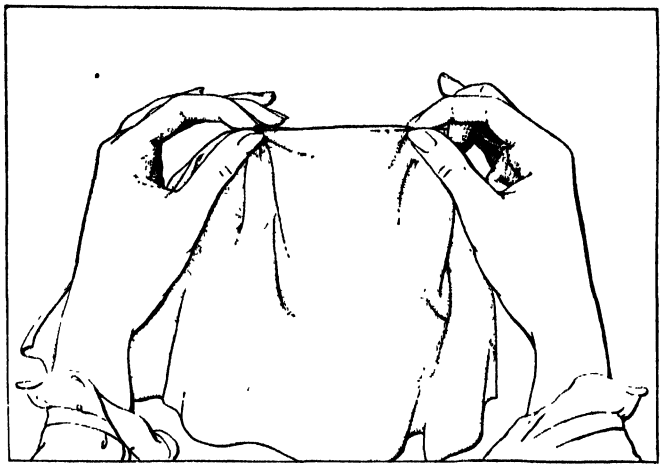

FIG. 1.—CORRECT POSITION OF THE HANDS FOR THE RUNNING STITCH

the hands. For general use, cotton thread No. 70 in an 18 in. length, and needle No. 7 sharp give satisfactory results. The point of the needle should be held in the right hand between the

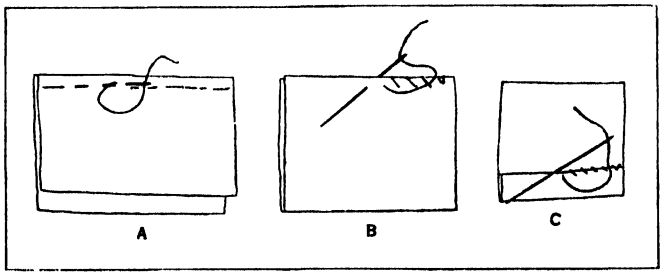

FIG. 2.—CORRECT NEEDLE POSITIONS. (A) BACK-STITCH. (B) OVER-CASTING STITCH. (C) HEMMING STITCH

thumb and forefinger. The hand must be so spread that the needle's eye rests on the upper side of the thimble, on the sharply bent second finger. The needle points diagonally over the left

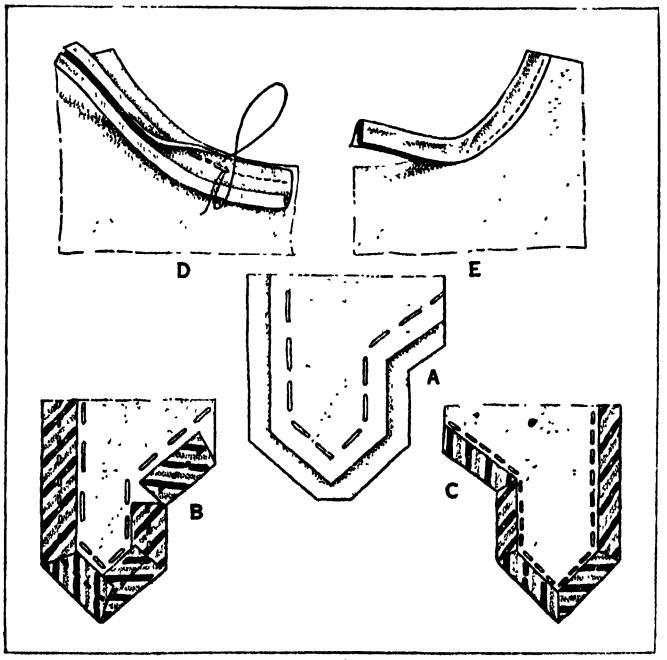

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FIG. 3.—PIPING AND BINDING: (A) EDGE TO BE PIPED. (B AND C) FINISHED EDGE FROM RIGHT AND WRONG SIDES; (D AND E) METHODS OF BINDING WITH BIAS-FOLD TAPE

shoulder and the work progresses from right to left, except in embroidering, which usually progresses from left to right.

The following stitches are helpful for constructing garments by hand. However, the sewing machine gives added strength to garment construction and saves much time and effort; hence, it should be used wherever feasible.

The running stitch is a succession of small, even stitches used to join two pieces of cloth, as in tucking or seaming. It is made

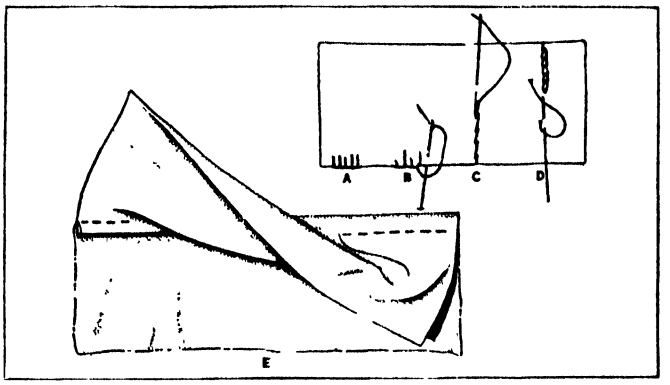

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FIG. 4.—(A) EVEN BLANKET STITCH. (B) LONG AND SHORT BLANKET STITCH. (C) OUTLINE STITCH. (D) CHAIN STITCH. (E) FRENCH SEAM

by holding the cloth between the forefinger and thumb of both hands; the left keeps the cloth taut and permits it to slip forward as needed; the right holds the point of the needle as well as the cloth and makes the stitch by twisting the wrist as the needle is pushed forward. The needle should be taken from the cloth only when it has travelled the entire length. Slight variations are used for basting or gathering an edge.

Backstitching is a reinforced running stitch. The needle is brought out of the cloth at every third stitch and re-entered at the beginning of it.

In overcasting, a small slanting stitch is repeated on a raw edge to prevent its ravelling.

The hemming stitch is a small slanting stitch beginning in the cloth and ending in the folded edge it should hold in position.

Simple embroidery stitches give charm. The blanket stitch protects the raw edge as well as decorates it. The outline and chain stitches outline a design or hold a hem in place

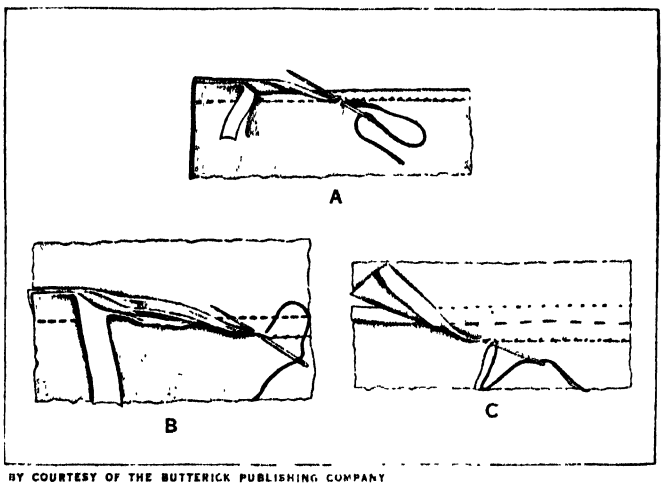

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FIG. 5.—(A) FRENCH FELL SEAM. (B) FLAT FELL SEAM. (C) STITCHED FELL SEAM

The use is suggested also of cross-stitching, feather or coral stitching, hemstitching, smocking and French embroidery—based on the use of the French knot, satin, bullion and wheat stitches.

Commercial patterns for garment construction are carefully designed and charted. Hence, with care in selecting the size and style, and in following the directions given, the novice may get excellent results. Attention to the following suggestions may save errors: Buy the pattern by measurements; study the chart for

placing and cutting thoroughly before cutting any pieces; test the pattern before cutting; cut pieces for the right and left side of the body with the right or the wrong sides of the cloth together if the material has a right and wrong side in order to avoid constructing both pieces for the same side; when the material has a decided design, each piece should be cut with consideration for its relation to pieces in juxtaposition on the finished garment. The inexperienced sewer should first make lingerie, sleeping garments, aprons or house-dresses. Woollens and silks are more difficult to make up than cottons or linens.

Seams vary in kind with their position on the garment and the weight of the cloth. A French seam is used on sheer cloth. Baste the seam so that the edges match and the wrong sides of the cloth meet; stitch it $\frac{1}{8}$ in. from the edge, crease the seam flat and turn it so the right sides meet; crease sharply on the line of stitching and baste and stitch $\frac{1}{4}$ in. from the crease.

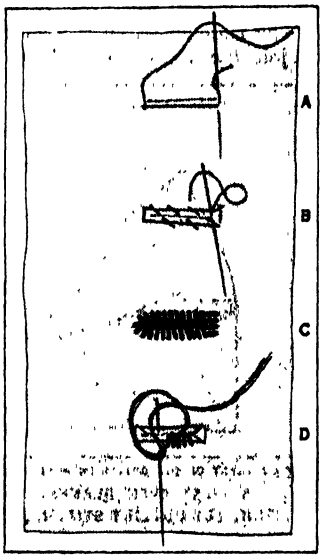

FIG. 6.—STEPS IN MAKING BUTTONHOLE.
(A) Boxing, needle in position for tying stitch, (B) Boxes and overcast, (C) Worked button-hole, showing fan end and bar end, (D) Button-hole stitch

The stitched fell seam is used on heavy material and gives a tailored finish. Baste the seam so that the wrong sides of the material meet and stitch $\frac{1}{2}$ to $\frac{5}{8}$ in. from the edge. Trim one piece to within $\frac{1}{8}$ in. of the stitching and crease the other edge towards the trimmed one. Lay the seam flat on the garment and baste and stitch $\frac{1}{16}$ in. from the creased edge. This leaves a double row of stitching on the right and makes a smooth seam

A plain seam is used on heavy material that does not readily ravel. Baste the seam so that the right sides of the material meet; stitch it $\frac{1}{2}$ in. from the edge; trim and bind or overcast the edges separately or together. On wool, they may be pinked with a pinking machine or shears. They may be creased towards each other and stitched or run together.

A hem, used to finish a straight raw edge, is made by two turns of the cloth to the wrong side. It is held in position by machine stitching or hand hemming. One-quarter inch is an average measurement for the depth of the first turn. This may be creased with the thumb nail, pressed with an iron or basted into position. The depth of the second turning depends upon the location and purpose of the hem. It may have a decorative function and should be studied carefully. Three or four inches is a popular depth for a skirt hem. On bulky material the edge may be turned but once and bound before hemming. A bias facing or binding may finish a shaped edge.

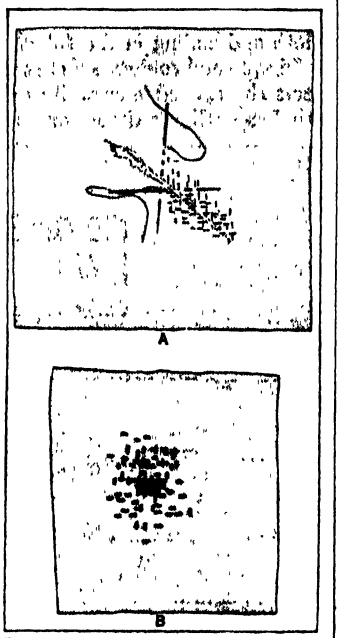

FIG. 7.—DARNING: (A) CLOTH DARN ON DIAGONAL TEAR, (B) STOCKINETTE DARN

Set-in pockets and bound buttonholes do much to give a tailored dress a professional look. A worked buttonhole should be made in at least two thicknesses of cloth. Mark and cut a slit on a thread of the cloth slightly longer than the diameter of the button. Hold the buttonhole along the first finger of the left hand and box the slit; overcast the edges, making two stitches on either side and tying stitches across either end. Buttonhole stitch along the first side to the tying stitches and put in two more "ties"; turn it half around and work a bar of fine blanket stitches across the end covering the tying stitches. Give the buttonhole a second half turn and continue the buttonhole stitch along the second side; bar the second end. One end may be made fan-shaped if preferred, omitting the bar and carrying the buttonhole stitches around the end.

The samplers, darns and patches of our grandmothers and the cleverly embroidered and constructed articles of the European

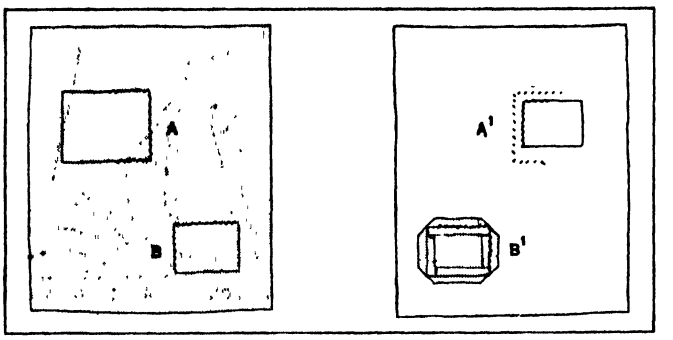

FIG 8.—PATCHING: LEFT, HEMMED PATCH, (A) RIGHT SIDE, (B) WRONG SIDE; RIGHT, OVERHAND PATCH, (A') RIGHT SIDE, (B') WRONG SIDE

peasants, the Chinese, Japanese and the natives of the West Indies and Philippine Islands, give us high standards of perfection. (K. W. K.)

HOMESTEAD, a borough of Allegheny county, Pa., U.S.A., on the south bank of the Monongahela river, 6·5m. from the heart of Pittsburgh. It is served directly by the Pennsylvania, the Pittsburgh and Lake Erie, and the Union railways, and has connections with several others; the river is used largely for the transportation of coal, and recently also for shipments of steel. The population in 1920 was 20,452, of whom 5,945 were foreign-born white, largely from eastern Europe. The "Homestead District," including the contiguous boroughs of Munhall, West Homestead, Hays and Whitaker, and Mifflin township (of which all these boroughs were originally a part) had in 1928 a population of over 50,000. In the Homestead District are more than 30 large industrial plants, employing between 15,000 and 20,000 men, and producing annually goods valued at over $200,000,000. The principal products are iron, steel, engines, mill machinery, castings, car-wheels, valves, axles, brick, tile, concrete blocks, ornamental iron, ice, cigars and aeroplane propellers. The great steel works covers 290ac. (lying chiefly in Munhall); has 100m. of railroad track within the plant, over which in a year move some 400,000 cars, carrying millions of tons of incoming materials and outgoing products. In West Homestead is a 20ac. plant where machinery for iron and steel works is made.

Homestead was planned as a residential centre in the beautiful Monongahela valley. The first lots were laid out in 1870, and the borough was incorporated in 1881. In 1879 appeared the first manufacturing plant, a glass factory; and in 1880–81 the original steel works was built, which in 1883 was bought by Carnegie, Phipps and company. In 1892 Homestead was the scene of one of the most serious strikes in the history of the United States, carried on by the National Amalgamated Association of Iron and Steel Workers against the Carnegie Steel company. It lasted 143 days and ended in a victory for the company. The arrival of 200 Pinkerton detectives on July 6 resulted in a riot in which 7 men were killed and 20 or more wounded. To restore order the governor sent the entire militia of the State. (*See* STRIKES AND LOCK-OUTS.)

HOMESTEAD: *see* FARM.

HOMESTEAD AND EXEMPTION LAWS, laws (principally in the United States) designed primarily either to aid the head of a family to acquire title to a place of residence or to protect the owner against loss of that title through seizure for debt. These laws have all been enacted in America since about

the middle of the 19th century, and owe their origin to the demand for a population of the right sort in a new country, to the conviction that the freeholder rather than the tenant is the natural supporter of popular government, to the effort to prevent insolvent debtors from becoming useless members of society, and to the belief that such laws encourage the stability of the family.

Public Land Policies.—By the cessions of several of the older States, and by various treaties with foreign countries, public lands have been acquired for the United States in every State and Territory of the Union except the original 13, and Maine, Vermont, Kentucky, Tennessee and Texas. For a time they were regarded chiefly as a source of revenue, but about 1820, as the need of revenue for the payment of the national debt decreased and the inhabitants of an increasing number of new States became eager to have the vacant lands within their bounds occupied, the demand that the public lands should be disposed of more in the interest of the settler became increasingly strong, and the homestead idea originated. Until the advent of railways, however, the older States of the north were opposed to promoting the development of the West in this manner, and soon afterwards the Southern representatives in Congress opposed the general homestead bills in the interests of slavery, so that except in isolated cases where settlers were desired to protect some frontier, as in Florida and Oregon, and to a limited extent in the case of the Pre-emption Act of 1841 (*see* below), the homestead principle was not applied by Washington until the Civil War had begun.

Early Homestead Laws.—A general homestead bill was passed by Congress in 1860, but this was vetoed by President James Buchanan; two years later, however, a similar bill became a law. The act of 1862 originally provided that any citizen of the United States, or applicant for citizenship, who was the head of a family, or 21 years of age, or who, if younger, had served not less than 14 days in the army or navy of the United States during an actual war, might apply for 160 ac. or less of unappropriated public lands, and might acquire title to this amount of land by residing upon and cultivating it for five years immediately following, and paying such fees as were necessary to cover the cost of administration; a homestead acquired in this manner was exempted from seizure for any debt contracted prior to the date of issuing the patent. A commutation clause of this act permitted title to be acquired after only six months of residence by paying $1.25 per acre, as provided in the Pre-emption Act of 1841. The act of 1872, amended in 1901, allowed any soldier or seaman, who had served at least 90 days in the army or navy of the United States during the Civil War, in the Spanish-American War or in the suppression of the insurrection in the Philippines, and who was honourably discharged, to apply for a homestead, and permitted deduction of the time of such service, or, if discharged on account of wounds or other disability incurred in the line of duty, the full term of his enlistment, from the five years otherwise required for perfecting title, except that in any case he shall have resided upon and cultivated the land at least one year before the passing of title.

Post-World War Homesteads.—Pursuant to legislation enacted during and since the World War, ex-service men of that war are granted privileges in connection with homestead entries made by them similar to those conferred upon veterans of the Civil and Spanish wars, and in addition a preference over the general public in the entry of lands opened to entry by restoration from withdrawal or reservation, or by the filing of plots of survey of lands formerly unsurveyed. In the meantime, by an act of June 6, 1912, the period of residence required to perfect a homestead entry was reduced from five years to three, and a specific area to be cultivated substituted for the former indefinite provisions. After the more desirable and easily cultivable public land had passed into private ownership and that remaining was either chiefly valuable for grazing or generally cultivable only by dry farm methods, the need for a greater area to sustain a family was met by the Enlarged Homestead Act of Feb. 19, 1909, and the stock-raising act of Dec. 29, 1916, granting a maximum area of 640 acres. More than 250,000,000 ac. have been patented to individuals under the various homestead laws.

Exemption Features.—The principle of protecting the home against involuntary loss by reason of debt was recognized as a public policy by the original Homestead Act of 1862, which provided that no lands acquired thereunder should in any event become liable to the satisfaction of a debt contracted prior to the issuance of patent, and by a public resolution of Congress, approved on April 28, 1922, the provision was made applicable to all homesteads acquired under the later homestead laws. A short time before the original homestead law, providing for the acquirement of homesteads on the public domain, went into operation, some of the State legislatures had passed homestead and exemption laws designed to protect homesteads or a certain amount of property against loss to the owners in case they should become insolvent debtors, and by the close of the century the legislature of nearly every State in the Union had passed a law of this nature. At the present time every State has some sort of exemption law. These laws vary greatly, but with few exceptions exempt the home property, country or city, as well as certain personal property such as moneys, household effects, tools of trade and the like. The value of exempted real property ranges in the several States from $5,000 downward. To some debts the exemption does not usually apply; the most common of these are taxes, purchase money, a debt secured by mortgage on the homestead and debts contracted in making improvements upon it. If the homestead belongs to a married person, the consent of both husband and wife is usually required to mortgage it. Some States require that the homestead for which exemption is to be claimed shall be previously entered upon record, others require only occupancy and still others permit the homestead to be designated whenever a claim is presented. Exemption laws have also been enacted by the insular possessions of the United States.

Canadian Laws.—Canada has provided for the acquisition of homesteads on its public lands, and the several provinces have exemption laws similar to those of the United States. The same is true of other British possessions.

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HOMEYER, KARL GUSTAV (1795–1874), German jurist, born on Aug. 13, 1795 at Wolgast in Pomerania. He became professor of law (1827) at Berlin, and in 1854 a member of the council and of the upper house of the Prussian diet. He died on Oct. 20, 1874. His principal works are his edition of the *Sachsenspiegel* (in 3 vols., 1827, 3rd ed., 1861, containing also some other important sources of Saxon or Low German law), which is still unsurpassed in accuracy and sagacity of research; *Die Haus- und Hofmarken* (1870); and many papers contributed to the *Transactions* of the Berlin Academy: *Über die Heimat* (1852); *Genealogie der Handschriften des Sachsenspiegels* (1859); *Die Stadtbücher des Mittelalters* (1860); *Der Dreissigste* (1864), etc.

HOMICIDE, the general and neutral term for the killing of one human being by another. The nature of the responsibility of the slayer to the State and to the relatives of the slain has been one of the chief concerns of all systems of law from the earliest times, and it has been variously considered from the points of view of the sanctity of human life, the interests of the sovereign, the injury to the family of the slain and the moral guilt, *i.e.*, the motives and intentions of the slayer.

In England under the Norman system homicide became a plea of the Crown, and the rights of the kindred to private vengeance and to compensation were gradually superseded in favour of the right of the king to forfeitures where the homicide amounted to a crime (felony). Though homicide was thus made a public offence and not a matter for private vengeance, it took long to discriminate between those forms of homicide which should and those which should not be punished. The terms in English law used to describe *criminal* homicide are murder, manslaughter and *felo de se* (or suicide by a person of sound mind).

After the Conquest, and for the protection of the ruling race,

a fine (also called *murdrum*) was levied for the king on the hundred or other district in which a stranger was found dead, if the slayer was not brought to justice and the blood kin of the slain did not present Englishry, there being a presumption (in favour of the Exchequer) that the deceased was a Frenchman. After the assize of Clarendon (1166) the distinction between the killing of Normans and Englishmen gradually evaporated and the term murder came to acquire its present meaning of deliberate as distinct from secret homicide. In 1267 it was provided that the murder fine should not be levied in cases of death by "misadventure" (*per infortunium*). But at that date and for long afterwards homicide in self-defence or by misadventure or even while of unsound mind involved at the least a forfeiture of goods, and required a pardon. These pardons, and restitution of the goods, became a matter of course, and the judges appear at a later date to have been in the habit of directing an acquittal in such cases. But it was not until 1828 that the innocence of excusable homicide was expressly declared. The rule is now expressed in s. 7 of the Offences against the Person Act 1861: "No punishment or forfeiture shall be incurred by any person who shall kill another by misfortune, or in his own defence, or in any other manner without felony."

The further differentiation between different degrees of criminal homicide was marked by legislation of Henry VIII. (1531) taking away benefit of clergy in the case of "wilful murder with malice prepensed" (aforethought). That phrase is still the essential element in the definition of "wilful murder," which is committed "when a person of sound memory and discretion unlawfully killeth any reasonable creature in being and under the king's peace with malice aforethought either express or implied" (3 Co. Inst. 47), and the penalty is death (Offences Against the Person Act 1861, s. 1). Attempted murder is a felony and the penalty penal servitude for life. In the case of conspiracy and incitement to murder, a misdemeanour, the penalty is penal servitude for ten years. The whole development of the substantive law as to murder rests on judicial rulings as to the meaning of malice prepense coupled with the extrajudicial commentaries of Coke, Hale and Foster; for parliament, though often tempted by bills and codes, has never ventured on a legislative definition.

The expression "malice prepense" or "aforethought" has given rise to much discussion, especially when used to include so-called "constructive" murder. It implies an intent preceding the act intended. Express malice is the positive possession of an intention, and implied malice the possession of an intention shown by the acts of the accused. And so malice is implied where knowledge exists that the act is likely to kill or do grievous bodily harm to any person; where a police officer is resisted in the execution of his duty; where a felony is attempted or committed and death results, certainly if death were likely to result.

As in the case of other crime, infancy and insanity are excuses for homicide. A child under seven years of age is absolutely presumed to be *doli incapax*, and between seven and 14 there is a presumption but it may be rebutted. Now by the Children Act 1908 a sentence of death may not be pronounced or recorded against a child under 16. A person who satisfies the rules in *McNaghten's Case* (10 Cl. and F. 200) must be found guilty but insane. Drunkenness which produces insanity may be an excuse within *McNaghten's Case*, but drunkenness which falls short of this is no excuse, as in *Beard's Case* (26 Cox, C.C. 573) where the accused, under the influence of drink, while ravishing a girl inadvertently suffocated her. That was held to be murder. Again, in cases of homicide, the death must occur within a year and a day after the act of the accused.

Justification and Excuse.—English law still retains so much of its mediaeval character as to presume all homicide to be "malicious, and therefore murder, unless it is either *justified* by the command or permission of the law, *excused* on the ground of accident or self-preservation, or alleviated into manslaughter by being the involuntary consequence of some act not strictly lawful or occasioned by some sudden and sufficiently violent provocation." The truth of the facts alleged in justification, excuse or alleviation, is for the jury to determine: the question whether if true they support the plea for which they are put forward is for the court.

In the administration of the English criminal law as to homicide the consequences of too strict an adherence to the technical definitions of the offences are avoided (*a*) by the exercise by the jury of their powers to convict of manslaughter only even in cases where they are directed that the offence is murder or nothing; (*b*) by the report of the judge as to the particular circumstances of each case in which a conviction of murder has been followed by the statutory sentence of death; (*c*) by the examination of all the evidence in the case by the Home Office in order to enable the secretary of State to determine whether the prerogative of mercy should be exercised.

Homicide is *justifiable* and not criminal when the killing is done in the execution of the law. The most important case of justifiable homicide is the execution of a criminal in due course of public justice. This condition is most stringently interpreted. The execution must be carried out by the proper officer or his deputy: any person executing the sentence without such authority, were it the judge himself, would be guilty of murder. And the sentence must be strictly pursued: to execute a criminal by a kind of death other than that to which he has been judicially condemned is murder.

Homicide committed by an officer of justice in the course of carrying out his duty, as such, is also justifiable; *e.g.*, where a felon resists a legal arrest and is killed in the effort to arrest him; where officers in dispersing a riotous assemblage kill any of the mob, if the riot cannot be otherwise suppressed. In these cases the homicide must be shown to have been absolutely necessary. Again, homicide is justifiable if committed in the defence of person or property against forcible and heinous crime, such as murder, violent robbery, rape or burglary.

Homicide is *excusable* and not criminal at all when committed either by misadventure or in self-defence. In the former case the homicide is excused; where a man in the course of doing some lawful work, accidentally and without intention kills another, *e.g.*, shooting at a mark and undesignedly hitting and killing a man. The act must be strictly lawful, and death by misadventure in unlawful sports is not a case of excusable homicide. Homicide in self-defence is excusable when the slayer is himself in immediate danger of death, and has done all he could to avoid the assault. Accordingly, if he strikes and kills his assailant after the assault is over, this is not excusable homicide. But if the assault has been premeditated, as in the case of a duel, the death of either antagonist has under English law always been held to be murder and not excusable homicide. The excuse of self-defence covers the case in which a person in defence of others whom it is his duty to protect—children, wife, master, etc.—kills an assailant (*see* s. 7 of the Offences against the Person Act 1861 *supra*).

Manslaughter.—In English law the term "manslaughter" is applied to those forms of homicide which though neither justifiable nor excusable are attended by alleviating circumstances which bring them short of wilful murder. The offence is not defined by statute, but only by judicial rulings, and may be described as unlawful and felonious killing without malice express or implied. Its punishment is as a maximum penal servitude for life, and as a minimum a fine or recognizances to be of good behaviour. The quantum of punishment between the limits above stated is in the discretion of the court, and not, as under Continental codes, with fixed minima; and the offence includes acts and omissions of very varying gravity, from acts which only by the charitable appreciation of a jury fall short of wilful murder, to acts or omissions which can only technically be described as criminal.

There are two main forms of "manslaughter":—

1. "Voluntary" homicide under grave and sudden provocation or on a sudden quarrel in the heat of passion, without the slayer taking undue advantage or acting in an unusual manner. The substance of the alleviation of guilt lies in the absence of time for cool reflection or the formation of a premeditated design to kill. Under English law the provocation must be by acts and not by words or gestures, and must be serious and not trivial, and the killing must be immediately after provocation and while the slayer has lost his self-control in consequence of the provocation. The

provocation need not be by assault or violence, and perhaps the best-recognized example is the slaying by a husband of a man found committing adultery with the slayer's wife.

2. "Involuntary" homicide as a result of rashness or negligence in respect of matters involving danger to human life, *e.g.*, in driving trains or vehicles, or in dealing with dangerous weapons, or in performing surgical operations, or in taking care of the helpless.

The whole question of criminal responsibility for negligence was considered by the court of criminal appeal in 1925 in *Rex.* v. *Bateman* (28 Cox C.C. 33) and it was there laid down that it was not a question of epithets, but that "in order to establish criminal liability the facts must be such that, in the opinion of the jury, the negligence of the accused went beyond a mere matter of compensation between subjects and showed such a disregard for the life and the safety of others as to amount to a crime against the State and conduct deserving punishment." In the criminal courts the amount and degree of negligence is the determining question, and there must be *mens rea*.

From the point of view of civil as distinct from criminal responsibility homicide does not by the common law give any cause of action against the person causing the death of another in favour of the wife or blood relations of the deceased. In early law this was otherwise; and the wer of the deceased came historically before the right of chief or State But under English law the rights of relations, except by way of appeal for felony, were swept aside in favour of the Crown, on the principle that every homicide is presumed felonious (murder) unless the contrary is proved, and that in all cases of homicide not justifiable by law a forfeiture was incurred Trial by battle or appeal for felony was abolished in 1819 by 59 Geo. III , C. 46 in consequence of the case of *Ashford* v. *Thornton* (1 B. and Ald. 405) where the right was successfully maintained. The rights of the relatives were also defeated by application of the maxim *"actio personalis moritur cum persona"* ("a personal action dies with the person") to all proceedings for injury to the person or to reputation.

In England the law was altered at the instance of Lord Campbell in 1846 (9 and 10 V. c. 93) so as to give a right of a claim by the husband, wife, parent or child of a person killed by a wrongful (or even criminal) act, neglect or default by another which would have given the deceased if he had survived a cause of action against the wrongdoer. The compensation payable is what the surviving relative has lost by the death, and under the Workmen's Compensation Acts (in all cases to which they apply) the employer is liable even without negligence to compensate the dependants of an employee killed by an accident arising out of and in the course of the employment; and in such cases even if the death was due to serious and wilful misconduct by the employee, compensation is payable.

In the Indian penal code the definitions of murder are so drawn as to limit the offences to cases where it was actually intended to cause death or bodily injury by the acts or omissions of the slayer, and the definition of culpable homicide short of murder is so drawn as to exclude the forms of unintentional manslaughter due to neglect of duty.

In European codes distinctions corresponding to those of the English law are drawn between premeditated and other forms of criminal homicide; but more elaborate distinctions are drawn between the degrees of deliberation or criminality manifested in the slaying, and the minimum or maximum penalty is varied accordingly.

The most notable difference between England and the United States in regard to the law on this subject is the recognition by State legislation of degrees in murder. English law treats all unlawful killing not reducible to manslaughter as of the same degree of guilt in law. American statutes seek to discriminate for purposes of punishment between the graver and the less culpable forms of murder. (*See* CRIMINAL LAW; MURDER; MANSLAUGHTER; FELO DE SE.)

HOMILETICS, in theology the application of the general principles of rhetoric to the specific department of public preaching (Gr. ὁμιλητικός, from ὁμιλεῖν, to assemble together). It may be further defined as the science that treats of the analysis, classification, preparation, composition and delivery of sermons. (*See* HOMILY, PREACHING.)

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HOMILY, a simple religious address confining itself principally to the practical exposition of some ethical topic or some passage of Scripture. The Greek word ὁμιλία, from which homily is derived, means communion, intercourse and especially interchange of thought and feeling by means of words (conversation); it was early employed in classical Greek to denote the instruction which a philosopher gave to his pupils in familiar talk (Xenophon, *Mem.* 1. ii 6, 15). This usage of the word was long preserved (Aelian, *Varia Hist.* iii. 19); and the ὁμιλήσας of Acts xx. 11 may suggest a didactic character in the apostle Paul's discourse in the upper chamber of Troas, when "he talked a long while, even till break of day." The custom of delivering expositions or comments more or less extemporaneous on the lessons of the day had become a regular part of the service of the Jewish synagogue; and this custom passed over soon and readily into the Christian Church, as may be gathered from the first *Apology* (lxvii.) of Justin Martyr, where we read that, in connection with the practice of reading portions from the collected writings of the prophets and from the memoirs of the apostles, it had by that time become usual for the president (ὁ προεστώς) to deliver a discourse in which "he verbally instructs and exhorts us to the imitation of these excellent things." This discourse was later regarded as a part of the regular duty of the bishop, but he could devolve it, if he thought fit, on a presbyter or deacon, or even on a layman. An early and well-known instance of such delegation is that mentioned by Eusebius (*Hist. Eccl.* vi. 19) in the case of Origen (A.D. 216). In course of time the exposition of the lesson for the day came more frequently to assume a more elaborate character; but when it did so the fact was as far as possible denoted by a change of name, the word ὁμιλία being reserved for the expository or exegetical lecture as distinguished from the pulpit oration or sermon. While the church of the 3rd and 4th centuries could point to a brilliant succession of great preachers, whose discourses were wont to be taken down in shorthand and circulated among the Christian public as edifying reading, it does not appear that the supply of ordinary homiletical talent kept pace with the rapidity of church extension throughout the Roman empire. In the smaller and remoter communities it not uncommonly happened that the minister was totally unqualified to undertake the work of preaching; and though, as is curiously shown by the case of Rome (Sozomen, *Hist. Eccl.* vii. 19), the regular exposition of the appointed lessons was by no means regarded as part of the necessary business of a church, it was generally felt to be advisable that some provision should be made for the public instruction of congregations. Even in Jerome's time (*De Vir. Ill. c.* 115), accordingly, it had become usual to read, in the regular meetings of the churches which were not so fortunate as to possess a competent preacher, the written discourses of celebrated fathers; and at a considerably later period we have on record the canon of at least one provincial council (that of Vaux, probably the third, held in A.D. 529), positively enjoining that if the presbyter through any infirmity is unable himself to preach, "homilies of the holy fathers" (*homiliae sanctorum patrum*) are to be read by the deacons. Thus the finally fixed meaning of the word homily as an ecclesiastical term came to be a written discourse (generally possessing the sanction of some great name) read in church by or for the officiating clergyman when from any cause he was unable to deliver a sermon of his own. As the standard of clerical education sank during the dark ages, the habit of using the sermons of others became almost universal. Among the authors whose works were found specially serviceable in this way may be mentioned the Venerable Bede, who is credited with no fewer than 140 homilies in the Basel and Cologne editions of his works, and who certainly was the author of many *Homiliae de Tempore* which were much in vogue during the 8th and following centuries. Prior to Charlemagne it is probable that several other

collections of homilies had obtained considerable popularity, but in the time of that emperor these had suffered so many mutilations and corruptions that an authoritative revision was felt to be imperatively necessary. The result was the well-known *Homiliarium*, prepared by Paul Warnefrid, otherwise known as Paulus Diaconus (*q.v.*). It consists of 176 homilies arranged in order for all the Sundays and festivals of the ecclesiastical year; and probably was completed before the year 780. Though written in Latin, its discourses were doubtless intended to be delivered in the vulgar tongue; the clergy, however, were often too indolent or too ignorant for this, although by more than one provincial council they were enjoined to exert themselves so that they might be able to do so. Hence an important form of literary activity came to be the translation of the homilies approved by the church into the vernacular. Thus we find Alfred the Great translating the homilies of Bede; and in a similar manner arose Aelfric's Anglo-Saxon *Homilies* and the German *Homiliarium* of Ottfried of Weissenburg. Such *Homiliaria* as were in use in England down to the end of the 15th century were at the time of the Reformation eagerly sought for and destroyed, so that they are now extremely rare, and the few copies which have been preserved are generally in a mutilated or imperfect form.

The books of *Homilies* referred to in the xxxvth Article of the Church of England originated at a convocation in 1542, at which it was agreed to make certain homilies "for stay of such errors as were then by ignorant preachers sparkled among the people." After some delay a volume was published in 1547 called *Certain Sermons, or Homilies, appoynted by the Kynges Maiestie to be declared and redde, by all Parsones, Vicars, or Curates, euery Sōday in their Churches, where thei haue cures.* A second book of *Homilies* was issued in 1563, called *The Seconde Tome of Homelyes, of such matters as were promysed and Instituted in the former part of Homelyes, set out by the aucthoritye of the Quenes Maiestie: And to be read in eurey paryshe Churche agreablye.* Of the 12 homilies in the first book, Nos. 1 and 3–5 are by Cranmer, No. 6 by Bonner, No. 2 by Nicholas Harpsfield, No. 11 by Thomas Becon. The authorship of the rest is uncertain: 8 and 9 may be by Ridley and 12 by Latimer. Of the original 20 in the second book, Nos. 1–3, 7–9, 15, 16, 19 are probably by Jewel; No. 4 by Grindal; Nos. 5, 6 by Pilkington; others are derived from other sources; *e.g.*, 10 from Erasmus' *Paraclesis*, etc.; 14 from Taverner's *Epistles*, etc. No. 21 was added by convocation in 1571. The two books were combined in *Certain Sermons or Homilies appointed to be read in Churches* (London, 1623). *See* J. Griffiths, *The two books of Homilies* (Oxford, 1859); J. T. Tomlinson, *Prayer Book, Articles and Homilies* (London, 1897).

HOMINISM, a term applied by W. Windelband to that form of Pragmatism which in England is usually called Humanism. The name is associated with the dictum of Protagoras the Sophist, *Homo mensura*, man is the measure of all things. *See* PRAGMATISM.

HOMOEOPATHY. A system of therapeutics based upon the law *similia similibus curentur*, which was introduced in 1796 by S. C. F. Hahnemann, a native of Meissen in Germany. (Formerly the accepted form was *similia similibus curantur* ["like is cured by like"] but research has proved that Hahnemann himself used the less positive subjunctive *curentur*, signifying "like should be cured by like.") Some points of Hahnemann's system were borrowed from previous writers—as he himself, though imperfectly, admits. Not to mention others, he was anticipated by Hippocrates, and especially by Paracelsus (1495–1541). The identical words *similia similibus curantur* occur in the Geneva edition (1658) of the works of Paracelsus, as a marginal heading of one of the paragraphs. The essential tenets of homoeopathy are that the cure of disease is effected by drugs that are capable of producing in a healthy individual symptoms similar to those of the disease to be treated, and that to ascertain the curative virtues of any drug it must be "proved" upon healthy persons—that is, taken by individuals of both sexes in a state of health in gradually increasing doses. The manifestations of drug action thus produced are carefully recorded, and this record of "drug-diseases," after being verified by repetition on many "provers," constitutes the distinguishing feature of the homoeopathic materia medica, which, while it embraces the sources, preparation and uses of drugs, as known to the orthodox pharmacopoeia, contains, in addition, the various "provings" obtained in the manner above described.

Another peculiar feature of homoeopathy is its theory of dose. This was one of the later creations of Hahnemann's mind. Most homoeopathists believe more or less in the action of minute doses of medicine, but it must not be considered as an integral part of the system. The dose is the corollary, not the principle. The question of dose has divided the members of the homoeopathic school into bitter factions, and is therefore a matter for careful consideration. Many employ low potencies; *i.e.*, mother tinctures, first, second, sixth dilutions, etc., while others use hundred-thousandths and millionths.

Some homoeopathists of the present day still believe with Hahnemann that, even after the material medicinal particles of a drug have been subdivided to the fullest extent, the continuation of the dynamization or trituration or succession develops a spiritual curative agency, and that the higher the potency, the more subtle and more powerful is the curative action. Hahnemann says (*Organon*, 3rd American edition, p. 101), "It is only by means of the spiritual influence of a morbific agent that our spiritual vital power can be diseased, and in like manner only by the spiritual operation of medicine can health be restored." This is absolutely denied by others. Thus there exist two schools among the adherents of homoeopathy. On the one hand there are the Hahnemannians, the "purists" or "high potency" men, who still profess to regard the *Organon* as their Bible, who believe in all the teachings of Hahnemann, who adhere in their prescriptions to the single dose, the single medicine, and the highest possible potency, and regard the doctrine of the spiritual dynamization acquired by trituration and succession as indubitable. On the other side there are the "rational" or "low potency" men, who believe in the universality of the law of cure, but think that it cannot always be applied, on account of an imperfect materia medica and a lack of knowledge on the part of the physician. They believe that in many cases of severe and acute pain palliatives are required, and that they are free to use all the adjuvants at present known to science for the relief of suffering humanity—massage, balneology, electricity, hygiene, etc. The American Institute of Homoeopathy, the national body of the United States, has adopted the following resolution and ordered it to be published conspicuously in each number of the *Transactions* of the society: "A homoeopathic physician is one who adds to his knowledge of medicine a special knowledge of homoeopathic therapeutics. All that pertains to the great field of medical learning is his by tradition, by inheritance, by right."

It is claimed that the effect produced upon both the laity and the general profession of medicine by the introduction of homoeopathy was salutary in many ways. It diminished the quantity of medicine that was formerly considered necessary, and thus revealed the fact that the *vis medicatrix naturae* is often sufficient, with occasional and gentle assistance, to cure many diseases, especially those fevers that run a definite and regular course. Corroboration of the law *similia similibus curentur* is seen, according to homoeopathists, in the adoption of the serum therapy, which consists in the treatment of the most malignant diseases (diphtheria, lock-jaw, typhoid fever, tuberculosis, bubonic plague) by introducing into the system a modified form (similar) of those poisons that produce them in the healthy individual. Hahnemann undoubtedly deserves the credit of being the first to break decidedly with the old school of medical practice, in which, forgetful of the teachings of Hippocrates, nature was either overlooked or rudely opposed by wrong and ungentle methods. We can scarcely now estimate the force of character and of courage which was implied in his abandoning the common lines of medicine. More than this, he and his followers showed results in the treatment of disease which compared very favourably with the results of contemporary orthodox practice.

Homoeopathy has given prominence to the therapeutical side of medicine, and has done much to stimulate the study of the physiological action of drugs. It has done service in directing more

special attention to various powerful drugs, such as aconite, nux vomica, belladonna, and to the advantage of giving them in simpler forms than were common before the days of Hahnemann. But in the medical profession homoeopathy nevertheless remains under the stigma of being a dissenting sect. It is in the United States that homoeopathy chiefly flourishes. In other countries it has a few practitioners and a few homoeopathic hospitals have been founded. Associations (some of which conduct examinations and grant diplomas) are in existence in England, the United States, Canada, Germany, France and Italy to further the principles of the school and in each of the countries mentioned one or more journals devoted to homoeopathy is in existence.

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HOMOLOGY. Owen (1804–92) introduced the terms homology and analogy into biological literature to imply two different types of similarity of structure in organisms. Homologous structures were such as were capable of being shown by study of a series of forms to be structurally equivalent, though not necessarily functionally similar, to a part or organ of the "archetype." Analogous structures were those which showed physiological similarity only. With the coming of the evolution theory the archetype of Cuvierian biology became identified with a common ancestor, so that the current definition of homology in biology is that of Dendy (1912): "homologous organs are such as have the same essential structure which they owe to inheritance from a common ancestor." In 1870 Lankester introduced the term homoplasy to indicate structural resemblance associated with similar physiological activity but derived independently in the evolutionary process, and added the term homogeny to signify homology in the sense in which that term is now employed. In the light of modern experimental work on evolution it is doubtful whether the distinction, stated thus, is of so fundamental a character as it then appeared. The important researches of Sturtevant (1924) show that similar bodily modifications have arisen as sports again and again in different species of the fruit-fly *Drosophila*; and that these *mutant* characters can be referred to changes in the corresponding location on equivalent chromosomes (*see* CYTOLOGY). There is good reason to believe parallel mutation (appearance of sports) has occurred constantly in the evolutionary process; and if this is so, it is impossible on purely morphological grounds to say when a new structure has arisen independently or has been inherited from a common ancestor. Owen's archetype may be replaced in the future not by the Darwinian concept of a common ancestor, but by a common locus of instability in the chromosome, or a similar physico-chemical pattern in the hereditary materials. (*See* ZOOLOGY; EVOLUTION.)

(L. T. H.)

HOMONYM, a term for those words which differ in sense but are alike in sound or spelling or both (Gr. ὁμώνυμος, having the same name). Words spelt but not sounded alike, *e.g.*, "bow," are *homographs;* and words alike only in sound, *e.g.*, "meat," "meet," *homophones.* Skeat (*Etymol. Dict.*) gives a list of English homonyms.

HOMOPHONY, a musical term signifying literally "like voices," that is, voices or instruments in unison, but which in practice has come to signify music with one outstanding part, to which the other parts are subordinate, as opposed to polyphonic music, composed of a number of parts of more or less equal importance.

HOMS or **HIMS,** a city of Syria, situated in the great Orontes plain, on a canal about 1 m. from the river; pop. estimated at 50,000 (35,000 Muslims). The neighbourhood is exceptionally fertile, and the climate good. The gardens and orchards of Homs have always been famed for their yield. Silk is the chief industry.

History.—Through Homs passed the road along which was borne the traffic of Egypt, Palestine, and Damascus bound for the northern lands, and its plain was the battleground of warring empires. At Kadesh (now identified with *Tell Nebi Mend,* near Homs) Rameses II. fought the great indecisive battle against the Hittites. Known as Emesa in classical times it was devoted to the worship of the Sun god. Heliogabalus was born here and became a priest in its temple. On his elevation to the imperial throne (A.D. 218) he showed favour to the city, and rebuilt its temple. It was there that Aurelian quelled the rebellion led by Zenobia (A.D. 272); and Caracalla made it into a Roman colony. In 635 Homs concluded a treaty with the Arabs, and peace and security were bought for a sum of money. The arrangement did not endure, and in 638 it fell to Abu 'Ubaida. It rebelled in the reign of Merwān II, who lashed it with shot from 80 catapults for five months, reduced it and dismantled its walls (745). The subsequent centuries saw its subordination to Aleppo, Damascus and Hama. It passed under Egyptian rule (1831–40), and was moved to a revolt which was with difficulty suppressed.

The mausoleum of the famous Muslim general, Khālid ibn el-Welīd, is in one of its mosques. (E. Ro.)

HONAN, one of the most densely peopled and historically one of the most famous provinces of China. Its name signifies "south of the River," *i.e.*, of the Hwang-ho, whose basin was the scene of Chinese civilization in its formative period, but in fact a part of the province lies north of the river. Honan comprises the south-western portion of the great plain of north China which is here broken by eastward extensions of the Tsin-ling mountain axis. In the north of the province are the fertile terraces bordering the Yellow river and the important valley of the Lo. This is separated by the chains of the Fu-niu-shan from the rich agricultural land in the valleys of the Upper Hwai and its numerous affluents. The southern boundary of the province follows in part the crest of the Hwai-yang shan which divides the Hwai from the Yang-tze basin, but in the south-west it includes the upper valley of the Han river which affords direct communication with the Wu-Han cities. The western and south-western portions of Honan have a general elevation of about 3,000 feet.

If not the birthplace, Honan was certainly the chief centre of the spread and dispersion of early Chinese culture. The open lands above the marshy levels of the Yellow, Hwai and Upper Han rivers were not only valuable settlement sites but controlled the lines of movement either along the Hwai-Hwang-ho watershed to Shantung or by the Hwai-Yang-tze divide to the new culture centres in the Yang-tze valley. It was also the terminus of the corridor route from the west between the Shansi plateau and the easterly spurs of the Tsin-ling and its two chief centres in the north, Loyang (Honan-fu) and Kai-feng, were frequently selected as imperial capitals. The area of the province is about 81,000 sq.m. supporting a population of 32,000,000, which is mainly rural in character, for more than 90% of the population lives in towns and villages of less than 10,000 inhabitants.

The densest grouping is in eastern Honan on the higher agricultural land bordering the Peking-Hankow railway. These eastern plains, especially the districts lying between Changte and Juning yield excellent crops of wheat, maize, millets, cotton, sesame, beans and hemp. But the double danger of drought and flood (from both the Yellow and Hwai rivers) constantly menaces this countryside. A secondary focus of population occurs in the Upper Hwai basin with Nan-yang as its centre. The main industrial development has been the exploitation of the anthracite coal measures of Honan-fu and the bituminous coals of the Lushan-Juchow district. At present the output is moderate in amount and serves only a local demand. Iron, tin and argentiferous lead are also found. Other industrial enterprises include the cotton industry of north-east Honan based on local supplies and the silk industry of Nan-yang which utilizes silk from worms fed on the small oaks of the neighbouring Fu-niu-shan. The value of the central position of Honan is as yet neutralized by the lack of transport facilities. The rivers are subject to great seasonal variation of level, while the railway routes, apart from short mineral lines, are restricted to the Peking-Hankow railway and the east-west Lung-Hai line. Honan stands to gain greatly by the development of motor transportation. Kai-feng, the capital city,

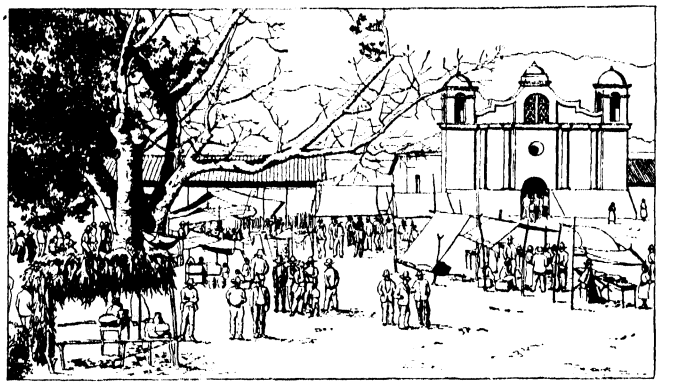
has an estimated population of nearly 300,000 and Cheng-chow, at the junction of the Lung-Hai line with the trunk railway is an industrial town of growing importance.

HONAVAR, a seaport of British India, North Kanara district of Bombay. Pop. (1921) 7,038. It is mentioned as a place of trade as early as the 16th century. In 1670, the English factors here had a bull-dog which killed a sacred bull, in revenge for which they were murdered, to the number of eighteen. In 1784 it was defended for three months by Captain Torriano and a detachment of sepoys against Tippoo Sultan.

HONDA or **SAN BARTOLOME DE HONDA,** a town of the department of Tolima, Colombia, on the west bank of the Magdalena river, 580 m. above its mouth. Pop. (1918) 7,999. It is about 650 ft. above sea-level and overlooks the rapids of the Magdalena, shut in closely by spurs of the Eastern and Central Cordilleras. The climate is hot and damp and the temperature frequently rises to 102° F in the shade. Honda dates back to the beginning of the 17th century, and has been one of the important centres of traffic in South America for 300 years. There is a suspension bridge across the Magdalena at the head of the rapids. A railway 18 m. long connects with the landing place of La Dorada, or Las Yeguas, where the steamers of the lower Magdalena discharge and receive their cargoes and with Beltrán 34 m. above, where navigation of the upper river begins. Up to 1908 the greater part of the traffic for Bogotá crossed the river at this point, and was carried on mule-back over the old *camino real,* which was at best only a rough bridle-path; now the trans-shipment is made to smaller steamboats on the upper river for carriage to Girardot, 93 m. distant, from which place a railway runs to the Bogotá plateau. Honda was nearly destroyed by an earthquake in 1808.

HONDECOETER, MELCHIOR D' (1636–1695), Dutch painter, born at Utrecht, was the pupil of his father Gysbert and of his uncle J. B. Weenix. He lived at The Hague (1659–63) and at Amsterdam where he married in 1663 and lived till his death on April 3, 1695. One of his earliest works is a "Tub with Fish," dated 1655, in the gallery of Brunswick. He acquired celebrity as a painter of birds, which he represented not exclusively, like Fyt, as the gamekeeper's perquisite after a day's shooting, or stock of a poulterer's shop, but as living beings with passions, joys, fears and quarrels. Without the brilliant tone and high finish of Fyt, his birds are full of action. Very few of his pictures are dated, though more are signed. Amongst the former we should note the "Jackdaw deprived of his Borrowed Plumes" (1671), at The Hague, "Game and Poultry," and "A Spaniel hunting a Partridge" (1672), in the gallery of Brussels; or "A Park with Poultry" (1686) at the Hermitage of Leningrad. William III. employed Hondecoeter to paint a picture, now at The Hague, of his menagerie at Loo. But he is better in the homelier works with which he adorned the royal chateaux of Bensberg and Oranienstein. His masterpieces are at The Hague and at Amsterdam. But there are fine examples in private collections in England, and in the public galleries of Berlin, Carlsruhe, Cassel, Cologne, Copenhagen, Dresden, Florence, Glasgow, Hanover, Leningrad, London, Montpellier, Munich, New York, Paris, Rotterdam, Stuttgart and Vienna.

HONDURAS, a republic occupying the central portion of Central America, with a coastline of 400 m. on the Caribbean sea and a frontage of some 40 m. on the Gulf of Fonseca, on the Pacific Ocean. It is bounded on the north by the Caribbean sea, on the east by Nicaragua, on the south by Nicaragua, the Pacific ocean and Salvador, and on the west by Guatemala. (*See* CENTRAL AMERICA MAP.) The name is Spanish (it may be translated "wave-like") and is explained with equal insistence either as referring to the depths off shore, or to deep, wave-like valleys and hills which scar the entire country, excepting for the relatively narrow coastal plains on either shore. The country faces on the sea to the north and on inlets on the north-west, where the boundary is the Gulf of Honduras which forms the only Caribbean frontage of the neighbouring country, Guatemala, as well as the southern boundary of Belize or British Honduras. Around many inlets and lagoons the coastline follows a generally easterly direction until it reaches Cape Gracias a Dios (Cape "Thanks-to-God"), named, it has been suggested, because there the coast turns sharply south and the Spanish mariners who were seeking a westward passage gratefully found themselves again skirting a north and south shore line that might possibly open into the passage to the long-sought Oriental islands. Cape Gracias a Dios marks the boundary of Honduras and Nicaragua, which continues inland along the river variously known



FIESTA DAY IN ONE OF THE SMALL INLAND VILLAGES OF HONDURAS

as the Wanks, Segovia or Coco. The frontier, which is still in dispute and runs through a sparsely inhabited territory which furnishes a base for revolutionary movements between the two countries, crosses the continental divide and at present follows the river Negro to the Bay of Fonseca. There, for a short distance, Honduras fronts on this great arm of the Pacific, holding sovereignty over the islands of Tigre (where its Pacific port, Amapala, is situated), Sacate Grande and Gueguensi. The boundary line with Salvador starts at the mouth of the river Goascoran and follows an irregular line through the mountains, first in a northerly and then in a westerly direction, to a point directly west of Ocotepeque: there the boundaries of Honduras, Salvador and Guatemala meet. The boundary line between Honduras and Guatemala has been in dispute for nearly four centuries, and has been a serious question since the independence and break-up of the captain-generalcy of Guatemala into the five countries of Central America. Along the western frontier the line is fairly well accepted, but as it approaches the Caribbean the divergence of claims covers a relatively great area, whose growing economic importance, owing to the increasing banana industry, became an important issue in 1928. Following the mediation of the secretary of State of the United States, the whole subject was in that year submitted to the decision of a Central American tribunal under the 1923 treaties.

Physical Features.—The general aspect of the country is mountainous; its southern half is traversed by a continuation of the main Nicaraguan Cordillera. The chain does not, in this republic, approach within 50 or 60 m. of the Pacific; nor does it throughout maintain its general character of an unbroken range, but sometimes turns back on itself, forming interior basins or valleys, within which are collected the headwaters of the streams that traverse the country in the direction of the Atlantic. Nevertheless, viewed from the Pacific, it presents the appearance of a great natural wall, with many volcanic peaks towering above it and with a lower range of mountains intervening between it and the sea. It would almost seem that at one time the Pacific broke at the foot of the great mountain barrier, and that the subordinate coast range was subsequently thrust up by volcanic forces. At one point the main range is interrupted by a great transverse valley or plain known as the plain of Comayagua, which has an extreme length of about 40 m., with a width of from 5 to 15 miles. From this plain the valley of the river Humuya extends north to the Atlantic, and that of the Goascoran south to the Pacific. These three depressions collectively constitute a great transverse valley reaching from sea to sea, which was pointed out soon after the conquest as an appropriate course for inter-oceanic communication. The mountains of the northern half of Honduras are not volcanic in character and are inferior in altitude to those of

the south, which sometimes exceed 10,000 feet. The relief of all the highlands of the Atlantic watershed is extremely varied; its culminating points are probably in the mountain mass about the sources of the Choluteca, Sulaco and Roman, and in the Sierra de Pija, near the coast. Farther eastward the different ranges are less clearly marked and the surface of the country resembles a plateau intersected by numerous watercourses.

The rivers of the Atlantic slope of Honduras are numerous and some of them large and navigable. The largest is the Ulua, with its tributary the Humuya. It rises in the plain of Comayagua and flows north to the Atlantic; it drains a wide expanse of territory, comprehending nearly one-third of the entire State, and probably discharges a greater amount of water into the sea than any other river of Central America, the Segovia excepted. It may be navigated by light draught steamers for the greater part of its course. The Rio Roman or Aguan is a large stream falling into the Atlantic near Trujillo, with a total length of about 120 miles Its largest tributary is the Rio Mangualil, celebrated for its gold washings, and may be ascended by light draught boats for 80 miles. Rio Tinto, Negro, or Poyer or Poyas, is a considerable stream, navigable by small vessels for about 60 miles. Some English settlements were made on its banks during the 18th century. The Patuca rises near the frontier of Nicaragua, and enters the Atlantic east of the Brus or Brewer lagoon. The Segovia or Wanks is one of the longest rivers in Central America, rising within 50 m. of the Bay of Fonseca, and flowing into the Caribbean sea at Cape Gracias a Dios. Three considerable rivers flow into the Pacific—the Goascoran, Nacaome and Choluteca, the last named having a length of about 150 miles. The Goascoran, which almost interlocks with the Humuya, in the plain of Comayagua, has a length of about 80 miles. The lake of Yojoa or Taulébe is the only large inland lake in Honduras, and is about 25 m. by 6 to 8 m.; its surface is 2,050 ft. above the sea. It has two outlets on the south, the rivers Jaitique and Sacapa, which unite about 15 m. from the lake; and it is drained on the north by the Rio Blanco, a narrow, deep stream falling into the Ulua.

Honduras resembles the neighbouring countries in the general character of its geological formations, fauna and flora. Here, as in other Central American States, there are but two seasons, the wet, from May to November, and the dry, from November to May. On the moist lowlands of the Atlantic coast the climate is oppressive, but delightful on the highlands of the interior. At Tegucigalpa, on the uplands, a year's observations showed the maximum temperature to be 90° F in May, and the minimum to be 50° F in December (*see* CENTRAL AMERICA for Fauna, Flora, Climate).

The People.—The population of Honduras, according to official reports of 1928, is 700,811, of whom 348,465 are males. The census of 1916 showed a total of 605,997, of whom 299,952 were males. The area of Honduras is about 46,250 sq. m.; the density of population 15 to the sq. mile. The census figures of Honduras show a steady growth in population of 1 to 1½% per year; but an exact enumeration is virtually impossible, owing to the scattering of population and the large proportion of Indians. While the Indians—many thousands of them still living in a primitive state—constitute the majority of the population of Honduras, the cities are populated with mixed-bloods and the ruling groups are largely of almost pure Spanish descent. The Hondurans have been leaders of most of the various efforts to form a Central Union (*see* CENTRAL AMERICA), and the keen political acumen of the leaders has often sought expression in the most idealistic movements and in a broad analysis of the situations surrounding the relations of the Central American countries to each other, to the United States and to the outside world. There are about 20,000 negroes in Honduras, the larger proportion being British subjects imported under contract for work in the banana plantations. The descendants of the negro slaves brought to Honduras during the colonial days still survive, some mixed with the Indians and others retaining their race purity while evincing sound Honduran citizenship and patriotism. The negro blood, as in the other Central American countries, is closely confined to the Caribbean littoral. The Indian tribes of Honduras are fairly well defined in characteristics and race, being generally peaceable small farmers, but about 100,000 are officially estimated to live in the mountains in an almost wild state. The Carib Indians of tradition are believed to be the progenitors of certain groups on the Caribbean coast, who are the mainstay of the mahogany and pine lumbering interests of the river regions.

There is some immigration into Honduras from Salvador, the thickly settled farming sections of that country sending forth an excellent type of farmer-immigrant into the sparsely populated regions of the Honduran interior. The driving overland of herds of cattle for the markets of Salvador and Guatemala has opened routes along which this immigration moves, and while it is as yet not a great item and ebbs and flows with the needs of the crops, it indicates a tendency toward readjustment of the populations in Central America. There is virtually no immigration from Europe, although some small groups of European farmers have arrived from time to time. The importation of negroes from the British West Indies is, as noted, on a contract basis which provides for their return to their homes after certain periods.

The chief city of Honduras is the capital, Tegucigalpa (*q.v.*), in the highlands of the interior, with a population of 38,950. Other important urban centres are Comayagua (6,412); Juticalpa (8,000); Santa Rosa de Copan (13,000); San Pedro Sula (8,000); Puerto Cortes (4,000); Tela (3,500); Trujillo (2,000); Pespire (7,000); Yuscaran (5,000); Ceiba (10,000); Puerto Castilla (4,000); Amapala (3,000); Nacaome (8,000); Santa Rosa (10,000); La Esperanza (11,000). In general, the population of Honduras flocks less to large towns than is common elsewhere in Spanish America, tiny farms being found at close intervals along the highways, and the rural life being more generally scattered over the country than the sparse population figures would seem to promise.

Political Organization.—The present Honduran constitution was promulgated on Sept. 10, 1924, previous instruments or modifications having been dated Dec. 11, 1825, Jan. 1839, Feb. 1848, Sept. 1865, Dec. 1873, Nov. 1880, Oct. 1894, Sept. 1904 (later replaced by the older instrument of 1894). The first article of the present constitution declares Honduras to be "a state separated from the Republic of Central America. Consequently it recognizes as a primal necessity return to union with other sec-



THE BACK YARD OF A NATIVE HUT, SHOWING LIVESTOCK AND AN OVEN

The majority of the Honduran population is composed of Indians. Although of friendly disposition and, here and there, converts to Roman Catholicism, for the greatest part they remain an aboriginal people

tions of the dissolved republic." The Constitution gives citizenship, on mere declaration of desire, to citizens of the other Central American republics. Every Honduran male citizen of 21 years, or of 18 years if he is married or able to read and write, is entitled to vote.

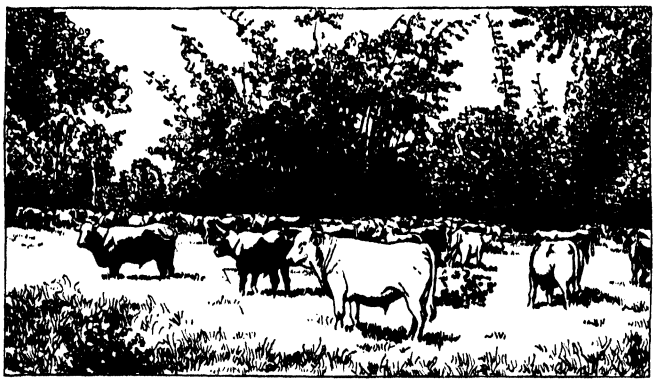
The legislative power in Honduras is vested in a single chamber, the Congress of deputies, whose members are elected for four years, half being renewed every two years; there is one deputy for each 10,000 inhabitants. No relative of the president "within the fourth degree of consanguinity or second of affinity" may serve

in the Congress, nor may he be appointed to any high administrative office. Congress meets on Jan. 1 of each year and sits for 60 days. The executive power is vested in the president, a vice-president being elected at the same time, both for four years, by popular and direct vote. They take office on Feb. 1, 1925, 1929, etc. In case of a failure to obtain an absolute majority the election goes to Congress, which must choose between the three highest candidates for both offices. The president's cabinet consists of from three to six secretaries of State, in charge of the usual government departments, each cabinet officer sometimes having two or more departments under his charge. The president and vice-president may not succeed themselves nor may any close relative succeed them.

The judiciary consists of a supreme court of five magistrates elected for four years by popular vote; the judges may be re-elected. Inferior courts are established under special laws. Justices of the peace are elected by popular municipal vote. Honduras is divided into 17 departments and one territory, each having a governor appointed by the president. The municipal governments are elected by direct vote. Police power is locally administered, the centralized form of the republic permitting the use of Federal troops if necessary.

Religion and Education.—Education is under the direction of a cabinet officer, the minister of public instruction, who has a staff of inspectors and officials. Local schools are under the municipalities but are supervised by the department governors, as the schools receive help from the Federal government. According to the latest available statistics (1925) there were 987 primary schools, with 28,050 pupils out of a school population of 78,857. The secondary schools, entered after the pupils pass through five grades, include the National Institute and School of Commerce at Tegucigalpa, and seven other schools, with a total enrolment of something over 500. There are special industrial and agricultural schools, the national agricultural school near Comayagua being one of the best in Central America. There are three normal schools, one of them at Tegucigalpa, for both men and women, and there are branches for the education of teachers in some of the secondary schools. The Central university at Tegucigalpa and special schools give technical education in law, medicine, etc.

The constitution grants freedom of worship, and there is no State-supported church. Roman Catholicism is the chief religion, however. The Indians in some of the interior villages



A HERD OF NATIVE CATTLE FEEDING ON PARA OR JARAGUA PASTURES
The rich pasture lands of Honduras have been utilized extensively, with the result that cattle-raising and dairy-farming are prosperous industries now. The clump of trees in the background is tarros, native bamboo

continue tribal rites; but even there the Roman Catholic churches are established and the support of the natives is general.

Finances.—The Honduran peso is on a silver basis, its value approximating 2s., or 50 cents United States currency, the old silver peso being the basis of exchange. While the coins of a dozen countries circulate freely, the United States dollar is the most common unit of exchange; one bank, whose chief offices are on the Caribbean coast where the banana companies are active, guarantees to redeem its own paper money at "two-for-one" with American dollars, while the official currency of the Banco Nacional fluctuates with the price of silver. The revenues of Honduras are derived from the customs, and from the liquor, powder and tobacco monopolies. The revenues for the fiscal year ending July 31, 1926 were £944,568 and the expenditures estimated at £1,135,417. The deficit is made up from time to time by internal bonds, and by advances from the large fruit and mining companies against their estimated import and export taxes. The internal debt as of April 30, 1926, was 7,553,425 pesos, which included the following items: war claims, to Aug. 1, 1926, 4,959,541 pesos; annual interest at 3%, 375,389 pesos; due to banks, 2,000,000 pesos; due to private companies, 1,140,000 pesos; obligations incurred in connection with the National railway, 3,138,000 pesos.

The entire public debt of Honduras as of Dec. 31, 1926, totalled £2,456,000. There is a United States loan of $500,000, and the old British loan, once carried, with 60 years interest, at £29,114,775, is fully accounted for in the total at £452,000, according to the agreement entered into on Oct. 29, 1925. This drastic reduction of the old debt was reached after many negotiations and periods of despair of ever being able to reach a settlement. The debt, the principal of which was contracted in 1867, 1869 and 1870, chiefly for the building of the National railway, was £5,398,570, the balance being unpaid interest. The Honduran loan was floated at varying prices in London, the sales averaging around 20% of the face value, but the money that reached Honduras and went into the railway was only a fraction of the receipts, and the entire transaction was the cause of a parliamentary investigation whose hearings were published. While the scandal was finally placed at the doors of the Honduran agents in London and certain British brokers, the debt has been held against Honduras for 60 years, although various offers on both sides have been made. The final settlement arranged in 1925 recognizes the debt and accepts the terms of the Corporation of Foreign Bondholders. The debt is being paid through a 3% customs surcharge paid to the fiscal agent of the corporation which furnishes stamps to be affixed to customs documents. The agreement provides for payments of £20,000 annually and for interest of 8·86% on the unpaid balance after 1925. The total will be £1,200,000. The Banco de Honduras is the chief bank; it is native owned and operated, and is the official bank of issue. It has branches throughout the country and collects and expends Government funds on order from the treasury. The only private bank of importance is the Banco Atlantida at Ceiba owned by one of the leading banana shipping companies; it issues paper currency and has branches in the chief business centres.

Defence.—The army, under the Washington treaties of Feb. 7, 1923, is limited to 2,500 officers and men, but under the Constitution all able bodied men are liable to 19 years' military service (2 years' active) at the age of 21; this provision, long existent, has been practically inoperative. Honduras developed military aviation earlier than most other Latin American countries, and the military aviation school outside Tegucigalpa has a number of planes, repair shops and hangars.

Economics and Trade.—Honduras is a producer of tropical hardwoods, pitch-pine and dyewoods, of bananas and coffee, and of cattle in large numbers. Its mineral resources are considerable, but there are only two important mining companies, extracting gold and silver. Silver only reaches an important figure in exports, the total for the fiscal year ending July 31, 1927 being $1,362,718 (the conversion to American dollars is here followed, as the official data of the Pan American Union in Washington are in that currency). The chief export item is, however, bananas, which totalled 17,090,182 bunches valued at $13,580,937, in 1926–27. Sugar, a growing industry, showed exports of 49,827,666 lb., valued at $1,363,179, together with $59,993 worth of molasses. Coffee exports were valued at $493,828, hides at $82,548 and cattle (6,766 head) at $108,542. The United States took $13,485,731 of the $17,546,290 of exports in 1926–27, Great Britain $2,135,488, Canada $1,006,894, Germany $431,936, the Netherlands $64,949 and France $43,072. The total of exports shows a steady growth from $7,897,001 (1923–24) to $11,983,053

(1924–25), and to $13,456,005 (1925–26) and to $17,546,290 (1926–27). Imports in 1926–27 totalled $10,630,416, of which the United States sent $8,445,384, Great Britain $748,037, Germany $456,297, France $192,974 and Italy $113,180. Imports were $11,137,917 in 1923–24, $12,752,763 in 1924–25 and $9,899,950 in 1925–26. The largest single item of import was cotton cloth, $1,701,701; the second was oils, $564,133; the third flour, $362,580. Iron and steel manufactures, unclassified, totalled $646,007.

Communications.—The National railway originally built from Puerto Cortes to Potrerillos has 60 m. of track. The other railways total 450 m., including the following private lines: Trujillo railway, 74 m.; Vacarro Bros. line from Ceiba, 127 m.; Cuyamel Fruit Co. line in Cuyamel district, 27 m.; United Fruit Co. in Tela district, 125 m.; Tropical Lumber Co., 7 m.; Ulua branch, 32 miles. There is now a through highway between the Atlantic and the Pacific, including a boat trip across Lake Yojoa. The original highway in this system was the solidly and expensively built road up from San Lorenzo (the mainland terminus on the Pacific, 24 m. by water from the island port of Amapala in the Gulf of Fonseca), up to Tegucigalpa, a distance of 84 miles. This has been built for some years and is one of the most picturesque arterial highways of Latin America. The newer portion of the transcontinental highway leads from Tegucigalpa to Comayagua, 70 m., while from Comayagua to Lake Yojoa the road was built by the Hondura- Petroleum company as a portion of its obligation for its oil concession. The lake is crossed by motor launch and the road continues from Limon, on the lake, to Potrerillos, the terminus of the railway. Other roads are gradually linking up interior towns, and while the dream of railway development still stirs the country from time to time, modern motor transport and good roads are now regarded as the surest and most permanent type of communications.

There is aeroplane service along the Caribbean coast, and a line has been operated from time to time between Tegucigalpa and the Caribbean ports. There are landing fields at various points throughout the country. The steamship lines on the Pacific side serve Amapala, the only Pacific port, which, although land-locked and calm, has no deep water pier and offers no direct facilities for transport to the interior, as the highway to Tegucigalpa and the rest of the country is 24 m. distant and can be reached only by combined lighter-schooners, loaded again at Amapala after freight has been lightered from the steamers, or vice versa. On the Atlantic side, service is given by a number of banana fruit lines, which make quick trips to New Orleans, New York and Boston. Fruit ships now sail to British ports direct from Honduras, and in general the banana traffic has given the north coast of Honduras exceptionally good steamship service—far better than a country of similar total trade would enjoy if its produce were less perishable. The telegraph and wireless systems of Honduras are well developed. The Tropical Radio, originally established by the United Fruit company for the convenience of its ships and agents, has transmitting and receiving towers at Tegucigalpa and various ports. The telegraph is Government-operated and communicates with virtually every town in the republic and through the connections with other Governments' lines provides very cheap and relatively quick communication throughout Central America.

HISTORY

Honduras, at the point now known as Cape Honduras, was the first landing place of Columbus on the soil of Central America, on his last voyage. Here the discoverer took possession of the continent in the name of the king of Spain, in 1502. The first settlement in Honduras was made by Cristobal de Olid under orders from Hernando Cortes, in Mexico, but the reports of the discovery of gold and silver mines tempted Olid to seek to set up a private principality, and Cortes made his memorable march from Mexico over the mountains and through the jungles and innumerable rivers of southern Mexico and Guatemala to reassume control. He founded Puerto Cortes in 1525, re-established order and the loyalty of the succeeding governors, and returned to Mexico in 1526. Honduras was incorporated into the captaincy general of Guatemala in 1539, and was then regarded as one of the promising sources of mineral wealth in the New World (*see* CENTRAL AMERICA). Honduras has been a continual sufferer from revolutions and war, one explanation being that, lying as it does between Guatemala, Salvador and Nicaragua, all fairly well balanced against one another, Honduras has been in a position to throw the balance to any of the contending nations, and has thus been subject to intrigue from all three sides. Each ruler of a neighbouring country, if he had designs on another, sought to put one of his puppets into power as president of Honduras, either by intrigue or by revolution, a practice hardly conducive to peace. Between 1867 and 1870, Honduras assumed its heavy burden of debt in the hope of obtaining the Interoceanic railway, but dishonesty at home and in London dissipated the moneys received from the loans, and left Honduras bankrupt and in trouble, both domestic and with her neighbours. Intervention by the neighbouring States placed Marco Aurelio Soto, a nominee of Guatemala, in the presidency in 1873, and he was re-elected in 1877 and 1880, following the promulgation of a new constitution.



YELLOW-PINE FOREST IN INTERIOR
The highlands of Inner Honduras are covered with large tracts of pine and other conifers, which would yield rich export profits if properly managed

There was a succession of rulers and revolutions, from 1883 to 1903 in which year Manuel Bonilla was elected president and promised to consolidate and pacify the country. His enemies appealed to José Santos Zelaya, the dictator of Nicaragua and, in the course of the war which followed, American marines intervened to end hostilities and Miguel R. Dávila, a creature of Zelaya, became president of Honduras. In 1910 Dávila was eliminated by a revolution led by Manuel Bonilla, and following the peace conference and the subsequent death of Bonilla in 1913, Dr. Francisco Bertrand became president. A liberal revolution led by General Rafael López Gutierrez ousted Bertrand in 1919, and Gutierrez became president. Revolution threatened in 1922 and 1923, and in April 1924 the United States sent a personal representative of President Coolidge to mediate between the factions. Marines and bluejackets were landed twice and promptly withdrawn, and after various conferences and postponements of the 1924 election, difficulties were smoothed out and Dr. Miguel Paz Baraona was elected president, with Presentación Quesada as vice-president. They took office, under the new constitution which had been a part of the results of the discussions and conferences, on Feb. 1, 1925. The only issue of importance which arose in President Paz Baraona's term was that of the boundary with Guatemala, precipitated in 1927 by the development of banana lands and the increased economic importance of the disputed territory. The United States offered its good offices and conferences were held under the chairmanship of the American minister to Costa Rica, and when no results were obtained, the United States secretary of State assumed the rôle of mediator and brought about a submission of the question to a Central American tribunal set up under the Treaties of 1923.

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HONDURAS, BRITISH: *see* BRITISH HONDURAS.

HONE, NATHANIEL (1718–1784), Irish painter, was born in Dublin, but spent the greater part of his life in London, where he died on Aug. 14, 1784. He was a foundation member of the Royal Academy, and exhibited portraits there regularly. Among his best works are the portrait of himself in the National Portrait Gallery, and another of himself in the Royal Academy collection. He was an excellent engraver in mezzotint, and a good miniaturist and enamel-worker.

HONE, WILLIAM (1780–1842), English writer and bookseller, was born at Bath, and established himself as a bookseller in London. From Feb. 1 to Oct. 25, 1817, he published the *Reformer's Register,* writing in it as the serious critic of the State abuses, which he soon after attacked in the famous political squibs and parodies, illustrated by George Cruikshank. In April 1817 three *ex-officio* informations were filed against him by the attorney-general, Sir William Garrow. Three separate trials took place in the Guildhall before special juries on Dec. 18, 19 and 20, 1817. The first, for publishing Wilkes's *Catechism of a Ministerial Member* (1817), was before Mr. Justice Abbot (afterwards Lord Tenterden); the second, for parodying the litany and libelling the prince regent, and the third, for publishing the *Sinecurist's Creed* (1817), a parody on the Athanasian creed, were before Lord Ellenborough. Hone was acquitted on each count, and received a popular ovation. Among Hone's most successful political satires were *The Political House that Jack Built* (1819), *The Queen's Matrimonial Ladder* (1820), in favour of Queen Caroline, *The Man in the Moon* (1820), *The Political Showman* (1821), all illustrated by Cruikshank. In 1826 Hone published the *Every-day Book,* in 1827–28 the *Table-Book,* and in 1829 the *Year-book;* all three were collections of curious information on manners, antiquities and various other subjects. These entertaining books are the works by which Hone is best remembered. In preparing them he had the approval of Southey and the assistance of Charles Lamb, but they were not profitable, and Hone was lodged in King's Bench prison for debt. Friends rescued him and set him up in a coffee-house in Gracechurch street; but this, too, ended in failure. Hone became devout in later years, and used to preach in Weigh House chapel, Eastcheap. He died at Tottenham on Nov. 6, 1842.

HONE, a variety of finely siliceous stone employed for whetting or sharpening edge tools, and for abrading steel and other hard surfaces. Hones are generally prepared in the form of flat slabs or small pencils or rods, but some are made with the outline of the special instrument they are designed to sharpen. Their abrading action is due to the quartz or silica which is always present in predominating proportion, some kinds consisting of almost pure quartz, while in others the siliceous element is very intimately mixed with aluminous or calcareous matter, forming a uniform compact stone, the extremely fine siliceous particles of which impart a remarkably keen edge to the instruments for the sharpening of which they are applied. In some cases the presence of minute garnets or magnetite assists in the cutting action. Hones are used either dry, with water or with oil, and generally the object to be sharpened is drawn with hand pressure backward and forward over the surface of the hone; but sometimes the stone is moved over the cutting edge.

The coarsest type of stone which can be included among hones is the bat or scythe stone, a porous fine-grained sandstone used for sharpening scythes and cutters of mowing machines, and for other like purposes. Next come the ragstones, which consist of quartzose mica-schist, and give a finer edge than any sandstone. Under the head of oilstones or hones proper the most famous and best-known qualities are the German razor hone, the Turkey oilstone, and the Arkansas stone.

The hones yield on analysis 98% of silica, with small proportions of alumina, potash and soda, and mere traces of iron, lime, magnesia and fluorine. They are white in colour, extremely hard and keen in grit, and not easily worn down or broken. Geologically the materials are called novaculites and are supposed to be metamorphosed sandstone silt, chert or limestone resulting from the permeation through the mass of heated siliceous waters. The finer kind is employed for fine cutting instruments, and also for polishing steel pivots of watch-wheels and similar minute work, the second and coarser quality being used for common tools. Both varieties are largely exported from the United States in the form of blocks, slips, pencils, rods and wheels.

HONEGGER, ARTHUR (1892–), Swiss composer, was born at Havre in 1892. He studied for two years at Zurich before entering the Paris conservatoire in 1912, where he was under Gédalge and Widor. As one of the group known as "les Six" he must be classed with the newest French school and he undoubtedly owes much to the influence of Debussy and Florent Schmitt. But there is a sturdy element in his music which recalls his true nationality and in the mass effects of his recent oratorios he has broken away more and more from French traditions. While some of his harmonic audacities are startling, the impetus of his rhythm is so strong that they fall into place in the general scheme. His development may still have surprises in store; his personal idiom, on the other hand, seems to be well established. The clashing of scale passages and rhythmic figures in contrary motion is a device which he uses constantly with great effect. His respect for sonata form is shown particularly in his chamber music. The success of his biblical drama *King David* has made him known to a wide public whose ear would normally be shocked by atonality and modern counterpoint. The choruses are the outstanding feature of this work, which was first written for the stage at Mézières (canton Vaud) in 1921 and completely revised as an oratorio for concert purposes in 1926.

After *King David,* Honegger's best known work is *Pacific 231* (1924), a brilliant example of modern programme music which at once hit the popular taste. The two works represent the extremes of Honegger's style. In his opera *Judith* (1924) the choruses are again the backbone of the work. The form is more concise and the rhythm sharper and more syncopated than in *King David.* Both here, and in his latest opera *Antigone,* the solo parts tend to be dramatic rather than lyrical. The composer has explained that his aim is to replace recitative by a melodic leading of the singing voice, which is to grow out of the text itself, to avoid dwelling on high notes (in the interests of distinct enunciation) and to be definitely non-instrumental. The oratorio *Judith* adapted from the opera and produced at Leipzig in 1928, is an interesting experiment to bring oratorio into line with modern feeling. It is short, lasting little over an hour, and is divided into thirteen numbers, so arranged as to offer sharp contrasts.

HONESTY (*Lunaria biennis*), hardy biennial of the family Cruciferae, suitable for garden cultivation. It is an attractive everlasting plant 2 ft. to 4 ft. high, with a silvery dissepiment. The similar but less ornamental perennial honesty (*L. rediviva*) is also cultivated.

HONEY, a sweet viscid liquid, elaborated by honey-bees from nectar obtained by them chiefly from the nectaries of flowers, and after transportation to the hive in the honey-stomach, ripened into honey and finally deposited into the cells of their combs prepared for this storage. The U.S. Department of Agriculture has defined honey for purposes of preventing adulteration in the following terms: "Honey is the nectar and saccharine exudations of plants, gathered, modified, and stored in the combs by honey-bees (*Apis mellifica*); is laevo-rotatory, contains not more than 25% of water, not more than 0·25% of ash, and not more than 8% of sucrose." This official definition, largely expressed as limitations in the quantities of materials normally found in honeys, does not attempt to itemize all the materials found in honeys but only those which are of greatest importance in detecting sophistication of this product. By this definition, only honey produced by the common honey-bee is properly designated honey, even that of the other species of Apis being excluded. This is due to the fact that the honey of *A. dorsata, zonata, indica* and others does not enter U.S. markets. Honey gathered by other species of insects is equally excluded by the definition for the same reason. The same limitations apply to honey in practically all European countries. Further official definitions are given of comb-honey, extracted honey (removed from the comb by centrifugal force) and

strained honey (removed by squeezing or the application of heat by the older methods of bee-keeping). Some species of wasps, the honey-ants of Texas and Mexico, and some other ants not only collect nectar as food, but store it for later use by various means. These cases are of biological interest but the honeys thus produced are not used as human food except in certain cases where Mexican Indians are said to collect the stores of the honey-ants.

It was formerly a popular saying in some temperate regions (as England) that where there is the best honey there also is the best wool, a pastoral region often affording a greater profusion of nectar-secreting flowers than lands under tillage. Dry weather with cool nights and hot days is that usually most favourable to the secretion of nectar. In most European countries, nectar is obtained largely from plants growing wild in their native habitat, but in America, where the honey-bee is not native, the larger part of the marketed honey crop is derived from cultivated and to a considerable degree from imported plants. Nectar is often protected in the flowers from rain and other adverse factors by special morphological structures of great complexity. The odour of flowers was formerly associated with the presence of nectar, but now this is not held to be true, since many flowers possess strong odours without ever containing nectar, while others overflow with nectar without giving forth an odour perceptible to man.

The exudation of a nectar-like or saccharine fluid is a function exclusively of flowers but may be found as a secretion or excretion on all parts of various plants which occur above ground. A sweet material, manna, is produced by leaves and stems of a species of ash, and nectar-secreting glands are found on leaves, petioles, stipules, bracts and even on the outer surfaces of corollas and calyces of various plant species. The origin of nectar-secretion manifested specially by flowers among the several parts of plants has been carefully considered by Darwin, who regards the saccharine matter in nectar as a waste product of chemical changes in the sap, which, when it happens to be excreted within the envelopes of flowers, is utilized for the important object of cross-fertilization, and subsequently is much increased in quantity and stored in various ways (see *Cross and Self Fertilization of Plants*, p. 402 *et seq.*, 1876). It has been noted with respect to the nectar of various species of plants that it is most abundant when the anthers are about to dehisce and absent in the unexpanded flower. Bonnier showed that in most flowering plants there occurs an accumulation of soluble food in the form of sugars at the bases of flowers to act as a quick food supply immediately after fertilization occurs, and in some species there is regularly a secretion of this sugar supply in the form of nectar, while the majority of flowering plants form no such secretion regularly but may do so under unusual environmental conditions. The secretions or excretions of nectar from parts of plants other than the interior of flowers are commonly called plant honey-dews.

Another important source of sweet liquid for honey-bees is the excretions of many species of sucking insects, these being called insect honey-dews to distinguish them from normal plant secretions. Various orders of Hemiptera form this material which is eagerly gathered by bees, but only when no supplies of nectar are available. These insects vary in their locations on plants and often confine themselves to certain plant species. The insects extract the sap from leaves or stems, utilize what is needed for their own livelihood and excrete the residue, which often contains considerable quantities of sugars. Insect honey-dews contain the same sugars that occur in nectars and approximately in the same proportions, but the final product made from these materials by bees contains considerably larger quantities of dextrin, more ash and usually has a dark colour and none too attractive flavour. Plant secretions from parts of plants other than flowers also may contain more dextrin and ash and may have stronger flavours.

Pettigrew is of opinion that few bees go more than 2 m. from home in search of honey. The number of blossoms visited in order to meet the requirements of a single hive of bees must be very great; for it has been found by A. S. Wilson that 125 heads of common red clover, which is a plant comparatively abundant in nectar, yield but one gramme (15·432 grains) of sugar; and as each head contains about 60 florets, 7,500,000 distinct flower-tubes must on this estimate be exhausted for each kilogramme (2·204 lb.) of sugar collected. Among the richer sources of nectar of north temperate regions are reckoned the apple, asparagus, asters, barberry, basswood, and the European lime or linden, beans, boneset, borage, broom, buckwheat, catnip, or catmint, cherry, cleome, clover, cotton, crocus, currant, dandelion, eucalyptus, figwort, furze, golden-rod, gooseberry, hawthorn, heather, horehound, hyacinth, lucerne (alfalfa in America), maple, mignonette, mint, motherwort, mustard, onion, pear, poplar, quince, rape, raspberry, sage, sycamore, teasel, thyme, tulip-tree, turnip and willows, and the "honey-dew" of the leaves of the whitethorn, oak, linden, beech and some other trees.

Content of Honey.—Honey contains a large number of materials which have been detected by chemical means as well as others which appear only from physiological experimentation. An average analysis, as made by Browne of the U.S. Department of Agriculture from American honeys, is as follows: water, 17·70%; laevulose, 40·50%; dextrose, 34·02%; cane-sugar (sucrose), 1·90%; dextrins and gums, 1·51%; ash (a large number of inorganic compounds, doubtless varying greatly with honey from different plant and geographical sources), 0·15%. These percentages still leave a considerable amount of material not accounted for in the usual chemical analysis. Several materials are found in honey which either vary considerably or are difficult to determine quantitatively, as follows: pollen grains suspended in honey, derived probably by accidental contamination during the gathering or ripening process, a minute source of protein material in the honey; small particles of bees-wax, probably not all derived from the process of extracting honey by modern methods; some albuminoids, possibly in part from pollen grains but also possibly normal to honey itself; free acid, usually calculated by chemists as formic but said to consist largely of malic (the calculation as formic being a result of an unfounded theory of former times that bees use formic acid from the poison glands as a preservative, whereas the poison glands do not produce formic acid); various colouring materials of plant origin, such as chlorophyll derivatives, carotin, zanthophyll, etc. Other substances which have been found in honeys but which cannot be determined quantitatively are: various enzymes, such as invertase produced in considerable quantities by honey-bees and used in the transformation of sucrose in nectar into dextrose and laevulose, diastase (amylase), catalase, inulase and other enzymes in certain honeys; aromatic bodies of doubtful character and origin which give the characteristic aromas to honeys from various plant species. In certain honeys or honey-dew honeys, higher alcohols, mannite, dulcite, have been detected, and in rare cases the trisaccharide melezitose has been found. The recent work in nutrition has caused a search to be made for vitamins in honeys of various sources. Vitamins A, B and C have been found, but far more work is needed in this field.

Honey is a supersaturated solution of these materials in a non-crystallizable sugar under ordinary conditions, whereas dextrose forms crystals most readily. The proportions of these two sugars vary enormously in honeys of different plant origin, those of the California sages and tupelo of the south-eastern United States being high in laevulose, as a result of which these honeys rarely, if ever, form crystals. On the other hand, honeys from lucerne (alfalfa) are high in dextrose and form crystals quickly after removal from the hive and combs. The fineness of the crystals formed in honey depends on the rapidity of granulation or crystallization, since dextrose crystals are not definite and fixed in form. A disturbance of the balance of the supersaturated honey solution, as by the artificial removal of some ash, immediately upsets the balance and precipitation immediately follows. Dextrose forms a crystal with one molecule of water of crystallization, with the result that when honey granulates, the water content of the solution of uncrystallized sugars is increased. As a result of this, fermentation of honey is more apt to occur in granulated honey than in liquid honey. Honey also has certain interesting physical properties, so far unexplained. For example, if a solution of honey and water in equal parts is made and subjected to extremely low temperatures, the solution does not freeze solid as a similar sugar solution would do, but forms a mushy mass. This is the explana-

tion of the use of honey and water as an anti-freeze solution for automobile radiators.

Honey in Ancient Times.—The term "virgin-honey" is an ancient designation applied to the honey from combs that have never contained brood, or to that which flows spontaneously from honey-comb with or without the application of heat. The honey obtained from old hives was formerly considered inferior in quality, because of contaminations, but this does not hold true in modern bee-keeping practice. The far-famed honey of Narbonne is white, granular and highly aromatic; and still finer honey is that procured from the Corbières mountains, 6 to 9 m. to the south-west. The honey of Gâtinais is usually white, and is less odorous and granulates less readily than that of Narbonne. Honey from white clover has a slight amber, and that from heather a dark, golden-yellow hue. What is made from honey-dew is often dark in colour, and disagreeable to the palate, and some such honeys do not crystallize. "We have seen aphide honey from sycamores," says F. Cheshire (*Pract. Bee-keeping*, p. 74), "as deep in tone as walnut liquor, and where much of it is stored the value of the whole crop is practically *nil*." The honey of the stingless bees (*Meliponia* and *Trigona*) of Brazil varies greatly in quality according to the species of flowers from which it is collected, some kinds being black and sour, and others excellent. The fine aroma of Maltese honey is due to its collection from orange blossoms, Narbonne honey being harvested chiefly from Labiate plants, as rosemary.

Adulterants of honey are cane-sugar, artificially prepared invert sugars, various syrups and the different varieties of manufactured glucose. Honey sophisticated with glucose containing copperas as an impurity is turned an inky colour by liquids containing tannin, as tea. These adulterations are readily detected by modern chemical methods.

Honey is mildly laxative in effect. Some few kinds are purported to be poisonous, as the reddish honey stored by the Brazilian wasp *Nectarina* (*Polistes*, Latr.) *Lecheguana*, Shuck., the effects of which have been vividly described by Aug. de Saint-Hilaire, the spring honey of the wild bees of East Nepaul, said to be rendered noxious by collection from rhododendron flowers (Hooker, *Himalayan Journals*, i. 190, ed. 1855), and the honey of Trebizond, which from its source, the blossoms of *Azalea pontica* and *Rhododendron ponticum* (perhaps to be identified with Pliny's *Aegolethron*), acquires the qualities of an irritant and intoxicant narcotic, as described by Xenophon (*Anab.* iv. 8). Pliny (*Nat. Hist.* xxi. 45) describes as noxious a livid-coloured honey found in Persia and Gaetulia. Honey obtained from *Kalmia latifolia*, L., the calico bush, mountain laurel or spoonwood of the northern United States, and allied species, is sometimes reputed deleterious; and G. Bidie (*Madras Quart. Journ. Med. Sci.*, Oct. 1861, p. 399) mentions urtication, headache, extreme prostration and nausea, and intense thirst among the symptoms produced by a small quantity only of a honey from Coorg jungle. A South African species of *Euphorbia*, as was experienced by the missionary Moffat (*Miss. Lab.* p. 32, 1849), yields a poisonous honey. The nectar of certain flowers is asserted to cause even in bees a fatal kind of vertigo. The evidence for any honey having poisonous properties is exceedingly doubtful and in all probability the symptoms described by these old writers were due either to overeating or to sensitivity to osmotic pressure set up by honey in an empty stomach. Later observations do not substantiate these old theories. As a demulcent and flavouring agent, honey is employed in the *oxymel, oxymel scillae, mel boracis* and *confectio piperis* of the *British Pharmacopoeia*.

To the ancients honey was of very great importance as an article of diet, being almost their only available source of sugar. It was valued by them also for its medicinal virtues. According to Hindu medical writers, honey when new is laxative, and when more than a year old astringent (U. C. Dutt, *Mat. Med. of the Hindus*, p. 277, 1877). Ceromel, formed by mixing at a gentle heat one part by weight of yellow wax with four of clarified honey and straining, is used in India and other tropical countries as a mild stimulant for ulcers in the place of animal fats, which there rapidly become rancid and unfit for medicinal purposes. Pills prepared with honey as an excipient are said to remain unindurated, however long they may be kept (*Med. Times*, 1857, i. 269). Mead, of yore a favourite beverage in England, is made by fermentation of the liquor obtained by boiling in water combs from which the honey has been drained. In the preparation of sack-mead, an ounce of hops is added to each gallon of the liquor, and after the fermentation a small quantity of brandy. Metheglin, or hydromel, is manufactured by fermenting with yeast a solution of honey flavoured with boiled hops (*see* Cooley, *Cyclop.*). A kind of mead is largely consumed in Abyssinia, where it is carried on journeys in large horns (Stern, *Wanderings*, p. 317, 1862). In Russia a drink termed *lipez* is made from the delicious honey of the linden. The *mulsum* of the ancient Romans consisted of honey, wine and water boiled together. The *clarre*, or *piment*, of Chaucer's time was wine mixed with honey and spices, and strained till clear; a similar drink was *bracket*, made with wort of ale instead of wine. Honey is occasionally employed for giving strength and flavour to ale. In ancient Egypt it was valued as an embalming material; and in the East, for the preservation of fruit, and the making of cakes, sweetmeats, and other articles of food, it is largely consumed. Grafts, seeds and bird's eggs, for transmission to great distances, are sometimes packed in honey. In India a mixture of honey and milk, or of equal parts of curds, honey and clarified butter, is a respectful offering to a guest, or to a bridegroom on his arrival at the door of the bride's father; and one of the purificatory ceremonies of the Hindus is the placing of a little honey in the mouth of a new-born male infant. Cream or fresh butter together with honey, and with or without bread, is a favourite dish with the Arabs.

Among the observances at the Fandròana or New Year's festival, in Madagascar, is the eating of mingled rice and honey by the queen and her guests; in the same country honey is placed in the sacred water of sprinkling used at the blessing of the children previous to circumcision. Honey was frequently employed in the ancient religious ceremonies of the heathen, but was forbidden as a sacrifice in the Jewish ritual (Lev. ii. 11). With milk or water it was presented by the Greeks as a libation to the dead (*Odyss.* xi. 27; Eurip. *Orest.* 115). A honeycake was the monthly food of the fabled serpent-guardian of the Acropolis (Herod. viii. 41). By the aborigines of Peru honey was offered to the sun.

Honey Production.—In Hungary, the amounts of honey and of wax are in favourable years respectively about 190,000 and 12,000 cwt., and in unfavourable years, about 12,000 and 3,000 hundredweights. In Poland the system of bee-keeping introduced by Dolinowski has been found to afford an average of 40 lb. of honey and wax and two new swarms per hive, the common peasant's hive yielding, with two swarms, only 3 lb. of honey and wax. Recently other methods of bee-keeping have been introduced. When, in August, in the loftier valleys of Bormic, Italy, flowering ceases, the bees in their wooden hives are, by means of spring-carts, transported at night to lower regions, where they obtain from the buckwheat crops the darker honey which serves them for winter consumption. Similar migratory bee-keeping is practised in many parts of Europe and America.

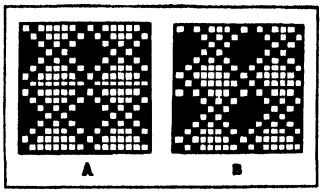
In Palestine, "the land flowing with milk and honey" (Ex. iii. 17; Numb. xiii. 27), wild bees are numerous, especially in the wilderness of Judaea, and the selling of their produce, obtained from crevices in rocks, hollows in trees and elsewhere, is with many of the inhabitants a means of subsistence. Commenting on I Sam. xiv. 26, J. Roberts (*Oriental Illust.*) remarks that in the East "the forests literally flow with honey; large combs may be seen hanging on the trees, as you pass along, full of honey." In Galilee, and at Bethlehem and other places in Palestine, a more modern bee-keeping is now extensively carried on. The ancient hives, sometimes still used, are sun-burnt tubes of mud, about 4 ft. in length and 8 in. in diameter, and, with the exception of a small central aperture for the passage of the bees, closed at each end with mud. These are laid together in long rows, or piled pyramidally, and are protected from the sun by a covering of mud and of boughs. The honey is taken from the bees when the ends have been removed, by means of an iron hook. On the precipitous slopes of the Teesta valley, in India, the procuring of

honey from the pendulous bees' nests, which are sometimes large enough to be conspicuous features at a mile's distance, is the only means by which the idle poor raise their annual rent.

The vast increase in the use of cane and beet-sugars, together with the extensive sale of artificially manufactured syrups made from cane, starch and other materials, has to a considerable degree reduced the importance of honey as an article of human diet. In most countries at present, the amount of cane and beet-sugar consumed exceeds the honey used by 50 times, whereas in ancient times honey was the most important source of sweetness. There is, of course, much evidence that the present excessive use of artificially manufactured sugars and syrups is detrimental. All such sugars and syrups are wholly deficient in vitamins and have had extracted from them many other important food constituents in the manufacturing processes; just as occurs in the highly developed manufacture of other modern food-stuffs. The recent protest against artificially manufactured foods is resulting in an increase in the advice that honey be used as a natural food product, in place of such large quantities of manufactured sweets. Various new and important uses are also being found for honey, in which other syrups cannot be employed satisfactorily.

It is also now known that honey has the important virtue of being a mild disinfectant, in fact, if bacteria of various species are placed in honey, they die within a few hours by the dehydration set up by the high laevulose content of the honey. Furthermore, modern processes of removing honey from the comb have been developed so that any danger of contamination is reduced to the utmost. Comb-honey is of course sealed by the cleanly bees themselves in the cells, where contamination is impossible. These facts, together with the various materials now known to occur in honey and not in other sweets, are rapidly increasing the importance of honey as an article of human food. (*See* also BEE-KEEPING.)

HONEYCOMB, a cloth so called because of the particular pattern made by the arrangement of the crossing of the warp and weft threads; these form cells somewhat similar to those of the real honeycomb. They differ from the latter in that they are rectangular instead of hexagonal. The bottom of the cell is formed by those threads and picks which weave "plain," while the ascending sides of the figure are formed by the gradually increasing length of float of the warp and weft yarns.



DESIGNS USED IN THE MANUFACTURE OF HONEYCOMB TOWELLING
The pattern at left is known as the "perfect 8-thread honeycomb"; that at right is a modification of the "perfect honeycomb"

The figure shows two of the commonest designs which are used for these cloths, design A being what is often termed the "perfect honeycomb." In the figure it will be seen that the highest number of successive white squares, representing a weft thread floating or passing over warp threads, is seven, whereas the corresponding highest number of successive black squares, a warp thread passing over weft threads or picks, is five. Two of each of these maximum floats form the top or highest edges of the cell, and the number of successive like squares decreases as the bottom of the cell is reached when the floats are one of black and one of white (*see* middle of design, etc.). The weave produces a reversible cloth, and it is extensively used for the embellishment of quilts and other fancy goods. It is also largely used in the manufacture of cotton, linen and union towels. B is, for certain purposes, a more suitable weave, than A, but both are very largely used in the towel industry. (T. W.)

HONEY DEW, a secretion consisting of exudations of sugar from the leaves of various trees under certain atmospheric conditions. It is usually the result of a superfluity of sap, but may also be produced by the puncture of certain insects (*Aphides, q.v.*); the latter condition constitutes a form of plant disease. *See* PLANTS: *Pathology.*

HONEY-EATER, or HONEY-SUCKER, the name given to birds of the family *Meliphagidae,* characteristic of the Australian region, and possessing a long protrusible tongue by means of which they obtain honey, and also the insects attracted thereto. They are small birds, mostly of restricted range, though *Glycyphila rufifrons,* the white-throated honey-eater, is found over the greater part of Australia and Tasmania. One of the most curious forms is *Prosthemadera,* the parson-bird of New Zealand, so-called from its dark plumage and the two tufts of white feathers beneath the chin. The bell-bird of the same island, *Anthornis melanura,* the Australian wattle-birds (*Anthochaera*) and the pugnacious friar-birds (*Tropidorhynchus*) are related to this group. These latter are the objects of mimicry by two orioles (*Mimeta*) in the islands of Bouru and Ceram (Wallace, *Malay Archipelago*).

HONEY-GUIDE, a bird so called from its habit of pointing out to man and to the ratel (*Mellivora capensis*) nests of bees, the produce of which it then hopes to share. Stories to this effect are found in the narratives of many African travellers. But Layard says (*B. South Africa,* p. 242) that the birds not infrequently lead to a leopard or a snake, and will even follow a dog with vociferations. Nevertheless its noisy cry and antics unquestionably have, in many cases, the effect signified by its English name. Further observations on the meaning of this habit are needed. The honey-guides are small birds, of plain plumage with a sparrow-like bill. Two species are Asiatic, while the remainder are confined to Africa. The largest genus is *Indicator.*

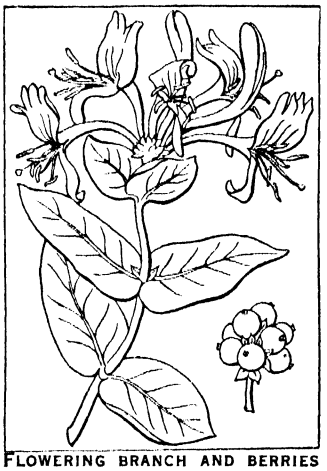
HONEY LOCUST, the popular name of a North American tree (*Gleditschia triacanthos*), of the family Leguminosae, native to fertile soils from western Pennsylvania through Ohio and Ontario to Michigan and Minnesota and southward to Alabama and Texas, and also naturalized from cultivation eastward of this range. It reaches from 75 to 140 ft. in height with a trunk 2 or 3, or sometimes 5 or 6 ft. in diameter, and slender spreading branches which form a broad, flattish crown. The branchlets bear numerous simple or three-forked (whence the species-name *triacanthos*) sharp stiff spines, 3 to 4 in. long, at first red in colour, then chestnut brown; they are borne above the leaf-axils and represent undeveloped branchlets; sometimes they are borne also on the trunk and main branches. The long-stalked leaves are 7 to 8 in. long with eight to fourteen pairs of narrowly oblong leaflets. The flowers, which are of two kinds, are borne in racemes in the leaf-axils; the staminate flowers in larger numbers. The brown pods are often 12 to 18 in. long, have thin, tough walls, and contain a quantity of sweetish, succulent pulp between the numerous seeds; they contract spirally when drying. The tree was first cultivated in Europe towards the end of the 17th century by Bishop Compton in his garden at Fulham, near London, and is now extensively planted as an ornamental tree. The much smaller swamp honey locust or water locust (*G. aquatica*), with shining brown pods, 1 in. to 2 in. long and containing only 1 or 2 seeds, inhabits deep swamps in the Mississippi valley from Illinois southward, ranging also eastward to South Carolina and Florida. The name of the genus commemorates Johann Gottlieb Gleditsch (1714–1786), a friend of Linnaeus, and the author of one of the earliest works on scientific forestry.

HONEYSUCKLE, botanical name *Lonicera,* a genus of climbing, erect or prostrate shrubs, of the family Caprifoliaceae, so named after the 16th-century German botanist Adam Lonicer. The common British species is *L. Periclymenum,* the woodbine; *L. Caprifolium* and *L. Xylosteum* are found in a few counties in the south and east of England. Some of the garden varieties of the woodbine are very beautiful, and are held in high esteem for their delicious fragrance, even the wild plant, with its pale flowers, compensating for its sickly looks "with never-cloying odours." The North American sub-evergreen *L. sempervirens,* with its fine heads of blossoms, commonly called the trumpet honeysuckle, the most handsome of all the cultivated honeysuckles, is a distinct and beautiful species producing both scarlet and yellow flowered varieties, and the Japanese *L. flexuosa* var. *aureoreticulata* is esteemed for its charmingly variegated leaves netted with golden yellow. The fly honeysuckle, *L. Xylosteum,* a hardy shrub of dwarfish, erect habit and *L. tatarica,* of similar habit, both European, are amongst the oldest English garden shrubs, and bear axillary flowers of various colours, occurring two on a peduncle. There are numerous other species, many of them introduced to

our gardens, and well worth cultivating in shrubberies or as climbers on walls and bowers, either for their beauty or the fragrance of their blossoms.

The wood of the fly honeysuckle is extremely hard and is employed to make teeth for rakes; and, like that of *L. tatarica,* it is a favourite material for walking-sticks.

There are about 175 species, widely distributed in the northern hemisphere, upwards of 30 of which, together with numerous varieties, are more or less cultivated. Some 25 species, inclusive of several naturalized from the Old World, are found in the United States and Canada. Honeysuckles (*Lonicera*) flourish in any ordinary garden soil. Pruning should be done about March, cutting out some of the old wood, and shortening back some of the younger growths of the preceding year.



FLOWERING BRANCH AND BERRIES OF THE BRITISH HONEYSUCKLE OR WOODBINE (L. PERICLYMENUM)

In the western counties of England the name honeysuckle is applied to the meadow clover, *Trifolium pratense.* Another plant of the same family (Leguminosae), *Hedysarum coronarium,* a very handsome hardy biennial, is called the French honeysuckle. The name is moreover applied with various affixes to several other totally different plants. Thus white honeysuckle and false honeysuckle are names for the North American *Azalea viscosa;* Australian or heath honeysuckle is the Australian *Banksia serrata;* Jamaica honeysuckle, *Passiflora laurifolia;* dwarf honeysuckle, the widely spread *Cornus suecica;* Virgin Mary's honeysuckle, the European *Pulmonaria officinalis;* while West Indian honeysuckle is *Tecoma capensis,* and is also a name applied to *Desmodium.*

HONFLEUR, seaport of France, in the department of Calvados, 57 m. N.E. of Caen by rail, on the Seine estuary, opposite Havre, with which it communicates by steamboat. Pop. (1926) 8,158. Honfleur dates from the 11th century and is 500 years older than Havre, which supplanted it in the 18th century. During the Hundred Years' War it was frequently taken and re-taken, the last English occupation ending in 1440. In 1562 the Protestants took it after a siege of the suburb of St. Léonard; and though Henry IV. captured it in 1590 he had again to invest it in 1594 after the rest of Normandy had submitted to his arms. Early in the 17th century Honfleur was a centre for exploration, its colonists founded Quebec, and Honfleur traders established factories in Java and Sumatra and a fishing establishment in Newfoundland.

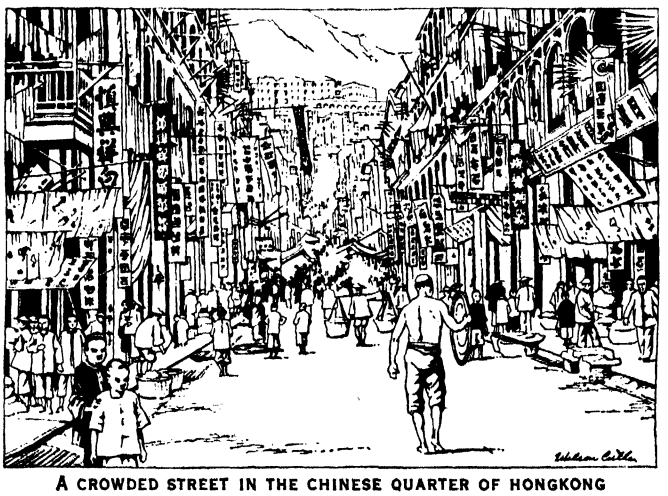
The most noteworthy building is the timber church of St. Catherine. The church tower stands on the other side of a street. St. Léonard's dates from the 17th century, with the exception of its ogival portal and rose-window of the 16th, and its 18th century octagonal tower. The ruins of a 16th-century castle, called Lieutenance, and houses of the same period are also of interest. Above the town is the chapel of Nôtre-Dame-de-Grâce, a shrine resorted to by pilgrim sailors, founded in 1034 by Robert the Magnificent of Normandy and rebuilt in 1606. The town has a tribunal and a chamber of commerce. The port consists of the tidal harbour and four floating basins. A reservoir affords the means of sluicing the channel and supplying the basins. The harbour was begun by Duquesne in 1668. Honfleur has regular steamship service for passengers to Havre, Southampton and London and bus service with Trouville. Honfleur exports mainly to England and trades in poultry, butter, eggs, cheese, chocolate, baskets, shell work, vegetables, fruit, seeds and purple ore. Timber from Scandinavia, English coal and artificial manures are imported. There are important saw-mills, as well as shipbuilding yards, manufactories of chemical manures, oil, shoes and iron foundries.

HONGKONG, an important British island possession off the south coast of China in 22° 9′–22° 17′ N.; 114° 5′–114° 18′ E. The present British colony of Greater Hongkong is a compact group of islands and peninsulas, comprising the island of Hongkong itself, the Kowloon peninsula and the so-called New Territories, which together command the entrance to the Canton river. The island of Hongkong lies 75 miles S.E. of Canton and has a dominant position in the group. It is very irregular in shape, about 11 miles in length, and has an area of about 32 square miles. It is separated from the mainland by a channel about a mile broad between Victoria, the island capital, and Kowloon point, but narrowing at Ly-ee-mun Pass to about half a mile.

Hongkong island, a detached fragment of the South China massif, is chiefly composed of primary rocks, of which granite occupies about half the total area and forms the basis of the structure. The main topographical features of the whole group of islands are largely due to two sets of fracture-lines trending N.E.–S.W. and N.W.–S.E. As a result, the coasts are extremely broken and provide a number of splendid natural harbours. The chief physical feature of the island is an E.–W. range of steep conical hills which rise some 1,500 ft. above the basal plateau, very little of which is suitable for cultivation. Victoria Peak (1,774′) in the north-west and immediately south-west of the capital, is the highest point. From the sea, and especially from the fine harbour which fronts the capital, the general aspect of the city rising in hill-side terraces, is very attractive.

Hongkong lies just within the tropics and had formerly the reputation of being unhealthy. This has been largely remedied by sanitation but some districts of the colony are healthier than others, owing to differences of altitude or aspect. The Peak in Hongkong island is usually 8° F cooler than Victoria below and so affords a valuable sanatorium for the white population. The prevailing winds throughout the year are easterly. The mean July temperature is 82° F, but that of February only 57·7° F, the relatively cool winters being due to north-east winds. The monsoonal rainfall increases to a June maximum of 16·3″ with a secondary maximum in August. The mean annual rainfall is 90 inches. Typhoons account for most of the climatic eccentricities and at times cause great damage to property and shipping.

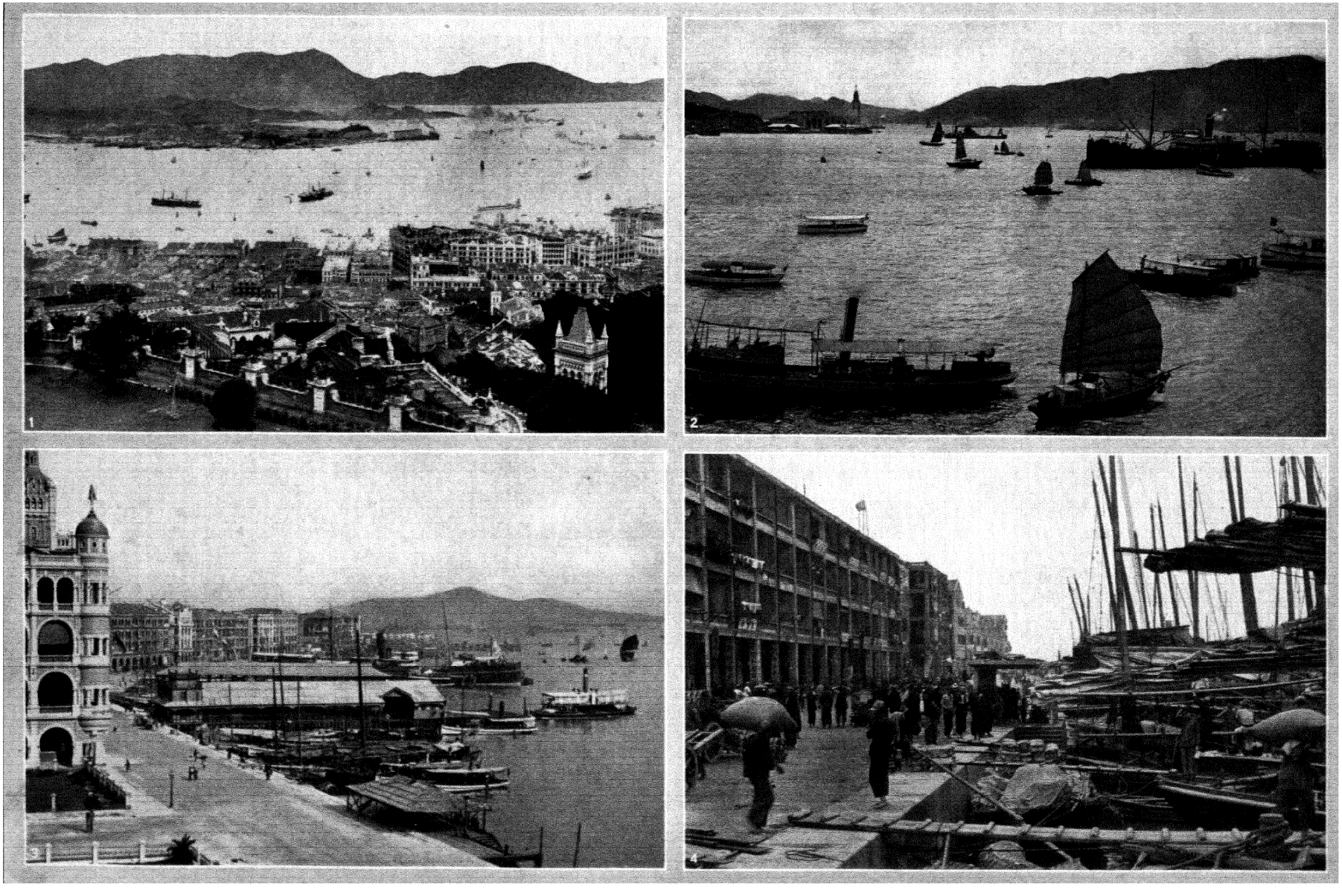
Prior to the British occupation Hongkong was a desolate island, occupied by a small fishing population, and was a notorious haunt of pirates. It was during the "Opium War" of 1839–42 that its harbour, which since 1821 had sheltered opium vessels, was utilized as a naval base for British ships. Barren and unhealthy as



A CROWDED STREET IN THE CHINESE QUARTER OF HONGKONG

the island was and lacking natural resources, the great commercial and strategic significance of this deep, sheltered harbour, ten square miles in area, possessing east and west entrances and lying right on the path of the chief trade route to China, was quickly realized. Its cession to Great Britain in 1841, confirmed by the Treaty of Nanking (1842), was one of the chief results of the war and, despite the fact that owing to the lack of other resources its development was for a long time purely commercial, it has grown in less than a century to be one of the world's greatest ports.

The history of Hongkong since 1842 has been inseparably con-

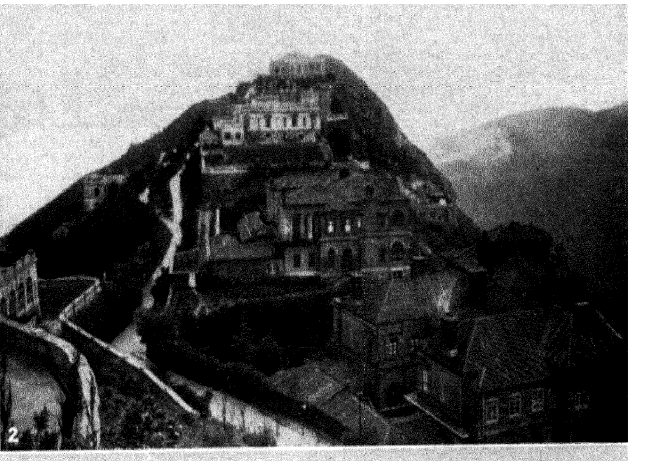


VIEWS OF THE HONGKONG HARBOUR AND THE CITY OF VICTORIA

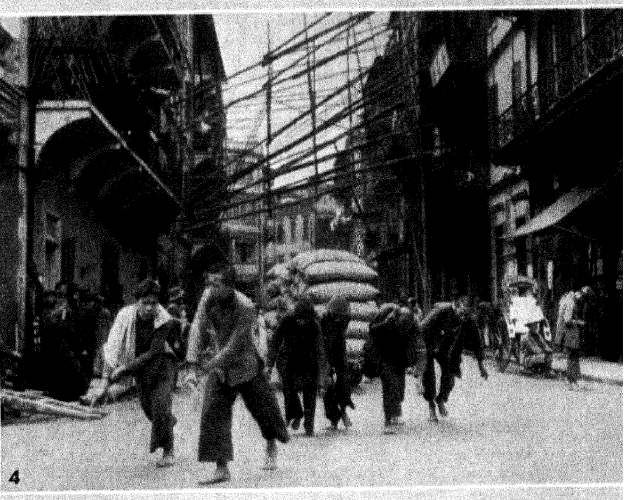
1. View of the Harbour of Hongkong and the City of Victoria, capital of the British colony of Hongkong. The harbour, which is a distributing centre for Chinese trade, lies between Victoria and the peninsula of Kowloon on the mainland
2. The naval anchorage in the harbour of Hongkong, with Kowloon peninsula in background
3. View of "The Bund," a boulevard in Victoria along the harbour, showing a corner of the Queens Buildings in the foreground
4. On the Hongkong water front, native houses line the thoroughfare which skirts the wharves

HONGKONG













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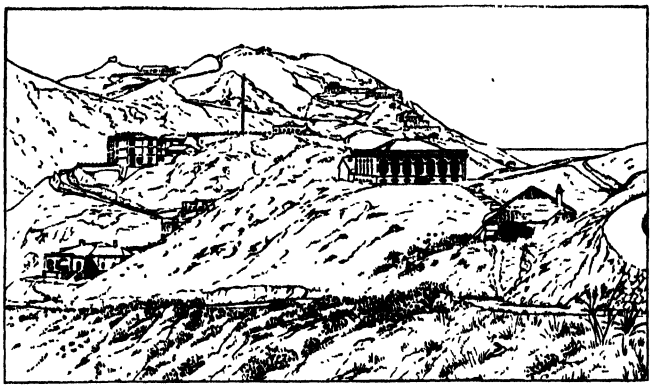
VICTORIA AND THE SURROUNDING COUNTRY

1. Government Plaza, showing Government House, situated in the second stratum of the city of Victoria. Victoria is built on three levels: the lowest given over to shipping, business and native dwellings; the second largely to government buildings and parks; while the third, on Victoria Peak, is the residential section and summer colony
2. View of Victoria Peak, 1774 feet above the harbour of Hongkong, showing residences built on its slopes. The peak district is especially popular during the hot season, between May and October, when the temperature is many degrees cooler there than in the lower levels of the city
3. View of Victoria, rising in terraces from the waterfront, showing in the background the ridge of steep hills, which at some points is nearly 1800 ft. high
4. Dock hands in Victoria, transporting goods on a street near the waterfront. Hongkong is a shipping centre for goods passing between China and other parts of the world, and the entrepôt for the coastal trade between North and South China
5. "The Bund" or waterfront esplanade of Victoria City
6. Des Veoux Road, running parallel with "The Bund"; one of the principal shopping and business streets of Victoria

nected with the development of its trade and this, fostered by a free-port policy, has grown with the progressive opening up of China's foreign relations. Hongkong's development falls into well defined stages. During the first years of British control opium was the foundation of its trade, but in 1849 the island became the chief centre for the coolie transport-traffic to the gold fields of California and Australia. From 1850–60 Hongkong acquired the



VIEW OF THE PEAK (1,825 FT.), THE HIGHEST GROUND NEAR HONGKONG
The Peak is the summer resort of the official classes and wealthier merchants. On the left is the Commodore's residence

nucleus of a settled Chinese population which has proved essential to its commerce. A short period of reaction set in with the loss of the raw-cotton trade built up during the American Civil War, but in 1869, the opening of the Suez canal enlarged its sphere and brought it into closer touch with Europe. While the tonnage of ships calling at Hongkong doubled between 1860 and 1870, it quadrupled between 1870 and 1880, following the opening of the canal.

It had been apparent from the beginning that Hongkong was menaced owing to its proximity to the mainland. A special source of danger was the Kowloon peninsula which dominated the harbour and threatened Victoria. Following the 2nd Opium War, Britain obtained (1860) the cession of Kowloon peninsula and Stonecutter's island; but Hongkong was not completely defensible so long as the whole harbour was not contained within British territory. Hence during the struggle for concessions, at the end of the century, Great Britain obtained (1898) a 99 years' lease of the mainland as far north as the Shumchun river and of the islands around Hongkong within the limits of 114° 5′ and 114° 18′ E. and 22° 17′ N. This involved the control of a relatively wide stretch of sea, and so provided additional security.

Although both territorial extensions were acquired on strategic grounds, they have since proved useful in other directions for Kowloon is now an outlet for the overflow population of Hongkong and a field for its industrial development while the New Territories are a potential source of raw materials for its trade and industry. Thus the three units are supplementary, and together make up the complex but compact unit of Greater Hongkong.

Hongkong for Chinese customs purposes is regarded as a foreign port but its essential trade function is to serve as a point of transhipment for goods passing between China and the outer world, and at the same time act as an entrepôt for the coastal trade between north and south China. Although it has commercial relations with all parts of the world, the Far East trade in 1922 accounted for no less than 95% of its exports and 66% of its imports. The nature of this trade is well illustrated by the chief commodities—rice, sugar, cotton yarn, tin and coal. In recent years Hongkong has been the principal centre of rice distribution in the world. The main source of supply is French Indo-China, which in 1922 stood second in the total import and export trade of Hongkong and is mainly an exporter of foodstuffs and raw materials in return for Chinese and foreign goods. The rice-exports of the port, whose value in 1924 amounted to £9,681,958 are chiefly to China, for Hongkong, lying between the chief supplier and consumer, handles 85% of China's total rice-import. Rice is exported to a smaller extent to the United States, Cuba and the Philippines while Japan is supplied only when her crops fail. Hongkong is also, after Java, the chief sugar-distributing centre of the Far East. The bulk of the imports, largely determined by the colony's refining industry, comes from the Dutch East Indies (74%), and most of the remainder from the Philippines. The total exports in 1924 were valued at £7,911,373. China takes about 70% of the refined and 75% of the raw sugar exports. Cotton-yarn is usually third in both the import and export trade of Hongkong. It is imported from India (57%), Japan, North China, the United States and Great Britain, to the value of about £4,000,000. Of the total exports South China takes about 50% and French Indo-China 40%. Japan is increasing its hold on the cotton piece goods trade, formerly almost monopolized by Britain. After Singapore, Hongkong is the chief tin market of the Far East. This commodity comes chiefly from Yunnan, via Haiphong, and is sent to Hongkong to obtain the best market and the best facilities for exportation, its chief destination being America, and to a lesser degree, Japan. The total value of tin-exports in 1924 was £1,774,049. The importation of coal, great as it is, is only sufficient to meet the needs of the coastal and local traffic. Japan supplies about 65% of the total imports, of which only 25% is re-exported mainly to neighbouring ports. The importation and exportation of raw opium was prohibited by Ordinance No. 30 of Dec. 21, 1923, and there is now no legitimate movement of opium in the colony.

Although Hongkong's commercial relations embrace the whole field of China, its real trade-sphere in that country radiates from a centre in the Canton delta into Indo-China and East Yunnan, and as far north as a line passing west from between Amoy and Foochow along the main watershed into Kweichow. With Canton, the chief collecting and distributing centre for all the foreign trade of the interior of South China, Hongkong's relations are especially close. Since ocean vessels cannot get beyond Whampoa, commodities for Canton are transhipped at Hongkong and sent up the river in small vessels. Thus Hongkong is in a sense the deep-water port of this ancient outlet of south China. In 1922 out of Hongkong's exports to China, amounting to about 60% of her total exports, Canton took 53%, to the value of £17,000,000. Hongkong in that year supplied 94% of Canton's imports and took 99·5% of its exports, the silk-trade accounting for 68% of the latter. So too, more than 90% of the total trade of the southern ports of Kwangtung is with Hongkong, which is also the chief source of foreign goods for Swatow and Amoy. Imports from Hongkong reach as far as Hankow, but the export trade of the Yang-tze basin is in the hands of Shanghai. Hongkong can, however, compete more successfully in north China where the demand for its refined sugar is the chief factor in the trade, and it is probable that the completion of the Canton-Hankow railway will increase its contacts with the Yang-tze lands.

Next to the Far East, the United States looms largest in Hongkong's trade relations, receiving about 3·5% of its exports and supplying 16% of its imports. Hongkong's chief export to the States during the period 1913–18 was rice but tin is now the chief commodity. In return the United States is the main source of its imports of flour and kerosene, the value of which in 1924 was £2,309,925 and £1,594,806 respectively. Britain's share in the trade with Hongkong is relatively small; the latter can, in no sense, be regarded as a centre of British Imperial trade, for its sphere is essentially the Far East and the Pacific.

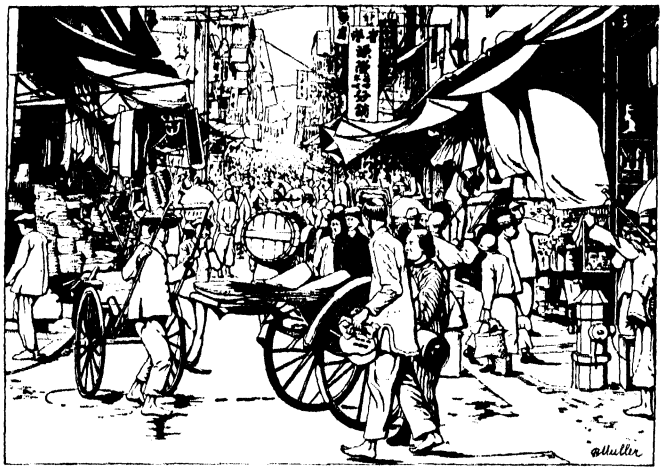
Hongkong is tending to become the centre of Japan's growing trade with south China, and it is the point of transhipment in the trade between Japan and Indo-China. The latter exports rice and tin (originally from Yunnan) via Hongkong to Japan, and in return receives cotton yarn and manufactured goods. There is also a steady trade with the Straits Settlements, because exports are mainly Chinese foodstuffs and manufactured goods for the Chinese colonies in Malaya.

The Total Trade of Hongkong (excluding Treasure)

Year	Imports	Exports	Total
	£	£	£
1923 . . .	61,954,498	61,372,331	123,326,829
1924 . . .	72,155,478	63,674,794	135,830,272

Depending as it does on the changing demand and supply of the Far Eastern market, Hongkong's trade is liable to great fluctuations. In the boom period after the World War the import trade more than doubled between 1918 and 1920, but this was followed by a marked decrease, due partly to the continued fall of exchange on the *tael*, partly to the troubled internal conditions of China and the political and trade friction between Hongkong and Canton. Trade in 1925 and 1926 was hurt by the Cantonese boycott.

The total shipping entering and clearing at ports in the colony during 1924 amounted to 764,492 vessels of 56,731,077 tons. Of



MARKET IN HONGKONG

Many of the articles on view in the crowded markets are made by native craftsmen, who may be seen working in their shops. The crafts of jewellery, furniture-making and weaving are carried on extensively

these, 56,765 vessels of 37,770,499 tons were engaged in foreign trade. The growth of Hongkong's shipping after the war was remarkable, the tonnage in 1923 exceeding that of 1918 by no less than 24,000,000 tons.

Hongkong has become the chief centre of the Far East passenger service and is a port of call for the largest liners in the service. River steamers, launches and junks trade with Macao, Canton and the smaller delta ports of Kwangtung and as far up the Sikiang river as Wuchow where they connect with a fleet of Chinese motor-boats. In colonial waters the traffic is very heavy, varying with the amount of ocean shipping. Steam launches in the local trade in 1923 amounted to 17,400,000 tons, while junks in both local and foreign trade totalled 3,900,000 tons. These river and harbour fleets are vitally important to Hongkong since its chief markets lie in the adjacent delta-lands of the Si-kiang and the hinterland of Canton. Although commerce remains the life-blood of the colony, Greater Hongkong has in recent years developed considerable industrial and agricultural activities. The industries depend on trade for most of the necessary raw materials and so cover a wide range—tin- and sugar-refining, rice polishing, furniture-making, ship-building and engineering, the manufacture of cement, paper, rope, glass, soap, ginger, canned and knitted goods. The chief industries are controlled by Europeans but the factory system under purely Chinese management is proving successful. Local production of raw materials, wherever possible, will greatly assist further industrial development in the colony. The island itself has no valuable mineral resources except building-stone, but the New Territories contain deposits of copper, tin, iron, wolfram, silver-lead and limestone. These may prove workable after initial expert investigation and the revision of the present Mining Ordinances of the colony.

The chief economic value of the New Territories, however, lies in their agriculture in spite of the limitations imposed by the high relief. Rice supplies the needs of the whole peasant population and occupies 90% of the total cultivated area. Sugar is at present the only important commercial crop. There are, however, great possibilities for fruit-growing, especially if the hill-sides are terraced. The pineapple crop is already considerable, and is the basis of a growing native canning-industry. Road-making is helping to improve the facilities for marketing the garden-produce of the New Territories. The great extent of hill-pasture also affords opportunities for stock-raising. While Hongkong itself is of small agricultural value, afforestation has converted the "desolate rock" of 1842 into a fairly well-wooded island; the main objects of the forestry policy have been soil-preservation, water-conservation, revenue and beauty. The chief tree is the pine but several others, including the camphor and eucalyptus, have been successfully acclimatised. Oil-producing trees are receiving especial attention.

In addition to the Chinese roads, the best of which are paved, Hongkong island contains a network of good macadamised roads which are essentially defensive and are of small economic value. They take the form of a circular route following the coast with cross-connections using the hill-gaps. The construction of a railway from Kowloon to Canton was one of the conditions accompanying the lease of the New Territories. The through route was opened in 1911 and connects with Hongkong by ferry from Kowloon. There are no other good external communications. Not least among the many important economic aspects of Hongkong is its pre-eminence as a banking centre. The circulation on Dec. 31, 1924 of notes of the three banks having authorized issues amounted to $62,511,402 and the total amount of coin in circulation was $17,864,370.96. The revenue of the colony for 1924 was $24,209,640 and the expenditure $26,726,428. During the period 1915–24 the assessment of the whole colony rose from about 14¼ to over 22 million dollars.

The population of Greater Hongkong was in 1924 made up as follows: Foreign Civil Community, 16,000; City of Victoria, 420,000, Villages of Hongkong Island, 29,800. New Territories, 85,000; Population Afloat, 68,750; Total Chinese Population 783,550; Total Civil Population 799,550. The boat-population which centres in Victoria harbour, and the agricultural population of the New Territories are both indigenous and form distinct and stable elements in what is, as a whole, a fluctuating and changing native population. Thus in 1924, no less than 129,859 emigrants left the colony, more than half of whom were bound for the Straits Settlements, but these were balanced by 130,194 new arrivals. Immigrants from the Canton delta account for 76% of the total population of Hongkong and Kowloon. The industrial element is appreciably growing, especially in Kowloon. The colony is faced with the social problems involved in the new industrialism of the Far East and has to its credit the first factory regulations governing the conduct of industry and the employment of woman and child labour, following the report of a special enquiry in 1921–2. A good deal of pioneer educational work has also been done. In 1924 the total number of children and schools in the colony was 47,933, of whom nearly 15,000 were at English schools. The educational system is crowned by the University of Hongkong, which in the face of serious financial difficulties, offers advanced instruction in most forms of Western science and learning, and, as the only British university in the Far East, makes a wide appeal.

Acquired in the first instance as a defensive base for the China trade, Hongkong has become by the stress of events a vital factor in the strategic geography of the Pacific. As a naturally strong naval base and the focus of British interests in the Far East, its status in any regional agreement concerning the peace of the Pacific is of world-wide significance. One of the most important results of the Washington Conference of 1921–2 was an agreement by the United States, Great Britain and Japan respecting the non-fortification of naval bases in the Pacific, as part of which Great Britain undertook not to develop a first-class naval base at Hongkong. It has been claimed in consequence that its strategic security in case of a naval war will in part depend on the efficiency of Singapore. (P. M. R.)

HONGKONG AND SHANGHAI BANKING CORPORATION, one of the largest and most influential financial institutions in the Far East, with branches in many of the principal cities in China, Japan, Siam, India, Burma and the Straits Settlements, as well as in London, Lyons, Hamburg, New York and San Francisco. The Bank was founded in Hongkong in 1864, and opened its doors to business simultaneously in Hongkong and Shanghai on April 3, 1865. A year later it was incor-

porated by a Special Ordinance of the Legislative Council of Hongkong, with a capital of silver $5,000,000 divided into 40,000 shares of $125 each.

After 1870 extension was rapid, due to a great extent to the work of the late Sir Thomas Jackson, the chief manager from 1876 to 1902, and the history of the Bank for the past half-century has been one of signal and continuous progress. The capital has been increased on four separate occasions, in 1883, 1890, 1907 and 1921, to its present figure of $20,000,000.

Apart from its ordinary routine banking operations the Hongkong Bank has from its earliest days enjoyed the confidence of the leading statesmen and financiers of China, and has been responsible for the issue of the principal Government and railway loans. At first without competition, later in association with other British banking houses, and since 1913 as head of the British group in the international Consortium of Banks, the Hongkong and Shanghai Bank has been closely associated with the whole of China's foreign financial transactions. The court of directors and general management remains as from the first in Hongkong. (A. MON.)

HONITON, a market town and municipal borough in Devonshire, England, situated on the left bank of the Otter, 16½ m E.N.E. of Exeter by the S.R. Pop. (1921) 3,093. Honiton (*Honetona, Huncton*) is situated on the British Icknield Street, and was probably the site of an early settlement, but it does not appear in history before the Domesday Survey, when it was a considerable manor, held by Drew (Drogo) under the count of Mortain, who had succeeded Elmer the Saxon, with a subject population of 33, a flock of 80 sheep, a mill and 2 salt-workers. The borough was founded before 1217 by William de Vernon, earl of Devon, whose ancestor Richard de Redvers had received the manor from Henry I. In the 14th century it passed to the Courtenays, and in 1698 Sir William Courtenay was confirmed in the right of holding court leet, view of frankpledge and the nomination of a portreeve, these privileges having been surrendered to James II. The borough was represented by two members in parliament in 1300 and 1311, and then not again till 1640, from which date it returned two members until disfranchised by the act of 1868, the returning officer being the portreeve, who was also the chief magistrate of the borough until its incorporation by charter of 1846. In 1221 Falkes de Breauté, then custodian of the borough, rendered a palfrey for holding a three days' fair at the feast of All Saints, transferred in 1247 to the feast of St. Margaret, and still held under that grant. A great market for corn and other produce is still held on Saturday by prescription. The wool manufacture flourished at Honiton in the reign of Henry VII., and it is said to have been the first town at which serges were made, but the industry entirely declined during the 19th century. The lace manufacture was introduced by Flemish refugees, and was flourishing in the reign of Charles I.

The town consists of one wide street, down which a stream of water runs, extending for about 1 m., and crossed at right angles by a lesser street. The restored church of St. Michael, formerly a parish church about ½ m. from the town, was built by Courtenay, bishop of Exeter, about 1482. It retains a carved screen, and the black marble tomb of Queen Elizabeth's physician, Marwood. Allhallows Grammar School, founded in 1614, was enlarged in 1893; St. Margaret's hospital, founded as a lazar-house in the 14th century, is converted into almshouses. Honiton is famous for its lace industry, established by refugees from Flanders under Queen Elizabeth. The delicate fabric made by hand on the pillow was long in demand; its sale was, however, greatly diminished by the competition of cheaper machine-made goods, and a school of lace-making was opened to promote its recovery. The town possesses breweries, flour-mills, saw-mills and an iron foundry; its trade in butter is considerable.

HONNEF, a town and health resort (in the Prussian Rhine province) situated on the right bank of the Rhine, at the foot of the Siebengebirge, 8 m. above Bonn by the Cologne-Linz railway. Pop. (1925) 8,123. It does a considerable trade in wine. The town is surrounded by vineyards and orchards, and has a mineral spring.

HONOLULU, capital and principal port of Hawaii (*q.v.*), and seat of the city and county of Honolulu, is situated in 21° 19′ N., 157° 52′ W., on the south coast of Oahu island 2,091 m. S.W. of San Francisco. Pop. (1890) 22,907; (1900) 39,920; (1910) 52,183; (1920) 83,327; (1927) 106,600. The city extends 10 m. along the shore and 4 m. inland across a plain a mile wide and up ridges and valleys to a mountain range 2,000–3,100 ft. high. Near the middle are the modern harbour, business section, civic centre, and, a mile back, the crater Punchbowl (500 ft.); at the east end stands, like a lion couchant, the crater Diamond Head (760 ft.); at the west end are the lower Salt lake craters. With foreground of opalescent waters, middleground of colourful exotic vegetation, background of deeply-cut verdant mountains and a sky of azure, it is reputed one of the most beautiful of cities. Tempered by cool trade breezes, the temperature on the plain is 56°–88° with a mean of 74·6°, while annual rainfall averages 28·6 in., the temperature decreasing and rainfall increasing with altitude. At the cross-roads of trans-Pacific trade routes, arrivals of ocean steamers average three a day. The city is headquarters for a fleet of inter-island steamers. Rural Oahu is reached by railway and concrete and macadam roads. Honolulu is well served by electric railway, light and power, gas, automatic-telephone, water and sewer systems, inter-island and shore-to-ship wireless and trans-Pacific cable and wireless. The civic centre, a spacious park, contains or is bordered by the Federal building, the Territorial capitol (formerly palace), judiciary, office, library, archives and armoury buildings and several fine quasi-public and private buildings. The new Royal Hawaiian hotel at Waikiki beach is notable among other fine buildings. There are many drives, parks and playgrounds, the largest being Kapiolani park, between Waikiki and Diamond Head. Much has been done for beautification, including elimination of bill boards from the island. There is a profusion of introduced plants: monkey-pods, Indian and Chinese banyans, silk, cotton and umbrella trees, Norfolk island pines and Australian ironwoods, numerous palms, variegated coleus and croton shrubs, bougainvillea, bignonia, cup-of-gold and night-blooming-cereus vines, flame trees, shower trees, and the jacaranda, coral and African tulip trees, and over 2,000 varieties of hibiscus; the whole city indeed is a botanical garden. The principal manufactories are pineapple canneries and iron works. There is a chamber of commerce and a stock and bond exchange. Periodicals are published in seven languages. There are numerous civic, scientific, historical, literary, art, dramatic, music, professional, industrial, religious and social welfare organizations. The United Welfare Fund (community chest) contributes $450,000 annually towards the million-dollar expense of 25 welfare organizations. The principal clubs are the Pacific (oldest west of the Missouri), University, Commercial, Oahu Country, Mid-Pacific Country, Honolulu Hawaii Polo and Racing and Pearl Harbour Yacht. There is an excellent art museum. The Bernice Pauahi Bishop museum, besides having the most extensive Polynesian collections, maintains a large staff of scientists and is now making a scientific survey of the Pacific. Honolulu is a centre for Pan-Pacific conferences, notably those of the Institute of Pacific Relations and the Pacific Science Association, and others under the auspices of the Pan-Pacific Union. Pearl Harbour, with the largest U.S. naval station, is 7 m. west. Schofield Barracks, largest U.S. military post, is 20–25 m. west on a plateau 800–1,000 ft. high. Ft. Shafter, 3 m. west of the civic centre, is military headquarters of the Hawaiian department. Forts Ruger, De Russy, Armstrong and Kamehameha are respectively at Diamond Head, Waikiki and the entrances to Honolulu and Pearl harbours. (W. F. FR.)

HONORIUS, the name of four popes and one antipope.

1. HONORIUS I., pope from 625 to 638, was of a noble Roman family. He continued the work of Gregory the Great, especially in England; Bede (*Hist. Eccl.* ii. 17) gives a letter of his to King Edwin of Northumbria, in which he admonishes him diligently to study Gregory's writings; and it was at Edwin's request that Honorius conferred the pallium on the bishops of Canterbury and York (*ib.* ii. 18). He also admonished the Irish for not following the custom of the Catholic Church in the celebration of Easter

(*ib.* ii. 19), and commissioned Birinus to preach Christianity in Wessex (*ib.* iii. 7). The emperor Heraclius aided him in his difficulties with the schism of the "three chapters" in Istria and Venetia, a schism that was ended by the deposition in 628 of the schismatic patriarch Fortunatus of Aquileia-Grado and the elevation of a Roman sub-deacon to the patriarchate. The support given to him by Constantinople may have influenced Honorius, who joined the patriarchs of Constantinople and Alexandria in supporting the doctrine of "one will" in Christ, and expounded this view forcibly, if somewhat obscurely, in two letters to the patriarch Sergius (Epist. 4 and 5 in Migne, *Patrologia. Ser. Lat.* lxxx. 470, 474). For this he was (October 638) anathematized by name along with the Monothelite heretics by the council of Constantinople (First Trullan) in 681; a condemnation after confirmed by more than one pope, particularly by Leo II. *See* Hefele, *Die Irrlehre des Honorius u. die vaticanische Lehre der Unfehlbarkeit* (1871), who, however, modified his view in his *Conciliengeschichte* (1877). Honorius I. was succeeded by Severinus.

See the articles by R. Zöpffel and G. Krüger in Herzog-Hauck, *Realencyklopädie* (ed. 1900), and by T. Grisar in Wetzer and Welte's *Kirchenlexikon* (Freiburg, 1889). *See* also U. Chevalier, *Répertoire des sources hist.*, etc., Bio-bibliographie, s. "Honorius I." (Paris, 1905).

2. HONORIUS II. (d. 1072), antipope, was the name taken by Peter Cadalus, who was born at Verona and became bishop of Parma in 1046. After the death of Nicholas II. in 1061 he was chosen pope by some German and Lombard bishops at Basel in opposition to Alexander II., who had been elected by the Hildebrandine party. The antipope marched on Rome in 1063, and entered the city, but soon took refuge in the castle of St. Angelo. After a war lasting about a year Cadalus fled from Rome. He died in 1072, without having abandoned his claim to the papal chair.

See art. on Honorius II. in Hauck's *Realencyklopädie*, Bd. viii. (1900).

3. HONORIUS II. (Lamberto Scannabecchi), pope from Dec. 15, 1124, to Feb. 13, 1130, a native of Fagnano near Imola, of considerable learning and great religious zeal, successively archdeacon at Bologna, cardinal-priest of Sta. Prassede under Urban II., cardinal-bishop of Ostia and Velletri under Paschal II, shared the exile of Gelasius II. in France, and helped Calixtus II. to conclude the Concordat of Worms (1122), which settled the investiture contest. He was consecrated on Dec. 21, 1124. By means of a close alliance with the Frangipani, he maintained peace at Rome. He recognized the Saxon Lothair III. as king of the Romans and later as emperor, and excommunicated his rival, Conrad of Hohenstaufen. He sanctioned the Praemonstratensian order and that of the Knights Templars. He excommunicated Count William of Normandy for marriage in prohibited degree; brought to an end, through the influence of Bernard of Clairvaux, the struggle with Louis VI. of France; and arranged with Henry I. for the reception of papal legates in England. He laid claim as feudal overlord to the Norman possessions in southern Italy (July 1127), and excommunicated the claimant, Duke Roger of Sicily, but was unable to prevent the foundation of the Neapolitan monarchy, for Duke Roger defeated the papal army and forced recognition in August 1128.

The chief sources for the life of Honorius II. are his "Epistolae et Privilegia," in J. P. Migne, *Patrol. Lat.* vol. 166, and the *Vitae* of Cardinals Pandulf and Boso in J. M. Watterich, *Pontif. Roman. vitae*, vol. 2 (Leipzig, 1862); also "Codice diplomatico e bollario di Onorio II." in *Fr. Liverani opere*, vol. 4 (Macerata, 1859), and Jaffé-Wattenbach, *Regesta pontif. Roman.* (1885–1888).

See J. Langen, *Geschichte der römischen Kirche von Gregor VII. bis Innocenz III.* (Bonn, 1893); F. Gregorovius, *Rome in the Middle Ages*, vol. 4, trans. by Mrs. G. W. Hamilton (London, 1896); H. H. Milman, *Latin Christianity*, vol. 4 (London, 1899); Fr. Liverani, "Lamberto da Fiagnano" in *Opere*, vol. 3 (Macerata, 1859); A. Wagner, *Die unteritalischen Normannen und das Papsttum 1086–1150* (Breslau, 1885); E. Bernheim, *Zur Geschichte des Wormser Concordats* (Göttingen, 1878); Volkmar, "Das Verhältnis Lothars III. zur Investiturfrage," in *Forschungen zur deutschen Geschichte*, vol. 26.

4. HONORIUS III. (Cencio Savelli), pope from June 18, 1216, to March 18, 1227, a highly-educated and pious Roman, successively canon of Sta. Maria Maggiore, cardinal-deacon of Sta. Lucia in Silice, vice-chancellor, chamberlain and cardinal-priest of Sti. Giovanni e Paolo, was the successor of Innocent III. He made peace with the emperor Frederick II. (*q.v.*) Honorius was eager to carry out the decrees of the Lateran Council of 1215 against the Albigenses and to further the crusade proclaimed by his predecessor. He crowned Peter of Courtenay emperor of Byzantium in April 1217; espoused the cause of the young Henry III. of England against the barons; accepted the Isle of Man as a perpetual fief; arbitrated differences between Philip II. of France and James of Aragon; and made special ecclesiastical regulations for the Scandinavian countries. He sanctioned the Dominican order (1216), making St. Dominic papal major-domo in 1218; approved the Franciscan order (1223); and authorized many of the tertiary orders. He was succeeded by Gregory IX.

Honorius III. left many writings which have been collected and published by Abbé Horoy in the *Medii aevi bibliotheca patristica*, vols. i.–ii. (Paris, 1879–1883). Among them are five books of decretals, compiled about 1226; a continuation of the *Liber Pontificalis;* a life of Gregory VII.; a coronation form; and a large number of sermons. His most important work is the *Liber censuum Romanae ecclesiae*, written in 1192 and containing a record of the income of the Roman Church and of its relations with secular authorities. The last named is admirably edited by P. Fabre in *Bibliothèque des écoles françaises d'Athènes et de Rome* (Paris, 1892). The letters of Honorius are in F. Liverani, *Spicilegium Liberianum* (1863). There are good *Regesta* in Latin and Italian, edited by P. Pressutti (Rome, 1888, etc.).

HONORIUS, FLAVIUS (384–423), son of Theodosius I., ascended the throne as "emperor of the West" in 395 During the early part of his reign the West was attacked on all sides by barbarian hordes. Italy was saved by the exertions of Honorius' guardian and father-in-law, the Vandal Stilicho (*q.v.*), but Gaul was overrun by barbarians (winter 406–407) and in 409 the central Government was forced to abandon Britain. After the murder of Stilicho (408), Italy was again invaded by Alaric, the Visigoths, and in 410 Rome was taken and sacked. Alaric died in the same year, and in 412 Honorius concluded peace with his brother-in-law and successor, Ataulphus (Adolphus), who married the emperor's sister Placidia and removed with his troops to southern Gaul.

A succession of usurpers arose (411–416) in Gaul and Spain, but were overthrown by Honorius' general, Constantius, who was rewarded with a share in the Government (d. 421). It was only as a supporter of the orthodox church and persecutor of the heathen that Honorius displayed any energy In 309 the exercise of the pagan cult was prohibited, and the revenues of the temples, which were to be appropriated for the use of the public or pulled down, were confiscated to defray the expenses of the army. Honorius was equally severe on heretics, such as the Donatists and Manichaeans. He is also to be credited with the abolition of the gladiatorial shows in 404 (although there is said to be evidence of their existence later), a reduction of the taxes, improvements in criminal law, and the reorganization of the *defensores civitatum*, municipal officers whose duty it was to defend the rights of the people and set forth their grievances. Honorius at first established his court at Milan, but on the report of the invasion of Italy, fled to Ravenna, where he resided till his death on Aug. 27, 423.

See Gibbon, *Decline and Fall*, chs. 28–33; J. B. Bury, *Later Roman Empire*, i. chs. 1–5, ii. chs. 4, 6; E. A. Freeman, "Tyrants of Britain, Gaul and Spain" in *Eng. Hist. Rev.* (Jan. 1886); T. Hodgkin, *Italy and her Invaders* (Oxford, 1892), i. chs. 13, 15–18; E. V. Wietersheim, *Geschichte der Völkerwanderung*, ii. 2. Seek, *Geschichte des Untergangs der Antiken Welt.* v. vi. For the loss of Britain *see* Collingwood in *Journ. Roy. Soc.* 12. p. 74 *seq.*

HONOUR, a term which may be defined as respect, esteem or deference paid to, or received by, a person in consideration of his character, worth or position; also the state or condition of the person exciting the feeling or expression of such esteem; particularly a high personal character coupled with conduct in accordance with a nice sense of what is right and true and due to the position so held. Further, the word is commonly used of the dignities, distinctions or titles, granted as a mark of such esteem or as a reward for services or merit, and quite generally of the credit or renown conferred by a person or thing on the country, town or particular society to which he or it belongs. The standard of conduct may be laid down not only by a sense of what is due to lofty personal character but also by the usages of society, hence it is that debts which cannot be legally enforced, such as gambling debts, are

called "debts of honour." Similarly in the middle ages and later, courts, known as "courts of honour," sat to decide questions such as precedence, disputes as to coat armour, etc. (*see* CHIVALRY); such courts, chiefly military, are found in countries where duelling has not fallen into desuetude (*see* DUEL).

In English the word was spelled with or without the *u* indifferently until the 17th century, but during the 18th century it became fashionable to spell the word "honor"; Johnson's and Webster's Dictionaries stereotyped the English and American spellings respectively.

HONOURABLE, a style or title of honour common to the United Kingdom, the British colonies and the United States of America. *See* FORMS OF ADDRESS.

In the British colonies the title "honourable" is given to members of the executive and legislative bodies, to judges, etc., during their term of service. It is sometimes retained by royal licence after a certain number of years' service.

In the United States of America the title is very widespread, being commonly given to any one who holds or has held any office of importance in state or nation, more particularly to members of Congress or of the state legislatures, judges, justices, and certain other judicial and executive officials. (*See* also PRECEDENCE.)

HONOURABLE ARTILLERY COMPANY. On Aug. 25, 1537, Henry VIII. granted a Charter of Incorporation to the Guild of Fraternity of Saint George, a Guild of Archers and Handgunmen. The wording of the charter, however, implies that a guild existed before the grant was made and that it was now receiving royal support. As a military formation it is probably the oldest regiment in the world. All kinds of archery being classified as "artillery," this Guild of archers soon became known as the "Artillery Company." (It has, however, had numerous designations.) Under the Charter the government of the Guild was placed in the hands of four Masters or Rulers and they were charged (*inter alia*) with the establishment of a Perpetual Fraternity of Saint George for the general encouragement of the "Science of Artillery for Longe Bowes Crosbowes and Handgonnes, etc." Under Edward III., the chief resort of London archers for practice was in the open spaces at Finsbury and Moorfields, later known as the "Artillery Ground" or "Artillery Garden" and in this neighbourhood the H.A.C. has always had its headquarters, except for the first few years of its existence. During the early years following its incorporation the Company was the training centre for the City of London when necessity demanded an augmentation of the forces, a notable occasion being the year of the Great Armada. On this occasion not only did it train the citizens of London in the science of "small-artillery" but many of its members went to several parts of the kingdom with the rank of officers to train the various Trained Bands.

The system of training inaugurated in London by the Company stimulated the corporations of other towns to follow their example, notably in the early part of the 17th century. None of these provincial companies have survived but an off-shoot of the old Company still flourishes in the U.S.A. as "The Ancient and Honourable Artillery Company of Boston, Massachusetts," the oldest military body in the New World, whose original title was "The Military Company of Massachusetts." The original members of this American Company were members of the London Company who had migrated in the 16th century. They trained the citizens in the art of war and when the militia came into existence, its officers were drawn from the Company.

The Roll of the Regiment contains the name of one of England's greatest poets, viz., John Milton who was entered on June 2, 1635. His military career was short but no doubt he gained an intimate knowledge of the pike or musket. Charles I. took an interest in the Company and sanctioned the enrolment of the Prince of Wales, then only eleven years old, and his brother, James, Duke of York, as members of the Company. The Elector of Palatine, a grandson of James I., became a member also on the same day—June 1, 1641.

At the outbreak of the Civil War the Company represented the only efficient trained bands in the country and Parliament regarded them as a reliable reserve. Of their number the name of Skippon is known to history. Captain Philip Skippon was Captain of the Company in 1639 and became "commander of the forces" with the rank of "Sergeant-Major General" in 1642. He joined the Parliamentary forces and became Chief of the Staff to the Earl of Essex.

In 1660 the Duke of York was elected "commander-in-chief" of the Company, he being the first and last holder of that title. His successor, William III., styled himself "Captain-General" and this title still survives, King George V. being "Captain-General and Colonel" of the Company. In the middle of the 17th century the Company was in great favour at Court and many of the nobility and gentry of the royal household enrolled themselves as members, *e.g.*, Prince Rupert, the Duke of Albemarle, the Earl of Sandwich, Lord Craven, the Dukes of Monmouth, Ormonde, Manchester, Anglesey and Buckingham. Other distinguished members of the Company about this time were, Marlborough, Christopher Wren the architect, Vauban the great French Engineer, William, second Earl of Denbigh, an ancestor of the present Colonel Commandant, and Kirke—the notorious Colonel of "Kirke's Lambs." The Company kept abreast of the times as regards developments in the military art and in 1714 added some grenadiers to the establishment. In 1860 a troop of horse artillery was added but this was disbanded in 1869.

The Company was well represented in the British Expeditionary Force during the South African War 1899–1902 for which it was granted the battle honour "South Africa 1900–02." In 1908 it became a unit of the Territorial Army. During the World War it was greatly expanded and three of its infantry battalions and 7 batteries of artillery fought either in France, Italy, Iraq, Palestine or Aden, battle honours for which are now borne upon its King's Colour. This is the only regiment which has the unique distinction of having battle honours on its King's Colour only.

(T. J. E.)

See G. A. Raikes, *History of the Honourable Artillery Company;* G. Goold Walker, *The Honourable Artillery Company 1547–1926.*

HONTHEIM, JOHANN NIKOLAUS VON (1701–1790), German historian and theologian, was born of noble family on Jan. 27, 1701, at Trier. He was educated at Trier, Louvain and Leyden, and after travelling extensively in Europe, spent three years in Rome, where he was ordained priest in 1728. Returning to Trier as canon, he became a professor at the university in 1732, but six years later went to Coblenz as official to the archbishop-elector. In 1747, broken down by overwork, he retired to St. Simeon's at Trier, and in May 1748 was appointed auxiliary bishop and vicar-general. He was consecrated at Mainz, in Feb. 1749, under the title of bishop of Myriophiri *in partibus.* The archbishop of Trier was practically a great secular prince, and upon Hontheim fell the whole spiritual administration of the diocese; this work, in addition to that of pro-chancellor of the university, he carried on single-handed until 1778. Hontheim died on Sept. 2, 1790, at his château at Montquentin near Orval.

As a historian his reputation rests on his *Historia Trevirensis diplomatica et pragmatica* (3 vols., 1750), and his *Prodromus historiae trevirensis* (2 vols., 1757). The *Historiae scriptorum et monumentarum Trevirensis amplissima collectio,* remains in ms. at the city library of Trier. It is, however, as "Febronius" that Hontheim is best remembered. The character of his book on "the state of the church and the lawful power of the Roman pontiff" is described elsewhere (*see* FEBRONIANISM). The author of the book was known at Rome almost as soon as it was published; but it was not till some years afterwards (1778) that he was called on to retract. The removal of the censure followed (1781) when Hontheim published at Frankfort his *Justini Febronii acti commentarius in suam retractationem,* etc.

See O. Mejer, *Febronius, Weihbischof Johann Nikolaus von Hontheim und sein Widerruf* (Tubingen, 1880), and article in *Allgemeine deutsche Biographie* (1881).

HONTHORST, GERARD VAN (1590–1656), Dutch painter, born at Utrecht on Nov. 4, 1590, was brought up in the school of Bloemart. He then went to Italy, where he copied the naturalism and eccentricities of Michelangelo da Caravaggio.

Home again in 1622, he entered the Guild of St. Luke, becoming dean in 1625–26–28 and 1629. The queen of Bohemia, sister of Charles I. and electress palatine, being an exile in Holland, asked him to teach her children drawing; and Honthorst, thus approved, was invited by Charles I. to England. There he painted several portraits, and a vast allegory, now at Hampton Court, of the king and queen of Bohemia as Diana and Apollo in the clouds receiving the duke of Buckingham as Mercury and guardian of the king of Bohemia's children. In his home at Utrecht Honthorst finished, in 1631, a large picture of the king and queen of Bohemia "and all their children." For Lord Dorchester about the same period he completed some illustrations of the *Odyssey;* for the king of Denmark he composed incidents of Danish history, of which one example remains in the gallery of Copenhagen. In 1637 he settled at The Hague, and became court painter (1641).

His most attractive pieces are those in which he cultivates the style of Caravaggio, those, namely, which represent taverns, with players, singers and eaters. He shows great skill in reproducing scenes illuminated by candlelight (*e.g.,* Christ before Pilate in the National Gallery, London), and he liked to transmute every subject into a night scene. He died on April 27, 1656.

HOOCH, PIETER DE (hōch) (1629–after 1683), Dutch painter, born in Rotterdam, and a pupil of N. Berchem at Haarlem. From 1653 he was in the service of Justus de Grange, and lived at Delft, The Hague and Leyden. In 1654 he married a girl of Delft, Jannetje van der Burch. From 1654 to 1657 he was a member of the painter's gild of Delft, but after that date we have no traces of his doings until about 1667, when his presence is recorded in Amsterdam. His dated pictures prove that he was still alive in 1683. His work shows affinity with the painting of Vermeer, who was a pupil of Carel Fabritius and who was living at Delft at the same period as De Hooch. De Hooch only once painted a canvas of large size, and that unfortunately perished in a fire at Rotterdam in 1864. But his small pieces display perfect finish combined with great power of discrimination. Though he sometimes paints open-air scenes, these are not his favourite subjects. He is most at home in interiors illuminated by different lights, with the radiance of the day, in different intensities, seen through doors and windows. He thus brings together the most delicate varieties of tone. Sometimes he chooses the drawing-room where dames and cavaliers dance, or dine, or sing; sometimes—mostly indeed—he prefers cottages or courtyards, where the housewives tend their children or superintend the labours of the cook. Satin and gold are as familiar to him as camlet and fur; and there is no article of furniture in a Dutch house of the middle class that he does not paint with pleasure.

It is possible to bring together over 320 examples of De Hooch. There are three at Leningrad, three in Buckingham Palace, six in the National Gallery, London, two in the Wallace Collection, six in the Amsterdam museum, some in the Louvre and at Munich and Darmstadt and New York; many others are in private galleries.

See Hofstede de Groot's *Catalogue raisonné* (1907).

HOOD, HORACE LAMBERT ALEXANDER (1870–1916), British naval officer, was born in London on Oct. 2, 1870, the third son of the 4th viscount Hood and a lineal descendant of the 1st viscount, Adml. Sir Samuel Hood (*q.v.*). He entered the navy in 1883, saw service on the Nile (1897–98), and in the Somaliland expedition (1903–4). After serving a year as naval attaché at Washington, he commanded the naval college at Osborne from Oct. 1910 to Jan. 1913. He commanded a squadron of battle cruisers in the battle of Jutland (May 31, 1916), and went down on his flagship "Invincible."

See J. S. Corbett (Official) *History of the Great War. Naval operations* (vol. iii., 1923).

HOOD, JOHN BELL (1831–1879), American soldier, lieut.-general of the Confederate army, was born at Owingsville, Ky., in 1831, and graduated at West Point Military Academy in 1853. As a cavalry officer he saw service against Indians, and later he was cavalry instructor at West Point. He resigned from the U.S. service in 1861, and became a colonel in the Confederate army. He was soon promoted brigadier-general, and with the famous "Texas brigade" of the Army of Northern Virginia he served throughout the campaign of 1862. At Gettysburg he commanded one of the divisions of Longstreet's corps, receiving a wound which disabled his arm. With Longstreet he was transferred in the autumn of 1863 to the Army of Tennessee. At the battle of Chickamauga (Sept. 19–20) Hood was severely wounded again and his leg was amputated. He remained with the Army of Tennessee as a corps commander, and when the general dissatisfaction with the Fabian policy of Gen. J. E. Johnston brought about the removal of that officer, Hood was put in his place. He had won a great reputation as a fighting general, and it was with the distinct understanding that battles were to be fought that he was placed at the head of the Army of Tennessee. But in spite of skill and courage he was uniformly unsuccessful in the battles around Atlanta. In the end he had to abandon the place, but he forthwith sought to attack Sherman in another direction, and finally invaded Tennessee. His march was pushed with the greatest energy, but he failed to draw the main body of the enemy after him, and, while Sherman with a picked force made his "March to the Sea," Thomas collected an army to oppose Hood. A severe battle was fought at Franklin on Nov. 30, 1864, and finally Hood was defeated and his army almost annihilated in the battle of Nashville on Dec. 15–16, 1864. He was then relieved at his own request (Jan. 23, 1865). After the war he engaged in business in New Orleans, where he died of yellow fever on Aug. 30, 1879. His experiences in the Civil War are narrated in his *Advance and Retreat* (New Orleans, 1880).

See Ida Richardson Hood, "In Memory of General J. B. Hood," in *Southern Hist. Soc. Papers,* vol. xxxii., p. 151–156 (1904).

HOOD, SAMUEL HOOD, VISCOUNT (1724–1816), British admiral, was the son of Samuel Hood, vicar of Butleigh, Somerset, and prebendary of Wells. He was born on Dec. 12, 1724, and entered the navy on May 6, 1741. He served part of his time as midshipman with Rodney in the "Ludlow Castle," and became lieutenant in 1746. In 1754 he was made commander of the "Jamaica" sloop, and served in her on the North American station, where in 1756, he was posted to the "Lively." He returned to England later in the year in the "Grafton" to which he had been appointed by Commodore Charles Holmes. In 1757, while in temporary command of the "Antelope" (50 guns), he drove a French ship ashore in Audierne Bay, and took two privateers. In recognition of his services he was given command of the frigate "Bideford." In 1759, when captain of the "Vestal" (32), he captured the French "Bellona" (32) after a sharp action off Cape Finisterre. During the war his services were wholly in the Channel, and he was engaged under Rodney in 1759 in destroying the transports collected by the French for the proposed invasion of England. In 1760 he was sent by his own request to the Mediterranean. In 1778, after further service in North America, he became commissioner of the dockyard at Portsmouth and governor of the Naval Academy; and in 1780 was promoted rear-admiral and was sent to the West Indies as second in command under Rodney.

Hood joined Rodney in Jan. 1781, and remained in the West Indies or on the coast of North America till the close of the War of American Independence. The unfortunate turn taken by the campaign of 1781 was largely due to Rodney's neglect of his advice. If he had been allowed to choose his own position there can be no doubt that he could have prevented de Grasse from reaching Fort Royal with the reinforcements from France in April (*see* RODNEY, LORD). When the fleet went on to the coast of North America during the hurricane months of 1781 he was sent to serve with Admiral Graves in the unsuccessful effort to relieve the army at Yorktown. When he returned to the West Indies he was for a time in independent command owing to Rodney's absence in England and the British islands of St. Kitts and Nevis were attacked by the French admiral, the Comte de Grasse, with a much superior force to Hood's squadron. Hood's attempt to save it from capture, Jan. 1782, with 22 ships to 29, failed, but the bold movements by which he first turned the French out of their anchorage at the Basse Terre of St. Kitts, and then beat off the attacks of the enemy, were the most brilliant things done by

any British admiral during the war. He was made an Irish peer for his share in the defeat of de Grasse on April 9 and 12 near Dominica.

On the outbreak of the revolutionary war Hood was sent to the Mediterranean as commander-in-chief. His period of command (May 1793–Oct. 1794), was very active. In Aug. he occupied Toulon on the invitation of the French royalists, and in co-operation with the Spaniards. In Dec. of the same year the allies, who did not work harmoniously together, were driven out, mainly by the generalship of Napoleon, and Hood now occupied Corsica, which he had been invited to take in the name of the king of England by Paoli. Meanwhile the French at Toulon had recovered sufficiently to send a fleet to sea. In June Hood sailed in the hope of bringing it to action. The plan which he laid to attack it in the Golfe Jouan in June may possibly have served to some extent as an inspiration, if not as a model, to Nelson for the battle of the Nile, but the wind was unfavourable, and the attack could not be carried out. In Oct. Hood, who was now full admiral, was recalled to England. He held no further command at sea, but in 1796 he was named governor of Greenwich Hospital, a post which he held till his death on Jan. 27, 1816. A peerage of Great Britain was conferred on his wife as Baroness Hood of Catherington in 1795, and he was himself created Viscount Hood of Whitley in 1796. The titles descended to his only son, Henry (1753–1836), the ancestor of the present Viscount Hood. There are several portraits of Lord Hood by Abbot in the Guildhall and in the National Portrait Gallery. He was also painted by Reynolds and Gainsborough.

Bibliography.—There is no good life of Lord Hood, but a biographical notice of him by M'Arthur, his secretary during the Mediterranean command, is in the *Naval Chronicle,* vol. ii. Charnock's *Biogr. Nav.* vi., Ralfe, *Nav. Biog.* i., may also be consulted. His correspondence during his command in America has been published by the Navy Record Society.

HOOD, SIR SAMUEL (1762–1814), British vice-admiral, cousin of Lord Hood and of Lord Bridport, entered the Navy in 1776. His first engagement was the battle off Ushant in 1778, and he was present in the West Indies, under the command of his cousin Sir Samuel Hood, at all the actions which culminated in Rodney's victory of April 12, 1782. After the peace, he spent some time in France, and on his return was given the command of a sloop, from which he proceeded in succession to various frigates. Early in 1793 the "Juno" went to the Mediterranean, and Hood distinguished himself by an audacious feat of seamanship in extricating his vessel from the harbour of Toulon, which he had entered in ignorance of Lord Hood's withdrawal. Soon afterwards he was put in command of a frigate squadron for the protection of Levantine commerce, and in 1797 was given the "Zealous" (74 guns), being present at Nelson's unsuccessful attack on Santa Cruz. He conducted the negotiations which relieved the squadron from the consequences of its failure. At the battle of the Nile the "Zealous" put her first opponent out of action in twelve minutes, and Hood immediately engaged other ships, the "Guerrier" being left powerless. When Nelson left Egypt Hood commanded the blockading force off Alexandria and Rosetta. Later he rejoined Nelson on the coast of the two Sicilies.

In the "Venerable" Hood was present at the action of Algeciras, and the battle in the Straits of Gibraltar (1801) when his ship suffered heavily. A year later Captain Hood was employed in Trinidad as a commissioner, and, upon the death of the flag officer commanding the Leeward station, succeeded him as Commodore. Island after island fell to him, and soon, outside Martinique, the French had scarcely a foothold in the West Indies. In command next of the squadron blockading Rochefort, Hood had a sharp action on Sept. 25, 1805, with a small French squadron which was trying to escape. On this occasion he lost an arm. Promoted rear-admiral, Hood brought the operations against Madeira to a successful conclusion (1807) and a year later took part, in the "Centaur," in the war between Russia and Sweden. Present in the roads of Corunna at the re-embarkation of the army of Sir John Moore, Hood thence returned to the Mediterranean, where for two years he commanded a division of the British fleet. In 1811 he became vice-admiral. He died at Madras, Dec. 24, 1814.

See *Naval Chronicle,* xvii. 1 (the material was furnished by Hood himself; it does not go beyond 1806).

Hood, Alexander (1758–1798), brother of Admiral Sir Samuel Hood, entered the Navy in 1767, and accompanied Captain Cook in his second voyage round the world Under Howe and Rodney he distinguished himself in the West Indies, and at the victory of April 12, 1782, was in command of one of Rodney's frigates. Under Sir Samuel Hood he then proceeded to the Mona passage, where he captured the French corvette "Cérès." It was not until 1797 that he went afloat again. His first experience was bitter; his ship, the "Mars," was unenviably prominent in the mutiny at Spithead. On April 21, 1798, occurred the famous duel of the "Mars" with the "Hercule," fought in the dusk near the Bec du Raz, in which, though successful, Hood lost his life

See *Naval Chronicle,* vi 175; Ralfe, *Naval Biographies,* iv. 48; James, *Naval History,* and Chevalier, *Hist. de la marine française sous la première république.*

HOOD, THOMAS (1799–1845), British humorist and poet, the son of Thomas Hood, bookseller, was born in London on May 23, 1799. On the death of her husband in 1811 Mrs. Hood removed to Islington, where Thomas Hood had a schoolmaster who appreciated his talents. The boy earned a few guineas—his first literary fee—by revising for the press a new edition of *Paul and Virginia.* After a short period in a counting-house, where the confinement threatened his health, he was transferred to the care of his father's relations at Dundee On his return to London in 1818 he learned engraving, in which he acquired a skill that enabled him to illustrate his own works.

In 1821 he became sub-editor of the *London Magazine,* and thus came into contact with Charles Lamb, Cary, de Quincey, Allan Cunningham, Proctor, Talfourd, Hartley Coleridge, the peasant-poet Clare and other contributors to the magazine. He had married in 1825, and *Odes and Addresses*—his first work—was written in conjunction with his brother-in-law J H Reynolds, the friend of Keats. *The Plea of the Midsummer Fairies* (1827), a book of verse written under the strong influence of Keats, and a dramatic romance, *Lamia,* published later, belong to this time. But reputation came to him not from his serious verse, but from the series of the *Comic Annual,* dating from 1830, which Hood undertook and continued, almost unassisted, for several years. He treated current events in a fine spirit of caricature, entirely free from grossness and vulgarity, without a trait of personal malice, and with an undercurrent of true sympathy and honest purpose that gives these papers, like the sketches of Hogarth, a permanent value. Hood was an inveterate punster, and annoyed his more serious readers by his excesses in this direction. He defended himself in the couplet:

> However critics may take offence,
> A double meaning has double sense.

In another annual called the *Gem* appeared the poem on the story of "Eugene Aram," which first showed his full poetical power. Hood started a magazine in his own name, and conducted this work from a sick-bed. To this period belong those poems, too few in number, but immortal in the English language, such as the "Song of the Shirt" (which appeared anonymously in the Christmas number of *Punch,* 1843), the "Bridge of Sighs" and the "Song of the Labourer," which pictured in moving verse the appalling condition of the industrial worker of his day.

Hood was associated with the *Athenaeum,* started in 1828 by J. Silk Buckingham, and he was a regular contributor for the rest of his life. Prolonged illness brought on straitened circumstances; and Sir Robert Peel allotted to him a small pension from the civil list, which was continued to his wife and family after his death on May 3, 1845. When nine years later Lord Houghton unveiled a monument to the poet at Kensal Green, many workingmen and women came to do honour to the writer whose best efforts had been dedicated to the cause and the sufferings of the workers of the world.

Bibliography.—The list of Hood's separately published works is as follows: *Odes and Addresses to Great People* (1825); *Whims and Oddities* (two series, 1826 and 1827); *The Plea of the Midsummer Fairies, Hero and Leander, Lycus the Centaur and other Poems* (1827), his only collection of serious verse; *The Dream of Eugene Aram, the*

Murderer (1831); *Tylney Hall*, a novel (3 vols., 1834); *The Comic Annual* (1830–42); *Hood's Own; or, Laughter from Year to Year* (1838, second series, 1861); *Up the Rhine* (1840); *Hood's Magazine and Comic Miscellany* (1844–48); *National Tales* (2 vols., 1837), a collection of short novelettes; *Whimsicalities* (1844), with illustrations from Leech's designs; and many contributions to contemporary periodicals.

The chief sources of his biography are: *Memorials of Thomas Hood, collected, arranged and edited by his daughter* (1860); his "Literary Reminiscences" in *Hood's Own;* Alexander Elliot, *Hood in Scotland* (1885). *See* also the memoir of Hood's friend C. W. Dilke, by his grandson Sir Charles Dilke, prefixed to *Papers of a Critic;* and M. H. Spielmann's *History of Punch*. There is an excellent edition of the *Poems of Thomas Hood* (2 vols., 1897), with a biographical introduction of great interest by Alfred Ainger.

HOOD, TOM (1835–1874), English humorist, son of the poet Thomas Hood, was born at Lake House, Wanstead, Essex. After some years of journalism and five years at the War Office he became, in 1865, editor of *Fun*. In 1867 he first issued *Tom Hood's Comic Annual*. He died on Nov. 20, 1874.

See a memoir by his sister, F. F. Broderip, prefixed to his *Poems* (1877).

HOOD, MOUNT, a peak of the Cascade range in Clackamas and Hood River counties, Oregon, about 50 m. E. of Portland. It is an extinct volcanic cone of great symmetrical beauty rising to a height of 11,253 ft. above sea-level, the highest point in the State. The peak was built upon the comparatively level back of the range, which is about 4,000 ft., by successive volcanic eruptions. The summit is a part of the rim of the ancient crater; steam jets and fumaroles still exist about Crater Rock. Its crest, clad in perpetual ice and snow, gives rise to eight glaciers which extend down its sides to an elevation of about 6,000 ft. above the sea. Mt. Hood was first discovered in 1792 by a member of Vancouver's exploring expedition and was named in honour of Rear Admiral Samuel Hood of the British admiralty. The first successful ascent was made on Aug. 4, 1854, from the south side, by a party under Captain Barlow, builder of the pioneer road to Oregon. It is now more frequently climbed than any other snow-peak in America.

See J. H. Williams, *The Guardians of the Columbia; Mt. Hood, Mt. Adams and Mt. Helens* (1912).

HOOD, a covering for the head. Some form of hood as a loose covering easily drawn on or off the head has formed a natural part of outdoor costume both for men and women at all times and in all quarters of the globe where climatic conditions called for it. In the middle ages and later both men and women wore it, but with men it tended to be superseded by the hat before it became merely an occasional and additional head-covering in time of bad weather. For illustrations and examples of the hood as worn by men and women in mediaeval and later times *see* DRESS; for the hood or cowl as part of the dress of a religious *see* COWL, and as forming a distinctive mark of degree in academic costume *see* ROBES. The word is applied to many objects resembling a hood in function or shape, such as a folding cover for a carriage to protect the occupants from rain or wind, the belled covering for the head of a hawk trained for falconry, the endmost planks in a ship's bottom at bow or stern, and, in botany and zoology, certain parts of a flower or of the neck of an animal, which in arrangement of structure or of colour, recall this article of dress.

HOOD MOULD, in architecture, a moulding projecting from the face of the wall, immediately above an arch or opening whose curvature or outline it follows. It originated in the Romanesque period (*see* BYZANTINE AND ROMANESQUE ARCHITECTURE) as a protection to the mouldings below and to throw water away from the opening, and was later developed into an important decorative feature. It is almost universal over exterior arches in the Gothic work (*see* GOTHIC ARCHITECTURE) of France, Germany and Spain; in England it was, furthermore, common in interior work, especially in nave arcades. In profile, the hood mould has, usually, a downward sloping upper surface, and a hollow below to act as a drip (*q.v.*); at its lower end, near the spring of the arch, it is either received upon the capital of a column or ends in a projecting, carved, ornamented boss (*see* LABEL).

HOOD OF AVALON, ARTHUR WILLIAM ACLAND HOOD, BARON (1824–1901), English admiral, born on July 14, 1824, younger son of Sir Alexander Hood of St. Andries, Somerset, 2nd baronet, and grandson of Captain Alexander Hood. While still a boy Hood entered the navy (1836) and saw active service on the north coast of Spain, and on the coast of Syria. On Nov. 27, 1854 Hood was promoted to be commander in recognition of his service with the naval brigade before Sebastopol. In 1856 he commissioned the "Acorn" brig for the China station, and took part in the capture of Canton in Dec. 1857, for which, in Feb. 1858, he received a post-captain's commission. From 1862 to 1866 he commanded the "Pylades" on the North American station, and was then appointed to the command of the "Excellent" and the government of the Royal Naval college at Portsmouth. On the expiration of three years Hood was made director of naval ordnance. In June 1874 he commanded the "Monarch" in the Channel Fleet, and in March 1876 was promoted to flag rank. From 1880 to 1882 he commanded the Channel Fleet, becoming vice-admiral on July 23, 1880. In June 1885 he was appointed first sea lord of the Admiralty. The intense conservatism of his character, and his antagonistic attitude towards every change, helped to account for the alarming state of the navy on his resignation in 1889. He died on Nov. 15, 1901, and was buried at Butleigh on the 23rd. In Feb. 1892 he had been raised to the peerage as Lord Hood of Avalon, but on his death the title became extinct.

HOOD RIVER, a city of northern Oregon, U.S.A., on the Columbia river, at the mouth of Hood river; the county seat of Hood River county. It is on the Columbia River highway, and is served by the Mount Hood and the Union Pacific railways. The population in 1928 was about 3,500. The city has a marvellously beautiful location, on the south bank of the river, with Mount Hood 26m. away to the south-west and Mount Adams 40m. north. It is a shipping point for lumber and for the famous apples and other fruit grown in the valley; and has saw-mills, cider factories, vinegar works and other industries. The city was settled about 1882, and was incorporated in 1895.

HOOFT, PIETER CORNELISSEN (1581–1647), Dutch poet and historian, was born at Amsterdam on March 16, 1581. His father was for some time burgomaster of Amsterdam. As early as 1598 the young man was made a member of the chamber of rhetoric *In Liefde bloeiende,* and produced before that body his tragedy of *Achilles and Polyxena*, not printed until 1614. In June 1598 he left Holland and proceeded to Paris, Venice, Florence and Rome, and in 1600 to Naples. During his Italian sojourn he made a deep and fruitful study of the best literature of Italy. He returned through Germany, reaching Amsterdam in May 1601. In 1602 he brought out his second tragedy, *Theseus and Ariadne* (pr. 1614). In 1605 he completed his beautiful pastoral drama *Granida* (pr. 1615). Hooft produced three other plays: *Geeraerdt van Velzen* (1612, pr. 1613); *Ware-nar* (1614, pr. 1617), adapted from the *Aulularia* of Plautus; and *Baeto* (1616, pr. 1626). He studied law and history at Leyden from 1606 to 1609, and in June of the latter year received from Prince Maurice of Orange the appointment of steward of Muiden, bailiff of Gooiland and lord of Weesp, a joint office of great emolument. He repaired and adorned the decayed castle of Muiden, where he lived for the rest of his life. There he entertained the poet Vondel, the scholar Barlaeus, Constantin Huygens, Vossius, Laurens Reael and others.

In 1618 he abandoned poetry for history. His prose works are *History of Henry the Great* (Henry IV. of France) (1626); *Miseries of the Princes of the House of Medici* (Amsterdam, 1638); a *Dutch History* (in 20 books, 1642), embracing the period from 1555 to 1585, a magnificent performance, to the perfecting of which he had given 15 years of labour. The seven concluding books were published posthumously in 1654. Hooft died on a visit to The Hague, on May 21, 1647, and was buried in the New Church at Amsterdam.

Hooft is one of the most brilliant figures that adorn Dutch literature at its best period. He was the first writer to introduce a modern and European tone into *belles lettres,* and the first to

refresh the sources of native thought from the springs of antique and Renaissance poetry. His lyrics and his pastoral of *Granida* are strongly marked by the influence of Tasso and Sannazaro; his later tragedies belong more exactly to the familiar tone of his native country. But high as Hooft stands among the Dutch poets, he stands higher—he holds perhaps the highest place—among writers of Dutch prose. His historical style has won the warmest eulogy, and his letters are the most charming ever published in the Dutch language.

Hooft's poetical and dramatic works were collected in 2 vols. (1871, 1875) by P. Leendertz. His letters were edited by B. Huydecoper (Leyden, 1738) and by van Vloten (Leyden, 4 vols., 1855). The best original account of Hooft is given by G. Brandt in his *Leven van P.C. Hooft* (1677), and his funeral address (1647), edited together by J. C. Matthes (Groningen, 1874). There is an account of the Muiden circle in Edmund Gosse's *Northern Studies* (1879). *See* also P. Prinsen, *P. C. Hooft* (1922).

HOOGHLY or **HUGLI,** a town and district of British India, in the Burdwan division of Bengal. The town, situated on the right bank of the Hooghly river, 24 m. above Calcutta by rail, forms one municipality with Chinsura (*q.v.*). Pop. (1921) 29,938. The principal buildings are the Hooghly college (at Chinsura) and a handsome *imambara.* In the suburb of Bandel are a Portuguese church, built in 1660, and a monastery formerly occupied by Augustinians.

The DISTRICT, area of 1,188 sq.m. and a population of 1,080,142, is flat, with a gradual ascent to the north and north-west. The scenery along the Hooghly (outside the towns) has a quiet beauty of its own, presenting the appearance of a series of orchards and gardens, villages and temples interspersed with factories. Baidyabati, Champdani, Bhadreswar, Serampore and Rishria-Konnagore are all mill-towns on the bank of the river. The principal rivers, besides the Hooghly, are the Damodar and the Rupnarayan. As in other deltaic districts, the highest land lies nearest the rivers, and the lowest levels are found midway between two streams. There are in consequence considerable marshes; there are drainage works for the Dankuni marshes, which extend over 27 sq. miles. Rice and jute are the principal crops; a small area is irrigated from the Eden canal. The manufacture of jute gives employment to over 50,000 persons.

HOOGHLY or **HUGLI,** the most westerly and commercially the most important channel by which the Ganges enters the Bay of Bengal. It takes its distinctive name near the town of Santipur, about 120 m. from the sea. The stream now known as the Hooghly represents three western deltaic distributaries of the Ganges—viz., (1) the Bhagirathi, (2) the Jalangi and (3) part of the Matabhanga. The Bhagirathi and Jalangi unite at Nadia, above the point of their junction with the lower waters of the Matabhanga, which has taken the name of the Churni before the point of junction and thrown out new distributaries of its own. These three western distributaries are known as the Nadia rivers, and are the head waters of the Hooghly. Like other deltaic distributaries, they are subject to sudden changes and to silting up. The keeping open of the Nadia rivers, therefore, forms one of the great tasks of engineering in Bengal. Proceeding south from Santipur, with a twist to the east, the Hooghly river divides Nadia from Hooghly district, until it touches the district of the Twenty-four Parganas. It then proceeds almost due south to Calcutta, next twists to the south-west and finally turns south, entering the Bay of Bengal in 21° 41′ N., 88° E.

In the 40 miles of its course above Calcutta, the channels of the Hooghly are under no supervision, and they have silted up and shifted, yet it was upon this upper section that all the famous ports of Bengal lay in olden times. From Calcutta to the sea (about 90 m.) the river is a record of engineering improvement and success. A minute supervision, with steady dredging and constant readjustment of buoys, keeps it a safe waterway for ships of the largest tonnage, and since 1915 65 m. of the lower reaches have been lighted. Much attention has also been paid to the port of Calcutta (*q.v.*).

HOOGSTRATEN, SAMUEL DIRKSZ VAN (1627–1678), Dutch painter, was born at Dordrecht on Aug. 2, 1627, and died there on Oct. 19, 1678. He studied first with his father, and then, from about 1642 onwards, in the school of Rembrandt. He then travelled as a master and a portrait painter, visiting, among other cities, Vienna (1651) and Rome. He was in London in 1662. He married (1656) at Dordrecht, where he became (1671) provost of the mint. Hoogstraten's works are scarce; but a sufficient number of them has been preserved to show that he strove to imitate different styles at different times. In a portrait dated 1645 in the Lichtenstein collection at Vienna he imitates Rembrandt; and he continues in this vein as late as 1653, when he produced that wonderful figure of a Jew looking out of a casement (Vienna Museum).

HOOK, JAMES CLARKE (1819–1907), English painter, was born in London on Nov. 21, 1819 He worked for a year in the sculpture galleries of the British Museum, and in 1836 he was admitted a student of the Royal Academy, where he worked for three years. He exhibited for the first time in 1839 The travelling studentship in painting was awarded to him for "Rizpah watching the Dead Sons of Saul" in 1846; and he went for three years to Italy. Hook passed through Paris, worked diligently for some time in the Louvre, traversed Switzerland, and, though he stayed only part of three years in Italy, gained much from studies of Titian, Tintoret, Carpaccio, Mansueti and other Venetians. On his return home with a series of Venetian subject pictures he became A.R.A. He then went to live in Surrey and in 1853 visited Clovelly. He turned from the anecdotic picture to a series of land and sea studies, some admirable examples of which, "The Stream," "The Seaweed Raker" and others, are in the Tate gallery. Hook died at Churt, Surrey, on April 14, 1907. He had been R.A. since 1860.

See A. H. Palmer, "J. C. Hook, R.A.," *Portfolio* (1888); F. G. Stephens, "J. C. Hook, Royal Academician: His Life and Work," *Art Annual* (1888); P. G. Hamerton, *Etching and Etchers* (1877).

HOOK, THEODORE EDWARD (1788–1841), English author, was born in London, spent a year at Harrow and subsequently matriculated at Oxford, though he never resided at the university. His father, James Hook (1746–1827), the composer of numerous popular songs, took great delight in exhibiting the boy's extraordinary musical and metrical gifts, and the precocious Theodore became "the little pet lion of the green room" At the age of 16, in conjunction with his father, he scored a dramatic success with *The Soldier's Return,* a comic opera, rapidly followed up by a series of over a dozen sparkling ventures, the instant popularity of which was hardly dependent on the inimitable acting of John Liston and Charles Mathews Hook gave up some ten of the best years of his life to the pleasures of the town, winning a foremost place in the world of fashion by his matchless powers of improvisation and mimicry, and startling the public by the audacity of his practical jokes. His unique gift of improvisation eventually charmed the prince regent into a declaration that "something must be done for Hook," and Hook was appointed accountant-general and treasurer of the Mauritius with a salary of £2,000 a year. For five delightful years he was the life and soul of the island, but in 1817 he was arrested and brought to England on a criminal charge. A sum of about £12,000 had been abstracted by a deputy official, and for this amount Hook was held responsible.

During the tardy scrutiny of the audit board he lived obscurely and maintained himself by writing for magazines and newspapers. In 1820 he launched the newspaper *John Bull,* the champion of high Toryism and the virulent detractor of Queen Caroline Witty, incisive criticism and pitiless invective secured it a large circulation. He was arrested for the second time on account of his debt to the State, which he made no effort to defray. In a sponging-house, where he was confined for two years, he wrote the nine volumes of stories afterwards collected under the title of *Sayings and Doings* (1826–29). In the remaining 23 years of his life he poured forth no fewer than 38 volumes, besides numberless articles, squibs and sketches. The best of his many racy novels are *Maxwell* (1830), *Love and Pride* (1833), the autobiographic *Gilbert Gurney* (1836), *Jack Brag* (1837), *Gurney Married* (1838), and *Peregrine Bunce* (1842). He died on Aug 24, 1841.

See the Rev. R. H. D. Barham, *Life and Remains of Hook* (3rd ed.,

1877); and an article by J. G. Lockhart in the *Quarterly Review* (May 1843).

HOOKAH, a pipe with a long flexible tube attached to a large bowl containing water, often scented, and resting upon its own base (Arabic *huqqah*, a vase or casket.) The smoke of the tobacco is made to pass through the water in the bowl, and is thus cooled before reaching the smoker. The *narghile* of India is in principle the same as that of the hookah; the word is derived from *nargil*, the coconut tree, as the water was at first placed in a coconut. The receptacle is now often made of porcelain, glass or metal. This pipe is common in India, Egypt and the East generally.

HOOKE, ROBERT (1635–1703), English experimental physicist, was born on July 18, 1635, at Freshwater, in the Isle of Wight. After 1655 he was employed and patronized by the Hon. Robert Boyle, who turned his skill to account in the construction of his air-pump. On Nov. 12, 1662 he was appointed curator of experiments to the Royal Society, of which he was elected a fellow in 1663, and filled the office during the remainder of his life. In 1665 he was appointed professor of geometry in Gresham college. He was secretary to the Royal Society between 1677 and 1683, publishing in 1681-82 the papers read before that body under the title of *Philosophical Collections*. Degrees and other marks of public respect were conferred on Hooke. He died on Mar. 3, 1703, in London.

Hooke's scientific achievements would probably have been more striking if they had been less varied. He originated much, but perfected little. His optical investigations led him to adopt in an imperfect form the undulatory theory of light. He was the first to state clearly that the motions of the heavenly bodies must be regarded as a mechanical problem, and he approached in a remarkable manner the discovery of universal gravitation. He invented the wheel barometer, discussed the application of barometrical indications to meteorological forecasting, and originated the idea of using the pendulum as a measure of gravity. He is credited with the invention of the anchor escapement for clocks, and also with the application of spiral springs to the balances of watches, together with the explanation of their action by the principle *Ut tensio sic vis* (1676). Hooke had an irritable temper, his habits were penurious and solitary. He made many virulent attacks on Newton and other men of science claiming that work published by them was due to him.

His principal writings are *Micrographia* (1664); *Lectiones Cutlerianae* (1674–79); and *Posthumous Works*, containing a sketch of his "Philosophical Algebra," published by R. Waller in 1705.

HOOKER, JOSEPH (1814–1879), American general, was born in Hadley (Mass.), on Nov. 13, 1814. He was educated at the military academy at West Point (1833–37), and entered the 1st United States artillery. In the war with Mexico (1846–48) he served as a staff officer, and rose to the rank of lieutenant-colonel. In 1853 he left the service and bought a large farm near Sonoma (Calif.). At the beginning of the Civil War he sacrificed his estate and offered his sword to the Federal Government. He was commissioned brigadier-general of volunteers, and major-general on May 5, 1862. In the engagement of Williamsburg (May 5) he received the sobriquet of "Fighting Joe." He was engaged at the battle of Fair Oaks, and did splendid service during the "Seven Days." In the campaign of Northern Virginia (Aug. 1862), he led his division with fiery energy at Bristoe Station, Manassas and Chantilly.

In the Maryland campaign (Sept.) he was at the head of the 1st corps, Army of the Potomac, forced the defile of South Mountain, and opened the way for the advance of the army. The 1st corps opened the great battle of Antietam, and in a sanguinary fight with the Confederates under Stonewall Jackson, Hooker was severely wounded. He was commissioned brigadier-general in the United States army on Sept. 20, 1862, and in the battle of Fredericksburg (*q.v.*) under Burnside, he commanded the centre grand division (3rd and 5th corps). When Burnside resigned the command Hooker succeeded him, and effected a much-needed reorganization in the army. In this task, as in subordinate commands in battle, Hooker was excelled by few. But his grave defects as a commander-in-chief were soon to be obvious. By a well planned movement, he placed himself on the enemy's flank, but at the decisive moment he checked the advance of his troops. Lee turned upon him, Jackson surprised and destroyed a whole army corps, and the battle of Chancellorsville (*see* WILDERNESS), in which Hooker was himself disabled, ended in a retreat. The second advance of Lee into Union territory was strenuously resisted by Hooker, who would have inflicted a heavy blow on Lee's scattered forces had he not been prevented by orders from Washington. Even then Hooker followed the Confederates only a day behind them, until, finding himself distrusted, he resigned the command on the eve of the battle (June 28, 1863).

But when after a signal defeat Rosecrans was besieged in Chattanooga, and Grant with all the forces of the West was hurried to the rescue, two corps of the army of the Potomac were sent over by rail, and Hooker, as one of the finest fighting generals of the service, went with them in command. He won the "Battle above the Clouds" on Lookout Mountain which cleared the way for the crowning victory of the Army of the Cumberland on Missionary Ridge (*see* CHATTANOOGA). And in command of the same corps he took part in all the battles and combats of the Atlanta campaign of 1864. When General McPherson was killed before Atlanta, the command of the Army of the Tennessee fell vacant. Hooker, as senior to the other army commanders, Thomas and Schofield, was normally entitled to receive it, but Gen. Sherman feared to commit a whole army to a man of Hooker's peculiar temperament, and the place was given to Howard. Hooker thereupon left the army. He retired from active service, with the full rank of major-general, on Oct. 15, 1868. He died at Garden City, Long Island, on Oct. 31, 1879.

HOOKER, SIR JOSEPH DALTON (1817–1911), English botanist and traveller, son of the botanist Sir W. J. Hooker, was born on June 30, 1817, at Halesworth, Suffolk. He was educated at Glasgow university, and after taking his M.D. in 1839 joined Sir James Ross's Antarctic expedition as assistant-surgeon. On his return in 1843 he published *Flora Antarctica*, *Flora Novae Zelandiae* and *Flora Tasmanica*. His next expedition was to the northern frontiers of India (1847–51), his survey of hitherto unexplored regions being published by the Calcutta Trigonometrical Survey Office, and his botanical observations forming the basis of elaborate works on the rhododendrons of the Sikkin Himalayas and on Indian flora. Hooker also journeyed to Palestine (1860), Morocco (1871) and the United States (1877). In 1855 he was appointed assistant-director of Kew Gardens, and from 1865–85 was full director. He was president of the Royal Society from 1873–78. He was an early friend of Darwin: it was he who, with Lyell, first induced Darwin to make public his views on the origin of species.

Hooker's works, in addition to those already mentioned, include *Outlines of the Distribution of Arctic Plants* (1862), a standard *Student's Flora of the British Isles* (1870) and a monumental work, the *Genera plantarum* (1862–83) based on the collections at Kew. On the publication of the last part of his *Flora of British India* in 1897 he was created G.C.S.I. Among other honours he was awarded the Order of Merit in 1907. He died at Sunningdale on Dec. 10, 1911.

See L. Huxley, *Life and Letters of Sir J. D. Hooker* (2 vols., 1918), containing a full list of his works.

HOOKER, RICHARD (1553–1600), English writer, author of the *Laws of Ecclesiastical Polity*, son of Richard Vowell or Hooker, was born at Heavitree, near Exeter. His uncle, John Hooker *alias* Vowell, chamberlain of Exeter, and a man of some literary repute, induced Bishop Jewel to become Richard's patron and to bestow on him a clerk's place in Corpus Christi college, Oxford. He was admitted in 1568, and became a fellow in 1577. After his marriage, in 1581, he was presented to the living of Drayton Beauchamp in Buckinghamshire, and a few months later (March 1585) to the mastership of the Temple. Here he had his famous controversy with Walter Travers, a Presbyterian and evening lecturer in the same church. At his own request, Hooker was transferred in 1591 to the rectory of Boscombe near Salisbury, where he completed the first four of the proposed

Eight Books of the Laws of Ecclesiastical Polity, published in 1593 or 1594. In 1595 he was promoted to the rectory of Bishopsbourne near Canterbury, where he lived to see the completion of the fifth book in 1597. In the passage from London to Gravesend some time in 1600 he caught a severe cold from which he never recovered; he died on Nov. 2 of the same year. A volume professing to contain books vi. and viii. of the *Polity* was published at London in 1648, but the bulk of book vi., as has been shown by Keble, is a deviation from Hooker's subject, and doubtless the genuine copy, known to have been completed, has been lost. Book vii., which was published in a new edition of the work by Gauden in 1662, and book viii., may be regarded as in substance the composition of Hooker; but they have been unskilfully edited, and probably manipulated for theological purposes.

Hooker's *Polity,* which exhibits his respect for reason and for liberty, his broad sympathies, his dignity of language, and his wide reading, especially in patristic literature, was an answer to the attacks of the Presbyterians on the Episcopalian polity and customs. Its theological interest lies in its recognition of the greatness of Calvin as well as of the weaknesses and dangers of the Puritan movement, in its contention that the Bible was never meant to regulate the externals of church worship and government, in its defence of the Anglican Church against the charge of Romanism and in its interpretation of the sacraments. Its philosophical interest lies in the fact that the fundamental principle on which Hooker bases his reasoning is the unity and all-embracing character of law. Law—as operative in nature, as regulating each man's individual character and actions, as seen in the formations of societies and governments—is a manifestation and development of the divine order according to which God Himself acts. Natural law is eternal and immutable; positive law, which includes all forms of government, varies according to external necessity and expediency. The application of positive laws is to be determined by reason enlightened and strengthened by every variety of knowledge, discipline and experience.

Applying his principles to man individually, the foundation of morality is, according to Hooker, immutable, and rests "on that law which God from the beginning hath set Himself to do all things by"; this law is to be discovered by reason; and the perfection which reason teaches us to strive after is stated, with characteristic regard to the facts of human nature, to be "a triple perfection: first a sensual, consisting in those things which very life itself requireth, either as necessary supplements, or as beauties or ornaments thereof; then an intellectual, consisting in those things which none underneath man is either capable of or acquainted with; lastly, a spiritual or divine, consisting in those things whereunto we tend by supernatural means here, but cannot here attain unto them." Applying his principles to man as a member of a community, he assigns practically the same origin and sanctions to ecclesiastical as to civil government. His theory of government forms the basis of the *Treatise on Civil Government* by Locke, although Locke developed the theory in a way that Hooker would not have sanctioned.

The force and justification of government Hooker derives from public approbation, either given directly by the parties immediately concerned, or indirectly through inheritance from their ancestors. His theory is in various of its aspects and applications liable to objection; but taken as a whole it is the first philosophical statement of the principles which, though disregarded in the succeeding age, have since regulated political progress in England and gradually modified its constitution. One of the corollaries of his principles is his theory of the relation of church and State, according to which, with the qualifications implied in his theory of government, he asserts the royal supremacy in matters of religion, and identifies the church and commonwealth as but different aspects of the same government.

BIBLIOGRAPHY.—A life of Hooker by Dr. Gauden was published in his edition of Hooker's works (1662). To correct the errors in this life Izaak Walton wrote another, which was published in the 2nd edition of Hooker's works in 1666. The standard modern edition of the works is that by Keble, which first appeared in 1836, and has since been several times reprinted (1888 ed., revised by Dean Church and Bishop Paget). The *Laws of Ecclesiastical Polity* was printed in the Everyman's Library (2 vols., 1907), and bk. i. was edited by R. W. Church (1868–76). *See* also V. Stanley, *R. Hooker* (1907) and L. S. Thornton, *R. Hooker, a Study of his Theology* (1924).

HOOKER, THOMAS (1586–1647), New England theologian, was born, probably on July 7, 1586, at Marfield, in the parish of Tilton, Leicestershire, England. He took his M.A. in 1611 at Emmanuel college, Cambridge, the intellectual centre of Puritanism, remained there as a fellow for a few years, and then preached in the parish of Esher in Surrey. About 1626 he became lecturer to the church of St. Mary at Chelmsford, Essex, delivering on market days and Sunday afternoons evangelical addresses which were notable for their moral fervour. In 1629 Archbishop Laud took measures to suppress church lectureships, which were an innovation of Puritanism. Hooker was placed under bond and retired to Little Baddow, 4m. from Chelmsford. In 1630 he was cited to appear before the Court of High Commission, but he forfeited his bond and fled to Holland, whence in 1633 he emigrated to the Colony of Massachusetts Bay in America, and became pastor at Newtowne, now Cambridge, Mass., of a company of Puritans who had arrived from England in the previous year and in expectation of his joining them were called "Mr. Hooker's Company." Hooker publicly criticized the limitation of suffrage to church members, and, according to a contemporary historian, William Hubbard (*General History of New England*) "after Mr. Hooker's coming over it was observed that many of the freemen grew to be very jealous of their liberties." He was a leader of the emigrants who in 1636 founded Hartford, Conn. In a sermon before the Connecticut general court of 1638, he declared that "the choice of public magistrates belongs unto the people by God's own allowance" and that "they who have the power to appoint officers and magistrates, it is in their power, also, to set the bounds and limitations of the power and place unto which they call them." Though this theory was in advance of the age and has caused many historians to call him "the father of American democracy," Hooker had no idea of the separation of church and state—"the privilege of election, which belongs to the people," he said, must be exercised "according to the blessed will and law of God." Hooker was pastor of the Hartford church until his death, on July 7, 1647. Hooker through his piety, zeal and wisdom was unquestionably one of the foremost of colonial clergymen.

See G. L. Walker's *Thomas Hooker* (1891), the best biography, which contains a bibliography of Hooker's published works.

HOOKER, SIR WILLIAM JACKSON (1785–1865), English botanist, was born at Norwich on July 6, 1785, and educated at the high school there. The natural history specimens of his first botanical expedition to Iceland in 1809 were lost on the homeward voyage through the burning of the ship, but Hooker was able to publish an account of the island and of its inhabitants and flora (*Tour in Iceland,* 1811). In 1814 he spent nine months in botanizing excursions in France, Switzerland and northern Italy, and in 1815 settled at Halesworth, Suffolk, devoting himself to the formation of his herbarium, which became of worldwide renown among botanists. In 1816 appeared the *British Jungermanniae,* succeeded by a new edition of William Curtis's *Flora Londinensis,* by the *Muscologia Britannica,* prepared in conjunction with Dr. T. Taylor (1818), and by his *Musci exotici* (2 vols., 1818–20), devoted to new foreign mosses and other cryptogams. In 1820 he accepted the regius professorship of botany in Glasgow. The following year he brought out the *Flora Scotica.* In 1841 he was appointed director of the Royal Botanical Gardens at Kew, and under his direction the gardens expanded from 11 to 75 acres. He died on Aug. 12, 1865.

Hooker's most important works besides those mentioned above are: *Exotic Flora* (3 vols., 1822–27); *Account of Sabine's Arctic Plants* (1824); *The Botanical Magazine* (58 vols., 1827–65); *Icones Filicum,* in concert with Dr. R. K. Greville (2 vols., 1829–31); *British Flora,* undertaken with Dr. G. A. W. Arnott, etc. (1830), *British Flora Cryptogamia* (1833); *Characters of Genera from the British Flora* (1830); *Flora Boreali-Americana* (2 vols., 1840); *The Journal of Botany* (4 vols., 1830–42); *Companion to the Botanical Magazine* (2 vols., 1835–36); *Icones plantarum* (10 vols., 1837–54); the *Botany of Beechey's Voyage to the Pacific and Behring's Straits* (with Dr. Arnott, 1841); the *Genera Filicum* (1842); *The London Journal of*

Botany (7 vols., 1842–48); *Species filicum* (5 vols., 1846–64), the standard work on this subject; *A Century of Orchideae* (1846); *Journal of Botany and Kew Garden Miscellany* (9 vols., 1849–57); *Niger Flora* (1849); *Victoria Regia* (1851); *Museums of Economic Botany at Kew* (1855); *Filices exoticae* (1857–59); *The British Ferns* (1861–62); *A Century of Ferns* (1854); *A Second Century of Ferns* (1860–61).

See *Sir William Jackson Hooker*, by his son J. D. Hooker (1903).

HOOKWORM, parasitism caused by the hookworms *Necator americanus, Ankylostoma duodenale,* and, more rarely, *Ankylostoma braziliense,* which inhabit a relatively small portion of man's small intestine. A single healthy female hookworm passes daily several hundred eggs which leave man in his excrement. Under favourable conditions, such as its deposit on suitable soil, larvae form therein, develop to an infective stage, and enter the soil. Infection ordinarily occurs through the piercing by infective larvae of the skin, commonly of one who walks barefoot over infected soil. Carried by the circulation from the skin to the lungs, larvae reach the air passages and, like all foreign bodies, are driven up these to the throat, are swallowed, and so finally reach the small intestine. Man's normal mechanisms are thus subverted to the hookworm's use.

The treatment of ankylostome infestation involves, firstly, disinfestation by a vermifuge or anthelmintic, and, secondly, neutralization of the consequences of infection. To increase their concentration in the bowel, and presumably their efficacy, anthelmintics have customarily been preceded by purging and fasting. Accumulating evidence, however, suggests that purging lessens effectiveness. Starvation, beyond the ordinary nightly fast, increases, for some drugs, risk of poisoning the host. Anthelmintics are best given in the early morning. The ideal vermifuge, with a dosage which poisons all hookworms without endangering the host, is non-existent. The dosage employed for any drug should give the greatest efficiency compatible with safety, and may be termed the optimum dose. Attainment of increased safety is attempted by dividing the optimum dose into fractions, usually 3 or 4, given with intervals of one or two hours, by which means treatment can be stopped at any stage should ill effects appear, while efficacy is apparently increased; nevertheless, supervising costs of mass treatment are thereby increased. Subsequent removal of the drug by purgation lessens risk of poisoning.

The many millions of persons infected throughout the tropics necessitates mass treatment, the essentials of which, namely safety, efficacy, cheapness, and palatability, are varyingly combined in the five anthelmintics in present or recent use. These are eucalyptus-chloroform, betanaphthol, thymol, oil of chenopodium, and carbon tetrachloride. By some they have been administered promiscuously to whole communities in which examination of a few individuals has shown a high rate of infection.

Eucalyptus-chloroform has been almost completely abandoned as inefficient. Pure betanaphthol, in optimum dosage of two grammes, is inefficient; in larger doses it has caused deaths in India and Brazil. Thymol and oil of chenopodium, in their respective optimum doses of 4 grammes and 1·2 cubic centimetres or mils (the latter dose equalling 48 drops or 20 minims) have for *N. americanus* equal efficiency and minimal risk; contrary statements emanate from the use of oil of chenopodium in excessive dosage of 3 mils, due apparently to considering a drop of this liquid as equivalent to a minim. For *A. duodenale* chenopodium appears the better drug, and is, in London, the cheaper. Its active principle is ascaridol. Unfortunately the oil contains markedly varying quantities of this substance, and its amount lessens on keeping. Ascaridol, extracted and administered in place of the whole oil, is effective but relatively costly. Carbon tetrachloride, recently introduced, has been taken by many thousands of persons in dosage of three mils, and has proved most efficient. The medicinally pure drug produces in large doses, in dogs, extensive fatty degeneration, followed by necrosis of the liver, and, apparently, of the kidneys; changes aggravated by starvation and fatty food, and lessened by glucose. Extensive similar change has been present in man when death has followed the 3-mil dose. A number of such deaths have been recorded. Clearly this dose required reduction, so that the efficacy of carbon tetrachloride under optimum dosage has still to be ascertained. It is the cheapest of all advocated treatments. A combination of this drug with ascaridol is being tested.

Hygienically viewed, treatment of whole unsanitated communities lessens the risk of further infections; since destruction of female worms diminishes the seeding of egg-containing material upon the soil, and, on the whole, the number of infective larvae originating therefrom. Nevertheless, an imperfectly treated, and still lightly infected, person, seeding a favourable spot, is a danger to the community.

Individually viewed, disinfestation, by treatment, of the obviously ill and presumably heavily infected, restores health, always provided damaged tissues be still reparable. In the case of apparently healthy, but infected, persons, comparison of their condition of general health, wage-earning capacity, blood state and, in children, development of body and mind, before, and again a sufficient period after, disinfestation shows that they are often markedly improved by disinfestation; so that a light infection definitely handicaps the apparently healthy. Whether the lightest infections do, or may, penalize the individual is questioned. If, as now appears likely, we can detect infection by a single female worm, treatment producing complete disinfestation of such cases, combined with critical observation of conditions before and after effecting this, will doubtless shortly settle this point, so vital to the individual and community.

Iron and arsenic, ineffective before, may be essential for combating anaemia after disinfestation. Treatment of skin lesions at the site of infection varies with the condition present. (*See* PARASITOLOGY; TROPICAL MEDICINE.)

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HOOLIGAN, the generally accepted modern British term for a young street ruffian or rowdy. It seems to have been first applied to the young street ruffians of the south-east of London about 1890, but though popular in the district, did not attract general attention till later, when authentic information of its origin was lost; however, it appears that the most probable source was a comic song which was popular in the lower class music-hall in the late '80s or early '90s, which described the doings of a rowdy family named Hooligan (*i.e.,* Irish, Houlihan). A comic character with the same name also appears to have been the central figure in a series of adventures running through an obscure English comic paper of about the same date, and also in a similar New York paper, where his confrère in the adventures is a German named Schneider (see *Notes and Queries,* 9th series, vol. ii. pp. 227 and 316 (1898), and 10th series, vol. vii. p. 115 (1901).

HOOLOCK: *see* PRIMATES, GIBBON.

HOOPER, HORACE EVERETT (1859–1922), publisher of *The Encyclopædia Britannica,* was born in Worcester (Mass.), on Dec. 8, 1859. He was of English descent, his father's family having settled in New England about 1650, while his mother was a descendant of John Leverett, governor of Massachusetts, 1672–79. Having been educated in the public schools of Worcester and of Washington (D.C.), he started in business in early life at Denver (Colo.), but a few years later removed to Chicago, where, with others, he organized the Western Book and Stationery Company, with book stores in a number of the large western cities. In 1895 he moved to New York and joined a company for the sale of *The Century Dictionary,* and his success in this enterprise led to wider fields. In 1897 he went to London and arranged with A. and C. Black, publishers of *The Encyclopædia Britannica,* for a reprint of the 9th Edition of that work, and with *The Times* for its sale through that paper. Later he purchased the copyright. By reducing the price and by providing for payments in small monthly instalments, the sale of the work was revolutionized, 70,000 sets being sold in the next five years.

The success of this enterprise led Hooper to have prepared, in 1902, a large supplement in 11 volumes (under the editorship of Sir Donald Mackenzie Wallace, President Arthur T. Hadley of Yale, and Hugh Chisholm) which, added to the volumes of the 9th Edition, formed the 10th Edition. For this also there was a large sale. His next enterprise was *The Historians' History of the World*, 1904, a work in 25 volumes. Meanwhile, Hooper's relation with *The Times* grew more close. He took an intimate part in the business management, and it was at his suggestion and under his personal direction that *The Times Book Club* was formed. In 1908 when the proprietorship of *The Times* passed into the late Lord Northcliffe's hands, Hooper's connection with that paper came to an end.

In 1903 Hooper entered upon a larger enterprise than any yet attempted, the preparation of an entirely new edition, the 11th, of *The Encyclopædia Britannica* under the editorship of Hugh Chisholm. This was published in the closing months of 1910 and the first of 1911 under an arrangement with the Cambridge University Press. Hitherto all large works of reference had been issued volume by volume over a period of years. By his energy and the liberal expenditure of money, Hooper arranged that the 11th Edition of *The Encyclopædia Britannica* should all be published at the same time, thus greatly enhancing the usefulness of the work. Of this edition 75,000 sets were sold in the next few years, the use of India paper being one factor in its success. In 1915 Hooper published the work in a smaller and cheaper form known as the Handy Volume Issue, the contents being identical with the original issue. In this form nearly 200,000 sets were sold within a few years. The last enterprise in which Hooper was engaged was the publication in 1922 of the Three War Volumes of *The Encyclopædia Britannica*, which supplemented the 11th Edition, and with the 29 volumes of that Edition constituted the 12th Edition.

Hooper's success in publishing and distributing so widely the important works mentioned above lay partly in the originality, boldness, and brilliance of his operations, but chiefly in his faith in the intelligence and ambition of the great masses of the people. He believed in the educational value of good books, and that the people would order such books and use them if the matter were properly placed before them. The ideals he set before himself were the maintenance in *The Encyclopædia Britannica* of the highest standard of scholarship and the placing of the work as an educational aid in the greatest number of homes. Many professional educationists of note have done less than he towards popular enlightenment. For a number of years Hooper lived in England. He was a strong believer in the unity of the English-speaking peoples, and exerted his influence toward the removal of causes of friction between England and America and the establishment of cordial feeling and a mutual understanding He died at Bedford Hills (N.Y.), on June 13, 1922

HOOPER, JOHN (d. 1555), bishop of Gloucester and Worcester and martyr, was born in Somerset about the end of the 15th century and graduated B.A. at Oxford in 1519. In 1538 a John Hooper appears among the names of the Black friars at Gloucester, another among the White friars at Bristol who surrendered their houses to the king, and another as canon of Wormesley priory in Herefordshire; but identification of any of these with the future bishop is doubtful, and in the sentence pronounced against him by Gardiner he is described as *"olim monachus de Cliva Ordinis Cisterciensis," i.e.*, of the Cistercian house at Cleeve, Somerset. Before 1546 he was employed in the household of Sir Thomas Arundell and Hooper speaks of himself at this period as being "a courtier and living too much of a court life in the palace of our king." But he chanced upon some of Zwingli's works and Bullinger's commentaries on St. Paul's epistles; and after some molestation in England and some correspondence with Bullinger he took refuge on the continent, reaching Strasbourg in the midst of the Schmalkaldic war. There he married Anne de Tserclaes, and later proceeded by way of Basle to Zürich, where his Zwinglian convictions were confirmed by constant intercourse with Bullinger, Zwingli's successor.

In May 1549 Hooper returned to England. He at once became the principal champion of Swiss Protestantism against the Lutherans as well as the Catholics and was appointed chaplain to protector Somerset. After Somerset's fall he became Warwick's chaplain and after a course of Lent lectures before the king was offered the bishopric of Gloucester. This led to a prolonged controversy; Hooper had already denounced the "Aaronic vestments" and the oath by the saints prescribed in the new Ordinal; and he refused to be consecrated according to its rites. Cranmer, Ridley, Bucer and others urged submission; confinement to his house by order of the council proved ineffectual; and he spent some weeks in the Fleet prison before he submitted to consecration with the legal ceremonies (March 8, 1551).

Although he had opposed Northumberland's plot for the exclusion of Mary from the throne, he was sent to the Fleet on Sept. 1, 1553, on a doubtful charge of debt to the queen; the real cause was his staunchness to a religion which was still by law established. Edward VI.'s legislation was, however, repealed in the following month, and in March 1554 Hooper was deprived of his bishopric as a married man. There was still no statute by which he could be condemned to the stake, but Hooper was kept in prison, and in December the heresy acts were revived. On Jan. 29, 1555, Hooper, Rogers, Rowland Taylor and others were condemned by Gardiner and degraded by Bonner. Hooper was sent to Gloucester, where he was burnt on Feb. 9, meeting his fate with steadfast courage and unshaken conviction.

Hooper was the first of the bishops to suffer, because his Zwinglian views placed him further beyond the pale than Cranmer, Ridley and Latimer. He represented the extreme reforming party in England. While he expressed dissatisfaction with some of Calvin's earlier writings, he approved of the *Consensus Tigurinus* negotiated in 1549 between the Zwinglians and Calvinists of Switzerland; and it was this form of religion that he laboured to spread in England against the wishes of Cranmer, Ridley, Bucer, Peter Martyr and other more conservative theologians. He would have reduced episcopacy to narrow limits; and his views had considerable influence on the Puritans of Elizabeth's reign, when many editions of his works were published.

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HOOPESTON, a city of Vermilion county, Ill., U.S.A., 100m. S. of Chicago. It is served by the Chicago and Eastern Illinois and the Nickel Plate railways. The population in 1920 was 5,451 (95% native white). Grain, hay and live stock are shipped in large quantities. The city has grain elevators, machine shops, corn-canning plants with an annual output of over 800,000 cases, and factories making cans, canning machinery, malleable iron and chemicals. It was settled about 1870 and incorporated in 1874.

HOOPOE (*Upupa epops*), a bird conspicuous by its variegated plumage and large erectile crest. It is a summer visitor to almost all Europe and to Siberia, wintering in Africa and India. It is resident in north-east Africa and China. It is about the size of a thrush, with a long, pointed, arched bill; its head and neck are golden buff; the crest, which it opens and closes continually, is tipped with black and white; the rest of the plumage is a combination of black, white, grey, and buff.

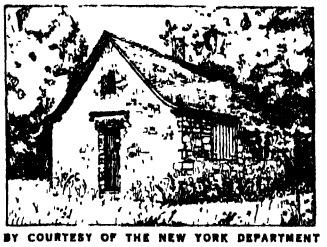
The hoopoe feeds on worms, grubs, and insects. The nest, in a hole in a tree or wall, rapidly becomes a noisome spot, the faeces of both parents and young being left where they are deposited. The hoopoe is esteemed as food in southern Europe.

Other species occur in Asia and Africa. The European species often reaches the British Isles, where it is usually soon shot by some collector. But for this barbarism, it would probably breed.

HOORN, a seaport in the province of North Holland, on a

bay of the Zuider Zee called the Hoornerhop, and a junction station 23½ m. by rail N. by E. of Amsterdam. Pop. (1926) 11,806. Hoorn, latinized as *Horna* or *Hornum*, is mentioned in a document of 1311. In 1356 it received municipal privileges, and in 1426 it was surrounded with walls. Here in 1416 the first great net was made for the herring fishery. In 1569 Spanish forces entered the town; but in 1572 it cast in its lot with the states of the Netherlands. Among the celebrities of Hoorn are William Schouten, who discovered in 1616 the passage round Cape Horn, or Hoorn, as he named it in honour of his birthplace; and Abel Janszoon Tasman, whose fame is associated with Tasmania. Hoorn is distinguished for the beauty of its numerous gabled houses of the 16th and 17th centuries. Many of these are decorated with inscriptions and bas-reliefs, some of which commemorate the battle on the Zuider Zee in 1573. The Gothic bastion tower overlooking the harbour was built in 1532; the East gate not later than 1578. Among the public buildings are the St. John's hospital (1563), now used for military purposes; the old mint; the hospital for aged men and women (beginning of 17th century); the weigh-house (1609); the town hall, in which the states of West Friesland formerly met; and the old court-house, which dates from the beginning of the 17th century, though parts of it are older. There is a considerable trade with other parts of the Netherlands, especially in cheese and cattle. The small industries include gold and silver work, tobacco factories, sawmills and some boat-building yards, a considerable number of vessels being engaged in the Zuider Zee fisheries.

HOOSICK FALLS, a village of Rensselaer county, New York, 30m. N.E. of Albany, on the Hoosick river. It is served by the Boston and Maine railroad. The population in 1925 was 5,050. The falls of the river furnish abundant water-power, and the village has various manufacturing industries. It was founded about 1688 by Dutch settlers, and was incorporated in 1827. At Walloomsac, 3m. N.E., was fought on Aug. 16, 1777, the battle of Bennington. The battlefield is now owned and maintained by the State.



BY COURTESY OF THE NEW YORK DEPARTMENT OF EDUCATION

OLD STONE SCHOOL-HOUSE BUILT NEAR HOOSICK FALLS IN 1812

HOOVER, HERBERT CLARK (1874–), thirty-first president of the United States, was born on Aug. 10, 1874, in the farming village of West Branch, Ia. He is the second of three children of Jesse and Huldah Minthorn Hoover, both Quakers with a long American Quaker ancestry. Jesse Hoover, the father, was the village blacksmith. He also sold farm machinery. He died when Herbert was six years old. Huldah, the mother, a woman of unusual mental gifts, was a Quaker preacher well known and admired not only in West Branch but in neighbouring Quaker communities for her speaking talent. She died when Herbert was nine.

After the death of the mother the three orphaned children were divided among the Hoover and Minthorn families, Herbert joining the family of his uncle Allan Hoover, who lived on a farm a few miles from West Branch. Later he was taken to Newberg, Ore., with the family of his mother's brother, Dr. John Minthorn, a physician much interested in education. Here he attended a small Quaker academy. Later his uncle moved to Salem where he opened a real estate office. Herbert went along as office boy, at the same time attending night school. He thus prepared himself for college and in Oct. 1891 he entered the just opened Stanford university in California, where he specialized in geology and engineering. He largely earned his way during the four university years, acting as secretary, in term time, to Dr. Branner, the professor of geology, and working during the summer vacation for the Arkansas State and U.S. Geological Survey.

Graduating in 1895 with Stanford's "pioneer class" he found a first job, not as a geologist or mining engineering expert, but as a day labourer in the Mayflower mine in California. But he soon graduated also from this rough but informing mining school and began a career as an engineer and technical expert. His work began in Colorado, New Mexico, Arizona and Nevada, and carried him on to western Australia, then (1897) experiencing an exciting development of gold mining. Here he rapidly made a name for himself which led to his being engaged in 1899 as chief engineer of the newly established governmental department of mines in China. He returned to America from Australia in 1899 and was married to Lou Henry of Monterey, Cal., who had just graduated from Stanford and with whom he had become acquainted in Dr. Branner's geological laboratories.

Departing at once for China the young couple began a busy life of geological and mining expeditions and surveys which were effectively arrested in the next year when the Boxer Rebellion broke out. The Hoovers, with other foreigners, were besieged for four harrowing and dangerous weeks in Tientsin. In 1900 they returned to America and Europe, but soon departed again for China, remaining there until 1901. Hoover was now 27 years old and ready to go anywhere in the world that opportunity offered. The opportunities were abundant and his responses to them during the next 12 years took him again to Australia, Russia, Burma, Italy, Central America and elsewhere. He became identified with more than a score of mining companies, for several of which he was managing director. During this period he maintained offices in San Francisco, New York and London. During this period also his two sons, Herbert, Jr., and Allan, were born. In 1909 appeared his book on *Principles of Mining* and in 1912 a translation by himself and his wife from the mediaeval Latin of Agricola's *De Re Metallica*, an exhaustive treatise on mining and smelting published in 1550.

When the World War broke out in 1914 thousands of travelling Americans, endeavouring to return home, found themselves stranded in London because of the impossibility of obtaining cash on checks and letters of credit. Hoover, also in London at this time on a mission for the Panama-Pacific Exposition, mobilized the resources of himself and a group of engineer friends, advanced cash on personal checks, arranged for hotel rooms and steamer accommodations and thus philanthropically assisted more than 150,000 of these stranded fellow countrymen, personally unknown to him, to return to America. Before he completed this useful work a much greater relief task called him. The immediate result of the occupation of Belgium and northern France by the German armies was practically to establish an impassable ring of steel around 7,500,000 Belgians and 2,500,000 French men, women and children. The situation spelled starvation for the isolated people unless the ring could be broken and philanthropy allowed to provide food for them. The Belgian national relief committee called on Hoover who, with the approval of Walter Hines Page, American ambassador in London, organized the Commission for Relief in Belgium, and arranged with the warring nations to permit the passage through the blockade of food and clothing for distribution under the protection and guidance of the commission. He appealed to the charity of the world and arranged with the Governments of France, England and the United States to advance funds for the purchase of food. The commission, of which Hoover was the responsible and controlling head throughout the war, sent into occupied Belgium and France, during those four long and difficult years, about 5,000,000 tons of food and clothing of a market value of about $1,000,000,000. This huge work was accomplished in the face of great and continuing diplomatic and practical difficulties, and its success brought world fame to Hoover. (*See* RELIEF.)

With the entrance of the United States into the war in April 1917, President Wilson called Hoover from Europe to be U.S. food administrator under the terms of the Lever Act. He at once developed an elaborate organization for stimulating production, checking hoarding and speculation and conserving food supplies. He had comparatively little authority in his hands, but he called on the people for co-operation and received almost universal backing for his requests. These even called for meatless and wheatless days and other personal food limitations. He extended the Food Administration to every State, city and hamlet and enrolled thousands of volunteer workers and local committee

members. By the activities of the Food Administration he was able to meet the large food demands of the Allies who were having difficulty in maintaining the *morale* of their people because of food shortage due to reduced production and to loss of cargoes by the U-boat destruction.

In connection with the Food Administration Hoover established the U.S. Grain Corporation, Sugar Equalization Board and Food Purchase Board, all for the purpose of a more centralized handling of food supplies during the emergency. He also served as chairman of the Interallied Food Council. After the Armistice, the terms of which, at his suggestion, provided for the furnishing of food supplies to enemy countries, he became chief executive officer of the joint Allied committee which later developed into the Supreme Economic Council and of which he was the head. This council exercised great authority in European economic affairs during the period of the Armistice.

When the Armistice came in Nov. 1918, and the dark curtain of war was lifted, revealing the terrible scene of disorganized and hungry eastern Europe, it was at once apparent that another great relief operation was necessary. The United States promptly took the first large-scale action by setting up, under Hoover's chairmanship, the American Relief Administration, with a congressional appropriation of $100,000,000 available for immediate use in getting food supplies to the suffering and panic-stricken countries. Later large loans were made by the American and Allied Governments to these countries. Altogether in eight months nearly 5,000,000 tons of food-stuffs of a value of $1,000,000,000 were sent into 23 countries. These supplies not only prevented starvation but aided largely in the economic reconstruction of the exhausted nations.

With the signing of the peace the American Relief Administration, as an independent agency acting for the U.S. Government, was liquidated, but as suffering from lack of food still persisted in parts of Europe Hoover and his associates formed a private charitable organization called the European Children's Fund to carry on the relief of millions of destitute and orphaned children in central and eastern Europe suffering from under-nutrition and disease. This organization continued its work until June 1922, and during its life it gave free meals to more than 8,000,000 children. In addition to this warm clothing valued at more than $8,000,000 was distributed to 2,000,000 children.

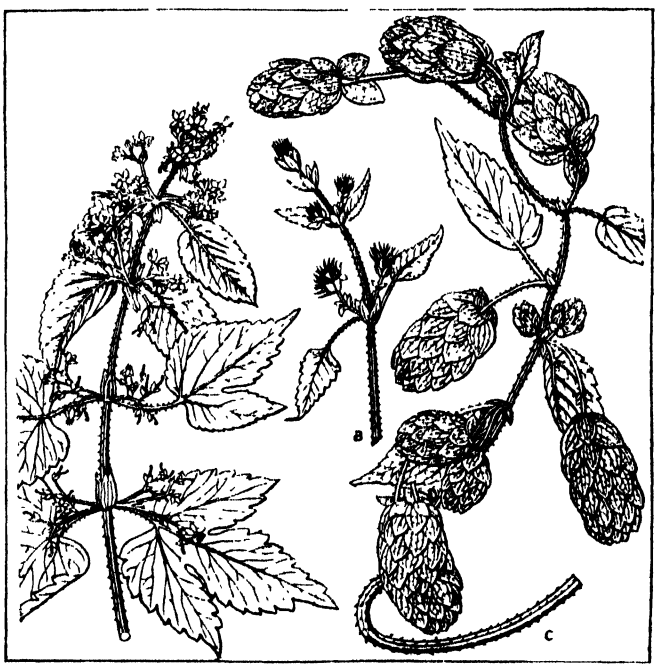
In 1920 some of Hoover's friends conducted an unorganized and unsuccessful campaign to secure his nomination as the Republican candidate for president. After Harding's election Hoover entered his cabinet as secretary of Commerce. With characteristic vigour and constructive capacity he began at once a reorganization and new development of the department based on the idea of changing the attitude of the Government toward business from one of interference and control to one of co-operation. He held many conferences of manufacturers, distributors and consumers and suggested many opportunities for bettering business methods by voluntary agreement. He gave special attention to the rapid development of means of collecting and distributing reliable information of business conditions abroad with the aim of revealing opportunities for expanding U.S. foreign trade. Through a division of simplified practice he took successful steps to effect a general reduction in the number of different varieties and sizes in which articles of commerce were manufactured (*see* STANDARDIZATION). The Patent Office and Bureau of Mines were transferred from the Department of the Interior to his department. He was offered at various times the secretaryship of the Interior and of Agriculture but preferred to continue his development of the Department of Commerce.

In addition to his governmental activities he accepted many other public responsibilities. In 1922 he organized the important American Child Health Association and became its first president. He became trustee of Stanford university, his alma mater, where he founded the famous Hoover War library and the Food Research institute. He accepted the active chairmanship of the National Research Fund established by the National Academy of Sciences for the support of research in pure science. In 1922 he published *American Individualism*, a book devoted to setting out his interpretation of the basis and character of American democracy.

In the fall of 1921, only a few months after he had become secretary of Commerce, Hoover was called on in his private capacity to undertake another great relief operation. Ten million people in the valley of the Volga in Russia were threatened with starvation as the result of drought and economic disorganization By appealing to American private and governmental charity he was able to distribute, in the famine-stricken regions, through an effective organization manned largely by associates in his earlier relief operations, nearly 1,000,000 tons of food and medical supplies of a total value of about $65,000,000.

In 1927, as personal representative of President Coolidge, and with the support of the army and navy and the American Red Cross, he went to the rescue of the sufferers from the great Mississippi flood. Under his vigorous direction effective local and governmental measures of relief were promptly adopted and 700,000 refugees removed from danger of drowning, disease and starvation.

At the Republican national convention in 1924 he was put forward, against his protest, for the vice-presidential nomination and 334½ votes were cast for him, Gen Charles G. Dawes being nominated with 682½. At the Republican convention in 1928 at Kansas City, Mo., he was nominated for president on the first ballot, with 837 votes out of a total of 1,089. In the ensuing election he received 444 of the 531 electoral votes and the overwhelming popular vote of 21,500,000 as compared with 15,005,000 (both figures are approximate) for Gov. Smith, the Democratic candidate. A notable incident of the election was Hoover's victory in the "Solid South"; he carried for the Republican Party, for the first time since the Reconstruction period, Florida, North Carolina, Texas and Virginia; on the other hand he lost Massachusetts and Rhode Island, which with one exception had gone Republican at every presidential election since 1860. Immediately after his success at the polls (Nov. 19) he sailed from San Pedro, California, on a good will mission to the sister republics of Latin America returning Jan. 6, 1929. (V. K.)



THE HOP, A PLANT EXTENSIVELY CULTIVATED THROUGHOUT THE TEMPERATE REGIONS FOR USE IN THE MANUFACTURE OF BEER. IT HAS MEDICINAL QUALITIES ALSO, AND IN BELGIUM IS EATEN LIKE ASPARAGUS
A, male inflorescence; B, female inflorescence; C, fruits

HOP, *Humulus lupulus*, L., an herbaceous twining plant, belonging to the family Moraceae. It is of common occurrence in hedges and thickets in the southern counties of England, but is believed not to be native in Scotland. On the European continent it is distributed from Greece to Scandinavia, and extends

through the Caucasus and Central Asia to the Altai Mountains. It has been introduced into the northern and western states of North America and also into Brazil, Australia and the Himalayas.

It is a perennial plant, producing annually several long twining roughish striated stems, which twist from left to right, are often 15 to 20 ft. long and climb freely over hedges and bushes. The roughness of stem and leaves is due to lines of strong hooked hairs, which help the plant to cling to its support. The leaves are stalked, opposite, 3–5 lobed, and coarsely serrate, and bear a general resemblance to those of the vine, but are, as well as the whole plant, rough to the touch; the upper leaves are sometimes scarcely divided, or quite entire. The stipules are between the leaf-stalks, each consisting of two lateral ones united, or rarely with the tips free. The male and female flowers are produced on distinct plants. The male inflorescence forms a panicle; the flowers consist of a small greenish five-parted perianth enclosing five stamens, whose anthers open by terminal slits. The female inflorescence is less conspicuous in the young state. The catkin or strobile consists of a number of small acute bracts, with two sessile ovaries at their base, each subtended by a rounded bractlet. Both the bracts and bractlets enlarge greatly during the development of the ovary, and form, when fully grown, the membranous scales of the strobile, they are known as "petals" by hop-growers. The bracts can then only be distinguished from the bractlets by being rather more acute and more strongly veined. The perianth is short, cup-shaped, undivided and closely applied to the ovary, which it ultimately encloses. In the young strobile the two purple hairy styles of each ovary project beyond the bracts. The ovary contains a single ovule which becomes in the fruit an exalbuminous seed, containing a spirally-coiled embryo. The light dusty pollen is carried by the wind from the male to the female flowers.

The ovary and the base of the bracts are covered with a yellowish powder, consisting of minute sessile grains, called lupulin or lupulinic glands. It is to the lupulin in these glands that the medicinal properties of the hop are chiefly due. Besides the common hop there are two other species, the American hop (*H. americanus*) and the Japanese hop (*H. japonicus*), both of which are cultivated. (V. H. B.)

HOP, CULTIVATION OF THE. There are two species commercially grown, *Humulus Lupulus*, a native of Europe and Asia, and *Humulus americanus*, a native of America. The cultivation of the Old World hop probably originated in Asia, whence it gradually extended westward through Europe to England and subsequently to America. The American hop is grown chiefly in the Pacific States. In all countries where the hop is cultivated the crop is localized in fairly well defined areas; this is due, to some extent to climate but also largely to the fact that many of the operations involved are very specialized and require experienced labour, which can be obtained only in districts where the workmen have lived among hops all their lives.

Hops are grown in Austria, Bavaria, Belgium, Czechoslovakia, England, France, Germany, Hungary, Jugoslavia, Poland, Rumania, Russia, Canada, the United States of America, Australia and New Zealand. Germany has the largest area of land under hops but England produces the greatest weight of hops, followed closely by the United States of America; the hops of the latter countries being pollinated develop larger cones and therefore a higher crop per acre.

The plant is somewhat sensitive to climatic conditions, and even the comparatively small differences in these in different hopgrowing districts are sufficient to determine the variety of hop which will thrive most satisfactorily. The mean summer temperature should be about 60° F and the district should not be subject to strong winds during the growing and ripening periods. The rainfall should be abundant during the growing period and light during the ripening period.

The most suitable soil for hop growing is a fairly heavy loam overlying a pervious subsoil, such as gravel or chalk; it must be deep enough to enable the roots to penetrate to a level where moisture is always available; this moisture however must not be stagnant—hops cannot tolerate a badly drained soil.

Hops are propagated vegetatively by means of cuttings (consisting of the basal portions of the previous year's bines) taken in the spring; they are grown in nursery beds for the first year and are then known as "bedded setts." These are exactly like the parent plants and the variety is thus kept true to type.

Planting.—Before planting hops the land is prepared by deep ploughing and loosening the subsoil with a subsoil plough; then, in early spring, the ground is set out with small sticks to indicate the positions of the "hills" or places where the hops are planted. (This term is derived from the old custom of growing hops on small mounds of earth.) These are commonly placed six or six and a half feet apart each way, the width of planting being governed by the vigour of the variety and the fertility of the soil. The setting out is carried out with great care as it is essential that the rows be perfectly straight and the hills exactly the correct distance apart, in order that they may be in the right positions relative to the overhead wire-work which supports the strings up which the bines climb. Having set out the ground and obtained "setts" of a suitable variety, planting is commenced at the first spell of fine weather in January or February. In England one male plant is provided for each 200 female plants, as it has been found that fertilized cones develop more rapidly and grow larger than unfertilized cones; in Germany and other mid-European hop growing districts however the male is rigorously excluded and seedless hops are produced. Holes about nine inches square are dug, a little farmyard manure or shoddy mixed with the soil in the bottom and, usually, two setts with the old bines trimmed off placed in the hole with the crowns close to the stick and just below soil level. The hole is then filled in and the stick pulled over at a slant to indicate that the setts have been planted.

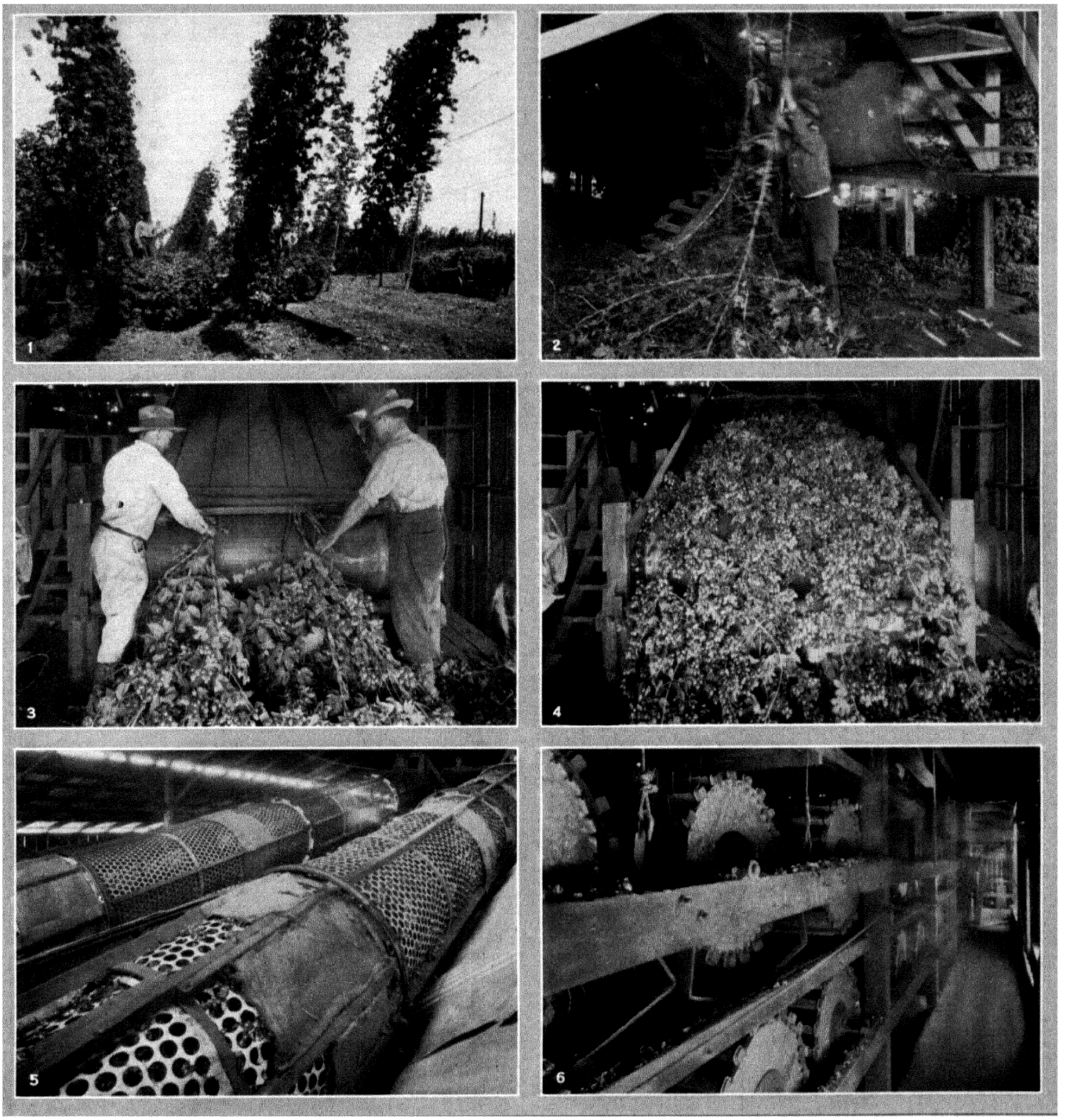
Methods of Training.—During the first year of growth in the hop garden only a small amount of bine is produced and small poles are sufficient to support it; during the second year the plants will grow to their normal height and it is necessary to provide full length supports. The old method was to train the bines up poles about 14 feet in length, two or three being placed at each hill; this method has however been almost completely replaced by various methods of training on string, supported by a system of wires attached to stout poles.

During the dormant period the hops are "dressed." The soil is scraped away with a hoe so that the crown of the plant is exposed. The bases of the previous season's bines are then cut off close to the rootstock and any underground runners that may have been produced are removed. The object of this operation is to restrict the number of shoots, to keep the rootstock below soil level and to prevent the plant from spreading into the alleys. When "dressing" has been completed the coconut fibre string (coir yarn) is put up.

Growth commences in April and by the end of the month or the beginning of May the young bines will be 1 or 2ft. long. Each hill produces more shoots than will be required to furnish the strings; it has been found that those of medium strength are the most fruitful and two of these are trained up each string; the remainder are pulled off. As growth continues it is necessary to go through the hops from time to time and replace any bines that may have fallen away from the strings.

In the autumn the land is ploughed in such manner that the rows of hills are situated on the ridges and the open furrows run along the middle of the alleys; this throws the excess water from heavy rains away from the hills and allows them to lie in a drier condition during the winter. In the spring the land is again ploughed; this time the furrow slices are thrown in the opposite direction, forming the ridge in the middle of the alley and leaving the rows of hops on narrow unploughed strips of land. When "dressing" has been completed these strips are dug by hand. The succeeding cultivation consists in working the ground with cultivators to produce a good tilth and to keep down weeds, the depth being gradually decreased as the season progresses until the hops are in "burr," when cultivation is either discontinued or carried out very shallow to keep weeds in check. The ground close to the hills is hand hoed periodically.

Hop Pests and Diseases.—The hop is subject to several



BY COURTESY OF E. CLEMENS [illegible] COMPANY

MODERN METHODS OF HARVESTING AND PICKING HOPS

1. High wire trellis system of raising hop vines. Pickers in wagons go between rows of trellises, pulling the vines from the wires above
2. Hop vines being pulled to the ground, after stripping (*see* fig. 3)
3. The picking machine, which strips pods and leaves from the stems
4. Vines carried by conveyor from ground to floor above for stripping
5. Revolving perforated cylinders through which picked hops and leaves pass after going through picking machine. The stems remain in the cylinders, which are tilted at an angle, while pods fall through holes
6. Interior of hop picking machine, showing revolving drums fitted with V-shaped wire fingers which remove the hops from the vines

fungous diseases and insect pests, and growers keep a careful watch for the first appearance of these enemies. Of fungous diseases perhaps the most serious is the Downy Mildew (*Pseudoperonospora humuli* [Miy. et Tak.] Wils.) which may attack the hop at any stage of its growth. When the young shoot is infected it assumes a characteristic "fir-tree" spiked appearance and blackish spores are produced on the underside of the leaves; the older leaves become spotted with angular brown patches. The greatest financial loss to the grower, however, is caused when the cones are attacked; a crop of hops nearly ready to harvest and in an apparently healthy condition may be turned brown and thus rendered of little commercial value in perhaps three or four days. The remedies suggested to combat this disease are the removal of all "spiked" shoots and spraying with "Bordeaux Mixture" as a protective measure; the spraying has to be repeated in order that all new growth may be covered by the copper compound.

Another serious fungous disease is the Hop Mould (*Sphaerotheca Humuli* [D.C.] Burr.). This fungus produces white powdery patches of spores on the leaves; if the "burr" becomes infected its growth will be arrested and it will remain in the form of a small knob covered with the white fungus. When fully grown cones are attacked they become foxy-red in colour (Red Mould) and dark brown bodies—the winter stage of the fungus—are found on the cone. The remedy for this disease is dusting the plants with finely divided sulphur.

The Mosaic disease, caused by a virus, gives considerable trouble with some varieties; the shoots become brittle and stunted, the margins of the leaves turn backward and their colour becomes mottled with light patches; the affected plants produce very few cones and are killed in a season or two. The plants suffering from this disease must be dug up and burned as soon as it is recognized. A similar disease, called "Nettlehead," occurs principally on the variety "Fuggles."

The most important insect enemy of the hop is the Hop Aphis (*Phorodon humuli,* Schrank). The eggs of this insect are laid on damson, plum and similar trees in the autumn and hatch out in April; from May to mid-June winged aphides fly to the hop where they produce wingless progeny which increase with great rapidity. In September another generation of winged aphides is produced which migrate to the damson trees. The aphides weaken the hop by extracting its sap as food; they also excrete a sticky substance ("Honeydew") which covers the leaves and blocks their pores. Upon this "Honeydew" a black fungus grows which gives the plant a sooty appearance. If the insects invade the cones the black fungus follows and the value of the crop is considerably reduced. The remedy for this pest is to wash the plants with a soapy solution of nicotine, or other insecticide, using a powerful spray.

Other important animal enemies are wireworms (the larvae of click beetles), which damage the young shoots below ground level, and red spiders (*Tetranychus altheae,* v. Haust.), which attack the leaves, particularly in dry weather.

Harvesting.—English hops are ready to harvest at the end of August or beginning of September. The signs of ripeness are as follows: the "seeds" become firm in texture and purplish in colour, the cones become crisp and rustle when pressed in the hand and develop their characteristic aroma.

The hops are picked into baskets, of five or six bushels capacity, or bins of loose sacking suspended on a light wooden framework. The pickers are organized into companies of six to ten baskets or bins, each company being in charge of a "binman" who is responsible for the work of the company. The price paid for picking varies from 2d. to 3d. a bushel according to the nature of the crop.

The hops are taken from the garden in loosely woven bags ("green bags" or "pokes"), holding ten bushels, to the kilns where they are dried as soon as possible after picking. In Kent the buildings containing the kilns are known as oast houses. The common kiln is built of brick, the wall being either circular or square, 18 or 20ft. in diameter or side and about 16ft. in height. From this a tiled roof, sealed inside with lath and plaster, extends in conical or pyramidal shape a further 18 to 24 feet. The roof terminates in an opening about 3ft. in diameter surmounted by a wooden cowl pivoted and provided with a vane, so that its opening is always away from the wind. An open batten floor is fixed in the kiln about 14ft. from ground level and upon this is laid a loosely woven horsehair cloth. In the lower part an open fire of anthracite burns in a brick fireplace. The hops are placed on the horsehair cloth ("hair") to a depth of 8 to 16in. and are dried by the hot air and products of combustion which pass through them from the fire.

The operation of the kiln requires very skilful management; a mistake in drying may reduce the commercial value of the hops enormously. Great care is necessary in the control of temperature; a thermometer is fitted below the "hair" floor to guide the dryer. At first the temperature is kept comparatively low, rising gradually from about 100° F at the time of loading to about 150° F at the end of four hours and reaching the maximum of 160° F at the end of the sixth hour. The rate at which the temperature is allowed to rise is, however, intimately connected with the strength of the draught. Nine or ten hours are generally required to dry a load.

The hops when dry are removed from the kiln, care being taken not to break the cones (which are then in a brittle condition) as breakage causes the loss of lupulin—the valuable part of the hop. They are allowed to remain exposed to the air for a few hours during which the residual moisture becomes more evenly distributed and some moisture is absorbed from the atmosphere. In America the hops are allowed to remain in this state for some weeks before being baled, but in England they are pressed into "pockets" (large bags made of stout jute sacking about 6ft. in length and 2ft. diameter) after four or five hours' exposure. Each pocket contains just over 1½cwt. of hops and is marked with a serial number, the name of the grower, parish, district and year of growth.

The pockets are sent by the grower to a hop factor who cuts a sample of about 1lb. from each pocket and by these samples sells the hops to hop merchants who, in turn, sell them to brewers.

For further information on the cultivation of hops, *see* "Cultivation, Diseases and Insect Pests of the Hop Crop" (Ministry of Agriculture and Fisheries) and the articles on "Hops" and "Diseases of Hops" in vol. iv., *Farm Crops* (The Gresham Publishing Company Ltd).

(A. H B.)

UNITED STATES

The growing of hops in the United States started in Virginia about 1648. Thereafter the industry shifted to New York and Wisconsin, and then to the Pacific coast, which now produces practically all the hops grown in the United States.

On the Pacific coast, hop farms are always called hop ranches and are located alongside or very close to rivers because of their need of an abundant water supply. At the same time, lands for hop growing must be well drained, as hops are easily drowned. Hops require exceptionally rich and deep soil, the roots often going to a depth of 20 feet. Nearly all hops on the Pacific coast are grown on the high wire trellis system, which runs between 16 and 20 ft. from the ground level.

The spraying of hop vines with insecticides is a guarantee against hop aphis if it is efficiently done throughout the hop growing season, but the expense of such spraying is too large a factor of cost for the hop growers to stand except when hops can be sold at prices well above 20 to 25 cents per pound. Hence when the prospects are such that hops must be sold below that price, less spraying against the aphis is done by the grower and the risk of loss or damage of the hop crop is greater. In some years the loss or damage of the hop crop in Oregon, western Washington and Sonoma county, Calif., by insufficient or inefficient spraying represents over 50% of the value of the crop.

During the past 15 years the consumption of hops within the United States, the export of hops from the United States and the prices of hops, have been subject to violent changes National Prohibition reduced the consumption of hops from about 35,000,000 lb. in 1914 to about 6,000,000 lb. in 1920. It is (1928) about 18,000,000 lb. per year. The United States exports of hops, which ran as high as 31,000,000 lb. in 1919, fell to about 11,600,000 lb. in 1927.

The controlling factor that determines the brewing value of

the hop is its quantity of brewing soluble resins. In that respect the Pacific coast hops are far richer than any other hops grown in the world. It is not uncommon for Pacific coast hops to run as high as 20% in resin content, nor is it uncommon for the best foreign hops to run as low as 10%. Pacific coast hops average about 30 to 40% richer in brewing resins than English and Continental hops.

By far the largest hop farms in the world are on the Pacific coast. One of its farms has 650 ac. in hops, all grown on the high trellis system. This farm is only one of a number of hop ranches owned and operated by the same company which grew in 1927 a total of 2,500 ac. of hops in various districts of the Pacific coast.

Hop Picking by Machine.—In California a large part of the hop crop is picked by machines invented by E. Clemens Horst. The advantages of machine picking are absolute cleanliness of the hops, complete picking, lower harvest cost, fewer workers and the opportunity to harvest hops both by day and by night, regardless of weather conditions. To pick hops by machine, they must be grown on the high wire trellis system. The vines are carried on wagons from the fields to the picking machine, which is located alongside the hop drying houses.

The theoretical picking capacity of one machine is 30 vines per minute; on the basis of 1,000 hop hills per acre and at 2 hop vines per hill, this would require 50 min. to pick an acre of hops, or 12 ac. of hops in a 10-hour day. The actual working capacity for machine runs from 5 to 6 ac. of hops per 10-hour day, according to the quantity of hops on the vines and the efficiency of the machine crew. A total of 60 persons is necessary to cut and load the hop vines in the field, haul them to the machine, operate the machines and deliver the clean hops to the hop drying floors.

Hop-drying.—The temperature at which hops are dried is one of the controlling factors in fixing the value of the hops for brewing purposes. The lower the maximum temperature used in drying the hops, the better will be their quality, because the higher the temperature, the greater will be the conversion of the resins that are soluble in the brewing process, into those that are insoluble and therefore useless. The lower the maximum temperature used, the smaller will be the aromatic oils of the hops. Some of the most desirable aromatic oils of the hops volatilize and are lost at temperatures of 100° F.

On the Pacific coast practically all the hop drying is done in stove kilns, thus avoiding any contact of the fuel fumes with the hops. The largest hop-growing company of the Pacific coast dries nearly all its hops by the heated air-drying system in which the air is driven through the hops with fan blowers, thus accomplishing the drying in about one-half the usual time and at very much lower temperatures. In 1927 this company developed a successful plan by which hops are dried by air at a natural outdoor temperature. This results in hops of the very highest quality both in aromatic oils and in soluble brewing resins. The method requires about ten times the drying floor space that is necessitated by the heated air-drying system. Large fan blowers are used to blow the natural air through the hops. (E. C. H.)

HOPE, ANTHONY, the pen-name of Sir ANTHONY HOPE HAWKINS (1863–), British novelist, who was born on Feb. 9, 1863, the second son of the Rev. E. C. Hawkins, vicar of St. Bride's, Fleet Street, London. He was educated at Marlborough and Balliol College, Oxford, where he was president of the Union Society. He was called to the bar at the Middle Temple in 1877. He won a great popular success with the publication (May 1894) of *The Prisoner of Zenda.* This was followed a few weeks later by *The Dolly Dialogues* (previously published in separate instalments in the *Westminster Gazette*). *The Prisoner of Zenda,* owing something to the *Prince Otto* of R. L. Stevenson, established a fashion for what was christened, after its fictitious locality, "Ruritanian romance"; while the *Dolly Dialogues* was the forerunner of a whole school of epigrammatic drawing-room comedy. A dramatic version of *The Prisoner of Zenda,* with Sir George (then Mr.) Alexander as "Rupert Rassendyll," had a long run at the St. James's Theatre. In 1894 also appeared *The God in the Car,* a novel suggested by the influence on English society of Cecil Rhodes's career; and *Half a Hero,* a complementary study of Australian politics. In a series of novels Anthony Hope advanced from his light comedy and gallant romantic inventions to the graver kind of fiction of which *The God in the Car* had been an earlier essay. Other notable novels were: *Quisante* (1900), a study of English society face to face with a political genius of an alien type; *Tristram of Blent* (1901), a study of family pride; the witty *The Intrusions of Peggy* (1902); *Double Harness* (1904); *A Servant of the Public* (1905); *The Great Miss Driver* (1908) and *Second String* (1909). Mr. Hawkins married (1903) Miss Elizabeth Somerville Sheldon of New York. He was knighted in 1918.

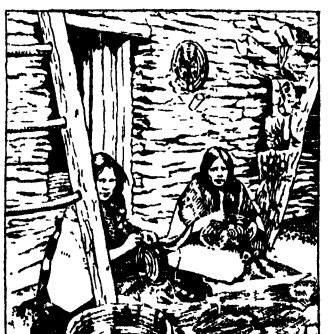
See his *Memories and Notes* (1927).

HOPE, THOMAS ["Anastasius"] (*c.* 1770–1831), English collector, born in London about 1770, was the eldest son of John Hope of Amsterdam, and was descended from a Scottish family of London and Amsterdam merchants. About the age of eighteen he travelled widely in Europe, Asia and Africa, making a large collection of works of art. On his return to London about 1796 he bought a house in Duchess Street, Cavendish Square. In 1807 he published sketches of his furniture, accompanied by letterpress, in a folio volume, entitled *Household Furniture and Interior Decoration,* which had considerable influence on interior decoration, notwithstanding Byron's scornful reference to "House-furnisher withal, one Thomas hight." Hope's furniture designs were in that pseudo-classical manner known as "English Empire." In 1819 he published anonymously *Anastasius, or Memoirs of a Modern Greek, written at the close of the 18th century.* It was at first generally attributed to Lord Byron, who told Lady Blessington that he wept bitterly on reading it because he had not written it and Hope had. Hope died on Feb. 3, 1831.

HOPE, a city of Hempstead county, Arkansas, U.S.A., in the south-western part of the State; on Federal highway 67, and served by the Frisco, the Louisiana and Arkansas and the Missouri Pacific railways. The population was 4,790 in 1920 (29% negroes). It is an important shipping point for cotton, lumber, cattle and hides, and for lumber products from its own mills.

HOPFEN, HANS VON (1835–1904), German novelist and poet, born at Munich on Jan. 3, 1835, became one of the circle of young writers encouraged by Maximilian II. of Bavaria. His early songs and ballads appeared in the *Münchener Dichterbuch.* In 1866 he settled in Berlin, where he died (at Lichterfelde) on Nov. 19, 1904. His novels include: *Peregretta* (1864); *Verdorben zu Paris* (1868, new ed. 1892); *Arge Sitten* (1869); *Der graue Freund* (1874, 2nd ed., 1876); and *Verfehlte Liebe* (1876, 2nd ed., 1879), while of his shorter stories *Tiroler Geschichten* (1884–85) command most favour.

An autobiographical sketch is contained in K. E. Franzos, *Geschichte des Erstlingswerkes* (1904).



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HOPI INDIANS WEAVING BASKETS

Hopi women work with fibre as other women work with yarn and thread. Here are two women constructing baskets of beautiful colour and intricate design

HOPI. A division of Shoshonean Indians in northern Arizona, inhabiting seven small towns and forming part of the Pueblo group. They are also known as Moki or Moqui and their district as Tusayan. They were discovered by Tobar of Coronado's expedition in 1540, annexed in 1598 by Oñate, missionized in 1629. After the Pueblo rebellion of 1680 most of the Hopi moved their towns on mesas for defence; only Oraibi perhaps still occupies the same site as in 1540. Soon after the rebellion, groups of Tewa from the Rio Grande established themselves among the Hopi; one of these remained and still preserves its old speech in the town of Hano. A single mission was re-established, at Awatobi, but permanently abandoned on the destruction of this pueblo by the other Hopi.

Awatobi and Oraibi were the largest towns in this period; Shongopovi, Mishongnovi and Walpi already existed; Sichomovi and Shipaulovi were founded in the 18th century. The population, perhaps 4,000 at discovery, has long been nearly stationary at about 2,000, nearly half of it in Oraibi until in recent years factionalism between the conservative and progressive elements in that town led to a secession and the founding of Hotavila.

Since their discovery, the Hopi have been the westernmost of the Pueblos. Spanish influence therefore rested lightly on them and native culture has been maintained more purely than at Zuñi, Acoma and especially the Rio Grande towns. The Hopi snake dance, perhaps the most famous native ceremony still practised in the United States, owes its interest and repute to the purity of its aboriginal flavour; except in details, it was like other Pueblo rites before these were modified or abandoned. The Hopi are also the last of the Pueblos to grow, spin and weave a native cotton.

See the series of monographs by Fewkes and Mindeleff in *Reports of the Bureau of American Ethnology*, and by Voth and Dorsey in *Publications of Field Museum of Natural History*. (A. L. K.)

HÖPKEN, ANDERS JOHAN, COUNT VON (1712–1789), Swedish statesman, was the son of Daniel Niklas Höpken, one of Arvid Horn's most determined opponents and a founder of the Hat party. When in 1738 the Hats came into power the younger Höpken obtained a seat in the secret committee of the diet, and during the Finnish war of 1741–42 was one of the two commissioners appointed to negotiate with Russia. During the diet of 1746–47 Höpken's influence was of the greatest importance. It was chiefly through his efforts that the estates issued a "national declaration" protesting against the arrogant attitude of the Russian ambassador, who attempted to dominate the crown prince Adolphus Frederick and the Government. This spirited policy restored the waning prestige of the Hat party and firmly established their anti-Muscovite system. In 1746 Höpken was created a senator. In 1751 he succeeded Gustaf Tessin as prime minister, and controlled the foreign policy of Sweden for the next nine years. On the outbreak of the Seven Years' War, he contracted an armed neutrality treaty with Denmark (1756); but in the following year acceded to the league against Frederick II. of Prussia. During the crisis of 1760–62, when the Hats were at last compelled to give an account of their stewardship, Höpken retired from the senate as well as from the premiership. After the revolution of 1772 he re-entered the senate, finally retiring in 1780 The noble style of Höpken's biographies and orations earned for him the title of the Swedish Tacitus. He helped to found the *Vetenskaps Akademi*, and when Gustavus III. in 1786 established the Swedish Academy, he gave Höpken the first place in it.

See L. G. de Geer, *Minne af Grefve A. J. von Höpken* (Stockholm, 1882); Carl Silfverstolpe, *Grefve Höpkens Skrifter* (Stockholm, 1890–93). (R. N. B.)

HOPKINS, ESEK (1718–1802), the first admiral of the U.S. navy, was born at Scituate, R.I., in 1718. He belonged to one of the most prominent Puritan families of New England. At the age of 20 he went to sea and rapidly came to the front as a good sailor and skilful trader. Marrying, three years later, into a prosperous family of Newport, he became commodore of a fleet of 17 merchantmen, the movements of which he directed with skill and energy. In war as well as peace, Hopkins was establishing his reputation as one of the leading colonial seamen, for as captain of a privateer he made brilliant and successful ventures during the Seven Years' War. At the outbreak of the Revolutionary War Hopkins was appointed brigadier-general by Rhode Island, was commissioned, in Dec. 1775, by the Continental Congress, commander-in-chief of the navy, and in Jan. 1776, hoisted his flag as admiral of the eight converted merchantmen which then constituted the navy of the United States. His first cruise resulted in a great acquisition of material of war and an indecisive fight with H.M.S. "Glasgow." At first this created great enthusiasm, but criticism soon made itself heard. Hopkins and two of his captains were tried for breach of orders, and, though ably defended by John Adams, were censured by Congress. The commands, nevertheless, were not interfered with, and a prize was soon afterwards named after the admiral by their orders. But the difficulties and mutual distrust continually increased, and in 1777 Congress summarily dismissed Hopkins from his command, on the complaint of some of his officers. Before the order arrived, the admiral had detected the conspiracy against him, and had had the ringleaders tried and degraded by court-martial. But the Congress followed up its order by dismissing him from the navy. For the rest of his life he lived in Rhode Island, playing a prominent part in State politics. He died at Providence in 1802.

See Edward Field, *Life of Esek Hopkins* (Providence, 1898); also an article by R. Grieve in the *New England Magazine* of Nov. 1897.

HOPKINS, SIR FREDERICK GOWLAND (1861–), biochemist, was born in 1861 at Eastbourne. He was educated at private schools and his first technical training was received in the laboratory of a consulting chemist. In 1888 he began his medical studies at Guy's hospital, and was at the same time appointed the first holder of the research studentship founded in memory of Sir William Gull. He combined activities in research with clinical work, and after taking his degree at the University of London in 1894 became a member of the staff of the medical school of Guy's. In 1898 he married Jessie Stevens, daughter of Edward Stevens of St. Lawrence, Kent, and in the following year was called by Sir Michael Foster to Cambridge where he joined the illustrious school of physiology which Foster was founding. From 1905 to 1910 he was a tutor at Emmanuel college but after that time Trinity college created the post of praelector in physiological chemistry specially for him.

His first research (*Philos. Trans. Roy. Soc.* 1895, *186B* 661) was of an academic character. He showed that the wing pigments of certain butterflies were derivatives of uric acid, and gave a new turn to thought concerning animal pigmentation by demonstrating that excretory substances may function in ornament. At this time much interest was taken in uric acid in medical circles and Hopkins contrived a method for its quantitative estimation which was for a long time the standard technique (*Proc. Roy. Soc.* 1892, *52* 93, and *Journ. Pathol. and Bacteriol.* 1893 i. 451). He himself applied it to a wide range of physiological and pathological questions. He early realized that one of the urgent needs of biochemistry, then entering its modern phase under Hoppe-Seyler and Hofmeister, was accurate knowledge of the proteins. While at Guy's he concerned himself with methods for obtaining pure material for study in this domain (*Journ. Physiol.* 1900 *25* 306) and his first publication from Cambridge (F G. Hopkins and S. N. Pincus., *Journ. Physiol.* 1899 *23* 130) described a crystalline egg-albumin which displayed the properties of a pure substance. Shortly afterwards he succeeded (with S. W. Cole) in isolating from proteins the amino-acid tryptophane (F. G. Hopkins and S. W. Cole, *Journ. Physiol.* 1901 *27* 418). In 1905 he was elected to the Royal Society and in the following year laid the foundation, in collaboration with Fletcher, of our knowledge of the chemistry of muscular contraction by his researches into lactic acid production in muscle (F. G. Hopkins and W. Fletcher, *Journ. Physiol.* 1906 *35* 247). In the same year he published preliminary reports of experiments involving "pure diets" which proved the existence of essential amino-acids (F G. Hopkins and C. Willcock, *Journ. Physiol.* 1906 *35* 88) and of those accessory factors in foods which were afterwards to be known by the name of vitamines (*Analyst*, 1906 *31* 395). Another important research was that of 1910 (with Savory) on Bence-Jones protein (F. G. Hopkins and G. Savory, *Journ. Physiol.* 1910 *42* 189) and two years later the full results of the vitamine experiments were published (*Journ. Physiol.* 1912 *44* 425).

Up to this time the department of physiological chemistry at Cambridge had been but an appanage of the department of physiology and Hopkins had been reader in Biochemistry, but in 1913 biochemistry became an independent department with Hopkins as its first professor. In this year he was a sectional president of the British Association and his address "The Dynamic Side of Biochemistry" (*Ann. Reports Brit. Assoc.*, 1913) achieved an international renown. From 1913 to 1918 he wrote the biochemical section of the annual reports of the Chemical

Society. In 1915 the Royal College of Physicians awarded him its Baly medal and in 1917 he delivered the Croonian lecture to the Royal Society (F. G. Hopkins and W. Fletcher, *Proc. Roy. Soc.* 1917. 89 B 444), receiving its Royal Medal in 1918 and its Copley Medal in 1926. In 1921 a munificent bequest by the trustees of Sir William Dunn established the Cambridge biochemical department on a surer foundation and in the same year Hopkins made his most recent fundamental contribution to the science by isolating from living tissues the sulphur-containing dipeptide glutathione (*Biochem. Journ.* 1921: 15, 286) and by showing its great importance for the oxidations in living cells. He was knighted in 1925 and in 1927 chosen to deliver the opening address at the 12th International Physiological Congress at Stockholm. The further fruits of his work, other than the very numerous experimental papers of his students and associates can be seen in the present biochemical laboratory at the University of Cambridge with its 40 research workers covering an unprecedentedly wide field of investigation. (J. Ne.)

HOPKINS, MARK (1802–1887), American educationist, great-nephew of the theologian Samuel Hopkins, was born in Stockbridge, Mass., on Feb. 4, 1802. He graduated in 1824 at Williams college, where he was a tutor in 1825–27, and where in 1830, after having graduated in the previous year at the Berkshire Medical college at Pittsfield, he became professor of moral philosophy and rhetoric. He was president of Williams college from 1836 until 1872, but retained his professorship till his death on June 17, 1887. He was one of the ablest and most successful of the old type of college president, being particularly noted for his stressing of the development of the individual student.

For Mark Hopkins *see* monographs by F. Carter (1892) and L. W. Spring (1888), the latter being No. 4, vol. i., of the *Monographs of the Industrial Educational Association.*

HOPKINS, SAMUEL (1721–1803), American theologian, was born in Waterbury (Conn.), on Sept. 17, 1721. He graduated at Yale college in 1741; studied divinity at Northampton (Mass.), with Jonathan Edwards; was licensed to preach in 1742, and in Dec. 1743 was ordained pastor of the church in the North Parish of Sheffield, or Housatonick (now Great Barrington, Mass.). There he laboured until 1769, for part of the time in intimate association with his old teacher, Edwards, whose call to Stockbridge he had been instrumental in procuring. Opposition to his theological views caused his dismissal, and from April 1770 until his death on Dec. 20, 1803, he was the pastor of the First Church in Newport (R.I.), though he preached elsewhere while Newport was occupied by the British. Personally he was remarkable for force and energy of character and for the utter fearlessness with which he followed premises to their conclusions. Though he was originally a slave-holder, to him belongs the honour of having been the first among the Congregational ministers of New England to denounce slavery both by voice and pen.

Among his publications are a valuable *Life and Character of Jonathan Edwards* (1799), and numerous pamphlets and addresses, including *A Dialogue . . . showing it to be the Duty and Interest of the American States to emancipate all their African Slaves* (1776), and *A Discourse upon the Slave Trade* (1793). His distinctive theological tenets are to be found in his important work, *A System of Doctrines Contained in Divine Revelation, Explained and Defended* (1793), which has had an influence hardly inferior to that exercised by the writings of Edwards himself. They may be summed up as follows: God so rules the universe as to produce its highest happiness, considered as a whole. Since God's sovereignty is absolute, sin must be, by divine permission, a means by which this happiness of the whole is secured, though that this is its consequence, renders it no less heinous in the sinner. Virtue consists in preference for the good of the whole to any private advantage; hence the really virtuous man must willingly accept any disposition of himself that God may deem wise—a doctrine often called "willingness to be damned." All have natural power to choose the right, and are therefore responsible for their acts; but all men lack inclination to choose the right unless the existing "bias" of their wills is transformed by the power of God from self-seeking into an effective inclination towards virtue.

Bibliography.—The best edition of Hopkins's *Works* (1852) contains an excellent biographical sketch by E. A. Park. In 1854 was published separately Hopkins's *Treatise on the Millennium. See* also Stephen West's *Sketches of the Life of the Late Reverend Samuel Hopkins* (Hartford, Conn., 1805); B. Dexter's *Biographical Sketches and Annals of Yale College* (1907); and Williston Walker's *Ten New England Leaders* (1901). (W. W.)

HOPKINSON, FRANCIS (1737–1791), American author and statesman, one of the signers of the Declaration of Independence, was born in Philadelphia (Pa.), Sept. 21, 1737. By his father, Thomas Hopkinson, a lawyer, first president of the American Philosophical Society, and a trustee of the college, he was enrolled as the first student in the College of Philadelphia (now the University of Pennsylvania), from which he received his bachelor's degree in 1757, his master's in 1760, and the degree of LL.D. in 1790. He aided the revolutionary movement and the later struggle for the adoption of the Constitution by a series of prose and poetic satires, which were widely reprinted and most effective. Perhaps the best known are *A Pretty Story* (1774); *A Prophecy; The Battle of the Kegs;* and *The New Roof, A Song for Federal Mechanics.* He died on May 9, 1791. His *Miscellaneous Essays and Occasional Writings* was published in 1792. Much of his work has never been reprinted from contemporary magazines.

His son Joseph Hopkinson (1770–1842), also a lawyer, legislator and judge, is best known as author of the patriotic anthem *Hail Columbia.*

See G. E. Hastings, *The Life and Works of Francis Hopkinson* (1926), which contains an excellent bibliography, and O. G. Sonneck's *Francis Hopkinson, the First American Poet-Composer* (1905).

HOPKINSON, JOHN (1849–1898), English engineer and physicist, was born in Manchester on July 27, 1849. After a brilliant career at Cambridge and London universities, he became a pupil in the engineering works in which his father was a partner. In 1872 he undertook the duties of engineering manager in the glass manufactories of Messrs. Chance Brothers and Company at Birmingham. Six years later he removed to London, where he established a most successful practice as a consulting engineer. His work was mainly electrical, and his services were in great demand as an expert witness in patent cases. In 1890 he was appointed director of the Siemens laboratory at King's college, London, with the title of professor of electrical engineering. His death occurred prematurely on Aug. 27, 1898, when he was killed, together with one son and two daughters, by an accident while climbing the Petite Dent de Veisivi, above Evolena. Hopkinson presented a rare combination of practical with theoretical ability. His name is best known in connection with electricity and magnetism. He worked out the general theory of the magnetic circuit in the dynamo (in conjunction with his brother Edward), and the theory of alternating currents, and conducted a series of observations on the phenomena attending magnetization in iron and nickel and the curious alloys of the two which can exist both in a magnetic and non-magnetic state at the same temperature. By the application of the principles he elucidated, he furthered to an immense extent the employment of electricity for the purposes of daily life. He made great improvements in the design and efficiency of the dynamo. Hopkinson took a leading part in the development of the three-wire system and the closed-circuit transformer used in the distribution of electric current and he introduced the series-parallel method of working motors. During his work with Messrs. Chance, Hopkinson turned his attention to problems of lighthouse illumination, and he was able to devise improvements in both the catoptric and dioptric methods for concentrating and directing the beam. He was a strong advocate of the group-flashing system as a means of differentiating lights, and invented an arrangement for carrying it into effect optically. He further undertook researches on electrostatic capacity, the phenomena of the residual charge, and other problems arising out of Clerk Maxwell's electro-magnetic theory.

His original papers were collected and published, with a memoir by his son, in 1901.

HOPKINSVILLE, a city of south-western Kentucky, U.S.A., 100m. S. of Evansville, Ind.; the county seat of Christian county.

It is on Federal highways 41, 241 and 68 and is served by the Illinois Central, the Louisville and Nashville, and the Tennessee Central railways. The population was 9,696 in 1920 (38% negroes) and was estimated locally at 14,000 in 1928. It is the seat of the Western State hospital for the insane and of Bethel Woman's college (Baptist; founded 1854); has the largest dark-fired tobacco market in the country and a large mule and live stock market; and its manufactures include flour, brick, crushed stone, cigar boxes, furniture, shirts and overalls. Race-horses are bred in the vicinity. When Christian county was created in 1797 Hopkinsville (originally called Elizabethtown), was made the county seat, and was renamed in honour of Samuel Hopkins (*c.* 1750–1819), a Kentucky pioneer and an officer in the Revolution. The town was incorporated in 1798, was chartered as a city in 1897, and in 1916 adopted a commission form of government.

HOPPE-SEYLER, FELIX (1825–1895), German physiologist, became in 1856 assistant to Virchow in Berlin, in 1864 professor of applied chemistry at Tübingen and in 1872 professor of physiological chemistry at Strasbourg. He pursued important researches on blood and metabolism, and was the first to obtain lecithin in the pure state. His most important studies concern milk, bile, urine and chlorophyll. He wrote a handbook of chemical analysis applied to physiology and pathology (1858) and a *treatise on physiological chemistry* (1877).

HOPPNER, JOHN (1758–1810), English portrait-painter, was born, it is said, on April 4, 1758, at Whitechapel. His father was of German extraction, and his mother was one of the German attendants at the royal palace. Hoppner received the patronage of George III., whose regard for him gave rise to the report that he was the king's natural son. As a boy he was a chorister at the royal chapel, and in 1775 entered as a student at the Royal Academy. In 1778 he took a silver medal for drawing from the life, and in 1782 the Academy's highest award, the gold medal for historical painting, his subject being King Lear. He first exhibited at the Royal Academy in 1780. His earliest love was for landscape, but necessity obliged him to turn to the more lucrative business of portrait-painting. At once successful, he had, throughout life, the most fashionable and wealthy sitters, and was the greatest rival of the growing attraction of Lawrence Ideal subjects were very rarely attempted by Hoppner, though a "Sleeping Venus," "Belisarius," "Jupiter and Io," a "Bacchante" and "Cupid and Psyche" are mentioned among his works. The prince of Wales especially patronized him, and many of his finest portraits are in the state apartments at St. James's Palace, the best perhaps being those of the prince, the duke and duchess of York, of Lord Rodney and of Lord Nelson. Among his other sitters were Sir Walter Scott, Wellington, Frere and Sir George Beaumont. A *Series of Portraits of Ladies* was published by him in 1803, and a volume of translations of Eastern tales into English verse in 1805. Hoppner died on Jan. 23, 1810.

He was confessedly an imitator of Reynolds. When first painted, his works were much admired for the brilliancy and harmony of their colouring, but the injury due to destructive mediums and lapse of time which many of them suffered caused a great depreciation in his reputation. The appearance, however, of some of his pictures in good condition has shown that his fame as a brilliant colourist was well founded.

The best account of Hoppner's life and paintings is the exhaustive work by William McKay and W. Roberts (1909).

HOP-SCOTCH, an old English children's game in which a small object, like a flat stone, is kicked by the player while hopping from one division to another of an oblong space marked upon the ground and divided into 10 or 12 numbered divisions. The stone must rest in each successively, without touching a line or going out of the division aimed for. The game consists in driving the stone into each division and back to the starting point.

HOPTON, RALPH HOPTON, BARON (1598–1652), Royalist commander in the English Civil War, was the son of Robert Hopton of Witham, Somerset. He appears to have been educated at Lincoln college, Oxford, and to have served in the army of the elector palatine in the early campaigns of the Thirty Years' War, and in 1624 he was lieutenant-colonel of a regiment raised in England to serve in Mansfeld's army. Charles I., at his coronation, made Hopton a Knight of the Bath. Hopton, as member of parliament successively for Bath, Somerset and Wells, at first opposed the royal policy, but after Strafford's attainder (for which he voted) he gradually became an ardent supporter of Charles, and at the beginning of the Great Rebellion he was made lieutenant-general under the marquess of Hertford in the west. His first achievement was the rallying of Cornwall to the royal cause, his next to carry the war from that county into Devon. In May 1643 he won the brilliant victory of Stratton, in June he overran Devon, and on July 5 he inflicted a severe defeat on Sir William Waller at Lansdown. In the last action he was severely wounded by the explosion of a powder-wagon and he was soon after shut up in Devizes by Waller, where he defended himself until relieved by the victory of Roundway Down on July 13. He was created Baron Hopton of Stratton. But his successes in the west were cut short by the defeat of Cheriton or Alresford in March 1644 After this he served in the western campaign under Charles's own command, and towards the end of the war, after Lord Goring had left England, he succeeded to the command of the royal army, which his predecessor had allowed to waste away in indiscipline. It was no longer possible to stem the tide of the parliament's victory, and Hopton, defeated in his last stand at Torrington (Feb 16, 1646), surrendered to Fairfax. Subsequently he accompanied the prince of Wales in his attempts to prolong the war in the Scilly and Channel islands. He died in exile, at Bruges in Sept. 1652.

HOQUIAM (hō'-kwī-ăm), a city of Grays Harbor county, Washington, U.S.A., on Grays Harbor, at the mouth of the Hoquiam river, 12m. from the ocean, adjoining the city of Aberdeen on the west. It is on the Olympic highway; is served by the Chicago, Milwaukee, St. Paul and Pacific, Northern Pacific and the Union Pacific railways; and has a municipal airport The population was 2,608 in 1900; 10,058 in 1920; and was estimated locally at 15,500 in 1928.

The Port of Grays Harbor (*see* ABERDEEN), the greatest lumber-shipping port in the country, and one of the greatest in the world, is at the junction of the two cities, the terminals lying within the bounds of Hoquiam. The commercial and industrial interests of the cities are identical. Back of them, in the Olympic Peninsula, is the greatest remaining stand of evergreen timber in the country. Hoquiam has giant saw-mills; door, veneer and other woodworking plants; a steel foundry; and canneries handling fruit and vegetables, clams and salmon. The pulp and paper industry has begun to develop. In 1927 the output of the factories within the city limits was valued at $20,000,000 Hoquiam is the gateway to the vast recreational area of the Olympic Peninsula, which contains Lake Quinault, the Olympic National Forest, Mount Olympus National Monument, and numerous sea-side resorts. The Quinault Indian Reservation is on the coast, to the north-west. Hoquiam was settled in 1882 and incorporated in 1889. The name is a modification of an Indian word meaning "hungry for wood."

HOR, MOUNT, the scene of Aaron's death, according to the Bible, and since the time of Josephus, generally identified with Jabal Hārōn, about 4,500 ft., near Petra. A shrine on the summit is said to cover the grave of Aaron, and is an object of pilgrimage to the surrounding tribes, but it is obviously of comparatively modern construction. This identification is challenged by many, and other localities have been suggested, *e.g.*, J. Madāra, Hermon, etc.

See Numbers, xxxiii. 37 and xxxiv. 7, 8.

HORACE (65–8 B.C.), Quintus Horatius Flaccus, second only in fame to Virgil amongst those Roman poets whose work is still extant, was born on Dec. 8, 65 B.C., two years before the birth of Augustus Caesar, and ten years before the first invasion of Britain by Julius, in the Consulship of L. Aurelius Cotta and L Manlius Torquatus. His works comprise four books of odes (*Carmina*), one of epodes, two of satires (or *sermones*), two of epistles, the *Carmen Saeculare*, and the letter to the Pisos called the *De Arte Poetica*. The main authorities for the facts of his life are the references in his own works, and a short essay by Suetonius. His birthplace was Venusia, a town on the borders of Apulia and

Lucania (*Lucanus an Apulus anceps*). He was the son of a freedman (*libertinus*), who received the name Horatius either because he was manumitted by one of the patrician family of Horatii or else because Venusia belonged to the Horatian tribe. To this father Horace owed a debt of gratitude which he has handed down to posterity in one of the pleasantest passages of his satires. The man was either a collector of taxes or of payments at auctions. He was not rich. His plot of land was unproductive. But he would not send his son to the school at Venusia to be educated amongst the children of the self-important local farmers and retired centurions. He took the boy himself to Rome, where he could receive a more liberal education, attended him to the schools, and so watched over his character and morals that, as the poet tells us, he preserved them from any taint of blame. (*Satires,* I., vi.) Under the name of Orbilius Horace has also rendered immortal one of his schoolmasters who grounded him by the free use of the cane in the Greek of Homer and the Latin of Livius Andronicus. From Rome the young student proceeded to Athens, then the university of the world. But he has left us no account of his residence in that city, nor of the academic courses in Greek poetry and philosophy of which he afterwards made such profitable use. He was still at Athens when the murder of Julius Caesar brought Brutus to Greece, and like other young Romans, Horace rallied to the republican cause. He appears to have proceeded with Brutus to Asia Minor, and when the army to resist Octavius and Antony was raised, he was given, despite his youth and inexperience (*imbellis et firmus parum*), the post of a military tribune, which entailed the command of a sixth part of a Roman legion. He fought in the battle of Philippi, 42 B.C., and has left it on record that he threw away his shield (*Od.* II. vii. 10), a playful reference to the defeat of his side which has been much debated by commentators, some of whom seem too apt to demand all the heroic virtues from any author who may form the subject of their notes. Horace speaks of himself as having been rescued, trembling, by Mercury, who wrapped him in a mist; and whilst, on the one hand, we need not press too closely a poet's description of his conduct during a rout, it is fairly obvious that a man of tact and humour would not boast overmuch of his bravery in defence of a cause which he afterwards forsook. Horace might, presumably, after Philippi, have joined the fleet of Sextus Pompeius, or have committed suicide. Happily he did neither, and was saved.

Of the circumstances in which he returned to Rome, after the amnesty granted by the conquerors, nothing is known, except that he found himself in want, "*decisis humilem pennis inopemque paterni et laris et fundi*" (*Ep.* II., ii. 50). His paternal property, that is to say, was confiscated, Venusia being one of the 18 cities awarded, after the Roman custom, to the victorious troops. He was on the wrong side in politics, and without friends, but he managed to secure the minor post of a scribe in the Quaestor's office. He also began to write verse. Poverty, he says, was his inspiration.

> Paupertas impulit audax
> Ut versus facerem.
>
> *Epist.* II., ii., 51.

The meaning of these words has been questioned. It has been thought, but this must remain doubtful, that early satirical efforts of Horace, which have not come down to us, may have been directed against the new régime, and that it was not merely the friendship which he now formed with Virgil, Varius and Asinius Pollio which introduced him to Maecenas, but in part the wise policy of that lover of literature and friend of Augustus, who made a practice of disarming criticism by patronage. At least it is certain that in his first interview with Maecenas Horace felt confusion and shame (*Sat:* I, vi., 54). But this may have been the natural attitude of a freedman's son in talking to a lineal descendant of Etruscan kings. Maecenas at any rate, grew to like him, and they formed a friendship which lasted for life. Apart from frequent apostrophes and references in the poet's own work, we have a surer testimony in the dying words of the courtier to his imperial master:

> Horati Flacci ut mei memor esto

Augustus also extended to the young writer his favour and confidence to so marked an extent that when in need of a secretary, he begged Maecenas to spare him his protégé: and when Horace declined, showed no resentment, but continued his efforts to gain the poet's good will. The attitude is characteristic of Augustus, but it marks also the estimation in which Horace came to be held during one of those comparatively rare periods of history in which monarchs and statesmen have possessed a genuine taste for literature. For Horace, if persuaded to the imperial cause, showed himself no effusive flatterer, and has deservedly won admiration for preserving a certain simplicity and independence of outlook in a Rome that was presently to become a forcing ground for sycophancy and corruption. Of his life, when established in the society of the capital, there are no outstanding incidents to be told. Maecenas gave him a small property among the Sabine hills, north-east of Tibur, which is still a place of pious pilgrimage even for many who have little knowledge of Latin verse, and this farm was the poet's delight:

> satis beatus unicis Sabinis (*Od.* II., xviii., 14).

There he loved to retire, to meditate, to write, and to be far from indifferent to the flavour of wine. In Rome he was contented with a very modest establishment (*Sat:* I vi. 114). An amused spectator of the pastimes and follies of the metropolis, he was a genuine lover of the countryside. He remembers fondly the resounding Aufidus, the familiar river of his youth, and in another place associates it with his hope of poetic immortality:

> ... usque ego postera
> crescam laude recens, dum Capitolium
> scandet cum tacita virgine pontifex.
> dicar, qua violens obstrepit Aufidus
> et qua pauper aquae Daunus agrestium
> regnavit populorum. Od. III., xxx. 7

He tells us how in his childhood the wood-pigeons covered him with leaves when he was asleep on the hillside of Monte Voltore, and how the protection of the Muses enabled him to escape at Philippi the dangers of a falling tree, and shipwreck off Palinurus. He is never tired of alluding to the rustic surroundings that he loves, and of picturing himself in the enjoyment of them, of depreciating with mock modesty his own talents, his religious zeal (*parcus deorum cultor et infrequens*) of writing descriptions of his pleasant but homely feasts. In the city we see him a late riser, reading a little, playing at ball, bathing and dining, strolling round the Circus or the Forum, vastly interested in fortune-tellers, in sorcerers, an observer of life rather than an eager pursuer of luxury and fashion.

He never married. It was not very fashionable, nor, we may say, very necessary, among literary men of the period to do so. He describes himself, at the age of 44, as being short, prematurely grey, fond of basking in the sun, quick-tempered but easily appeased. He was also stout. Augustus (if we are to believe Suetonius) mentioned this, together with his shortness of stature, in a jesting letter written to acknowledge the receipt of one of his books.

That he made many friends, and held them in affectionate esteem, the number of odes which take the form of invitations to his country hospitality abundantly proves. Nor can the depth of his friendship be doubted:

> Navis quae tibi creditum
> Debes Virgilium, finibus Atticis
> Reddas incolumem, precor,
> Et serves animae dimidium meae.
> Od. I., iii. 5

Virgil is his "other self." But his amatory addresses read often like exercises.

Of the many love affairs to which he alludes in his various writings, it may be safely surmised that some are imaginary, and those which have a foundation of truth were neither more reputable, nor more permanently disturbing to his emotions, than those of his pagan contemporaries. But he gives the impression of having outgrown in later life not only the violence of passion, but also the taste for dissipation, and having brought himself by degrees to find more delight in good company and philosophy than in the looser pleasures which at one time he certainly did not disdain.

Lenior et melior fis accedente senecta. (*Epist.* II., ii., 211)

His Epicurean philosophy seems to have been tempered in part by an occasional leaning towards Stoicism, in part by a genuine admiration for the simple virtues of the Sabine peasantry.

Quod si pudica mulier in partem juvet
Domum atque dulces liberos
(Sabina qualis aut perusta solibus
Pernicis uxor Apuli)
Sacrum vetustis exstruat lignis focum
Lassi sub adventum viri. *Epod.* ii.

He is a hedonist who moralizes on moderation and good sense, an agnostic with a touch of superstition—derived rather perhaps from his rustic origin than from any lingering reverence for the half-Hellenised mythology which he exploits so well.

He died in the month of November, 8 B.C. having almost completed his 57th year, of a sudden and severe illness which left him too weak to sign his will: but, according to a common custom of the time, he bequeathed by word of mouth his property to the emperor. He was buried on the extreme part of the Esquiline Hill, near the tomb of Maecenas, who had died about the middle of the same year.

Satires.—Of the permanent value of his poetry it is not easy to form a just estimate, because of the imitative quality of the task which he set himself and the limitations which it prescribed. He began as a writer of satires, the word *satira* or *satura* having at the time a technical significance in Rome. It was the only branch of Roman literature that was not formed on a Greek model (*satira quidem tota nostra est,* Quintilian, X., i., 93), although in the hands of Lucilius, its inventor, it already used a Greek measure, the hexameter, as well as the more native trochaic metre, for its expression. Lucilius aspired to be in Rome what the great Attic comedians had been in their age, but by writing direct satire instead of comedy. His works, except for a few fragments, have perished. Horace set out to adapt the hexameter, very rude and harsh in Lucilius, to the needs of satirical verse, and to embody therein his reflections on the Rome of his day. He succeeded marvellously in remoulding this heroic measure to fit the common speech demanded by his theme, and the facility with which Juvenal followed him in its use shows how well the work had been done. But the satires of Horace have none of the prophetic rage of Juvenal. They pillory types—the miser, the legacy hunter, the parasite, the nouveau riche, but exhibit no philosophy of anger against the conditions of the age. Between the publication of the first and second books the poet had received from Maecenas the Sabine farm, and acquired also, it may be gathered, a circle of kindly and critical readers, for he complains that there are some who consider him too bitter, others who say that his work is without force and too easy to produce. (*Sat.* II., i., 1.) From the sixth satire of this second book we learn that his intimacy with Maecenas has now lasted for seven years, a further indication, perhaps, that he may have written previous works which do not survive, as the output, even if we add the Epodes, published a year before the second book, seems small in comparison with the length of time. On the other hand the date of composition of some of the Odes may be considerably earlier than their publication.

Odes.—The Epodes are in lyrical form. If they are the iambi to which Horace refers in the lines

Parios ego primus iambos
Ostendi Latio, numeros animosque secutus
Archilochi. *Epod.* I., xix. 25

it is difficult to justify his claim, since other Roman poets, notably Catullus, had preceded him. Nor can it be said that either the personal lampoons or the other subjects treated in these poems rival Catullus in elegance or power. His talent did not ripen so early. The completion of the Epodes as a book is to be dated not long after the battle of Actium. It is to the Odes to which we must turn for Horace's true title to lyric fame both in his own eyes and amongst critics of succeeding generations. Both form and impulse are here borrowed from the Attic founts. Anacreon and Simonides, Sappho and Alcaeus are the models, and sometimes, especially at the beginning of an ode, they are followed not merely in outline, but in detail. In this respect, however, they differ in no way from the general body of Latin literature. No kind of verse, as is pointed out above, except satire was indigenous. The merit of Horace is to be decided by the extent to which, after the amazingly difficult task of taming his metres to the native tongue, he succeeded in showing feeling as well as rhetoric, beauty as well as grace.

His ingenuity, his subtle choice of epithets, his neat presentation of moral platitudes, have won the admiration of succeeding ages, established him as a text book in schools, and compelled the flattery of imitators and translators alike. The taste, the fancy, and the quality of playful irony which he brought to his work are not to be denied. But how far was he a great poet? Evidently he had not in his temperament the ardour of Catullus. He could never have reached the high solemnity of Lucretius or the strange mystical intensity of Virgil, if he had essayed the epic or the metaphysical muse. But he has not been altogether well served by his popularity. In the 18th century, when it was more important to write wittily than to write passionately, in the 19th century, when to have written as a gentleman for gentlemen, or for the sons of gentlemen, seemed a nobler thing than to be sublime, he acquired a prestige as a guide, philosopher and friend which must in any case have diverted attention from his more genuine claims. Furthermore, in the books of the Odes he mingles light themes with serious, or introduces into the same poem matters both grave and gay.

But where his subject allows, or, again, in moments of earnestness interrupting his frivolity, he well justifies a more serious consideration. To Ovid's mention of his rhythmical skill (*"numerous Horatius"*), and the tribute of Petronius, who praises him for his *curiosa felicitas,* justice compels us to add the *insurgit aliquando* of Quintilian. This quality of rising in a phrase above the playful or conventional nature of his theme appears particularly when he is stirred by a memory of the country in which he was born, of the country in which he lives, by a thought of the swift passing of years, the death of a friend, the greatness of the past history of Rome. He pretends to be a trifler, and, contrasting his aims with those of Pindar, writes.—

Ego, apis Matinae
More modoque
Grata carpentis thyma per laborem
Plurimum, circa nemus uvidique
Tiburis ripas, operosa parvus
Carmina fingo.

But in more than one place he shows a not unmerited confidence that he will survive as something more In his Odes, even occasionally in his other writings, he may be called the poet *malgré lui;* and no repetition in grammar books can make us insensible to the true emotion of passages like

Animaeque magnae prodigum Paulum

or "dulce et decorum est pro patria mori," or the beautiful in memoriam containing the lines

Ergo Quintilium perpetuus Sopor
Urget

In the same way, if we need not look for the traces of real passion in his list of Lalages, Glyceras and Chloes, his affection for the

Fons Bandusii splendidior vitro

and the music of running streams that almost recurs like a *motif* in the Odes, must remain.

Fies nobilium tu quoque fontium me dicente cavis impositam ilicem saxis, unde loquaces lymphae desiliunt tuae'

If the use of the Greek or Roman pantheon seems often an ornament for his verse, we are moved by all the sad beauty of paganism when he says:

Nos ubi decidimus
Quo pius Aeneas, quo dives Tullus et Ancus
Pulvis et umbra sumus.

The odes are of complicated structure. The metres used consist in the main of (1) combinations of Asclepiad verse, (2) of the Alcaic, (3) of the Sapphic stanzas. But there are several other experimental adaptations of minor importance used on single occasions. Four kinds of Asclepiad line are employed:—
(a) the lesser Asclepiad,

– – – ∪ ∪ – –∪∪ – ∪ ⏑

"Maecenas atavis edite regibus";

(b) the greater Asclepiad,

– – –∪ ∪– –∪∪ – – ∪ ∪ – ∪ ⏑

"Tu ne quaesieris scire nefas quem mihi quem tibi"

(c) the Glyconic,

– – –∪ ∪ – ∪ ⏑

"Nil mortalibus ardui est";

(d) the Pherecratic,

– – – ∪ ∪ – –

"Grato Pyrrha sub antro":

and these are used in several different combinations as the metrical arrangement of various odes. The Alcaic stanza used by Horace, as in

Justum et tenacem propositi virum
Non civium ardor prava jubentium
Non voltus instantis tyranni
Mente quatit solida neque Auster.

differs slightly from the Greek original and the Sapphic stanza, *e.g.*,

Sume, Maecenas, cyathos amici
Sospitis centum et vigiles lucernas
Perfer in lucem: procul omnisesto
Clamor et ira.

appears to have been wilfully altered or misunderstood, the Greek Sapphic, as we know it, being based on a central dactyl. Thus Sappho's

"φαίνεταί μοι κῆνος ἴσος θεοισιν"

becomes in Catullus

Ille mi par esse deo videtur.

But Horace, by the almost invariable use of a different caesura, as in "*aurcam quisquis mediocritatem*," obtains an entirely different rhythm, less dignified, but more rapid than the Greek.

It is noteworthy that he chose it for the *Carmen Saeculare*, where, however, he occasionally returns to a Sapphic line a little nearer to the Greek use. This ode was written to be sung publicly by a chorus of youths and maidens in the great secular games exhibited by Augustus in 17 B.C. As a stately command performance it reminds us of Tennyson. The selection of Horace to write it makes it clear that he was now the established poet laureate of Rome, and we may perhaps infer from his adoption of the Sapphic stanza on this important occasion that it had proved the most admired and popular of those metrical adaptations which he had so long laboured to achieve.

Epistles.—The *Epistles* form in spirit a quiet end to Horace's literary career. They were written, like the Satires, in hexameter verse. They may not have been published later than the first three books of the *Odes* (about 20 B.C.) but it is fairly certain that many of the odes were written, and presumably circulated, before they were collected and placed together, whilst the fourth book of the *Odes*, probably as late as 13 B.C., contains poems written, on state occasions, like the *Carmen Saeculare*, at the emperor's request, and shows throughout, in spite of the sustained perfection of the style, some failure of inspiration. The *Epistles*, however, of their kind, are perfect compositions. They have grace, good sense and wit. They are at the same time more urbane and more polished than the *Satires*. They exhibit, as before, the light of an Epicurean with leanings to more serious convictions, the philosopher of the golden mean. But he is mellowed and calm. He discovers the prevailing fault of his age, as other satirists have discovered of later ages, to be the desire to grow rich rather than happy or wise, to sacrifice the ends of life to a reckless pursuit of the means of living.

The last few Epistles—that is to say, the two Epistles in the second book and the letter to the Pisos—have a literary theme. One is addressed to the emperor. It takes him to task, with great humility and delicacy, for his admiration of the old comedy. Horace is evidently the dictator of public taste. He had smoothed and made elegant the roughnesses of Lucilius, and is surprised and a little hurt that his imperial master should care for the crude plays of Plautus and Afranius. The bad taste in general of the Roman public is assailed. They prefer pomp and noise to beauty, the spectacular to the sublime. The *De Arte Poetica*, left unfinished, seems to be written with the idea of dissuading one or other of the sons of Piso from becoming a poet. Let him understand the difficulties of the task, and if he must write, let him learn the primary laws of good composition. Above all things, let him remember the superiority of Greek originals.

vos exemplaria Graeca
nocturna versate manu versate diurna.

Polished as the *Epistles* are, and interesting as a picture of contemporary life, they display Horace rather as a critic than as a poet. For the latter title he must rely almost entirely upon the Odes. But in considering the humour of his more pedestrian work, it is worth remembering, and this applies to *Satires* and *Epistles* alike, that his verbal wit is probably greater than at this distance of time we can appreciate. Not only may some of the happiest allusions to topical matters escape us, but in the very handling of the hexameter so as to fit it for the prosaic uses of everyday speech, there may be metrical felicities which we are not competent to gauge.

There are, in fact, two, if not three Horaces. There is the sedulous adapter. There is the ironical yet kindly man of the world, with a copious if not ambitious flow of criticism upon the manners of his time. The irony and culture are conspicuous throughout. But, half hidden, and almost as though his own humour kept the impulse in rein, there is the poet. Phrases, stanzas, sometimes a whole poem, stand out, and beyond preciosity we find inspiration. Lyric poetry in Rome died with his death, and there must certainly have been a spark of something rarer in him than mere metrical ingenuity or neatness of fancy to account for this absence of successors To create his English equivalent, we should have to endow an Andrew Marvell with the wit and polish of a Pope.

None of the extant manuscripts of Horace are very ancient. The earliest date from the ninth century, though in the edition of Cruquius (Antwerp, 1598) there is reference to one, at least, of greater antiquity, destroyed in the sack of the Benedictine abbey of St. Peter at Blankenbergh in 1566 For the best account of the mss. and editions of Horace, Dr E. C Wickham's edition of the *Odes* and *Epodes* should be consulted, as also for the textual notes Dean Milman's edition of Horace's *Works* contains an excellent Life, and there are translations of the *Odes*, *Satires* and *Epistles* by Professor Conington. Readers are also referred to the *Horatii Opera* of T. E. Page. (E. V. K.)

HORAE, in Greek and Latin mythology the Seasons. In the *Iliad* (v. 749) they are the custodians of the gates of Olympus. In the *Odyssey*, they are represented as bringing round the seasons in regular order. The brief notice in Hesiod (*Theog.*, 901), where they are called the children of Zeus and Themis, who superintend the operations of agriculture, indicates by the names assigned to them (Eunomia, Dikē, Eirenē; *i.e.*, Good Order, Justice, Peace) the extension of their functions from nature to the events of human life, and at the same time invests them with moral attributes.

At Athens they were apparently two in number: Thallo and Carpo, the goddesses of the flowers of spring and of the fruits of summer. In honour of the Horae a yearly festival (Horaea) was celebrated. In later mythology, under Alexandrian influence, the Horae became the four seasons, daughters of Helios and Selene, each represented with the conventional attributes. Subsequently, when the day was divided into 12 equal parts, each of them took the name of Hora.

BIBLIOGRAPHY.—*See* the articles in Daremberg and Saglio's *Dictionnaire des antiquités* and in Roscher's *Lexikon der Mythologie;* also L. R. Farnell, *Cults of the Greek States*, v., p. 426. (*See* also GRACES.)

HORAPOLLON, of Phaenebythis in the nome of Panopolis in Egypt, Greek grammarian, flourished in the 4th century A.D. According to Suidas, he wrote commentaries on Sophocles, Alcaeus and Homer, and a work (Τεμενικά) on consecrated places. Photius (cod. 279) calls him a dramatist as well, and credits him with a history of Alexandria. Under the name of Horapollon two books on *Hieroglyphics* are extant, which profess to be a translation from an Egyptian original into Greek by a certain Philippus. The translation is evidently late and has been ascribed to the 15th century. All that can be said is that there is evidence of

the hieroglyphic tradition being still alive in the days of the author.

See editions by C. Leemans (1835) and A. T. Cory (1840) with English translation and notes; *see* also G. Rathgeber in Ersch and Gruber's *Allgemeine Encyclopadie;* H. Schäfer, *Zeitschrift für ägyptische Sprache* (1905), p. 72.

HORATII and **CURIATII,** in Roman legend, two sets of three brothers born at one birth on the same day—the former Roman, the latter Alban—the mothers being twin sisters. During the war between Rome and Alba Longa it was agreed that the issue should depend on a combat between the two families. Two of the Horatii were soon slain; the third brother feigned flight, and when the Curiatii, who were all wounded, pursued him separately he slew them one by one. When he entered Rome in triumph, his sister recognized a cloak which he was wearing as a trophy as one she had herself made for her lover, one of the Curiatii. She thereupon invoked a curse upon her brother, who slew her on the spot. Horatius was condemned to be scourged to death, but on his appealing to the people his life was spared (Livy i. 25, 26; Dion. Halic. iii. 13–22). The origin of the story is obscure and disputed. It obviously contains a traditional origin for the right of appeal to the people. The root of the legend is probably in the *sororium tigillum,* the purificatory yoke under which Horatius had to pass.

HORATIUS COCLES, a legendary hero of ancient Rome. With two companions he defended the Sublician bridge against Lars Porsena and the whole army of the Etruscans, while the Romans cut down the bridge behind. Then Horatius threw himself into the Tiber and swam in safety to the shore. A statue was erected in his honour in the temple of Vulcan, and he received as much land as he could plough round in a single day. According to another version, Horatius alone defended the bridge, and was drowned in the Tiber.

E. Pais finds the origin of the story in the worship of Vulcan, and identifies Cocles (the "one-eyed") with one of the Cyclopes. He concludes that the supposed statue of Cocles was really that of Vulcan. He suggests that the legend arose from some religious ceremony, possibly that of throwing the stuffed figures called Argei into the Tiber from the Pons Sublicius on the ides of May. The Horatian family were connected with the worship of Vulcan.

See Livy ii. 10; Dion. Halic. v. 23–25; Polybius vi. 55; Plutarch, *Poplicola,* 16. For a critical examination of the legend, see Schwegler, *Römische Geschichte,* bk. xxi. 18; W. Ihne, *History of Rome,* i.; E. Pais, *Storia di Roma,* i. ch. 4 (1898), and *Ancient Legends of Roman History* (Eng. trans., 1906).

HÖRDE, a manufacturing town in the Prussian province of Westphalia, 2 m. S.E. from Dortmund on the railway to Soest. Pop. (1925) 34,575. It has an old castle dating from about 1300. There are smelting-works, foundries, puddling-works, rolling-mills and manufactures of iron and plated wares. In the neighbourhood there are iron and coal mines.

HOREA, NICOLAS URSU, Rumanian patriot (1735?–85), was born in Zlatna, Transylvania, of well-to-do peasant stock and early appeared as champion of his nation (then serfs) against the dominant Magyars. He won renown as a notable agitator (*famosus seductor*) and paid three visits in this capacity to Vienna, where he had personal interviews with the emperor Joseph II. (whom he had met on the latter's visit to Transylvania in 1773) and secured his intervention in certain cases of oppression. In 1783 the peasants of Transylvania were in turmoil about the proposed transfer of part of their territory from noble rule to the Military Frontier system. Horea again visited Vienna; saw Joseph on April 1, 1784, and declared that unless the serfs were liberated they would rise and wipe out their oppressors. Joseph is said to have answered: "Thut Ihr das" (Do so), and to have given him a paper of secret instructions. Horea now set about organizing an army out of the peasants who were being conscribed and armed for the frontier regiments. This alarmed the authorities, who suspended the recruiting; whereupon, in Nov. 1784, hostilities broke out. This was probably not Horea's intention (he was thought to be organizing a general rising for May 1785); but he took command of his forces, some 10,000 men. At first the peasants genuinely believed themselves to be fighting for the Emperor; but when their successes, and the complaints of the nobles, forced the Government to move regular troops against them Horea proclaimed himself "Emperor" and "King of Dacia." He was at last defeated and captured (Dec 27, 1784). On capture he burned his mysterious paper. Convicted of high treason, Horea was broken on the wheel (Feb 28, 1785). This mysterious episode was hushed up as far as possible, although the Rumanian peasantry of Transylvania continued to regard Horea as a martyr and liberator; but *see* Densuşianu, *Revolutiunea lui Horea* (Bucharest, 1884). (C. A M.)

HOREB, the ancient seat of Yahweh, the tribal god of the Kenites, adopted by His covenant by Israel. This is the name preferred by the Elohistic writer (E) whose work is interwoven into the Old Testament narrative, and he is followed by the Deuteronomist school (D). The Yahwistic writer (J), on the other hand, prefers to call the mountain Sinai (*q.v.*), and so do the priestly writers (P). This latter form became the more usual

HOREHOUND. Common or white horehound, *Marrubium vulgare,* of the family Labiatae, is a perennial herb with a short stout rootstock, and thick stems, about 1 ft. in height, which, as well as their numerous branches, are coated with a white or hoary felt—whence the popular name of the plant. The leaves have long petioles, and are roundish or rhombic-ovate, with a bluntly toothed margin, much wrinkled, white and woolly below and pale green and downy above; the flowers are sessile, in dense whorls or clusters, small and dull-white, with a 10-toothed calyx and the upper lobe of the corolla long and bifid. The plant occurs in Europe, North Africa and West Asia to North-West India, and has been extensively naturalized in North America from Maine to British Columbia and southward to North Carolina, Texas and Mexico, being a common weed almost everywhere in California. In Britain, where it is found generally on sandy or dry chalky ground, it is far from common. White horehound contains a volatile oil, resin, a crystallizable bitter principle termed *marrubiin* and other substances, and has a not unpleasant aromatic odour, and a persistent bitter taste. Formerly it was officinal in British pharmacopoeias; and the infusion, syrup or confection of horehound has long been in popular repute for the treatment of a host of dissimilar affections. Black horehound, *Ballota nigra,* is a hairy perennial herb, belonging to the same family, of foetid odour, is 2 to 3 ft. in height, and has stalked, roundish-ovate, toothed leaves and numerous flowers, in dense axillary clusters, with a green or purplish calyx, and a pale red-purple corolla. It occurs in Europe, North Africa and West Asia, and in Britain south of the Forth and Clyde, and has been naturalized into North America from Massachusetts to Pennsylvania.

HORGEN, town in the Swiss canton of Zürich, on the left shore of the Lake of Zürich, and by rail 10½ m. S.S.E. of the town of Zürich. Pop. (1920) 8,471. It possesses industrial establishments of various kinds, and is a centre of the Zürich silk manufacture. In 1406 it came into the possession of Zürich, with which it communicates by lake steamer, as well as by rail.

HORIZON, the apparent circle around which the sky and earth seem to meet. At sea this circle is well defined, the line being called the sea horizon, which divides the visible surface of the ocean from the sky. In astronomy the horizon is that great circle of the sphere the plane of which is at right angles to the direction of the plumb line. Sometimes a distinction is made between the rational and the apparent horizon, the former being the horizon as determined by a plane through the centre of the earth, parallel to that through the station of an observer. But on the celestial sphere the great circles of these two planes are coincident, so that this distinction disappears. The *dip* of the horizon at sea is the angular depression of the apparent sea horizon, or circle bounding the visible ocean, below the apparent celestial horizon as above defined. It is due to the rotundity of the earth and the height of the observer's eye above the water. The dip of the horizon and its distance when the height of the observer's eye above sea-level is h feet, are approximately given by the formulae: Dip $=0'.97\sqrt{h}$; Distance $=1.17\sqrt{h}$ sea-miles. The difference between the co-efficients 0.97 and 1.17 arises from the refraction of the ray.

HORMAYR, JOSEPH, Baron von (1782–1848), German statesman and historian, was born at Innsbruck on Jan. 20, 1782. He entered the foreign office at Vienna (1801), rose in 1803 to be court secretary and, being a near friend of the Archduke John, director of the secret archives of the state and court. During the Tirolese insurrection of 1809 against Bavarian supremacy, Hormayr was the mainstay of the Austrian party, and assumed the administration; but, returning home without the prestige of success, he fell into disfavour both with the emperor Francis I. and with Prince Metternich, and when, in 1813, he tried to stir up a new insurrection in Tirol, he was arrested and imprisoned at Munkatt. In 1816 some amends were made to him by his appointment as imperial historiographer; but in 1828 he accepted an invitation of King Louis I. to Munich, where he became ministerial councillor in the department of foreign affairs. He was Bavarian minister-resident at Hanover (1832–37), and at Bremen (1837–46); superintendent of the national archives at Munich (1846–48). He died on Oct. 5, 1848.

Hormayr's history of the Tirolese rebellion (1817) is far from impartial; for he always liked to put himself into the first place, and the merits of Andreas Hofer and of other leaders are not sufficiently acknowledged. In his later writings he appears as a keen opponent of the policy of the court of Vienna.

See F. v. Krones, *Aus Österreichs stillen und bewegten Jahren 1810–1815; Biographie und Briefe an Erzhz. Johann* (Innsbruck, 1892); Hirn, *Tiroler Aufstand* (1909).

HORMISDAS (d. 523), pope from 514 to 523, was a native of Campania. He obtained the reunion of the Eastern and Western Churches, which had been separated since the excommunication of Acacius in 484. After two unsuccessful attempts under the emperor Anastasius I., Hormisdas was able to come to an understanding in 518 with his successor Justin. Legates were despatched to Constantinople; the memorial of the schismatic patriarchs was condemned; and union was resumed with the Holy See. Hormisdas secured Dionysius Exiguus to translate the Apostolic Canons and also renewed the Gelesian decretum. His memorials and briefs are printed in Migne's *Patrol. Lat.* vol. 63, in *Corpus script. eccl. Vindobon.*, vol. xxxv., and in A. Thiel, *Epistolae Rom. Pont. i.*

HORMIZD or **HORMIZDAS,** the name of five kings of the Sassanid dynasty (*see* Persia: *Ancient History*). The name is another form of Ahuramazda or Ormuzd (Ormazd), which under the Sassanids became a common personal name; strictly it is an abbreviation of Hormuzd-dad, "given by Ormuzd."

1. Hormizd I. (reigned 272–273) son of Shapur I., under whom he was governor of Khorasan, appears in his wars against Rome. In the Persian tradition of the history of Ardashir I., preserved in a Pahlavi text (Nöldeke, *Geschichte des Artachsir I. Pāpakān*), he is the son of a daughter of Mithrak, a Persian dynast, whose family Ardashir had extirpated because the magians had predicted that from his blood would come the restorer of the empire of Iran. Only this daughter is preserved by a peasant; Shapur marries her, and her son Hormizd is afterwards acknowledged by Ardashir. In this legend, partially preserved also in Ṭabari, the great conquests of Shapur are transferred to Hormizd.

2. Hormizd II., son of Narseh, reigned from 302 to 309. Of his reign nothing is known. After his death his son Adarnases was killed by the grandees; another son, Hormizd, was kept a prisoner, and the throne reserved for the infant of a concubine of Hormizd II. Hormizd escaped from prison and found refuge at the court of Constantine the Great. In 363 he served in the army of Julian against Persia; his son, with the same name, became consul in 366.

3. Hormizd III., son of Yazdegerd I., succeeded his father in 457. He had continually to fight with his brothers and with the Ephthalites in Bactria, and was killed by Peroz in 459.

4. Hormizd IV., son of Chosroes I., reigned 578–590. Some characteristic stories are told of him by Ṭabari (Nöldeke, *Geschichte d. Perser und Araber unter den Sasaniden*). Hormizd protected the common people and introduced a severe discipline in his army and court. When the priests demanded a persecution of the Christians, he declined on the ground that the throne and the government could only be safe if it gained the goodwill of both concurring religions. Consequently he raised a strong opposition in the ruling classes. From his father he had inherited a war against the Byzantine empire and against the Turks in the east, and negotiations of peace had just begun with the emperor Tiberius, but Hormizd haughtily declined to cede anything of the conquests of his father. Therefore the accounts given of him by the Byzantine authors, Theophylact, Simocatta (iii. 16 ff.), Menander Protector and John of Ephesus (vi. 22), are far from favourable In 588 his general, Bahram Chobin, defeated the Turks, but in the next year was beaten by the Romans; and when the king superseded him he rebelled with his army. This was the signal for a general insurrection. The magnates deposed Hormizd and proclaimed his son Chosroes II. king. In the war which now followed between Bahram Chobin and Chosroes II. Hormizd was killed by some partisans of his son (590).

5. Hormizd V. was one of the many pretenders, who rose after the murder of Chosroes II. (628). He maintained himself about two years (631, 632) in the district of Nisibis. (Ed. M.)

HORMONES. Certain glands deliver their secretions on to a free surface by means of a definite orifice or duct. Two clear examples of this type are the mammary glands and the sweat glands. Others, however, have no duct, and the substances elaborated by the activity of the gland cells are discharged not on to a free surface but into the blood stream. Such glands are known as the ductless glands or glands of internal secretion. The thyroid gland, the parathyroids, the suprarenal glands and the pituitary gland are the most important examples of this type of endocrine organ.

In certain cases the two functions of producing an external and an internal secretion may be combined in the same gland Thus the pancreas, in addition to delivering its external secretion the pancreatic juice into the duodenum via the pancreatic duct, also forms an internal secretion of great importance for the regulation of the sugar metabolism of the organism.

The substances produced by the activity of the cells of the ductless glands and discharged into the blood stream are characterized by the property of serving as chemical messengers, produced in one organ and carried in the blood to another where their effect is manifested. They enable a chemical correlation of the activities of the organism to be brought about through the blood, *pari passu* with that which is the function of the nervous system. To substances of this nature Bayliss and Starling gave the name "Hormones," derived from the Greek ὁρμάω, "I arouse to activity."

It seems clear that this chemical correlation is the more primitive of the two methods by which co-ordination between different parts of the body is achieved. Starling has pointed out that in the lowest animals before the appearance of a central nervous system, it is by chemical means that co-adaptation of function is ensured. As examples he gives the movement of phagocytic cells toward an irritant, the chase for food and the approach of the gametes or sexual cells. In order that this relatively slow process may be applicable to a more complex organism, the development of a blood circulation is necessary, but before this occurs the need for quick responses has necessitated the setting aside of special reactive cells—the rudiments of a central nervous system. That the two methods of correlation, chemical and nervous, are intimately connected will be clear from the detailed account of the various hormones.

The type of evidence which is relied upon in assigning endocrine function to a particular organ may now be considered. In the main the evidence is obtained by two methods, the one being the observation of changes resulting from the partial or complete removal of the organ under consideration, either experimentally or by disease; the other by observation of the effects produced by administration of various extracts of the gland. Information of the first kind dates from the introduction of castration probably as a religious rite; that of the second type from the work of Schäfer and Oliver in 1894.

Although a positive result under either or both of these heads does not constitute a rigid demonstration that a gland produces an internal secretion or hormone, much of the evidence on which

several familiar organs are classed with the ductless glands is of this nature. As Hogben points out, to infer endocrine activity solely from the effects of removal of an organ "is hardly less unwarranted than to deduce from the manifest consequences of decapitation that the head secretes a hormone that maintains the rhythmical contraction of the heart."

Owing to the difficulty in demonstrating the presence in the blood of a hormone which may be of unknown chemical constitution and in minute amount, it is in certain cases necessary to rely on evidence of the type mentioned. The effects of removal of certain glands, or of injection of their extracts, are, however, so specific that, together with other indirect evidence, it is difficult to avoid the conclusion that their normal function is actually to elaborate, and discharge into the blood stream, a hormone which produces the specific effects observed.

Secretin.—The work of Bayliss and Starling in 1902 and 1903 on the regulation of the pancreatic secretion provides one of the best examples of the elucidation of the mode of action of a hormone. It had long been known, particularly from the work of Pawlow and his pupils, that the entry of the acid contents of the stomach into the upper part of the small intestine normally initiated the flow of pancreatic juice; and that the introduction of acid into the duodenum also induced pancreatic secretion. Bayliss and Starling showed that the results were still to be obtained when acid was introduced into a loop of gut completely separated from all nervous connections. The secretion of pancreatic juice could not therefore be due to nervous impulses; injection of acid into the circulation itself did not activate the pancreas.

There remained therefore the possibility that by the action of the acid on the cells lining the upper part of the gut a substance capable of exciting the pancreas to active secretion was liberated into the blood stream. This was tested experimentally and verified by Bayliss and Starling. The mucous membrane scraped from a strip of the upper end of the small intestine was ground with sand extracted with 0·4% hydrochloric acid and filtered. The filtered extract injected into the circulation of a dog gave rise to a flow of pancreatic juice about one minute after the injection. To the active substance in the extract the name secretin was given, its precursor in the mucous membrane being called prosecretin.

Along with the secretin there was also in the extract a substance —termed a "depressor" substance—which brought about a fall in blood pressure following the injection. Bayliss and Starling demonstrated quite clearly that the pancreatic activity could be brought about equally satisfactorily with an extract which showed no depressor activity as a result of treatment with alcohol. The flow of pancreatic juice was not therefore a secondary effect due to the disturbance of the blood pressure.

Further, they demonstrated that secretin was a specific substance elaborated by the cells of the mucous membrane of the intestine; it was not to be found in extracts made from other tissues of the body.

In 1903 they demonstrated that the extracts from the mucous membrane of the small intestine of many animals caused pancreatic secretion when injected into a dog, and that the control of pancreatic secretion by the hormone secretin was a mechanism which exists in many vertebrates. The complete demonstration that secretin is present in the blood of an animal after the introduction of acid into the duodenum was given simultaneously in 1903 by Fleig and Enriquez and Hallion.

The chemical structure of secretin is still unknown. Bayliss and Starling showed that the molecule of secretin was probably not large since it diffuses slightly through parchment paper, and found that it was easily destroyed by pancreatic juice and many metallic salts.

In 1926 J. Mellanby described a method for isolating secretin by absorbing the active substance by means of bile salts and suggests that secretin is a polypeptide; it is, however, not certain that secretin has yet been obtained free from impurity.

It must not be forgotten that pancreatic secretion can be brought about by nervous stimulation, and the question of the relative importance of the hormonic and nervous control of the pancreas remains to be decided. The different properties of the juice obtained by these two methods of stimulation suggests that in the intact animal both mechanisms are involved (*see* DIGESTION).

Adrenalin.—Oliver and Schäfer in 1895 showed that an extract of the suprarenal glands contained a substance which when injected caused a large rise in the arterial blood pressure. They showed also that this "pressor" substance was present only in the medulla, and was absent from the cortex of the gland.

The active substance adrenalin was isolated in 1901 by Takamine and later by various workers shown to have the constitution $(OH)_2{\cdot}C_6H_3{\cdot}CHOH{\cdot}CH_2NH{\cdot}CH_3$; by the synthesis of this compound and the demonstration of its identity with the natural hormone the formula was finally established.

Natural adrenalin is optically active, rotating the plane of polarized light to the left. When a small amount of adrenalin is injected into the blood stream it produces constriction of almost all the small arterioles of the body with resulting rise of blood pressure. Its action, however, is not confined to the blood vessels but extends to all structures in the body which normally receive a nerve supply from the sympathetic nervous system. Thus it increases the force of the heart, inhibits the movements of the digestive tract and (in many animals) of the bladder; it may also produce sweating, erection of hair, contraction of the pregnant uterus and dilatation of the pupil. Adrenalin is an intensely active substance; 0·0025 milligram per kilogram of body weight, when injected into the circulation, produces a definite rise in blood pressure. At a dilution of 1:250,000,000 its effect on the vessels of the rabbit's ear could be detected. The exact point of action of adrenalin appears to be not on the true sympathetic nerve ending but on some receptive substance which lies between the actual nerve ending and the muscular fibre.

Owing to its constrictor effect on the blood vessels, adrenalin has proved of great value in checking haemorrhage when applied locally. It is probably more valuable in preventing than in checking haemorrhage, and is largely used in intranasal surgery. Its effect is, however, very temporary. The remarkable relationship between the hormone of the suprarenal medulla and the sympathetic nervous system has excited great interest; and it is worthy of note that Balfour showed in 1878 that developmentally the suprarenal medulla has the same origin as the sympathetic system. There is little doubt that adrenalin is discharged into the blood stream from the suprarenal medulla; indeed, its presence in the blood leaving the suprarenal gland has been clearly shown.

Cannon (1915) has collected a considerable amount of evidence that in states of violent emotion such as rage, fear or pain the output of adrenalin is considerably increased and by its action on the blood vessels and other tissues the reaction of the animal to these emotional conditions (in defence or in attack) are made more effective. Other workers, notably Stewart and Rogoff, have called into question the relation of such stimuli to the secretion of adrenalin. Whatever may be the final decision, it is clear that adrenalin is a hormone which is used only for special purposes, and there is no evidence that the suprarenal medulla plays a prominent or indispensable part in regulating the activities of the normal mammalian organism.

The cortex of the suprarenal gland, on the other hand, is indispensable to the life of the organism. In 1855 Addison described in man a fatal disease which is characterized by prostration, muscular wasting, vomiting and brown pigmentation of the skin, and showed that it was associated with disease or atrophy of the suprarenal glands. There is also evidence that overgrowth of the cortex in children is associated with sexual precocity and premature adolescence. Subsequent investigation has thrown little light on the functions of the cortex; it is not yet clear what are the relative parts played by loss of cortex or loss of medullary substance in the causation of the symptoms of Addison's disease, nor indeed is there any definite evidence that the cortex actually elaborates and discharges a hormone into the blood stream.

Thyroxin.—The importance of the thyroid gland to the organism was first realized from the observation that the gland was atrophied in the disease called myxoedema The symptoms of this disease are obesity, thickening and dryness of the skin, loss of

hair, slowness of speech and mental processes; the respiratory exchange is diminished and all the metabolic changes in the organism are sluggish.

Deficiency or absence of the gland at birth results in a condition known as cretinism in which mental and physical growth is tremendously retarded. The cretin of 18 years of age may have the mental intelligence of a normal child of two or three. Extracts of the gland, or the whole gland itself, given by the mouth, lead to complete recovery in myxoedema and marked improvement in cases of cretinism. Further evidence of the connection between the thyroid gland and growth is provided by the remarkable effects of thyroid extract on the metamorphosis of tadpoles. Feeding tadpoles with thyroid gland causes a greatly accelerated metamorphosis, so that, compared with an untreated control, a minute frog results much before the usual time.

Operative removal of the thyroid gland in man or animals is frequently complicated owing to the presence in the thyroid substance of the parathyroid glands. If the latter are left undisturbed, typical myxoedema results from removal of the thyroid gland, and the myxoedema so produced is completely cured by feeding the gland or extracts of it.

The thyroid is hypertrophied in the disease known as exophthalmic goitre or Graves disease, and the symptoms are the reverse of those noted in myxoedema. The patient loses weight, the pulse rate is increased, the excretion of nitrogen and carbon dioxide is higher than normal, and the resting consumption of oxygen may be increased by 50%. There is also great nervous excitability and in severe cases protrusion of the eyeballs.

Chemically the interesting fact about the thyroid gland is that it has a high content of iodine. Kendall in America in 1914 succeeded in isolating a crystalline compound containing iodine to which he gave the name thyroxin. Thyroxin possesses all the characteristic activities of the gland itself and is to be regarded as the hormone of the thyroid gland. Kendall suggested a chemical formula for thyroxin (which contains 65% of iodine), but the recent work of Harington in 1926 and Harington and Barger in 1927 in England has culminated in the elucidation of its structure and a brilliant synthesis of the natural product.

Thyroxin is an extremely active substance and a dose of one milligram produces definite effects on the oxygen consumption of a normal individual at rest. Daily doses of 2–3 milligrams may increase this resting oxygen usage by 30% above normal, but no effect is produced until about five days after a dose has been given. The human thyroid gland is believed to produce about one milligram of thyroxin per day. Thyroxin can of course completely replace thyroid gland substance or thyroid extracts in the cure of myxoedema or in the treatment of cretinism.

Direct evidence of the presence of thyroxin in the blood stream is not yet available, nor is it at present known at what particular point or tissue thyroxin exerts its action.

It is evident, however, that the hormone exerts an important control over the metabolism of the adult body and over the processes of mental and physical development; in its absence normal growth does not occur.

The Parathyroid Hormone.—The evidence for the existence of a parathyroid hormone is much less conclusive than in the case of the thyroid. Such evidence as is available is derived solely from experiments on mammals and from clinical observations. Extirpation of all four parathyroid glands is followed in a few days by acute symptoms which are chiefly of nervous origin. The excitability of the central nervous system is markedly increased so that reflexes are more readily and more powerfully elicited than normal. At intervals muscular twitchings and spasms occur, probably as a result of the increased excitability of the motor nerve cells of the spinal cord.

The condition is known as tetany, and is frequently fatal, particularly in the case of carnivorous animals. Two hypotheses concerning this condition of tetany have been advanced. Noel Paton and his collaborators reached the conclusion that the tetany is due to accumulation of quanidine derivatives in the blood after removal of the parathyroids, and showed that the introduction of quanidine into the circulation of a normal animal produced symptoms similar to those observed after parathyroid removal. These views have not met with universal acceptance and MacCallum has drawn attention to the beneficial results of calcium administration in cases of parathyroid tetany, and to the fact that the tetanic symptoms are also characteristic of deficiency in the calcium content of blood. Various workers confirmed these suggestions and showed that after removal of the parathyroid glands there is a fall in blood calcium content, and that the fatal effects of the ensuing tetany in a carnivorous animal such as the dog can be prevented by the administration of sufficient quantities of calcium lactate. A new light has been thrown on the question following the success of Collip in 1925 in obtaining an extract from parathyroid glands which has a strong effect on the calcium content of the blood in normal dogs and in dogs which have had the parathyroid glands removed.

Injection of the extract raises the blood calcium in both cases; the rise is greater in the case of the animals from which the parathyroids have been removed. Continued injections not only raise the calcium content to a more normal level, but completely prevent the appearance of the tetany which is normally the sequel of loss of the parathyroids.

Further information is required before it can be assumed that the extract prepared by Collip contains the parathyroid hormone. It has yet to be shown that the power of raising the blood calcium is a specific property of the extract, or that under normal conditions the parathyroid glands liberate the active substance into the circulation.

The Pituitary Hormone.—The pituitary gland, like the suprarenal gland, consists of two main portions which are fundamentally distinct. One part is derived embryologically from the roof of the primitive mouth cavity and the other from an outgrowth of nervous tissue. This nervous outgrowth forms the pars nervosa of the adult pituitary gland. The other portion develops into the pars anterior, the main glandular portion of the pituitary, and the pars intermedia, a thin layer which invests the pars nervosa. The pars nervosa with its investment of pars intermedia are together known as the posterior lobe of the pituitary from which is made the familiar pituitary extract of therapeutics, while the pars anterior forms the anterior lobe.

Although it is the anterior lobe which microscopically is the glandular portion of the pituitary, yet it is from the posterior lobe that is obtained the extract which exercises so powerful an effect on a variety of bodily functions.

Though no definite active principle has yet been obtained from the anterior lobe, there is little doubt that is does exercise the function of producing an internal secretion. The evidence is clear that overgrowth of the anterior lobe of the gland produces in man the disease known as acromegaly. This disease is characterized by enlargement of the bones of the face, hands and feet. Where overgrowth of the anterior lobe of the pituitary occurs in early life, there is produced a condition known as gigantism, in which there is general elongation of the long bones of the body. Administration of anterior lobe substance to developing amphibian larvae has been shown by various workers to cause accelerated metamorphosis and growth, while A. M. Evans has recently by similar means succeeded in producing experimental gigantism in rats. Some workers, as a result of extirpation of the anterior lobe, claim that it is essential for the life of the animal. The results are confusing, but it would appear that removal of the anterior lobe in a young animal greatly retards growth, and stops sexual development.

A strikingly active extract can, on the other hand, be obtained from the posterior lobe. Oliver and Schäfer showed, as in the case of the suprarenal gland, that an extract having a powerful pressor action could be obtained from the pituitary gland. Later it became clear that this active principle was confined to the posterior lobe, and that with a second or subsequent injection the blood pressure actually fell. In other words, the pressor effect was replaced by a depressor effect. The depressor substance can be removed from the gland by alcoholic extraction, leaving a pure pressor principle behind. The evidence is satisfactory that this depressor substance is not a specific principle of the pituitary but

one which can be obtained from almost any organ of the body.

Effects of the Extract.—The pressor action of the extract is due essentially to a direct action on the plain muscle fibres of the arteries, causing them to contract. The action, unlike that of adrenalin, appears to have no relation to innervation. Indeed, in mammalia the action on the plain muscle of practically all organs is to stimulate it to contraction. In birds, on the contrary, the effect is to cause a fall in blood pressure. This is definitely not due to the non-specific depressor substance already mentioned, but is apparently due to the substance which in mammals gives the purely pressor reaction.

A second action is an effect on the secretion of urine. In anaesthetised animals the effect is an inhibition of the secretion of urine which lasts until the rise of blood pressure has passed its maximum, and is then followed by an increased flow of urine. It is to be regarded as a corollary of the general pressor effect; the primary inhibition being due to constriction of the blood vessels of the kidney along with those of the body in general, and the later increase to the disappearance of the constriction of the kidney vessels sooner than in other organs, so that a larger volume of blood passes through the kidney.

A third action of the pituitary extract, which is the basis of its commonest therapeutic application, was observed by H. H. Dale in England. This is its intense stimulating action on the plain muscle of the uterus. By the use of this test some idea of the astounding activity of this oxytocic principle can be obtained. Abel of Baltimore has obtained a preparation from the posterior lobe which is capable of causing powerful uterine contractions in a dilution of 1 in 100,000,000,000. As the product is probably still not pure the actual activity of the pure principle will be even more impressive.

Schäfer and his co-workers observed yet another action of the extract—the galactagogue action, a rapid outpouring of milk from the lactating mammary gland when the pituitary extract is administered intravenously. There is no evidence of an increased formation of milk and it is probably a squeezing out of milk already formed in the gland. It is doubtful whether this action is of any serious importance or is even a specific effect of pituitary extract.

The same remarks apply to the action of the extract in causing expansion of the pigment cells of the skin of the frog. The action is exceedingly delicate, but it is difficult to assign any functional importance to it in the mammal. More important is the effect of posterior lobe extract in checking the flow of urine following on the ingestion of water, and in reducing the abnormal flow of dilute urine in cases of the disease diabetes insipidus. This antidiuretic effect must be clearly distinguished from the effect on the kidney mentioned previously as probably a corollary of the pressor effect.

The final effect which must be mentioned is the control which the extract appears to exercise over the metabolism of carbohydrates. This is of such a nature as to act antagonistically to the rise of blood sugar caused by adrenalin, and to the fall in blood sugar produced by the pancreatic hormone insulin.

The question arises whether the effects described are due to various activities of a single principle or whether there are several distinct principles present in the posterior lobe extract. The evidence obtained from the distribution of these activities in extracts of different parts of the gland, and on the results of chemical fractionation of the extracts, makes it necessary to assume that there are at least three different principles. One combines the pressor and diuretic action, the second the oxytocic and galactagogue, and the third is the principle causing expansion of the pigment cells in the frog's skin. Whether the antidiuretic effect and the action on sugar metabolism are due to still other principles is not yet ascertained.

Evidence that the various principles found in extracts of the posterior lobe of the pituitary gland function as true hormones is as yet slight.

The pressor substance does apparently play a part in the normal maintenance of the tone of the blood vessels, since removal of the posterior lobe in the frog causes loss of tone and oedema. The observations of W. E. Dixon and F. H. A. Marshall also suggest that the oxytocic principle acts as a true hormone. They observed that injection of an ovarian extract made towards the end of pregnancy brought about the appearance of an oxytocic principle in the cerebrospinal fluid. They suggest that the hormone reaches the circulation via the cerebrospinal fluid and is concerned in a mechanism for bringing into play the contractile mechanism of the uterus at the termination of pregnancy. The striking effect of the posterior lobe extract in checking the excessive secretion of urine in diabetes insipidus, and the fact that the latter is frequently associated with lesions of the pituitary gland, also suggest a hormonal control over some part of the kidney function.

Hormones of the Reproductive Organs.—The profound effects on the organism of removal of the testes have of course been known for centuries. In man castration in youth prevents the development of those changes—deepening of the voice, and growth of hair on the face and pubes—which normally occur at puberty. The body remains infantile and the accessory genital organs do not develop In the adult, castration leads to atrophy of the accessory organs, and frequently to obesity.

The same general effects are found in animals. Castration prevents the appearance of such secondary sexual characters as the comb of the cock and the antlers of the stag. It has been shown conclusively by many workers that transplantation of the testes under the skin of a castrated animal results in a normal development of these secondary sexual characteristics Indeed so marked is the effect that if testes are transplanted into animals congenitally female, the secondary male characters may develop. Examination of these transplanted testes reveals the fact that the spermatogenetic tissue of the testes degenerates, but that, the tissue being between the spermatic tubules, the interstitial tissue persists.

That the testis when removed from its normal position and transplanted in an abnormal position, where it no longer possesses its usual nerve connections, still retains its influence on the secondary male characters and on the accessory sexual glands, is evidence of the clearest type that it secretes a hormone or hormones into the blood which act on other distant organs in the body Injections of testicular extracts into castrated animals, although not so convincing, also support this conclusion. The interstitial cells are presumably the source of the internal secretion.

The idea of a connection between the testicular influence and rejuvenation has recently been revived by Steinach and others, particularly with reference to this interstitial tissue or "puberty" gland. The grafting into man of testicles from apes (the so-called "monkey glands") has been practised by Voronoff and others with resulting rejuvenation. Steinach also claims that rejuvenation can be brought about by section or ligature of the vas deferens which results in atrophy of the seminiferous tubules without interference to the interstitial tissue. Steinach indeed suggests that under these conditions the interstitial tissue increases in amount and attributes the resulting rejuvenation to this hypertrophy of the puberty gland. Although it is not easy to discriminate between improvement due to such causes as changed nutrition and environment, and suggestion, and that due to the operations described, it must be admitted that both vasectomy and transplantation of the testis lead frequently to a general improvement in condition which may be regarded as rejuvenation.

Removal of the ovaries in the human, before puberty, prevents the occurrence of menstruation, and their removal after puberty brings about the cessation of menstruation and the atrophy of the uterus. In animals, removal of the ovaries results in similar changes. The uterus degenerates and the cyclical changes (known as the oestrous cycle), which result in the animal coming on heat, also stop. If, instead of being completely removed, the ovaries are transplanted to an abnormal position, menstruation (or the oestrous cycle) continues and the uterus remains normal. Much recent work suggests that the onset of heat in mammals is closely connected with the activity of the cells lining the follicle in which the ripening ovum is found It has been shown by Allen and Doisy that "heat" can be induced in rats, after removal of the ovaries, by injecting an oil they obtained from the liquid contents of the ovarian follicles. Other workers have confirmed and extended their results.

The ovarian hormone (for such it must be regarded) is an oil soluble in alcohol, ether and chloroform. Its chemical nature is not yet known. The possible connection between the ovary and the uterus through the intermediation of the pituitary gland has already been mentioned. After the discharge of the ovum from the ovarian follicle, the cavity of the latter is filled with a mass of cells known as the corpus luteum. In pregnancy this corpus luteum persists for a considerable period. There is general agreement that this organ is responsible for changes which occur in the uterus and mammary glands during pregnancy. Although the actual hormone has not been isolated, there is a considerable amount of evidence that the corpus luteum exercises this control by means of an internal secretion.

Inter-relations of Hormones.—Various theories on the inter-relations between different hormones and ductless glands have been advanced. There are indeed certain features which suggest a balance or interplay of activities. Carbohydrate metabolism is influenced by insulin, the pancreatic hormone, by the thyroid in overactivity, in acromegaly, and by the injection of adrenalin Growth is affected by the internal secretion of the testis and by the cortex of the suprarenal gland, and arrested by the absence of the thyroid secretion. The anterior lobe of the pituitary gland has also a great influence on growth processes. The pituitary gland frequently enlarges as the result of thyroid removal, and thyroid enlargement may occur in acromegaly. The connection between the enlargement of the thyroid gland and the ovary is also well marked. Much speculation could be indulged in, but a clearer appreciation of the mode of action of the separate hormones is necessary before an adequate conception can be obtained of their normal inter-relations.

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HORMUZ, an island in approximately 27° 4′ N., 56° 28′ E., in the Strait of Ormuz, 1¾ m. from the coast of Persia, and 11 m. E.S.E. of Bandar Abbas. It has a perimeter of about 16 m. with a greatest length of 4½ m. and is composed of jagged hills of variegated hues of reddish purple and white of an average of 300 ft. in height, with one peak rising to 600 ft. The principal geological formations are rock-salt, red ochre and a greenish clay; a white encrustation of salt covers large areas. The barrenness of Hormuz is relieved only by a few *Kunar* trees and some small patches of barley or melons. Gazelle are the only wild fauna. The only permanently inhabited place on the island is the village of Hormuz, close southward of the site of the older city and comprising some 300 mat huts. It has a population which may rise to 1,000 males when the salt and oxide mines are being worked, but which falls to less than half in the summer when numbers migrate to the mainland, especially to Minab, for the date harvest or to escape the excessive heat. Persians predominate, but there are also Baluchis and Arabs. The water supply is from rain collected in pools or cisterns and is brackish and often very scanty even for so small a population.

Hormuz island is under the jurisdiction of the governor of the Gulf ports—but until recent years the revenues were farmed from the Persian Government for a fixed sum. The resources of the island are red oxide for export, and salt for local use; copper and iron ore are also present but are not worked. Red oxide (Hormuz red) has been an important article of export from Hormuz for centuries, and, since 1922, has been mined and exported under a concession granted to a Persian merchant. Shipments of this commodity, during the period 1921–27, averaged annually: 2,666 tons to the United Kingdom, 583 tons to the United States, 448 tons to India, and 5,000 tons were sent to Germany during 1926–7. For the better handling of the mineral a truck line has been constructed for some hundreds of yards along the shore.

Of the old and famous city which stood upon the promontory on the northern shore, scarcely anything of definite shape stands at the present day, except the old Portuguese fort, and much even of that has been undermined and washed away by the action of the sea; but traces of buildings of massive foundations, constructed of stone quarried in the island, and a great number of ruined water cisterns remain.

The name Hormuz referred originally to a town on the mainland situated probably on Khor Minab, near the present day Minab in 27° 9′ N., 57° 5′ E. The earliest mention of this name occurs, it seems, in the voyage of Nearchus (325 B.C.) when that admiral anchored Alexander's fleet on the shore of Harmozia at the mouth of the Anamis (R. Minab) in Kirman, "in a country pleasant and agreeable and abounding in everything except olives." The foundation of the city which eventually arose here is ascribed to Ardashir Papakan, founder of the Sassanian dynasty, but it was only after the Arab conquest that it attained great prominence. It was situated one parasang (about 4 miles) from the sea on a river which ships ascended to the town. Idrisi, Istakhri and Muqaddasi describe the place as the chief market of Kirman. Indigo is mentioned as the most important product, and Yaqut states that this Hormuz had attracted all the trade of India. After about the year A.D. 1100 Hormuz was under a dynasty of Arab rulers, and subsequent to 1262 it came under the rule of the Ilkhani of Persia. Marco Polo twice visited the place, in 1272 and 1293, and describes the business of the port, particularly noting the export of horses. It cannot be certainly ascertained what brought about the transference of the mart from the mainland to the island. Abul Fida says the town was destroyed by the "Tartars," but the Mongol invasion hardly touched the coast of Kirman.

Be that as it may, the new settlement was established by Qutb ud Din, on the island then known as Jerun or Zerun, and in spite of the unfavourable natural conditions, there arose a thriving centre of the world's commerce, from the 14th to the 16th centuries. The new Hormuz gradually superseded Qais (*q.v.*) as the most important emporium trade of the Persian gulf. Friar Odoric gives the earliest notice of the city which he describes as strongly fortified and abounding in costly wares. It was visited in the lapse of time by a number of other travellers from all of whom we infer that it was a fine city rising out of the sea and serving as a mart for all the products of India, which were distributed hence over all Persia. The princes of Hormuz at one time or another appear to have held sway over other islands of the Gulf and even over the shores of Oman. Nikitin, the Russian (*c.* 1470) conveys a similar impression of its importance and calls it "a vast emporium of all the World."

The appearance of the Portuguese in the Indian seas decided the fate of Hormuz. In 1507 the city was attacked by a Portuguese fleet under Albuquerque and partially subdued but it was not until 1514 that, having captured Goa and Malacca, Albuquerque returned and completed his conquest, and built a castle. For about a century, Hormuz remained practically in the dominion of Portugal, though the hereditary ruler, paying from his revenues a yearly tribute to Portugal (in lieu of which the latter eventually took the whole of the customs revenues) continued to be the instrument of government.

The rise of the English trade and factories, in the Indian seas, in the early part of the 17th century, led to constant broils and friction with the Portuguese; while the success of the East India Company in establishing trade relations with Persia only served to embitter the situation. Moreover Shah Abbas I. resented the Portuguese occupation of such a position as Hormuz within his dominions and was strongly desirous of obtaining the aid of English ships in attacking it. During 1620–1 the fleets of Portugal and of the East India Company more than once came into action in Indian waters, and in the latter year, the council of the company at Surat resolved on what was practically maritime war with the Portuguese flag, agreeing, though reluctantly, to lend the aid of their ships to the land forces of Persia, in an attack on the Portuguese. The combined forces first assaulted and destroyed the Portuguese fort on Qishm island and then turned their attention to Hormuz itself. The siege was opened on Feb. 18, 1622, and continued until May 1, when the Portuguese, after a gallant defence, surrendered. Hormuz never recovered from the blow.

The Persians transferred their establishments and material to Gombrun on the mainland, where Shah Abbas founded a port under the name of Bandar Abbas (*q.v.*), and in a few years Hormuz city was little more than a ruin.

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HORN, ARVID BERNHARD, COUNT (1664–1742), Swedish statesman, was born at Vuorentaka in Finland on April 6, 1664, of a noble but indigent family. He served for several years in the Netherlands, in Hungary under Prince Eugene, and in Flanders under Waldeck (1690–1695). He was one of the generals of Charles XII. in the earlier part of the great Northern War. In 1704 he was entrusted with his first diplomatic mission, the deposition of Augustus II. of Poland and the election of Stanislaus I. Shortly after the accomplishment of this mission he was besieged by Augustus in Warsaw and compelled to surrender. In 1705 he was made a senator, in 1706 a count and in 1707 governor of Charles XII.'s nephew, the young duke Charles Frederick of Holstein-Gottorp. In 1710 he succeeded Nils Gyldenstolpe as prime minister. Both in 1710 and 1713 Horn was in favour of summoning the estates, but when in 1714 the diet adopted an anti-monarchical attitude, he gravely warned and ultimately dissolved it. After the death of Charles XII. (1718) it was Horn who persuaded the princess Ulrica Leonora to relinquish her hereditary claims and submit to be *elected* queen of Sweden. He protested against the queen's autocratic behaviour, and resigned both the premiership and his senatorship. He was elected *landtmarskalk* at the diet of 1720, and contributed, on the resignation of Ulrica Leonora, to the election of Frederick of Hesse as king of Sweden, whose first act was to restore to him the office of prime minister. For the next eighteen years he controlled both the foreign and the domestic affairs of Sweden, and it was owing to his care that Sweden so rapidly recovered from the condition in which the wars of Charles XII. had plunged her. Horn increased the influence of the diet and its secret committees in the solution of purely diplomatic questions, thus weakening the central government. In 1734, however, the opposition in the diet denounced his neutrality on the occasion of the war of the Polish Succession, when Stanislaus I., again appeared upon the scene as a candidate for the Polish throne; but Horn was still strong enough to prevent a rupture with Russia. Henceforth he was bitterly but unjustly accused of want of patriotism, and in 1738 was compelled at last to retire before the impetuous onslaught of the triumphant young Hat party. The rest of his life was spent at his estate at Ekebyholm, where he died on April 17, 1742. Horn in many respects resembled his contemporary Walpole. The situation of Sweden, made his policy necessarily opportunist, but it was an opportunism based on excellent common sense.

See V. E. Svedelius, *Arvid Bernhard Horn* (Stockholm, 1879); R. N. Bain, *Gustavus III.,* vol. i. (London, 1894), and *Charles XII.* (1895); C. F. Horn, *A. B. Horn: hans lefnad* (Stockholm, 1852).

HORN, PHILIP DE MONTMORENCY, COUNT OF (1518–1568), a man of illustrious descent and great possessions in the Netherlands, became in succession under Charles V. and Philip II. stadtholder of Gelderland, admiral of Flanders and knight of the Golden Fleece. In 1559 he commanded the fleet which conveyed Philip II. from the Netherlands to Spain, and he remained at the Spanish court till 1563. On his return he placed himself with the prince of Orange and Count Egmont at the head of the party which opposed the policy of Cardinal Granvella. When Granvella retired the three great nobles continued to resist the introduction of the Spanish Inquisition and of Spanish despotic rule into the Netherlands. But though Philip appeared for a time to give way, he had made up his mind to visit the opponents of his policy with ruthless punishment. The regent, Margaret, duchess of Parma, was replaced by the duke of Alva, who entered the Netherlands at the head of a veteran army and at once began to crush all opposition with a merciless hand. Orange fled from the country, but Egmont and Horn, despite his warning, decided to remain and face the storm. They were both seized, tried and condemned as traitors, and were executed on June 5, 1568, in the great square before the town hall at Brussels. (*See* also EGMONT, LAMORAL, COUNT OF.)

See biographical notices in A. J. van der Aa, *Biographisch Woordenboek der Nederlanden* (Haarlem, 1851–79); J. Kok, *Vaderlandsch Woordenboek* (Amsterdam, 1785–99); also bibliography to chaps. vi. vii. and xix. in *Cambridge Modern History,* vol. iii., pp. 798–809 (1904).

HORN, English hero of romance. *King Horn* is a heroic poem or gest of 1,546 lines dating from the 13th century. Murry (or Allof), king of Sudenne (Surrey and Sussex?), is slain by Saracen pirates who turn his son Horn adrift with 12 other children. The boat drifts to Westernesse (Cornwall?), where the children are received by King Aylmer (Aethelmaer). Presently Horn is denounced by one of his companions as the lover of the king's daughter, Rymenhild (Rimel), and is banished, taking with him a ring, the gift of his bride and a talisman against danger. In Ireland he serves for seven years, and slays in battle the Saracens who had killed his father. Learning that Rymenhild is to be married against her will to King Mody, he returns to Westernesse disguised as a palmer, and makes himself known to the bride by dropping the ring into the cup she offers him, with the words "Drink to Horn of Horn." He then reconquers his father's kingdom and marries Rymenhild. The story of Horn resembles the legend of Havelok the Dane, and Richard of Ely followed the Horn tradition in the 12th century *De gestis Herewardi Saxonis.*

King Horn was re-edited for the Early English Text Soc. by G. H. McKnight in 1901.

HORN, a class of wind instruments primarily derived from natural animal horns, and having the common characteristics of a conical bore and the absence of lateral holes.

Modern horns may be divided into three classes: (1) the short horns with wide bore, such as the bugles (*q.v.*), and the post-horn. (2) The saxhorns (*q.v.*), a family of hybrid instruments designed by Adolphe Sax, and resulting from the adaptation of valves and of a cup-shaped mouthpiece to instruments of the calibre of the bugle. (3) The French horn, one of the most valuable and difficult wind instruments of the orchestra, having a very slender conical tube wound round in coils upon itself.

The French horn consists of four principal parts—the body, the crooks, the mouthpiece, and the slides.

(*a*) The *body* is the main tube, having a bore of the form known as trunco-conical measuring approximately 7ft. 4in. in length. The body is coiled spirally, and has at one end a wide-mouthed bell from 11 to 12in. in diameter, with a parabolic curve, and at the other a conical ferrule into which fit the crooks.

(*b*) The *crooks* are interchangeable spiral tubes of varying lengths, by attaching which to the mouthpiece the total length of the tube can be varied at will, and the pitch and key of the instrument thereby altered. The principle of the crook was known early in the 17th century, and it had been applied to the trumpet, trombone, and Jägertrummet before being adapted to the horn. From the crook, in turn, was developed the system of valves, which is but an instantaneous application of the same general principle to the individual notes of the harmonic series, each of which is thereby lowered a semitone, a tone, or a tone and a half as long as the valve remains in operation. The body of the horn without crooks is of the length to produce 8ft. C, and forms the standard, being known as the alto horn in C, which is the highest key in which the horn is pitched.

(*c*) The *mouthpiece* of the horn differs substantially from that of the trumpet. There is, strictly speaking, no cup, the inside of the mouthpiece being, like the bore of the instrument itself, in the form of a truncated cone or funnel.

(*d*) The *tuning slides* consist of a pair of sliding **U**-shaped tubes fitting tightly into each other, by means of which the instrument can be brought strictly into tune, and which also

act as compensators with the crooks.

Pitch.—The pitch of the horn, as of other wind instruments, depends almost exclusively on the length of the air-column set in vibration, but varies in accordance with the amount of blowing force employed.

As regards the fundamental tone, to set in vibration a column of air some 16 or 17ft. long, is a feat of extreme difficulty; hence it is quite exceptional to find a horn-player who can sound the fundamental on the low C or B♭ *basso* horns.

The practical aggregate compass of the natural horns from B♭ basso at the service of composers therefore ranges (actual sounds)

Scale.—By means of hand-stopping, *i.e.*, the practice of thrusting the hand into the bell in order to lower the sound by a tone or a semitone, or by the employment of valves, this compass may be rendered chromatic almost throughout the range.

The valve system consists of valves or pistons attached to additional lengths of tubing, the effect of which is almost invariably to lower the pitch.

Horns are made with either two or three valves by means of which the pitch can be lowered at will a semitone, a tone or a tone and a half. The three devices—crooks, valves, and slides—are, it will be seen, all based upon the same principle, that of providing additional length of tubing in order to deepen the pitch of the whole instrument at will, and to transpose it into a different key. But valves and slides, being instantaneous in operation, give to the instrument a chromatic compass, whereas crooks merely enable the performer to play in many keys upon one instrument instead of requiring a different instrument for each key.

Timbre.—The *timbre* of the natural horn is mellow, rich and sonorous, and distinguished at the same time by a certain human quality which differentiates it from that of all the other members of the brass wind. But it may be noted that the timbre of the piston notes is more resonant and less pleasing than that of the open notes, probably owing to the fact that the strictly conical bore of the natural horn has in this case been replaced by a mixed cylindrical and conical one, as in the trumpet and trombone.

History.—The origin of the horn must be sought in prehistoric times, when, by breaking off the tip of a short animal horn, one or at best two notes, powerful, rough, unsteady, only barely approximating to definite musical sounds, were obtained. This was undoubtedly the archetype of the modern families of brass wind instruments, and from it evolved the trumpet, the bugle, and the tuba no less than the horn.

Before civilization had dawned in classic Greece, the Egyptian, Assyrian and Semitic races were using wind instruments of wood and metal which had left the primitive ram or bugle horn far behind.

Among the Romans there were four instruments known by the name of *cornu:* (1) the short animal horn used by shepherds; (2) the longer, semicircular horn, used for signals; (3) the still longer *cornu*, bent and carried like the buccina, which had the wide bore of the modern tuba; and (4) a small instrument like the mediaeval hunting-horn, or post-horn, with a single spiral turn. A terra-cotta model of one of the last named, slightly broken, but with the spiral intact, was excavated at Ventoux, in France, and is preserved in the department of Greek and Roman antiquities at the British Museum.

All these wind instruments, to which may be added the lituus or cavalry trumpet, and the long straight tuba, seem to have been used during the classic Greek and Roman periods merely to sound fanfares, and therefore, in spite of the high degree of perfection to which they attained as instruments, they scarcely possess any claim to be considered within the domain of music.

After the fall of the Roman empire, when instrumental music had fallen into disrepute, and had been placed under a ban by the Church, the art of playing upon such highly-developed instruments gradually died out in Western Europe. With the disappearance of the civilization and culture of the Romans the skilled crafts also gradually vanished, and the art of making metal pipes of delicate calibre and of bending them was completely lost, and had to be re-acquired step by step during the middle ages from the more enlightened East.

During the middle ages the bugle-horn or bull's horn was extensively used as a signal instrument on land and sea (*see* BUGLE), by the night-watchmen in cities, in the watch tower of the feudal castle, and by foresters and huntsmen. The hunting-horn is generally represented as small and crescent-shaped in the hunting scenes which abound in illuminated mss. and early printed books, and when played it was held with the wide end curving upwards in front of the huntsman's head.

Music.—The earliest orchestral music for the horn goes back beyond the middle of the 17th century. Already, in 1639, Cavalli, in his opera *Le Nozze de Tito e Pelei* (act. i. sc. 1) introduced a short scena, "Chiamata alla Caccia" in C major for four horns on a basso continuo.

Cesti's operas of the same period likewise contain many passages evidently intended for the horn, although the instruments are not specified in the score, which was nothing unusual at the time. Later Lulli, in the incidental music for a ballet, *La Princesse d'Elide,* which formed part of Molière's divertissement, "Les plaisirs de l'île enchantée," written for a great festival at Versailles, on May 7, 1665, introduced a piece entitled "Les violons et les cors de chasse," written in much the same style as Cavalli's scena, by which, indeed, it is believed to have been inspired. The introduction of the natural horn into the orchestra of the French opera did not occur, however, until much later, viz., in 1735, in André Campra's *Achille et Deidamie,* and then only in a fanfare. In the meantime the horn had already won a place in most of the rising opera houses and ducal orchestras of Germany, and had been introduced by Handel into the orchestra in London in his *Water-music,* composed in honour of George I.

Horns were also employed by Bach, while it scarcely needs saying how largely they have been used since by modern composers from the time of Beethoven (who had an especial fondness for the instrument) onwards.

HORN. The weapons which project from the heads of various species of animals, constituting what are known as horns, embrace substances which are, in their anatomical structure and chemical composition, quite distinct from each other; and although in commerce also they are known indiscriminately as horn, their uses are altogether dissimilar. These differences in structure and properties were thus indicated by Sir R. Owen:—"The weapons to which the term horn is properly or technically applied consist of very different substances, and belong to two organic systems, as distinct from each other as both are from the teeth. Thus the horns of deer consist of bone, and are processes of the frontal bone; those of the giraffe are independent bones or 'epiphyses' covered by hairy skin; those of oxen, sheep, and antelopes are 'apophyses' of the frontal bone, covered by the corium and by a sheath of true horny material; those of the prong-horned antelope consist at their basis of bony processes covered by hairy skin, and are covered by horny sheaths in the rest of their extent. They thus combine the character of those of the giraffe and ordinary antelope, together with the expanded and branched form of the antlers of deer. Only the horns of the rhinoceros are composed wholly of horny matter, and this is disposed in longitudinal fibres so that the horns seem rather to consist of coarse bristles compactly matted together in the form of a more or less elongated sub-compressed cone." True horny matter is really a modified form of epidermic tissue, and consists of the albuminoid "keratin." It forms, not only the horns of the ox tribe, but also the hoofs, claws, or nails of animals generally, the carapace of the tortoises and the armadilloes, the scales of the pangolin, porcupine quills, and birds' feathers, etc.

Horn is employed in the manufacture of combs, buttons, the handles of walking-sticks, umbrellas, and knives, drinking-cups, spoons of various kinds, snuff-boxes, etc. In former times it was applied to several uses for which it is no longer required, although such applications have left their traces in the language. Thus the musical instruments and fog signals known as horns indicate their descent from earlier and simpler forms of apparatus made from horn. In the same way powder-horns were spoken of long after they ceased to be made of that substance; to a small extent lan-

terns still continue to be "glazed" with thin transparent plates of horn.

HORNADAY, WILLIAM TEMPLE (1854–), American zoological park administrator was born at Plainfield, Ind., on Dec. 1, 1854. He was educated at the Iowa State college. Having made a special study of zoology, he travelled extensively to collect specimens, visiting (1874–79) Florida, Cuba, the West Indies, South America, India, Ceylon, the Malay Peninsula and Borneo. From 1882 to 1890 he was chief taxidermist at the U S. National Museum, Washington, D.C. In 1896 he became director of the N.Y. Zoological Park at The Bronx, New York city, from which position he retired in 1926. He was active in promoting game preserves and instigating legislation for the protection of wild life, having been instrumental in founding the Permanent Wild Life Protection Fund ($105,000). For years he carried on a "war against the gamehogs of the Atlantic coast," in an attempt to preserve from extinction the vanishing species of mammals and birds which supply the legitimate game for North America. It was largely due to his action that the bison was saved from extinction on the American continent.

Hornaday wrote a number of fascinating works on animal life, among which may be mentioned *Two Years in the Jungle* (1885); *American Natural History* (1904); *Camp-fires in the Canadian Rockies* (1906); *Our Vanishing Wild Life* (1913); *Minds and Manners of Wild Animals* (1922); *A Wild Animal Round Up* (1925); *Wild Animal Interviews* (1928).

HORNBEAM (*Carpinus betulus*), a member of a small genus of trees of the family Betulaceae The common hornbeam, or yoke-elm, *Carpinus betulus*, is indigenous in the temperate parts of western Asia and of Asia Minor, and in Europe, where it ranges as high as 55° and 56° N lat. It is common in woods and hedges in parts of Wales and of the south of England. The trunk is usually flattened, and twisted as though composed of several stems united; the bark is smooth and light grey; and the leaves are in two rows, 2 to 3 in. long, elliptic-ovate, doubly toothed, pointed, numerously ribbed, hairy below and opaque, and not glossy as in the beech, have short stalks and when young are plaited. The stipules of the leaves act as protecting scale-leaves to the winter-bud and fall when the bud opens in spring. The flowers appear with the leaves in April and May. The male catkins are about 1½ in. long, and have pale-yellow anthers, bearing tufts of hairs at the apex; the female attain a length in the fruiting stage of 2 to 4 in., with bracts 1 to 1½ in. long. The green and angular fruit or "nut" ripens in Oct.; it is about ¼ in. in length, is in shape like a small chestnut, and is enclosed in leafy, 3-lobed bracts. The hornbeam thrives well on stiff, clayey, moist soils, into which its roots penetrate deeply; on chalk or gravel it does not flourish. Raised from seed it may become a tree 40 to as much as 70 ft. in height, greatly resembling the beech, except in its rounder and closer head. It is, however, rarely grown as a timber-tree, its chief employment being for hedges. The wood of the hornbeam is white and close-grained, and polishes ill, is of considerable tenacity and little flexibility, and is extremely tough and hard to work—whence, according to Gerard, the name of the tree. As a fuel it is excellent; and its charcoal was much esteemed for making gunpowder. In France the leaves serve as fodder. The tree is a favourite with hares and rabbits, and the seedlings are apt to be destroyed by mice.

The American hornbeam, blue or water beech, is *Carpinus americana;* the common hop-hornbeam, a native of the south of Europe, is a member of a closely allied genus, *Ostrya vulgaris;* the allied American species, *O. virginica*, is also known as ironwood from its very hard, tight, close-grained wood.

HORNBILL, the name given to a group of birds, from the horn-like excrescence (*epithema*) on the bill of most species; they form the family *Bucerotidae*, allied to the hoopoes and kingfishers. It is divided into the *Bucerotinae* or true hornbills and the *Bucorvinae* or ground hornbills, which contain but one genus, *Bucorvus*, confined to Africa.

In the helmet hornbill (*Buceros vigil*), the epithema is solid, but in all the other species is honeycombed with air spaces. Hornbills are found in Africa, south-eastern Asia and the Malay Archipelago. They live in flocks and feed mainly upon fruits and seeds, though the larger forms will devour snakes and the smaller eat insects. They breed in holes in trees, laying large white eggs. When the hen begins to sit, the cock plasters up the entrance with mud, leaving only a small hole through which the hen receives the food he brings. This he casts up enfolded in the lining of the gizzard (C. W Beebe, *The Bird*, 1907, p. 140) An account of a nestling hornbill is found in Wallace's *Malay Archipelago.*



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE GREAT PIED HORNBILL (DICHOCEROS BICORNIS)

HORNBLENDE is a member of the amphibole (*q.v.*) group of minerals. The name is now restricted to the sesquioxide-bearing members of the monoclinic amphiboles, hornblende occupying the same position in the amphibole group that augite occupies in the pyroxene group The hornblendes have a complex and variable composition, their constitution being at present unsatisfactorily elucidated. In addition to the dominant molecules, $Ca(Mg,Fe)_3(SiO_3)_4$, they contain variable amounts of Al_2O_3, Fe_2O_3 and Na_2O, the last probably as $NaAl(SiO_3)_2$, but the manner in which the excess sesquioxides enter into their constitution is undecided. The crystals are usually prismatic with well-developed cleavages (110–110) at 56°. The colour is grey, green, brown or black according to the composition. Coloured varieties are usually strongly pleochroic. Some hornblendes contain significant percentages of titanium—as in basaltic hornblende, while others rich in soda are known as alkali-amphiboles (*see* AMPHIBOLE).

The optical extinction angles in the plane of symmetry are usually smaller than those of the corresponding pyroxenes Hornblende is an essential constituent of many igneous and metamorphic rocks, being specially prominent in diorites, amphibolites and hornblende-schists. Exceptionally well-crystallized examples are known from the basalts of Bilin and Sçhima (Czechoslovakia).

HORN-BOOK, a name originally applied to a sheet containing the letters of the alphabet, which formed a primer for the use of children. It was mounted on wood and protected with transparent horn. The wooden frame had a handle, and it was usually hung at the child's girdle. The sheet, which in ancient times was of vellum and latterly of paper, contained first a large cross—the criss-cross—from which the horn-book was called the Christ Cross row, or criss-cross-row. The alphabet in large and small letters followed The vowels then formed a line, and their combinations with the consonants were given in a tabular form The usual exorcism—"in the name of the Father and of the Sonne and of the Holy Ghost, Amen"—followed, then the Lord's Prayer, the whole concluding with the Roman numerals.

HORNBY, SIR PHIPPS (1785–1867), British admiral, was born on April 27, 1785, the son of Geoffrey Hornby, rector of Winwick (Lancs). He entered the navy in May 1797, and served with Captain Bligh until 1804, when he was promoted lieutenant of the "Excellent." He took part in various naval engagements in the Napoleonic wars, distinguishing himself in particular in the frigate action off Lissa (1811) under Admiral Sir William Hoste (*q.v.*). From 1816 to 1832 he lived in retirement, and was then appointed superintendent of the Royal Naval Hospital at Plymouth. He again went to sea in 1847, when he was made commander-in-chief in the Pacific. In 1851–2 he was a lord of the Admiralty, and became vice-admiral in 1854 and admiral in 1858. He died on March 19, 1867.

HORNCASTLE, a market-town in Lincolnshire, England, at the foot of the Wolds, at the confluence of the Bain and Waring streams; the terminus of a branch line of the L.N.E.R., 130 m. N. from London. Pop. of urban district (1921) 3,459. The manor of Horncastle (Hornecastre) belonged to Queen Edith in Saxon

times and was royal demesne in 1086 and the head of a large soke. Under Stephen it belonged to Alice de Cundi, a partisan of the empress Maud, and passing to the crown on her death it was granted by Henry III. to Gerbald de Escald, from whom it descended to Ralph de Rhodes, who sold it to the bishop of Carlisle in 1230. The see of Carlisle retained it till the reign of Edward VI. when it was granted to Edward, Lord Clinton, but was recovered in the following reign. In 1230 Henry III. directed the men of Horncastle to render a reasonable aid to the bishop, who obtained the right to try felons, hold a court leet and have free warren. An inquisition of 1275 shows that the bishop had, besides the return of writs, the assize of bread and ale and waifs and strays in the soke. Horncastle was a centre of the Lincolnshire rebellion of 1536. Royalist troops occupied the town in 1643, and were pursued through its streets after the battle fought at Winceby. Horncastle was never a municipal or parliamentary borough, but during the middle ages it was frequently the residence of the bishops of Carlisle. Its prosperity has always depended largely on its fairs, the great horse fair described by George Borrow in *Romany Rye* being granted to the bishop in 1230 for the octave of St. Lawrence, together with the fair on the feast of St. Barnabas. The three other fairs are apparently of later date. The church of St. Mary is mainly Decorated and Perpendicular, with some Early English remains and an embattled western tower. Queen Elizabeth's grammar school was founded in 1562. The prosperity of the town is chiefly dependent on agriculture and its well-known horse fairs. Brewing and malting, and leather dressing are carried on, and there is some trade in coal, iron and wood.

HORN-DANCE, a mediaeval dance, still celebrated during the September "wakes" at Abbots Bromley, a village on the borders of Needwood forest, Staffordshire. Men, each wearing a deer's skull with antlers, dance through the streets, pursued by a comrade who bestrides a mimic horse, and whips the dancers to keep them on the move. The horn-dance usually takes place on the Monday after Wakes Sunday.

See C. J. Sharp, *The Sword Dances of Northern England together with the Horn Dance of Abbots Bromley* (1911).

HORNE, HENRY SINCLAIR HORNE, 1ST BARON cr. 1919 (1861–), British general, was born on Feb. 1, 1861. He joined the Royal Artillery in 1880 and served on the staff throughout the South African War (1899–1902). In 1912 he became inspector of artillery, and in Aug. 1914 went to France in command of the artillery of the I. Army Corps. At the end of 1915 he was given charge of the XV. Army Corps in Egypt and he took this to France in April 1916, commanding it during the opening phases of the battle of the Somme. His method of employing his guns during these operations attracted much attention and was signally successful, as was recognized by his being chosen in Sept. to succeed Sir C. Monro as leader of the I. Army. His troops took a prominent part in the battle of Arras, 1917, and when the enemy, in March and April 1918, made his great effort they repulsed all attacks that were made upon their front. Then, when the Allies' counter-offensive developed in the late summer, their part in the final victories was conspicuous. For his services he was raised to the peerage as Baron Horne of Stirkoke, and received a grant of £30,000. He held the Eastern command from 1919 to 1923, and retired in 1926. He received many honours, including the G.C.B. (1919).

HORNE, RICHARD HENRY or **HENGIST** (1803–1884), English poet and critic, was born in London. He was entered at Sandhurst, but receiving no commission he joined the Mexican navy, and served in the war against Spain. In 1837 he published two tragedies, *Cosmo de Medici* and *The Death of Marlowe*, and in 1841 a *History of Napoleon*. The book, however, by which he lives is his epic of *Orion* (1843). It was published originally at a farthing, and passed through many editions. In a volume of critical essays, *A New Spirit of the Age* (1884), he was assisted by Elizabeth Barrett (Mrs. Browning), with whom from 1839 to her marriage in 1846, he conducted a voluminous correspondence. The years 1852–69 were spent in Australia, where he was a commissioner of lands. He received a civil list pension in 1874.

HORNE, SIR ROBERT STEVENSON, G.B.E., 1920 (1871–), British statesman, was born at Slamannan Manse, Stirlingshire, on Feb. 28, 1871. Educated at George Watson's college, Edinburgh, and the University of Glasgow, he became, in 1895, lecturer in philosophy at University college, Bangor. Called to the Scottish bar in 1896, in 1910 he became a K.C., and stood unsuccessfully as a Unionist for Stirlingshire in both the general elections of that year. In the course of the World War he was appointed assistant inspector-general of transportation. In 1917 he was made director of the Admiralty department of Materials and Priority. In 1918 he became director of the Admiralty labour department, being also made third civil lord of the Admiralty. Later in the same year he was elected Unionist member for the Hillhead division of Glasgow. In 1919 he became minister of labour, and as such presided over the National Industrial Conference of February and April 1919. In 1920 he became president of the Board of Trade. In 1921 he was appointed chancellor of the exchequer in succession to Austen Chamberlain, in Lloyd George's Coalition ministry, but he did not accept office under Bonar Law or Baldwin. Instead he associated himself with the management of two or three large commercial undertakings, including one of the leading English banks and became an important figure in business circles. He was elected lord rector of Aberdeen university in 1921.

HORNE, THOMAS HARTWELL (1780–1862), English theologian and bibliographer, was born in London on Oct. 20, 1780, and educated at Christ's Hospital, with S. T. Coleridge as an elder contemporary. On leaving school he became clerk to a barrister, but showed a keen taste for authorship. As early as 1800 he published *A Brief View of the Necessity and Truth of the Christian Revelation,* which was followed by many works on very varied subjects. He was appointed (1824) senior assistant librarian in the department of printed books in the British Museum. After the project of making a classified catalogue had been abandoned, he took part in the preparation of the alphabetical one, and his connection with the museum continued until within a few months of his death on Jan. 27, 1862.

HORNED OWL, a name applied to an owl (*q.v.*) with tufts of feathers on the head simulating horns, and especially to the European eagle owl (*Bubo bubo*), and the American great horned owl (*B. virginianus*). Of the latter, several subspecies are recognized: the western horned owl (*B.v. pallescens*), the paler Arctic horned owl (*B. v. arcticus*), the dusky horned owl (*B. v. saturatus*) and the smaller Pacific horned owl (*B. v. pacificus*).

HORNED TOAD, the common name of North American lizards of the genus *Phrynosoma*. There are 17 species, of which 10 occur in the arid regions of the western United States and the remainder in similar situations in Mexico. They are short-legged, flat-bodied, harmless creatures of grotesque appearance. The hinder border of the head is armed with long, sharp, hornlike spines; the sides of the body and tail are often similarly protected. Upon these more or less erectile spines they depend chiefly for defence. The horned toads inhabit arid plains, deserts and dry forests, and feed chiefly upon insects. The eggs are retained within the body of the female until ready to hatch. The common horned toad (*P. cornutum*), one of the largest species, is about 6 in. long, with a body width of 2½ inches. It is abundant in high arid plains from western Nebraska and eastern Colorado southward to Texas. Other similar species, some of which are less than 4 in. long, are found from Wyoming to Washington and southward to Mexico.

HORNELL, a city of Steuben county, New York, 90m. S.E. of Buffalo, on the Canisteo river; served by the Erie and the Pittsburg, Shawmut and Northern railways. The population was 15,025 in 1920 (92% native white) and was estimated locally at 16,500 in 1928. It is the trade centre for a wide agricultural area; has large railroad shops and woodworking industries; and manufactures silk gloves, silk cloth, shoes, furniture and electrical specialties. The aggregate factory output in 1928 was valued at $15,000,000. A settlement was founded here in 1790, known as Upper Canisteo until 1820, when it was renamed Hornellsville in

honour of Judge George Hornell (d. 1813). It was incorporated as a village in 1852 and as a city in 1888, and in 1906 the name was shortened to its present form.

HORNEMANN, FREDERICK (1772–1801), German traveller in Africa, was born at Hildesheim. He was a young man when, early in 1796, he offered his services to the African Association of London as an explorer in Africa. In Sept. 1797 he arrived in Egypt, and, on Sept. 5, 1798, he joined a caravan returning to the Maghrib from Mecca, attaching himself to a party of Fezzan merchants who accompanied the pilgrims. Hornemann assumed the character of a young mameluke trading to Fezzan; he was accompanied as servant and interpreter by Joseph Freudenburg, a German convert to Islam, who had thrice made the pilgrimage to Mecca. Travelling by way of the oases of Siwa and Aujila, a "black rocky desert" was traversed to Temissa in Fezzan. Murzuk was reached on Nov. 17, 1798. Here Hornemann lived till June 1799, going thence to the city of Tripoli, whence in August of the same year he despatched his journals to London. He then returned to Murzuk. When he left Tripoli it was his intention to go direct to the Hausa country, which region he was the first European definitely to locate. A report reached Murzuk in 1819 that the traveller had gone to "Noofy" (Nupe), and had died there. Hornemann was the first European in modern times to traverse the north-eastern Sahara.

Hornemann's journal was printed at Weimar in 1801; an English translation, *Travels from Cairo to Mourzouk*, etc., with maps and dissertations by Major James Rennell, appeared in London in 1802.

HORNER, FRANCIS (1778–1817), British economist, born at Edinburgh on Aug. 12, 1778, was called to the Scottish bar in 1800. Horner removed to London in 1802, and occupied the interval that elapsed before his admission to the English bar in 1807 with researches in law, philosophy and political economy. In February 1806 he became one of the commissioners for adjusting the claims against the nawab of Arcot, and in November entered parliament as member for St. Ives. Next year he sat for Wendover, and in 1812 for St. Mawes, in the patronage of the marquis of Buckingham. He died at Pisa, on Feb. 8, 1817. As chairman of the parliamentary committee for investigating the depreciation of bank-notes, for which he moved in 1810, he extended and confirmed his fame as a political economist by his share in the famous *Bullion Report*. It was chiefly through his efforts that the paper-issue of the English banks was checked, and gold and silver reinstated in their true position as circulating media. Horner was one of the promoters of the *Edinburgh Review* in 1802. His articles in the early numbers of that publication, chiefly on political economy, form his only literary legacy.

See *Memoirs and Correspondence of Francis Horner, M.P.*, published by his brother in 1843.

HÖRNES, MORITZ (1815–1868), Austrian palaeontologist, born on July 14, 1815, at Vienna, where he was educated. He became assistant in the Vienna mineralogical museum. He studied the Tertiary mollusca of the Vienna Basin and on the Triassic mollusca of Alpine regions. He died in Vienna on Nov. 4, 1868. His son, RUDOLF HÖRNES (1850–1912), professor of geology and palaeontology in the university of Graz, carried on researches among the Tertiary mollusca. His *Elemente der Paläontologie* (1884) was translated into French. Another son, MORITZ HÖRNES (1852–1917), keeper of the Natural History museum in Vienna, carried out archaeological investigations in Bosnia and Hercegovina. Among his numerous works is *Natur- und Urgeschichte des Menschen* (2 vols., 1909).

HORNET, a name given to several species of large wasps (*q.v.*), especially the European *Vespa crabro* and North American *V. maculata*. (*See* SOCIAL INSECTS.)

HORNFELS, in petrology, the group designation for a series of rocks that have been partially or wholly recrystallized by the heat of intrusive igneous masses. Most hornfelses are fine textured and massive, recrystallization having effaced the structures and textures of the original rocks and replaced original minerals by new assemblages. They are the characteristic rocks forming the inner zone of the thermal aureole of alteration surrounding bosses or laccoliths of plutonic rocks. The commonest types of hornfelses are derived from shales, impure limestones and basic igneous rocks. Shales give rise to brown or black hornfelses rich in biotite mica, andalusite and cordierite; while impure limestones give the "calc-silicate hornfelses" rich in pyroxene, garnet, idocrase or wollastonite. The hornfelses derived from basic igneous rocks are dark green types rich in felspar and pyroxene or monoclinic amphibole These are the basalt or dolerite hornfelses. (*See* also METAMORPHISM.) (C. E. T.)

HORNIMAN, ANNIE ELIZABETH FREDERICKA (1860–), British theatrical manager, was born at Forest Hill, London, on Oct. 3, 1860. Educated privately, she studied art for a period at the Slade school under Professor Legros. At an early age she became interested in the theatre, and to the furtherance of this cause most of her subsequent life was devoted. Her first theatrical enterprise at the Avenue theatre, London, in 1894, was a failure. In 1904 she became associated with the Abbey theatre, Dublin, and subsidised the Irish National Theatre Society, which presented a series of plays by Irish dramatists dealing with various phases of Irish life. She will be chiefly remembered, however, for her institution in 1907 of the Repertory Theatre movement in Manchester. She acquired the Gaiety theatre, Manchester, in 1908 and converted it into a repertory house in which some of the best known plays of modern times were originally produced. In 1921 she relinquished her control as owner and conductor of this enterprise, after 14 years of unbroken success

See P. P. Howe, *The Repertory Theatre: a Record and a Criticism* (1910).

HORNING, LETTERS OF, a term in Scots law. Formerly all decrees of court for payment of money might be put in execution by letters issuing from the King's signet. These signet letters were called letters of horning or letters of four forms. Under them the debtor was charged four times successively to make payment, but in the fourth charge he was called on either to pay or to enter himself in a specified prison. Failing implement of the fourth charge he was denounced rebel at the horn. The method of declaring a person a rebel was by giving three blasts on a horn and publicly proclaiming the fact; hence the expression "put to the horn." This system of execution was simplified by an act of 1837 (Personal Diligence Act), and execution is now usually by diligence. (*See* EXECUTION.)

HORNPIPE, originally the name of an instrument now obsolete and now the name of an English national dance. The sailors' hornpipe, although the most common, is by no means the only form of the dance, for there is a pretty tune known as the "college hornpipe," and other specimens of a similar kind.

HORNSEY, a municipal borough in Middlesex, England, 6 m. N. of St. Paul's Cathedral, on the L.N.E.R. Pop. (1921) 87,659. The manor, called in the 13th century *Haringee* (a name which survives as Harringay), belonged from an early date to the see of London, the bishops having a seat here. In 1387 the duke of Gloucester, uncle of Richard II., assembled in Hornsey Park the forces by the display of which he compelled the king to dismiss his minister de la Pole, earl of Suffolk; and in 1483 the park was the scene of the ceremonious reception of Edward V., under the charge of Richard, duke of Gloucester, by Edmund Shaw, lord mayor of London. The parish church of St. Mary, Hornsey, has a Perpendicular tower (*c.* 1500). Finsbury Park, of 120 ac., is within the borough. Hornsey was incorporated in 1903.

HOROSCOPE: *see* ASTROLOGY.

HOROWITZ, ISAIAH (*c.* 1555–*c.* 1630), Jewish rabbi and mystic, was born at Prague, and died at Safed He held various rabbinates, notably at Frankfort-on-the-Main (*c.* 1606) and at Prague (1614). From 1621 onwards he lived in Palestine. In 1625 he was imprisoned by the pasha but, on being ransomed, settled in Safed, at that time the home of Jewish Kabbala. Horowitz's largest work, *Shelah* (abbreviated from the initials of the full title *Shene luhoth ha-berit*, "Two Tables of the Covenant") is a compilation of ritual, ethics and mysticism. It has been often reprinted, especially in abbreviated form. His prayer book is also marked by cabalistic doctrines.

For an account of the Jewish mystics at Safed *see* S. Schecter,

Studies in Judaism, series ii. (1908).

HORREUM, the Latin word for a magazine for the storage of grain. The storehouses of Rome were extensive, there being no fewer than 290 public *horrea* at the time of Constantine. They were used for the storage of food, being part of the great Roman system of providing food for the population, and were supplied constantly with corn and other provisions from Africa, Spain and elsewhere.

HORROCKS, JEREMIAH (1619–1641), English astronomer, was born in 1619 at Toxteth Park, near Liverpool. He was a student at Emmanuel college, Cambridge, from 1832–35; then he became a tutor at Toxteth and studied astronomy in his spare time. He calculated that, contrary to the prediction in Kepler's Rudolphine Tables, a transit of Venus would occur on Nov. 24 (O.S.) 1639. This was a Sunday, and Horrocks, acting at that time as curate of Hoole, rushed from his clerical duties just in time to see the transit take place. This was the first transit of Venus to be observed. Horrocks was a brilliant young man, and before his death on Jan. 3, 1641, when in his 22nd year, he had considerably advanced the lunar theory; reduced the solar parallax to 14″; suggested perturbations of the moon's orbit as due to the disturbing action of the sun; made observations of the tides; and investigated the irregularities of motion of Jupiter and Saturn.

Only a remnant of the papers left by Horrocks was preserved by the care of William Crabtree. After his death (which occurred soon after that of his friend) these were purchased by Dr. Worthington, of Cambridge; and from his hands the treatise *Venus in sole visa* passed into those of Hevelius, and was published by him in 1662 with his own observations on a transit of Mercury. The remaining fragments were, under the direction of the Royal Society, edited by Dr. Wallis as *Astronomia Kepleriana defensa et promota*, and published with numerous extracts from the letters of Horrocks to Crabtree, and a sketch of the author's life, in a volume entitled *Jeremiae Horroccii opera posthuma* (London, 1672). A memoir of his life by the Rev. Arundell Blount Whatton, prefixed to a translation of the *Venus in sole visa*, appeared at London in 1859.

See also J. Hevelius, *Mercurius in sole visus* (1662); Sir E. Sherburne, *Sphere of M. Manilius* (1675); T. Birch, *History of the Royal Society* (4 vols., 1756–57); B. Martin, *Biographia philosophica* (1764); J. B. J. Delambre, *Histoire de l'astronomie moderne* (2 vols., 1821); and *Histoire de l'astronomie au XVIIIe siècle* (1827); W. Whewell, *History of the Inductive Sciences* (3 vols., 1837); S. Rigaud, *Correspondence of Scientific Men* (2 vols., 1841–62); R. Grant, *History of Physical Astronomy* (1852); R. Brickel, *Transits of Venus, 1639–1874* (Preston, 1874); J. E. Bailey, "The Writings of J. Horrocks and W. Crabtree" in the *Palatine Note-Book* (with bibliography, 1883, also in *Notes and Queries*, Dec. 2, 1882). *See* also *Notes and Queries*, 3rd series, vol. v. (1864), 5th series, vols. ii. and iv. (1874).

HORROCKS, JOHN (1768–1804), British cotton manufacturer, was born at Edgeworth, near Bolton. His father was the owner of a small quarry, and John Horrocks spent his early days in dressing and polishing millstones. The Lancashire cotton industry was then in its infancy. Horrocks obtained a few spinning-frames which he erected in a corner of his father's offices. For a time he combined cotton-spinning on a very small scale with stone-working, but finally devoted himself entirely to cotton-spinning, working the frames with his own hands, and travelling through the Lancashire manufacturing districts to sell the yarn. In 1791 he removed to Preston, where he began to manufacture cotton shirtings and long-cloths in addition to spinning the cotton yarn. By taking full advantage of the machinery invented for manufacturing textiles, and by rigidly maintaining the quality of his goods, Horrocks rapidly developed his business. Within a year of his arrival in Preston he erected his first large mill, securing shortly afterwards from the East India Company a monopoly of the manufacture of cottons and muslins for the Indian market. In 1801 the firm became Horrockses, Miller and Company.

HORS D'OEUVRE. Hors d'oeuvre in cookery is the name given to small appetising morsels of food generally served cold, such as caviare, creamed meat or fish masked with aspic, etc. These dishes are served at the beginning of a meal and may be either handed round or placed ready in front of the diner.

Many different kinds of food are used for making hors d'oeuvre dishes, *e.g.*, meat, fish, vegetable or fruit. While some are "made-up" dishes, other foods are served in a raw state, *e.g.*, oysters. As far as possible, where "made-up" hors d'oeuvre are given, these should be prepared as complete portions so that they need no carving or cutting. Diminutive rolls, thin strips of pastry, toast or special small savoury biscuits are frequently used as *canapés* (foundations) for hors d'oeuvre mixtures. Sieved yolk of a hard-boiled egg, truffles, diced vegetables, aspic jelly, mustard and cress, parsley, etc., are among the many decorations used for these dishes.

Where vegetable salads are used as hors d'oeuvre a mayonnaise sauce mixed with aspic jelly is often employed as a coating. Stuffed hard-boiled eggs, jellied moulds of vegetables, fish, meat, etc., are other forms of hors d'oeuvre, also dainty sandwiches with a well-flavoured savoury paste.

Smoked and cured fish are popular forms of hors d'oeuvre, *e.g.*, smoked salmon, anchovies. Strips of smoked salmon are occasionally spread with a savoury mixture and rolled. Anchovies may be boned and coiled round olives, etc. Prawns may be served *au naturel* by sticking them into a whole lemon. Crab and lobster meat form the basis of many creams, while bivalves, such as oysters or mussels, may be served with vinegar or lemon, a relish sauce, etc., and handed with brown bread and butter.

Hors d'oeuvre *varié* is a mixed dish of different kinds of foods, *e.g.*, sardines, anchovies, olives, some form of galantine, slices of tomato, beetroot, etc.

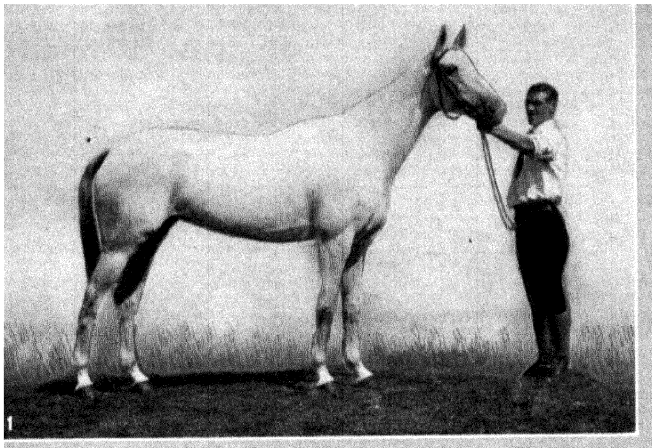
HORSE, the name given to the well known domestic mammal, *Equus caballus*, and its wild representative, *Equus przewalskii*; the term is also used to include various fossil species and sometimes, more widely, for the whole family *Equidae* (*q.v.*).

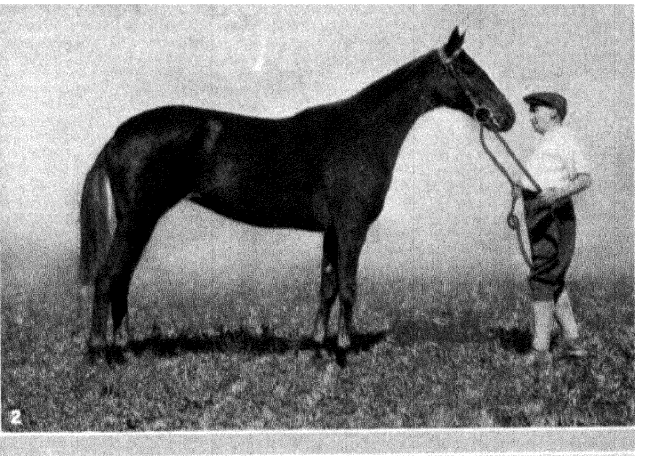
ORIGIN AND HISTORY

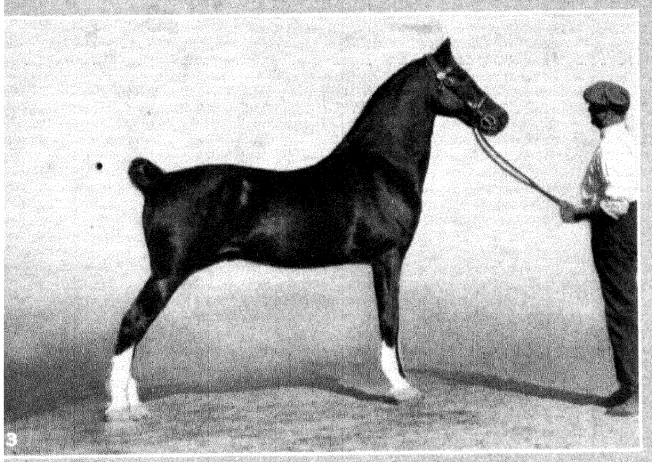
Despite a great deal of antiquarian research and much ingenious speculation there remain a good many unsolved riddles connected with the origin and early history of the horse. The most complete series of fossils has been found in America. It appears, however, that the real birthplace of the tribe was in Asia, and that North America was populated by successive waves, which crossed over by the land-bridges existing in Tertiary times. (*See* EQUIDAE.) Horses survived in North America throughout the Pleistocene period, but at the end of that epoch the whole tribe died out, and the continent was not repopulated until the time of the Spanish occupation. Probably the same is true as regards South America. We can only guess at the cause of the extermination of the American horse. Food or climatic conditions can hardly have been concerned, for the other large herbivorous animals of the prairie survived and multiplied—the bison for example. Perhaps the likeliest explanation is that some insect-borne disease, like the tsetse fly disease of Africa, broke out and spread before the race had time to acquire immunity.

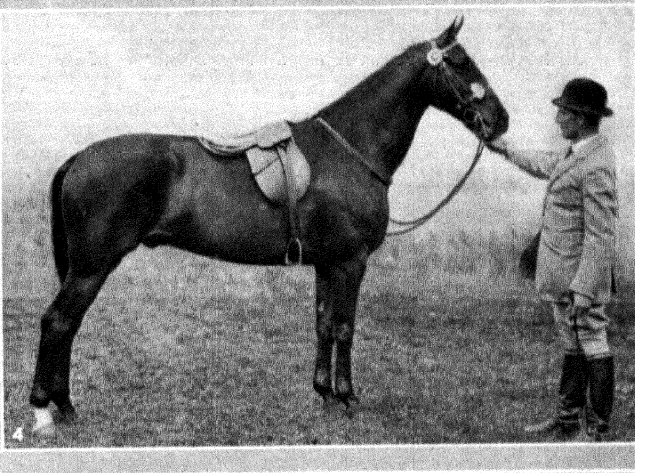
The other members of the *Equidae* (asses and zebras) are described in separate articles. There is no question of their specific distinctness from the horse. Hybrids of all kinds are easily bred, but there is no authentic case of fertility either in mules or in zebra-horse or zebra-ass hybrids.

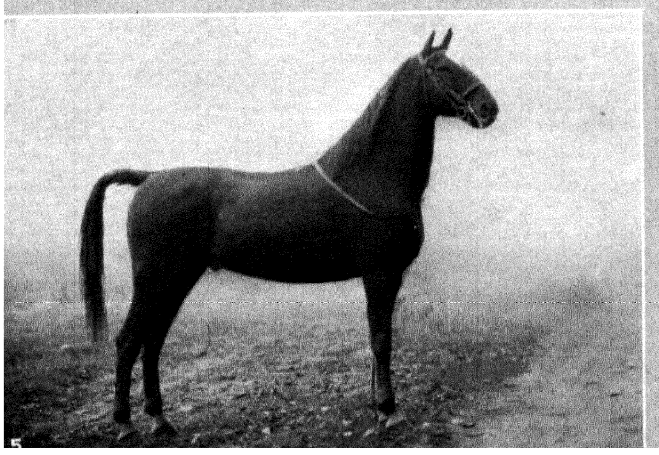
The Wild Horse.—The only truly wild horse now in existence is that known as Prejvalsky's horse (*Equus przewalskii*), named after the Russian explorer, to whom was presented, in 1879, the first specimen known to science. This horse, or rather pony, is found in the Kobdo district of western Mongolia. It lives in small herds of five to 15 head, each under the leadership of an old stallion. In 1902 Karl Hagenbeck of Hamburg led an expedition to the Gobi and succeeded, with the help of some 2,000 Kirghis whom he mobilized, in capturing 32 foals. From these a good many specimens have since been bred, and *Equus przewalskii* has become a familiar object in zoological gardens. An average specimen is about 12 hands (4ft.) high. The head is very large and rather ungainly, with a small eye and generally a rather wicked expression. The mane is short and erect and the forelock wanting; the tail, too, is rather mule-like, with short hair on the upper part of the dock; the feet are rather narrow, as in the asses and zebras, but the ears are quite short, and there are, as in most horses, callosities or "chestnuts" on all four legs. The colour is

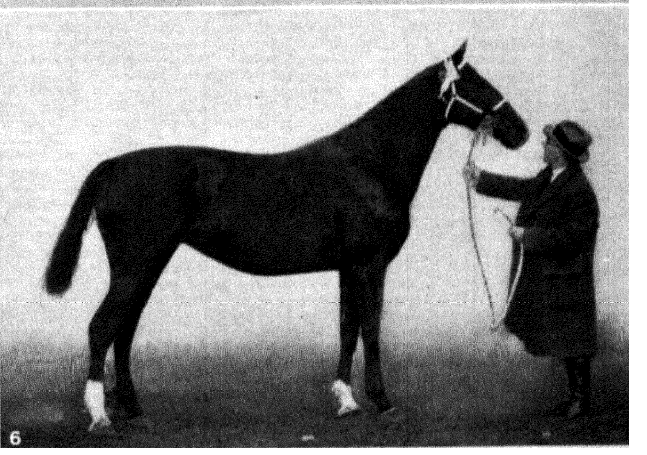










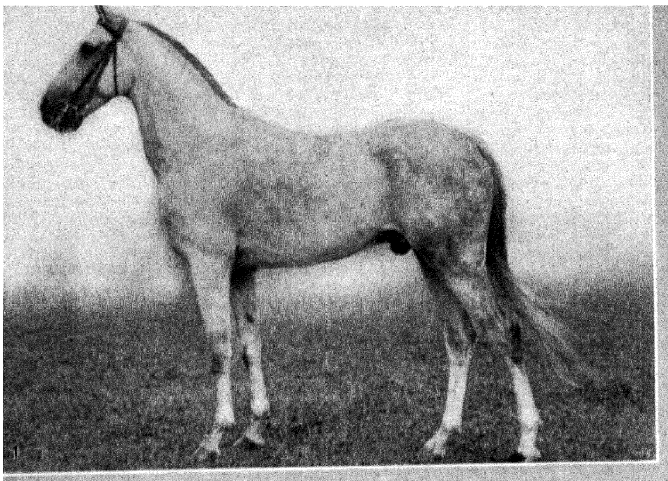


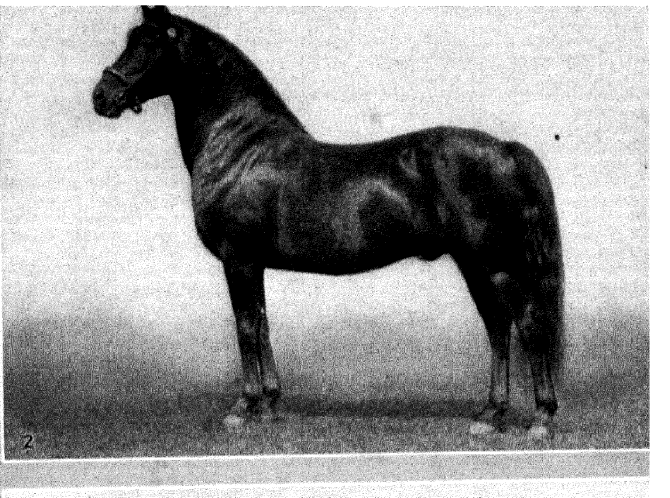
PHOTOGRAPHS, (1, 2, 3, 5, 6) H. A. STROHMEYER, JR., (4) SPORT AND GENERAL PRESS AGENCY, LTD

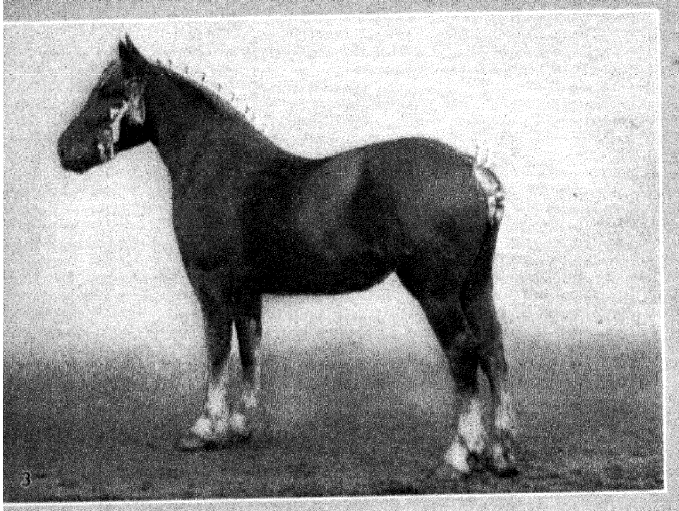
POLO PONIES AND SHOW HORSES

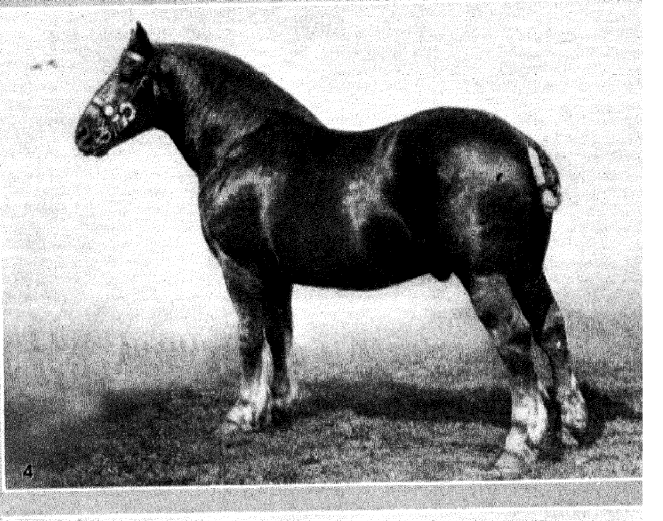
1. Polo pony, "White Mark," the best playing pony at the Polo Pony Show, Meadowbrook, L.I. Maharaja of Patiala, owner
2. Polo pony, "Campfield," best playing pony of the Polo Pony Show, Westbury, L.I. F. S. Von Stade, owner
3. Hackney pony, grand ch. "Marlboro." Mrs. Paul Moore, owner
4. Hunter, "Always There," champion hunter of the Somersetshire Agricultural Association exhibition at Bath, England. H. Frank, owner
5. "North Star," a Kentucky breed. R. C. Tway, owner
6. "Sandmark," grand champion thoroughbred mare Royal Winter Fair, Toronto, Ontario, 1924. W. B. Cleland, Hamilton, Ontario, owner

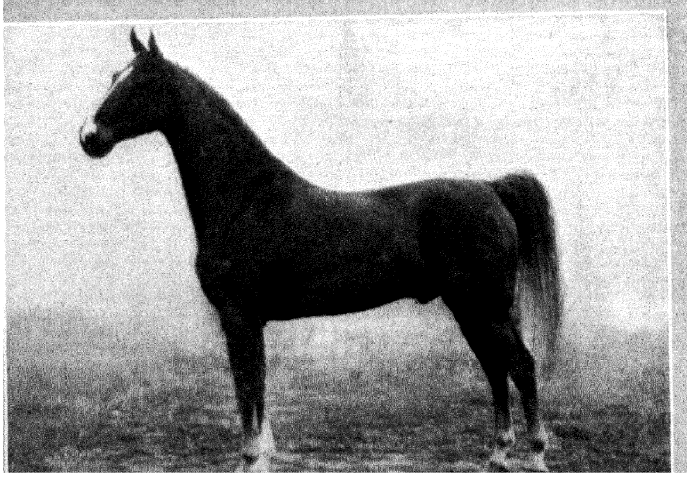
HORSE

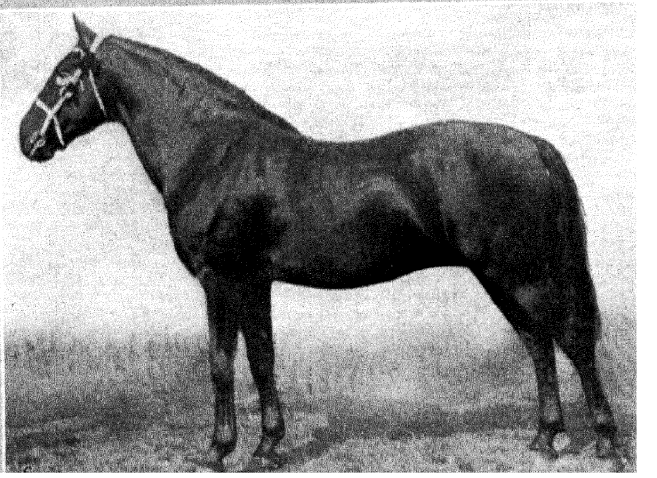












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TYPES OF HARNESS, SADDLE AND DRAUGHT HORSES

1. Arab stallion, "Shahzada," winner of the third annual Arab horse endurance test; S. G. Hough, owner. An important saddle horse, the Arab is the finest of the Eastern breeds. It is a small horse, commonly about 14½ hands, with remarkable strength and endurance
2. Coach and driving horse, grand ch. "Bobby B." E. A. Darling, owner
3. Belgian mare, a draught breed. The modern Belgian, regarded as a direct descendant of the old Flemish heavy horse, is a massive animal weighing from 2,000 to 2,500 pounds with a height of about 17 hands. The body is short, the shoulders rather short and drooping, but the back is strong and the muscles well developed
4. "Hintlesham Agility," champion Suffolk stallion. Horace Packard & Sons, owners. The Suffolk is a draught breed built rather long and low with a massive body on comparatively slender legs. He displays indomitable pluck in draught and will continue to pull at a dead weight after most horses would jib
5. Harness horse
6. Coach horse. Horses bred for this purpose were brought to a high pitch of perfection during the pre-railway era

dun, darker on the back and legs, but becoming whitish on the under parts of the body. There is also a conspicuous light coloured ring round the muzzle and a black "eel-mark" on the back. The species interbreeds quite freely with domesticated ponies and the hybrids are fertile. Although *Equus przewalskii* is undoubtedly a horse, it is rather a primitive type, being less sharply differentiated from the wild asses than are the domesticated forms. No competent authority has ventured on any precise theory about the relationship of the wild species and our modern domesticated breeds. That Prejvalsky's horse represents the common ancestor of all the latter is highly improbable.

Wild horses were very common in Europe during the Old Stone age, and were hunted and killed for food by Palaeolithic man. Stacked in front of the cave of Solutré, near Lyons, there were found the bones of several tens of thousands of horses, all slain presumably by the inhabitants of the cave, who could scarcely have numbered more than half-a-dozen families. That the horses were wild seems likely from the fact that they were all killed young, mostly indeed as foals; and that they were used for food is clear from the circumstances that the remains are completely dismembered and the long bones split open for their marrow.

Domestication.—The wild horse is a denizen of the dry open steppes; it is therefore understandable that the improvement of the climate and the consequent increase of forest which marked the New Stone age in Europe should have led to a decline in the horse population. In any case bones of horses are rarely found in Neolithic deposits, which contain plentiful remains of oxen, sheep, goats, pigs and dogs. That all the latter species were domesticated at this time is beyond doubt; and the remains of the wild ox and wild boar are easily distinguishable from those of their domesticated relatives. The evidence as regards the horses is not very conclusive, but most probably these were wild. Bronze age deposits, on the other hand, contain plentiful remains of the horse as well as occasional bits and other accoutrements. In Babylonia the horse first appeared about 2000 B.C. It was introduced into Egypt by the Hyksos or shepherd kings who came from the north and east of Syria and conquered Lower Egypt in the 17th century B.C. In both these cases, it is to be noted, the horse was preceded by many centuries by the ox and the ass. From these facts and a few other scraps of evidence one may picture the first domestication of the horse as occurring in central Asia. Probably it was accomplished by a people of nomadic herdsmen, to whom the convenience of riding would be obvious. Sooner or later the mounted nomad came to realize the measure of his advantage over the man who travelled and fought afoot, and was encouraged to wander further afield, conquering as he went. In any case the horse (either as a charger or yoked to a chariot) became in very early times an important factor in war. The use of horses for the workaday purposes of transport and tillage is comparatively a modern development; in Britain, for example, oxen were the common plough animals until the end of the 18th century. Horse flesh seems to have been eaten by certain peoples throughout historic times and is still consumed in considerable quantities in several countries of Europe. Mares' milk, especially in the fermented form of *koumiss*, is used as a beverage by the Kalmucks.

On the subject of the origin and classification of modern breeds of horses there is no general agreement. Probably the whole of the oriental light-legged group, including the Arab, Barb and Turk, and indeed all the native races of Africa and Asia, are to be regarded as the descendants of one original Asiatic ancestor. This type was introduced into Europe by two routes—the one from Asia direct and the other via Africa and Spain—in early historical times, and played an important part in the formation of the light-legged breeds of western Europe. (*See* HORSE-RACING.)

It seems necessary to suppose that at least one other sub-species of horse was separately domesticated, a European forest type with large bones and broad feet, heavily built and probably hairy legged. This gave rise in particular to the early Flemish heavy horse, which in turn played an important part in the evolution of other heavy breeds like the Clydesdale and Shire. Prof. Cossar Ewart makes a third original group of the Celtic ponies, and postulates a separate wild ancestor for these.

BREEDS

From the point of view of the practical horseman the most satisfactory classifications are those based on utility considerations, the chief groups being heavy draught, harness and saddle. The two last are further divided, according to size, into horses and ponies, the line of distinction being drawn at about 14½ hands.

The most important of the heavy draught breeds are the Belgian, Shire, Clydesdale, Suffolk and Percheron.

Belgian.—The Belgian is regarded as the direct descendant of the old Flemish heavy horse, which was held in high repute during the middle ages as a charger. The modern horse is a massive animal, sharing with the Shire the distinction of reaching the greatest weights. Stallions in full flesh quite commonly weigh from 2,000 to 2,500lb. and occasionally more. The height is generally about 17 hands in the male, and 16·1 or 16·2 in the mare. The body is short, the shoulder often rather steep, and the quarter short and drooping, but the back is strong and the muscles everywhere strongly developed. The legs carry little long hair or feather, and the bone is somewhat round; the head shows little refinement and the temperament is rather sluggish. The Belgian is a useful agricultural horse and a capital animal for heavy dray work. The colours are various—bay, chestnut and roan being common

Shire.—The Shire is descended from the old English Great horse or Black horse, which was valued in olden times principally for its ability to carry the enormous weight of the armoured knight. Various kings of England, from John to Henry VIII., were at considerable pains to foster the breed, and in particular to maintain its size. The Great horse was descended in part from the pre-Roman horses of the country and, in part, from larger and finer stock introduced mainly from Flanders. The modern Shire is the chief agricultural horse of England, occupying most of the country except the eastern counties and the extreme north, which are given over to the Suffolk and the Clydesdale respectively. The Shire is a large and heavy horse, stallions being generally over 17 and occasionally reaching 18 hands. The back is short and strong, the quarters heavy and powerful, and the whole body both deep and wide The bone is large and the legs are covered with abundant long hair. Despite his weight the Shire is an active horse, trotting freely and easily when required. The traditional black colour is now less common than bay and brown.

Clydesdale.—The Clydesdale dates from the early part of the 18th century, and originated in Lanarkshire from crosses between the old local breed and horses introduced from England. Some of the latter were of pure Flemish stock, while others were of the early Shire type. The Clydesdale is of similar height to the Shire, but the general build is less massive, the legs being proportionately longer and the body neither so deep nor so wide The head shows rather more refinement, the neck is more crested and the shoulder has often more slope, but the back is commonly longer and less strong. The bone, too, is smaller, and the "feather" or long hair is less abundant, being confined to the back of the leg. Broadly, it may be said that the Shire is stronger and has more endurance in heavy work than the Clydesdale, but the latter is somewhat faster, more agile, and more mettlesome. Clydesdales are of all the ordinary colours, bay and brown predominating.

Suffolk.—The Suffolk is less widely distributed than the Clydesdale and Shire, but is the common farm horse of Norfolk and Suffolk and of parts of the adjoining counties. Its origin is obscure, but it seems to be related to the other heavy breeds. The colour is uniformly chestnut and the limbs are free from long hair. The build is rather long and low, with a massive body on slender-looking rather than slender legs. The height is nearly a hand less than that of the Clydesdale, but the weight is often quite as great. The Suffolk is a hardy and long-lived horse, contented with plain fare and easily kept fat. He is also remarkable for indomitable pluck in draught, and will continue to pull at a dead weight long after most horses would jib.

Percheron.—The Percheron is so named from the old French district of La Perche, to which it is native. This district forms parts of the modern departments of Orne, Eure et Loir and

Sarthe. The breed contains a good deal of the same Flemish blood as the other heavy draught breeds, but modified by crossing with the Arab. Before the railway era the Percheron was bred largely for the stage coach, and although it has since those days been greatly increased in weight it is still hard limbed and active and able to keep up a steady trot for a considerable distance. The head is leaner and more refined than that of any other heavy draught breed, the ribs are very round and the feet shapely and sound though comparatively small. The height is about 16·2 hands in the male, or comparable to that of the Suffolk. The colour is most commonly some shade of grey, but black and bay occur. In the United States and Argentina the Percheron is the most popular of the draught breeds.

Harness Breeds.—Harness horses may be divided into two main types. On the one hand are breeds like the Hackney, the Yorkshire Coach, the Hanoverian and the Oldenburg, of considerable weight and strength and generally with high and stylish action; on the other hand, there is the light roadster type, represented by the American Standard Bred, in the breeding of which the main emphasis has always been placed on speed. The Hackney originated in the eastern counties of England during the period about 1800; an old local trotting breed, which formed the basis, being improved by the infusion of Thoroughbred blood. The Hackney was brought to a high pitch of perfection, as a strong and fast coacher, during the pre-railway era. Thereafter increasing attention was paid to symmetry and to stylish action and the breed supplied most of the fashionable high stepping carriage horses of Victorian days, but with the advent of the motor-car it lost a good deal of its commercial importance. The Hackney is a horse of 15 or 16 hands in height, with sloping shoulders, somewhat rounded quarters and hard, clean legs. The chief gait is the trot, in which considerable speed is combined with high knee and hock action. The Yorkshire Coach and Cleveland Bay are related breeds, somewhat taller and stronger than the Hackney, and with less extravagant action. The former is lighter in build and shows more Thoroughbred influence than the latter. The Cleveland Bay is indeed stout enough to be used for ordinary farm work; crossed with a Thoroughbred of suitable type it often produces an excellent weight-carrying hunter. The American Standard Bred, like many other breeds of light horses, owes a good deal to the English Thoroughbred; it has, however, been bred all along to trot or pace rather than to gallop. In the trot the legs are moved in diagonal pairs, *i.e.*, the right fore and left hind feet leave and meet the ground simultaneously. In the pace the two legs on the same side move together, as in a trotting camel. Most Standard Bred horses show a natural preference for one of these gaits, but can be easily trained to the other. Trotting and pacing matches run in "sulkies" and on hard cinder tracks have long been the popular form of racing in the United States. The speed attained is, of course, less than that reached by a galloping Thoroughbred, but is nevertheless very fast. The trotting record for the mile is just under 2min., and the pacing record is nearly 5sec. less.

Saddle Horses.—The most highly improved of the world's saddle horses are probably the English Hunter, the Arab and the American Gaited Saddle horse. The Hunter is a type rather than a breed. Many horses that are ridden to hounds are "clean bred," that is to say Thoroughbred. Others are the progeny of light cart or Cleveland Bay or half-bred or hunter mares by Thoroughbred sires, while others are of Hunter blood on both sides. Where, as is usual, a Thoroughbred sire is used for hunter breeding it is important that he be of large bone, short legged and with plenty of substance. The long-legged and "weedy" type of horse that is often successful as a flat racer is useless as a sire of commercial saddle horses, at least of those of the more valuble weight-carrying type. A good hunter must be able to show a fair turn of speed, must have strength and endurance enough to carry his rider for a long day across country, and should be comfortable to ride and easy to control in any of the four recognized gaits, the walk, trot, canter and gallop. The importance of hunter breeding is greater than that of hunting, for the bulk of cavalry and other riding horses are of the hunter type and are supplied from the same sources.

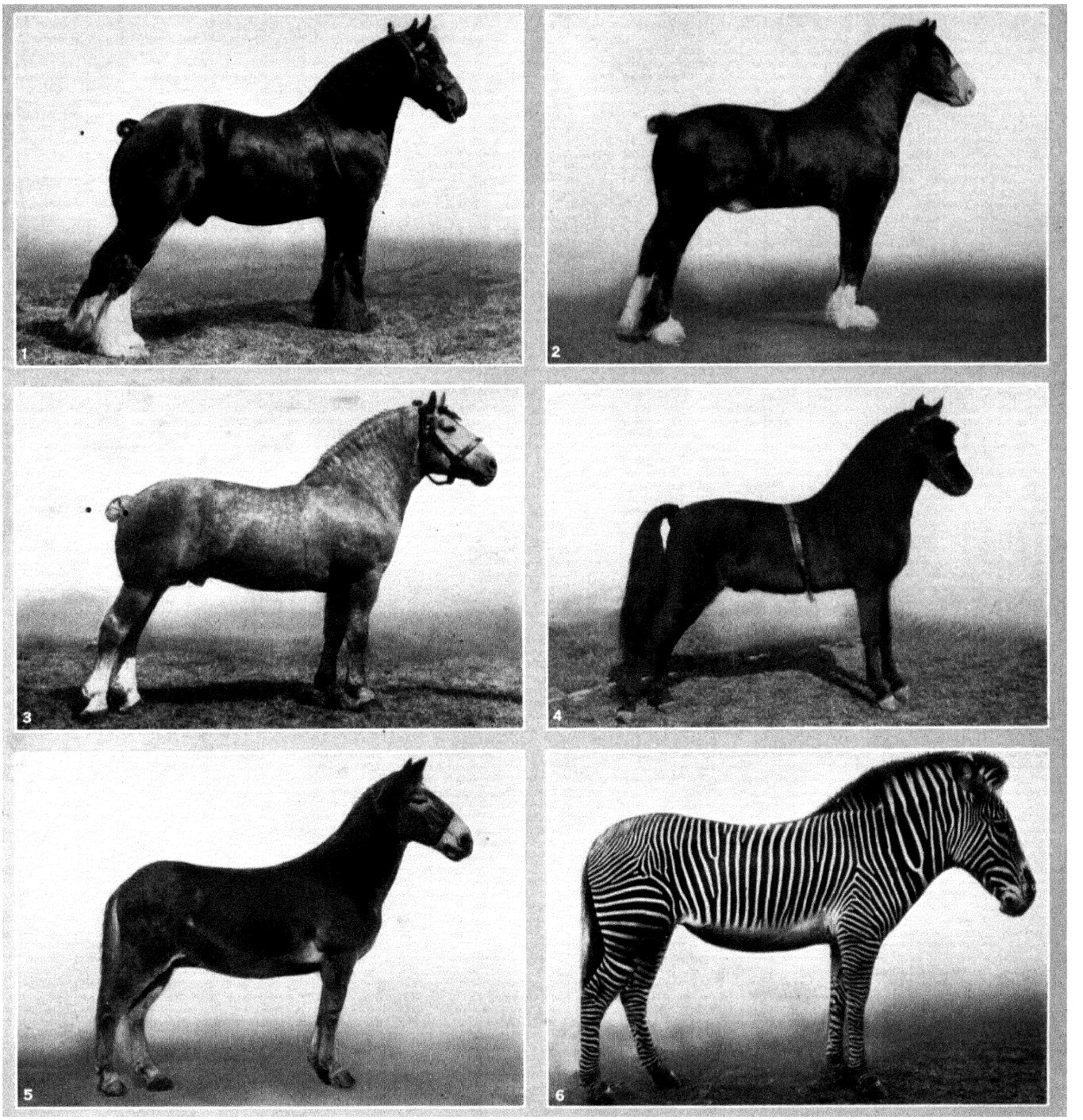
The Arab.—The Arab, though by no means the most ancient of the Eastern breeds, is the most highly improved, and is that which has exercised the widest influence on the horse-flesh of the world. The Arab is a small animal, commonly about 14½ and rarely exceeding 15 hands in height. The head is full of character and intelligence, with broad forehead and prominent eyes and nostrils. The shoulders are well sloped and the back short and strong, but the wither tends to be somewhat broad and low. The quarter is long and very level, the limbs hard and clean, the pasterns sloping and the feet small but strong. The common colours are white, grey, bay and chestnut, black being somewhat rare. The Arab has remarkable strength for his size and his endurance is rightly proverbial, but his speed has often been exaggerated; in the last respect he will not bear comparison with the thoroughbred or the American trotter. (J. A. S. W.)

The American Saddle Horse.—The American saddle horse is a distinct and recognized breed of the horse industry, dating from the organization of the American Saddle Horse Breeders' association at Louisville, Ky., in 1891. Antedating by many years, however, this organization of breeders, the five-gaited saddle horse was a necessary feature of farm life in the Blue Grass section of Kentucky and in many of the Central and Southern States. The early settlers who went over the mountains from Virginia into Kentucky, took with them at first horses without a developed gait, and of no particular breed. The Canadians had produced, by crossing on their mares of French descent stallions secured in New England and New York, a horse with a pace, or ambling gait, comfortable under saddle, and developed many years later into great speed in harness. A number of these Canadian mares and stallions were taken to Kentucky, and notably two, Copperbottom and Tom Hal, earned a large part in the saddle horse history of America. By the union of this Canadian blood with that of the native stock, and that of the thoroughbred and part thoroughbred which the Kentuckians were taking from Virginia, was produced the riding horse known universally in America, previous to 1891, as the Kentucky saddle horse. The five gaits which characterized the breed, and distinguished these horses from others were the flat-footed walk, the running walk (now often displaced by what is known as a "stepping," or slow pace), the trot, the canter and the rack.

Although the gaits of these earlier saddlers have been but little improved, their conformation has been radically changed. This has come about by the use of certain lines of thoroughbred blood, which modified and refined the physical appearance of these gaited horses. This thoroughbred part of the foundation is based on a "four mile" race-horse named Denmark, a son of Imported Hedgeford, an English bred horse taken to the United States in the early part of the 19th century. In later years another line of mixed trotting and thoroughbred blood, coming through Harrison Chief, has earned distinction in producing famous winners at the fashionable shows. That the saddle horse in America owes a large part of his ancestry to the racing thoroughbred is evidenced by an analysis of the pedigrees in the nine volumes of the *American Saddle Horse Register*, indicating that of the 27,000 pedigrees therein more than 90% contain thoroughbred blood.

At their best the American saddle horses are seen at the great exhibitions at Louisville, New Madison Sq. Garden (New York), Chicago, Kansas City, Los Angeles and other cities. Their average height is about 15 hands 2 in. and weight, 1,050 pounds. The neck is long, and gracefully arched. He differs, too, from the racing thoroughbred in being higher at the withers than over the hips, thereby relieving the rider of a feeling of pitching forward or "riding down-hill." The tail is curved and carried high above a line from the shoulders back. Among other famous saddle horses of the world are the Barb and the Turk and those of the Cossacks and Kalmucks. (C. M. T.)

Ponies.—The native ponies of Britain are mostly bred in mountain and moorland areas; they are, except in the case of one or two breeds, dwindling in numbers. The replacement of ponies by electric systems of haulage in mines is the chief cause of the lessened demand for these animals. The chief breeds are the Shetland, the Highland pony, the Dales and Fell breeds of the North



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VARIOUS MEMBERS OF HORSE FAMILY

1. Shire Gelding, of a heavy draught breed, descended from the old English Great Horse, or Black horse. It is a large and heavy horse, the stallions being generally over 17 hands. The modern Shire is the chief agricultural horse of England
2. A Clydesdale stallion, grand ch. "Mainring," a draught breed, similar to the Shire, although in general less massively built. The head shows more refinement, the neck is more arched and the shoulders often have more slope
3. "Carburateur," a Percheron stallion. The breed is so named from the old French district of La Perche of which it is a native. In the United States and Argentina it is the most popular of the draught breeds
4. "King Larago," grand champion Shetland stallion. Smallest of the ponies, the upper limit of size of this breed is 10½ hands. Shetland ponies are often used as first mounts for children
5. A mule, a sterile hybrid between the horse and ass, differing from the horse in its smaller size, long ears, and the character of its tail, hair and markings
6. A zebra, African striped member of the horse family. It stands about 4 feet at the shoulder with fairly long ears, a tail with a tuft of hair, and a short erect mane. Ground colour is white and the stripes, absent only on abdomen and inside thighs, are black

of England, the Welsh, the Dartmoor, the Exmoor, and the New Forest. The Shetland is well known as the smallest of these, with an upper limit of size, for Stud Book and show purposes, of 10½ hands. Many mature ponies are under 9 hands in height. Shetlands are sturdy and sure-footed little animals and make excellent first mounts for young children. The Highland pony is of two types. The larger form, found on the mainland, is rather of the cart horse type and is a useful animal for farm work. He is also often used for carrying game during the shooting and stalking seasons. The lighter type is found mainly in the Hebrides and is used by the crofter as a pack horse, carrying a pair of creels. The Fell and Dales ponies are of very sturdy and rather heavy build, whereas the southern breeds are of saddle type, and when crossed with small Thoroughbred or Arab sires produce excellent riding ponies. In Wales there are three types, a small (11 or 12 hand) mountain pony, a rather larger lowland breed with some Hackney blood, and a still larger form showing both Thoroughbred and Hackney influence, and known as the Welsh cob. The Hackney pony is closely related to the Hackney and is, except in the matter of size, of very similar type. The dividing line between the two is drawn at 14 hands. Hackney pony sires were formerly much used for crossing with Welsh and other native mares to produce driving ponies. The Polo pony stands in the same sort of relationship to the Thoroughbred as does the Hunter, some ponies being "clean bred" while others are the progeny of selected small Thoroughbred sires and mares of various sorts, from pure native to those with a high proportion of Arab or Thoroughbred blood. Playing ponies need to be of great strength for their size, and the best type is well described as a weight-carrying hunter in miniature. Quickness and cleverness in turning and a high measure of intelligence are also essential. Ponies are trained to answer to the pressure of the reins on the neck, so that they may be perfectly controlled with one hand.

MANAGEMENT AND FEEDING

Horses are broken to ordinary work at two or three years old, but the rather elaborate training of a lady's hunter or a polo pony is rarely completed before the age of five or six. Length of life varies a good deal, but may be put, on the average, at a little over 20 years. Individual animals have been known to live beyond the age of 40. In the care of horses the four most important points are careful regulation of the diet, provision for an adequate amount of exercise, thorough grooming and regular shoeing by a skilled shoeing-smith. In Britain oats is the standard food-corn, but elsewhere barley, maize, gram and other cereals and pulses are used The daily ration varies according to the size of the animal and the nature and severity of his work. A heavy dray horse in regular and severe work may require 20lb. of corn per day, a medium-weight hunter 10 or 12 and a Shetland pony about 6lb. The ration of hay is, on the average, about the same by weight as that of oats, less for animals on fast work and more for those on slow. Many horses are put to grass during summer, and although the change of diet is beneficial, a grass-fed animal is rarely fit for hard or fast work. An occasional feed of moistened bran and a daily swede or a few carrots are beneficial during winter. Horses must be fed at least three times daily. It is usual to chaff part of the hay and mix this with the corn, the remainder of the fodder being given in long condition. Horses should be allowed to drink freely before each meal The amount of exercise required varies according to the condition that it is desired to maintain. A heavy draught animal will usually keep healthy on an hour's walk two or three times a week, whereas riding horses, if they are to be kept really fit, should have two hours of walk and trot exercise daily. Thorough and vigorous grooming is most important, especially if the horse is required for fast work; it not only keeps the pores of the skin open, but improves the tone of the muscles. Horses should be re-shod at intervals of four or five weeks, whether the shoes are worn or not, as the hoofs otherwise become overgrown. Even when a horse is unshod the feet require to be trimmed and dressed occasionally. Stables should be kept cool and freely ventilated, clipped horses being rugged up in cold weather.

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(J. A. S. W)

FOSSIL HORSES

Fossil remains of horses have been found in the Pleistocene formations of all parts of Europe, Asia, Africa, North and South America, and these discoveries show the former wide distribution of the genus. Many of the remains found in the later Pleistocene of Europe and Asia have been referred to the domesticated species (*Equus caballus*), others to the ass and dziggetai (*E. hemionus*); and some South African fossils to the zebra. Most of the Old World fossils and all of those from the New World are referred to a large number of extinct species, only a few of which are sufficiently known and sufficiently distinct for characterization. The oldest and best known extinct species in the Old World is *Equus stenonis*, found in the upper Pliocene and older Pleistocene of Europe; a species of medium size and proportions near to the lighter breeds of domestic horses, and with a variable tooth-pattern sometimes quite close to that of *Plesippus* of the American Upper Pliocene. It is regarded by Boule (1910) as including races ancestral to the ass, zebra and the domestic horse, and various intermediate forms have been described from the middle and later Pleistocene of Europe and Asia.

Many fossil species of *Equus* have been described from the Pleistocene of North and South America. Two of the North American species known from a series of complete skeletons are *E. scotti* of the lower Pleistocene of Texas and *E. occidentalis* of California. Both are about as large as an average-sized *E. caballus*, but *E. scotti* has more the proportions of a zebra, with relatively large head, deep jaws, short back and relatively small legs and feet. *E. occidentalis* is similar in these general features but differs in minor characters of teeth and skull. The same is true of *E. niobrarensis* from the lower Pleistocene of Kansas. In general these species from the lower Pleistocene of North America are intermediate between *Plesippus* and the modern *Equus*.

The South American species of *Equus* are also in a rather primitive evolutionary stage according to Boule, but of several fairly distinct types. They occur only in the middle and later Pleistocene, following and finally superseding the aberrant short-legged horses of the *Hippidium* group. Both are invaders from North America, *Hippidium* probably derived directly from *Pliohippus*, *Equus* through the intermediate *Plesippus*.

Very little is known of the fossil horses of Africa south of the Sahara, but they seem to be all nearly related to the modern zebras. No fossil *Equidae* are known from Australasia.

For the Tertiary ancestry of the horse, *see* EQUIDAE.

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(W. D. M.)

HORSE CHESTNUT. The name of a tree, *Aesculus Hippocastanum* (family Sapindaceae or listed by some authors as Hippocastanaceae) thought to be indigenous in Greece, but now scattered throughout the temperate regions of the world. There are 20 or more named species and varieties of the genus *Aesculus*. One, in particular, is called the common horse-chestnut, but all are popularly known as buckeye or horse-chestnut. Several species are shrubby, as *A. parviflora*, *A. discolor*, *A. georgiana* and *A. splendens*, but the majority are rapid growing, pyramidal trees attaining a height of 60 or more feet. They thrive well in moist sandy loam. The buds, conspicuous for their size, are protected by a coat of viscous substance impervious to water The buckeyes are deciduous with large compound leaves and white, red or yellow flowers in terminal panicles. They blossom in May or June and the fruit, resembling the sweet chestnut, ripens about the middle of October. There is some disagreement as to uses to which the

fruit can be put, some even maintaining that it is poisonous *A. glabra*, the American buckeye, in particular, is thought to have poisonous seeds and leaves. Most of the species have bitter flavoured seeds and bark, the bark being used for tanning *A. californica*, *A turbinata*, and *A octandra* are known to bear edible seeds which are used as sweet chestnuts The wood of the horse-chestnut is not particularly useful, but as ornamentals both the trees and the shrubby kinds are very valuable (P W Z)

HORSE GUARDS, ROYAL: *see* GUARDS and HOUSEHOLD TROOPS

HORSEHAIR: *see* HAIR.

HORSE LATITUDES, the zones of high atmospheric pressure with calms and variable breezes along the polar edges of the belt of the trade winds (*q v*). The *New English Dictionary* gives two somewhat contradictory explanations of the origin of the name: one, that the calm kills horses on a sailing ship, the other, that the name signifies the unruly and boisterous nature of the winds of these latitudes compared with the pleasant trades Neither explanation is generally accepted.

HORSE-MACKEREL or **SCAD,** a genus of fishes (*Caranx*) found in temperate and especially in tropical seas Some 90 kinds are known, the majority being wholesome food, some species attain a length of over 3ft. The fish to which the name horse-mackerel is applied in Great Britain is *C trachurus* This species is found almost everywhere within the temperate and tropical zones of both hemispheres. The horse-mackerel, together with the American horse-head or ocean old-wife (*Argyeiosus vomer*), the pilot-fish (*q v*), and the true mackerel (*q v.*) and its allies belong to the division Scombriformes

HORSEMANSHIP AND RIDING, the art of managing the horse from his back; controlling his paces and the direction and speed of his movements. In the 16th century Pignatelli at Naples founded his famous academy of horsemanship, and the Italian school was so generally recognized that Henry VIII and other monarchs had Italian masters of the horse The Continental *haute école* developed from the teachings of these early masters The duke of Newcastle's *Méthode nouvelle de dresser les chevaux* (1648) was the standard work of the day, and in 1761 the earl of Pembroke published his *Manual of Cavalry Horsemanship* The Austrians at the imperial stables at Vienna and later the French at Saumur continued the *haute école* system up to recent years

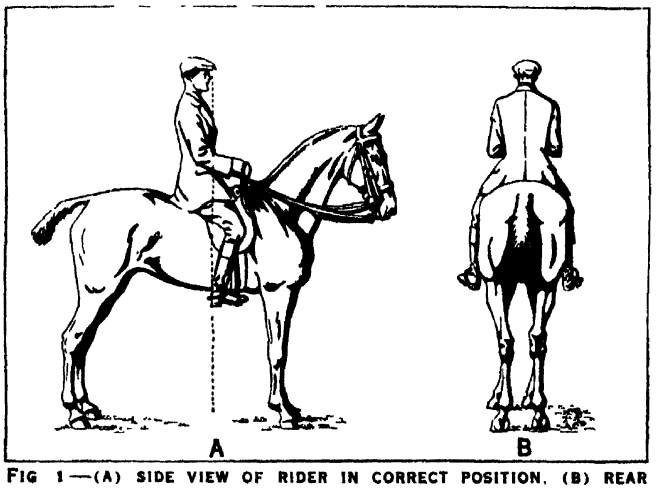


FIG 1—(A) SIDE VIEW OF RIDER IN CORRECT POSITION, (B) REAR VIEW OF RIDER IN CORRECT POSITION

It, however, never really found favour in England In a modified degree it is seen to-day at shows and at the Olympic games, as an example of extreme obedience and control of the horse. Though *haute école* produced handiness and dexterity, the horse lost the activity required by the English. The horse's head maintained a fixed profile with a lofty head-carriage, overbent at the poll and balance permanently back, thus becoming cramped in its action and losing its powers of extension and speed. The necessity of handiness, but not at the expense of speed, was recognized by horsemen in Great Britain. Consequently certain "aids" were adopted from the *haute école* to obtain this desideratum. These "aids" exist in the British Manual of Cavalry Training, vol. i. As opposed to the *haute école* the modern conception of a horse's balance is as follows. "A horse is said to be balanced when his own weight (and that of his rider) is distributed over each leg in such proportion as to allow him to use his powers with the maximum ease and efficiency at all paces" The head and neck form the governing factors in weight distribution, and it is by their position that the horse carries his weight forward or backward as his paces are extended or collected Modern horsemanship includes: (a) learning to ride. (b) Making an animal handy as a hack or charger or for polo (c) Schooling over fences (d) Show jumping (e) Riding to hounds (f) Racing over fences or on the flat

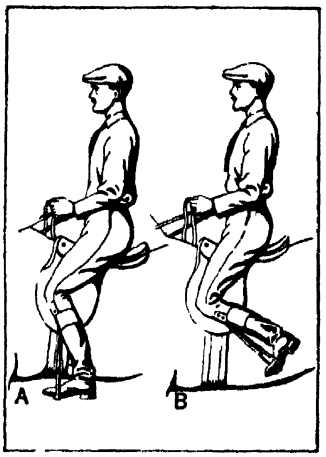


FIG 2—(A) CORRECT LEG POSITION, (B) CORRECT LEG POSITION IN ACTION

Riding for Beginners.—From Norman times through the Tudor, Stuart and Georgian reigns up to the early part of last century, riding was considered an essential part of a gentleman's education The introduction of railways and later of motor cars has resulted in the retention of the riding horse merely for pleasure and sport In spite of this there has been a large increase during recent years in the number of riders. All riding classes in horse shows are largely filled, including those for children, and in the hunting field the numbers have in no way diminished.

When mounting the rider should take up the reins in his left hand, at the same time holding a lock of the mane or the horse's neck above the withers with the same hand Standing by the horse's near (left) shoulder facing the tail, he should hold the stirrup with the right hand for the reception of the left foot Then place the right hand on the back arch of the saddle, spring off the right toe and drop lightly into the saddle

The rider's seat depends upon balance and grip It is essential for the beginner to get a good natural seat, comfortable and strong without being stiff After gaining confidence, first at the walk, then at the trot and canter with the aid of the stirrups, the rider should dispense with the latter for short periods and develop both his balance and grip

First of all, sit square to the front with the muscles relaxed, then grip with the flat of the thigh and the knee, the lower part of the leg parallel to the girth and the toes turned up If the stirrups are now adjusted to support the foot in this position they will be at the required length The body must be supple from the hips, swinging easily backwards and forwards as required or leaning over in the direction that the horse is turning.

Ride as far as possible with a long rein, a strong and well balanced seat independent of the reins is essential for good hands The upper arm should be normally parallel to the body The reins when held in both hands should be round the third or little finger In the case of double reins the bit (curb) reins should be outside round the little finger, unless it is intended to ride more on the bridoon, in which case the position is reversed The back of the hands should be towards the horse's mouth, and the wrists very slightly rounded. If the reins are held in one hand they are divided on one side by the little finger and on the other side by the forefinger By turning the wrist towards the body the reins are shortened A springy tension is obtained between the rider's hand and the bit, by (1) the fingers; (2) the flexion of the wrist; (3) the movement of the forearm from the elbow

The beginner will find difficulty in retaining his stirrups, but must avoid the habit of lowering the toes. He must learn to press on the stirrup, the heel forced lower down than the toe, which should be at a natural angle as when walking Pressure should be firmer on the inside of the stirrup next to the horse so that the

soles of the feet are turned slightly outwards. In this position, increased pressure on the stirrup strengthens the grip and the rider will not lose his stirrups.

At the trot rise with the action of the horse, leaning slightly forward; at the canter sit upright, keeping the loins supple, sufficient grip with the knee and thigh, and the leg below the knee vertical: at the gallop, shorten the reins, stand up in the stirrups,

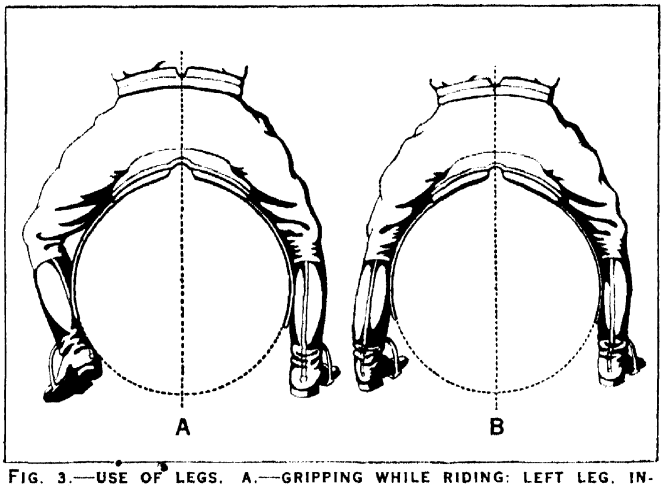


FIG. 3.—USE OF LEGS. A.—GRIPPING WHILE RIDING: LEFT LEG, INCORRECT; RIGHT LEG, CORRECT. B.—AT REST: LEFT LEG, INCORRECT; RIGHT LEG, CORRECT

lean slightly forward and increase the grip with the knees. At all times keep as light a contact with the horse's mouth as is compatible with adequate control.

Handiness.—Handiness is the result of perfect balance in a horse whose movements are readily controlled by the rider. First obtain direct impulsion and free forward movement. To make a horse walk out, close the legs to his flanks and lightly feel the snaffle in his mouth. Occasionally teach him to diverge from the straight line by leaning the rein against his neck on the opposite side to the change of direction. Preferably work on undulating ground. Increased impulsion from leg pressure in conjunction with the voice and possibly the whip will induce the horse to trot. When free forward movement at these paces has been obtained, the horse can gradually be taught to move collectively by a change of balance. The head is raised by means of the snaffle, a pressure of the rider's legs keeping the hind limbs well under the horse to support the weight thus brought back. Later he must be taught to bend from the poll and relax his jaw by a springy feeling of the fingers on the curb bit rein, the head being kept raised by the bridoon. The reins control the horse's forehand and the rider's legs the hindquarters; the combination of both controls the whole mass. The next stage is lateral impulsion, when the horse is taught to move diagonally forward (half passage) to one hand. To move to the half-right, apply a strong pressure of the left leg, pressing the left rein against the horse's neck, the right rein bending and leading him in the required direction, the right leg applied as required to hold the horse up to his bit. He must be kept collected and the head bent in the direction he is moving. Reverse the aids to move diagonally to the left. To obtain lateral movement to either flank, accentuate the above aids. These lessons should be taught first at a walk, then at a collected trot and later at a canter. The next lesson is the canter, which is a collected pace. For example, to canter with the off-fore leading, there are two methods. Firstly, trot collectedly on a large right-handed circle, increase the tension of the reins and the pressure of both legs, the left leg the stronger, at the same time bend the horse's head slightly to the left. He will then canter with the off-fore leading. Later, or if the horse is inclined to disobey this aid, make him half passage to the right at the trot, accentuate the aids to increase impulsion, when he will break into a canter with the off-fore leading, then move forward on a straight line. Reverse the aids to canter with the near-fore leading. To change the leading leg at the canter check to a trot, half passage in the required direction as above and break into a canter. By degrees reduce the number of paces at the half passage until the horse changes direct at the canter from one leading leg to the other. He must now be taught to canter on a loose rein, occasionally increasing the pace and stretching his neck and fore-legs, again coming back to a collected canter, readily and smoothly adjusting his paces and balance and learning to control his momentum. He can now be taught to rein back one step at a time, being pressed forward at a walk, trot or canter in accordance with the aids applied. He must next be taught to turn on the haunches, the only correct way of turning sharply at fast paces. To turn to the right or right-about, lead the forehand round with the right rein, holding the horse up to the bit with the legs, lean the left rein against his neck, apply a strong pressure of the left leg to check a tendency of the hindquarters to move to the left, and thus keeping them under control, the horse consequently pivots the forehand round the hindquarters. Gradually accentuate the aids to sharpen the turn, reversing them to turn left-handed. The horse must now be taught to pull up on the haunches, by feeling the reins, the rider at the same time closing his legs and leaning his body back. This must be practised first at a walk and trot and later at a canter. When the horse has learnt to extend himself at the gallop and then come back to a collected canter, the halt from the gallop may be taught and finally the turn on the haunches from the gallop. Progress must be slow but progressive, and if the horse is not performing smoothly it is due to his training being hurried. Riding on a loose rein with short periods of collected work will teach him to relax his jaw to the curb bit. But the above syllabus must be executed first on a snaffle, then in a curb bit, again commencing at the first stage. The entire training may extend from six to eighteen months according to the temperament, condition and previous training of the horse. Patience and sympathetic handling are essential.

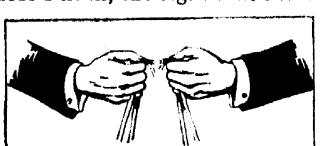


FIG. 4.—CORRECT CARRIAGE OF HANDS AND HANDLING OF REINS

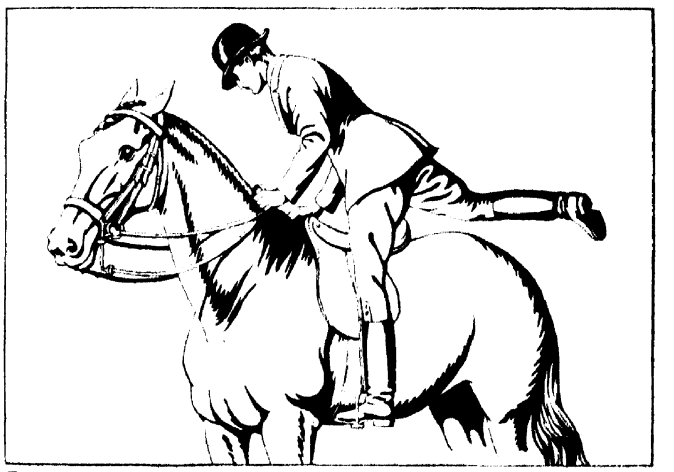


FIG. 5.—RIDER MOUNTING CORRECTLY WITH RIGHT LEG FULLY EXTENDED

Schooling over Fences.—First lessons may be confined to jumping free in a lane, using a trained horse as a leader, or the youngster may be led in hand over small obstacles. Training must be progressive over small but solid fences and ditches. Later, when mounted, the rider should approach the fence at a collected canter with the reins in both hands. Three lengths from the fence lower the hands, still maintaining contact with the horse's mouth. Unless the horse is a naturally free jumper, close the legs to retain impulsion and to keep the horse's hocks under him. The rider should be sitting upright ready to lean forward as the horse takes off, his own weight being borne on the knees, thighs and stirrups, the leg below the knee being free to drive on the horse. As the latter raises his forehand, the rider inclines his body forward, his weight being approximately over the horse's centre of gravity. He must be prepared in mid-air

to give the horse more rein which the latter will require on landing. If the rider is leaning back at this period, he will upset the horse's balance and when jumping slowly he is liable to give the horse a chuck in the mouth as he is thrown back himself. This is known as the horse "jumping away" from his rider as opposed to the rider "going with" his horse. Schooling a youngster over simple fences the rider need not attempt to lean back He can best assist

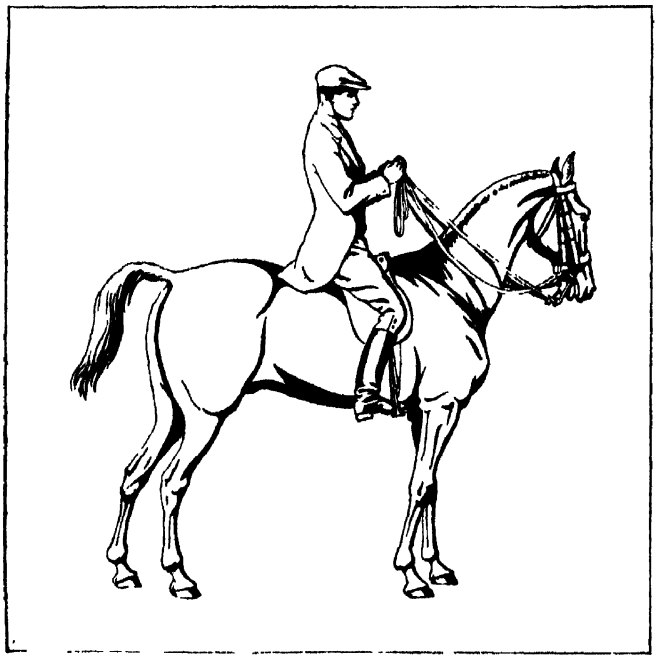


FIG 6.—RIDER SHOWN COMING TO A CORRECT STOP

the horse by keeping his weight constant over the latter's centre of gravity (approximately the dees of the stirrup leathers). The lighter the horse's mouth the lighter the contact between hand and mouth To strengthen the seat and ensure correct balance over fences it is advisable to ride about two inches shorter than is recommended to beginners and on no account must the knee be kept stiff.

Horses refuse from (1) Pain of the jar on landing (2) Heavy hands injuring the mouth (3) Too severe a bit. (4) Fear of falling and lack of confidence The cause once diagnosed, the remedy is obvious, rest and attention in the case of injury Regain the horse's confidence, schooling over small fences if necessary in a snaffle Concentrate on getting the horse to like jumping Reward him, humour him, keep him quiet and unflurried Only resort to punishment in extreme cases, after which it is essential to persevere and defeat a recalcitrant horse If he runs out left-handed turn him sharply to the right and vice versa If he takes off too close to his fences make use of a ditch or guard rail nine inches high and two to three feet from the fence. Normally he should take off not nearer than the height of the fence and not more than eight feet from it

Show Jumping.—Practically the same procedure should be adopted, but the rider should exaggerate the leaning forward, thus minimising the risk of touching the fence with the hind legs. The horse must lower his head to give free play to his loins when jumping, the more easily to tuck up his hind legs. It further assists him to judge his take-off and adjust his stride Never steady a horse too late so that he cannot lower his head The exaggerated forward seat is permissible as normally there is no question of jumping at speed over a drop on to sticky landing, hence there is no risk of the rider being thrown forward of the horse's centre of gravity and both coming to grief. A good horseman on a well balanced handy horse can lengthen or shorten his mount's stride as required to take off correctly. This necessitates a high standard of training and horsemanship. Show jumpers improve with years and experience. Horses like Broncho and Combined Training, who jumped for England and won the King George's Cup and the Championship at Olympia, were probably at their best when over twenty years old.

Riding to Hounds.—The seat is the same as for schooling over fences. Good horsemanship is essential for riding a young horse in a hunt. Never jump unnecessary fences, as it is unfair on the farmers and tiring to the horse. Hold your horse together over heavy ground, picking out the best going. Hold a gate open for the huntsman, shut it if you are the last to go through. Stand still when hounds check or are being cast, and if your horse has been galloping turn his head to the wind Don't ride on the tail of hounds, but to a flank level with the tail hounds and preferably on the downwind side Watch the leading hounds and the older ones in the body of the pack, who will generally put their more impetuous juniors right when scent is catchy With regard to all fences, preferably select a sound take-off. Sail on at a low fence with a ditch beyond With a ditch and possibly a blind one on the take-off, keep the horse collected up to the last few strides. Over trappy blind places it may even be advisable to jump from a walk or trot. Ride slowly over walls, timber and gates; *i.e.*, pull back to a collected canter unless there is a wide ditch beyond Over a drop, though the rider leans forward as the horse takes off, his body on landing should not exceed the perpendicular to the horse's back An experienced rider can feel whether the horse's balance is such that he may possibly pitch on landing, in which case he can lean back, or he may find it expedient to lean forward should he anticipate his horse dropping his hind legs in the ditch. If in mid-air the rider is too far forward or too far back, he cannot adjust his position and balance as described above. If he lands with his body too far forward and the horse overjumps and pecks badly, the rider's weight is thrown forward of the horse's centre of gravity and both will come to grief The horse must have freedom of his head to stretch his fore-legs over a wide place or to save himself if he has blundered on landing Certainly the rider cannot keep him on his legs by holding him up with the reins A horse that stumbles can be held together to prevent this, but when he has actually stumbled badly, freedom of his head admits a reasonable chance of recovery. Banks are encountered in many countries They may have a ditch on one or both sides and may be crowned with a hedge Invariably they should be ridden at slowly to prevent the horse attempting to fly them, and at the same time giving him time to change his legs at the top He requires a free head to alternate his change of balance when negotiating banks A line of pollards indicates the presence of a brook If the hounds attempt to jump it, it is safe to assume that the horse can clear it The rider must be determined or he will fail to inspire his horse for the effort Pull the horse together about twenty lengths from the brook, preparing him to adjust his stride for the take-off, then send him on with increased pace the last few strides, holding him straight at the obstacle. Impetus must be maintained, and this will ensure clearing a good fifteen feet of water Over dykes and big bottoms it may be necessary to crawl down one side, pop over the bottom and clamber up the far side Obedience to the rider's leg is necessary for opening gates Once unlatched, the horse can be trained to push open the gate, the rider giving the final push with the hook of his whip. When pulling back a gate with the latch on the left use the whip in the right hand, and vice versa.

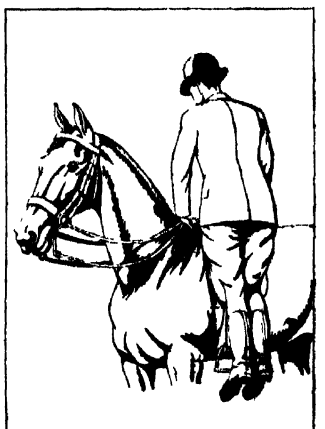


FIG. 7.—DISMOUNTING IN THE USUAL MANNER

Racing over Fences.—Over hurdles the jockey keeps his weight constant over the horse's centre of gravity; viz., he adopts the modern seat of the flat race jockey, the weight being well forward over the pivot of the leading foreleg. This position

gives the maximum assistance to the horse. In steeplechasing over park courses, the same principles are adhered to, but to a lesser degree, as the rider must be prepared to lean back if a horse blunders. The impetus of a bold fencer to some extent counterbalances the leaning back of the rider's body, but to enable the horse to get away from his fence with the utmost speed after landing, the rider must be forward in the recognized position for galloping. Over Liverpool, horses often fall from hitting the fences, but even more frequently from over-jumping. Under these circumstances the so-called forward seat increases the chances of grief. Here the first essential is to keep the horse on his legs and the rider in the saddle. This applies especially to a fence like Becher's brook, where the horse descends over the big drop at such an angle that he may pitch forward on landing It does not follow that a horse will fall over a drop if the rider is not sitting back. Over timber, for instance, the horse can see a drop on the far side and he can adjust his balance accordingly But in this case he cannot, added to which there is the momentum derived from the speed of his gallop and the fact that he has stood well back from the fence Much depends upon the horse and his particular style of jumping and the speed at which the fence is taken Under the following conditions it is advisable to sit back — (1) when a horse is inclined to over-jump himself especially when going at great speed. (2) When the landing is heavy. (3) When the drop comes as a surprise and the horse is not prepared to adjust his balance accordingly Coming at his fences a chaser should extend his paces, stand well back and gain ground at each obstacle.

Racing on the Flat.—This is confined to light-weights. Good jockeyship entails early apprenticeship to get the necessary experience. At first a lad should ride on easy horses, attention being paid to the length of his stirrups and reins The American jockey, Tod Sloan, was the first exponent of the modern racing seat in Great Britain The advantages are as follows: (1) Wind resistance is reduced to a minimum (2) The racehorse must advance his centre of gravity with the free extension of his head and neck to get full extension of his fore-limbs Therefore the rider's weight must be proportionately advanced (3) The leading foreleg at the gallop exerts the greatest effort, consequently a tired horse keeps changing his legs; the rider's weight being over the pivot of the leading foreleg reduces this effort. (4) At the same time the rider relieves the horse's loins of as much weight as he can to enable it to bring its hind legs as far forward as possible By adopting this method he obtains the maximum of propulsion.

The lad first learns to sit still and obey orders He next learns to keep his place on different types of horses, driving a sluggard, soothing and restraining an impetuous youngster, remaining quiet on a free but temperate horse. During this home training he develops a judgment of pace and learns to appreciate the peculiarities of different horses. If he is to become a successful jockey he must have brains, be keen, determined and in sympathy with horses. The latter quality is essential for good hands which alone can deal with a wayward animal. With these qualities he will develop confidence, and once endowed with this asset he is well on the road to success. smartly off at the start, with his horse instantly balanced in its gallop, seizing the opportunity of coming through his field, getting on the inside at the turns, keeping still when well placed and holding his horse together to make his final effort with a strong finish when required.

See Baucher, *Passe-temps Équestres* (1840); Hundersdorf, *Équitation allemande* (1843); d'Aure, *Traité d'équitation* (1847); Raabe, *Méthode de haute école d'équitation* (1863), *Méthode d'équitation* (1867); Barroil, *Art équestre;* Fillis, *Principles de dressage*, Haves, *Riding on the Flat*, etc. (1882); Goldsmidt, *Bridlewise* (1926), Brooke, *Horse-sense and Horsemanship* (1926); H. R. Hershberger, *A Work on Horsemanship* (1844); Henry William Herbert, *Horse and Horsemanship of the United States and of the British Provinces of North America* (1857) and *Hints to Horsekeepers; A Complete Manual for Horsemen* (1859); T. C. Patteson, *Observations on Riding* (1901) and *Saumur Notes* (1909); H. L de Bussigny, *Equitation* (1922); Baretto de Souza, *Elementary Equitation* (1922); L. L Fleitmann, *Comments on Hacks and Hunters* (1922); I. Maddison, *Riding Astride for Girls* (1923). (G. Br.)

THE UNITED STATES

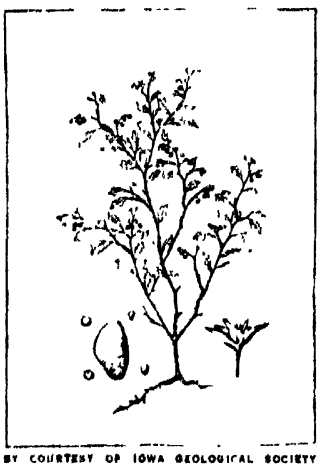
Riding, once the medium of transportation of men from place to place, has become in the 20th century in the United States solely a medium of recreation As such it is increasing rapidly, there being from 300 to 500% more riders in and near cities in 1928 than there were in 1921. The first essential for riding is adequate facilities—that is, good bridle paths in city parks, riding trails near cities; and in suburban districts, where wealthy men have large estates, arrangements whereby riders from one estate may use trails on neighbouring estates For such purpose swinging gates or panels are installed to permit easy passage of riders This adds variety to the route—which is important, for when men and women must ride over the same path every day they sometimes grow tired of the sameness of scenery and terrain

Chicago outranks other cities, except London, in excellency of bridle paths, its paths being broader, better constructed and better maintained than any others Boston and New York have good paths through the public parks, and Washington's paths are good though somewhat narrow. One of the most beautiful stretches of bridle path anywhere extends through the Wissahickon natural park area in Philadelphia Automobiles are forbidden in this area, which is an added attraction, for where riders are forced out upon paved highways in close proximity to speeding motor cars there is great danger of accident St Louis, San Francisco, Los Angeles and other cities also have built good paths and are steadily improving them There is likewise amazing development throughout the country in riding trails—which are distinguished from bridle paths through the fact that they are natural trails leading over rights-of-way Outstanding among these are trails on private estates about Piping Rock, L I, Greenwich, Conn, Aiken, S C, Oconomowoc, Wis and public trails in forest preserves of Westchester county, New York, and Union and Essex counties, New Jersey

The second essential to riding is good mounts, and in these there is wide variety of choice Some prefer three-gaited saddle horses, some five-gaited, while those who play polo want mounts of the polo type Still others, brought up in sections where hunting is popular, select their horses from hunter stock The important thing is to get a horse that is sure-footed, light-mouthed and that will give the rider a pleasurable and safe ride

(W Dr)

HORSE-NETTLE (*Solanum carolinense*), a North American plant of the nightshade family (Solanaceae), called also sandbrier, native to dry fields and waste places from western New England to Ontario and Nebraska and south to Florida and Texas It is an erect perennial, 1 to 4 ft high, armed with sharp yellow prickles, and bearing large more or less deeply-lobed leaves, light blue or white flowers, strongly resembling those of the potato, and orange-yellow berries, about ¾ in in diameter In sandy or gravelly soils the horse-nettle sometimes becomes a troublesome weed, spreading not only by its seeds, but also by its long underground rootstocks. (*See* Solanum)



BY COURTESY OF IOWA GEOLOGICAL SOCIETY

THE HORSE-NETTLE (SOLANUM CAROLINENSE) OR SANDBRIER

HORSENS, town of Denmark, at the head of Horsens Fjord, on the east side of Jutland, 32 m. by rail S.W. of Aarhus Pop. (1925) 28,135. It is the junction of railways to Bryrup and to Torring inland, and to Juelsminde on the coast. There is also a good harbour The monastery and church were built in 1270 and there is a museum with a famous collection of stone-age material There is much pleasure-boating on the fjord The principal manufactures are textiles, tobacco, soap, engines, electrical apparatus, dairy produce and condensed milk Organs are also manufactured.

HORSE-POWER. The device, frequently seen in farmyards, by which the power of a horse is utilized to drive threshing or other machinery, is sometimes described as a "horse-power," but this term usually denotes the unit in which the performance of steam and other engines is expressed, and which is defined as the rate at which work is done when 33,000 lb. are raised one foot in one minute This value was adopted by James Watt as the result of experiments with strong dray-horses, but, as he was aware, it is in excess of what can be done by an average horse over a full day's work It is equal to 746 watts On the metric system it is reckoned as 4,500 kilogram-metres a minute, and the French *cheval-vapeur* is thus equal to 32,549 foot-pounds a minute, or 0·0863 of an English horse-power, or 736 watts. The "nominal horse-power" by which engines are sometimes rated is an arbitrary and obsolescent term of indefinite significance. An ordinary formula for obtaining it is $\frac{1}{15.6} D^2 \sqrt[3]{S}$ for high-pressure engines, and $\frac{1}{47} D^2 \sqrt[3]{S}$ for condensing engines, where D is the diameter of the piston in inches and S the length of the stroke in feet, though varying numbers are used for the divisor The "indicated horse-power" of a reciprocating engine is given by ASPN/33,000, where A is the area of the piston in square inches, S the length of the stroke in feet, P the mean pressure on the piston in lb per sq in , and N the number of effective strokes per minute, namely one for each revolution of the crank-shaft if the engine is single-acting, but twice as many if it is double-acting The mean pressure P is ascertained from the diagram or "card" given by an indicator (*see* STEAM-ENGINE). In turbine engines this method is inapplicable

A statement of indicated horse-power supplies a measure of the force acting in the cylinder of an engine, but the power available for doing external work off the crank-shaft is less than this by the amount absorbed in driving the engine itself. The useful residue, known as the "actual" "effective" or "brake" horse-power, can be directly measured by a dynamometer (*q.v.*); it amounts to about 80% of the indicated horse-power for good condensing engines and about 85% for non-condensing engines, or perhaps a little more when the engines are of the largest sizes When turbines, as often happens in land practice, are directly coupled to electrical generators, their horse-power can be deduced from the electrical output. When they are used for the propulsion of ships recourse is had to "torsion-meters" which measure the amount of twist undergone by the propeller shafts while transmitting power Two points are selected on the surface of the shaft at different positions along it, and the relative displacement which occurs between them round the shaft when power is being transmitted is determined either by electrical means, as in the Denny-Johnson torsion-meter, or optically, as in the Hopkinson-Thring and Bevis-Gibson instruments. The twist or surface-shear being proportional to the torque, the horse-power can be calculated if the modulus of rigidity of the steel employed is known or if the amount of twist corresponding to a given power has previously been ascertained by direct experiment on the shaft before it has been put in place.

HORSE-RACING AND BREEDING. Horse-racing is mentioned in the *Iliad* (xxiii 212–650). It was also known to various Oriental peoples at a very early date Details, however, are few and it is doubtful whether horse-races as the West knows them to-day existed at all among early peoples.

GREAT BRITAIN

It is not possible to say with any conviction or certainty when horse-racing actually began in England. The writers and historians of old were vague and indefinite in the extreme. Probably it began with the origin of the horse itself in this country. For if human nature and the sporting instincts of the people who lived centuries ago had any relation to what they are understood to be to-day, then it is certain that one man matched his horse or pony with another man's for a wager of sorts, perhaps, indeed, for no wager at all but merely to put a dispute to the test. It really matters little. We are entitled to assume that human nature has changed little if at all through the ages, and that they probably did the same then as we do now, according to their limitations, which we may be sure were determined for them by the very definite limitations of the early English horse. What we are certain of is that racing has been carried on for hundreds of years; and that the horses that came over with the Norman conquest were big animals capable of carrying heavily armoured men and inevitably assisted in imparting to the later English horse that size which has been increasing with its steady evolution.

Kings, prime ministers, peers of the realm, and commoners of varying degree figure as owners in the long history of racing in this country. The reign of Henry VIII. is generally accepted as marking the first definite beginning of anything like organized race-meetings, for it was in that period that racing is believed to have taken place at Chester on what was called the "Rodhee" or "Roody" and must certainly be what is now known as the Roodee on which a three-day meeting each year flourishes to this day Queen Elizabeth, according to Nichols' *Progress of Queen Elizabeth*, maintained a breeding stud, and in 1585, accompanied by a brilliant retinue, attended the races at Croydon, as also in 1587 and 1588. The first mention of racing at Doncaster is dated 1600 "Wheatley More," which was probably the Doncaster Town Moor of to-day on which the St Leger is decided every September, was the scene. Probably the earliest description of a race occurs in Clarkson's *History of Richmond* (Yorkshire) (1821). It occurred on May 6, 1622, and is reproduced below.—

A new maid race upon Rychmond Moor of iiii myles, sett forth and measured by Mr. James Raine, Alderman, and Mr John Metcalfe, and many other gentlemen and good fellowes the vith of May And further the said James Raine, Alderman, with his brethren hath made up a sume of xii poundes for to buy a free cupp for those knights, gentlemen or good fellowes that have horses or mares to run, leavyng the cupp free to their own disposition, must make upp the value of the said cupp, to renue the same for the next yeare

Whereas the names in order as they came this present yeare 1622 was as followeth, John Wagget onely the starter.

Impunius Sir George Bowes	his horse 1
Impunius Mr. Hunphrey Wyvell,	his tryer
Impunius Mr. Thomas Bowyer	his horse 2
Impunius Mr. Christ Bollmer,	his tryer.
Impunius Mr. Francis Broughe	his horse 3
Impunius Mr. Matt Rymer,	his tryer.
Impunius Mr. Wansforde	his mare 4
Impunius Mr. Anthony Franckland,	his tryer.
Impunius Mr. Loftus	his horse 5
Impunius Mr. Francis Wickliffe,	his tryer.
Impunius Mr. Gilbert Wharton,	the last and the sixth.
Impunius Mr. Thomas Wharton,	his tryer

So every party putting xl shillings, hath made upp the stake of xii poundes, for the buying of another cupp for the next year following.

Newmarket.—Although there are the records and a few others which it may not be necessary to enumerate of that early racing it remains a fact that the history of horse-racing in England is really the history of racing at Newmarket since its beginning At least this can be made to apply until such time as there came a great organized expansion, but the headquarters of the Turf has always been Newmarket, and especially, of course, following the establishment of the Jockey Club in the years 1750 or 1751. James I. may be said to have "discovered" Newmarket and developed it as a sporting centre. Charles I. did much to encourage racing and improve the breed of horses, and there are definite records of the feats of Charles II. on Newmarket Heath. On October 12, 1671, as recorded by Frank Siltzer in "Newmarket," he rode his own horse, Woodcock, in a match against Mr. Elliot (of the Bedchamber) on Flatfoot which the latter won, but two days later the king rode the winner of the plate (being a flagon of 32 price), the other competitors being the Duke of Monmouth, Mr. Elliot, and Mr. Thomas Thin (short for "at the inn" afterwards written Thynne) an ancestor of the Marquess of Bath. In March, 1674, the king, wrote Siltzer, again won the plate, and Sir Robert Carr, writing to his colleagues at Whitehall, says:—"Yesterday his Majesty rode himself three heates and a course, and won the Plate—all fower were hard and ne'er ridden, and I doe assure you the King wonn by good horsemanshipp."

In 1740 (George II.) we have parliament for the first time taking cognizance of horse racing. In that year an Act was passed which had for its object the putting an end to a number of country meetings by raising the stakes run for. It was insisted that every horse entered for a race must be the *bona fide* property of the person entering it, and that one person might only enter one horse for a race on pain of forfeiture. Parliament also settled the weights which horses had to carry. Thus five-year-olds were set to carry 10st; six-year-olds 11st; and seven-year-olds 12st. It is interesting to note that enactment, since it was the beginning of the more elaborate weight-for-age scale which is of paramount importance at this day and to which reference is made later. Curious is it to note, too, that the penalty inflicted upon the owner of any horse carrying less than those weights was the forfeiture of the horse and the payment of a fine, in addition, of £200. In those days races were over a distance of four miles and it is not surprising that the racing of two-year-olds was unknown.

The Jockey Club.—At the outset of its existence the Jockey Club originating, as has been said, in 1750 or 1751, was concerned only with racing at Newmarket, but it was inevitable that its embrace should in time extend to all racing in England, there and elsewhere. That authority has now lasted for approaching two centuries It has stood the test of time and public opinion, which has varied enormously in its attitude to racing. Always, however, the honour and integrity of the Jockey Club have been beyond reproach and criticism, and to that fact the enormous development of the Turf and the inherent love of horse racing in the people is primarily due In 1752 race meetings were held at about 70 different places, ten of which were in Yorkshire, including, of course, York, where in 1709 there had been a race for a gold cup In 1789 racing took place at 72 places in England, at three in Wales, six in Scotland, and 15 in Ireland Newmarket then claimed ten fixtures in the year, there are only eight to-day —three each in the spring and autumn and two in the summer. To show how racing has grown through the generations it is worth recalling that 1,166 horses took part in flat races a hundred years ago while to-day the number may be anything between four and five thousand.

English Racehorse Origins.—It may not be inappropriate here to trace the origin of the English racehorse of to-day and note the foundation of the General Stud Book It is an indisputable fact that thoroughbreds all over the world, in France, North and South America, the countries of Europe, Australia, and the British dominions are all descended from English racehorses; that is to say, they all trace back in direct male line to three Eastern horses which were introduced to this country, viz., the Byerly Turk, the Darley Arabian, and the Godolphin The last-named was either an Arabian or a Barb, but we know that he was imported about the year 1728. Most interesting is it to know that of the 174 Eastern sires which were mentioned in the first volume of the Stud Book, covering a period of over 200 years, only the three mentioned survived to keep their descent intact to this day The Darley Arabian was imported by Mr Darley, brother of Mr. Darley, of Buttercrambe (now called Aldby Park), midway between York and Malton. The Byerly Turk was imported into England by Captain Byerly, whose charger he was through the whole of King William's wars in Ireland, prior to being put to the stud The Godolphin was discovered in Paris about 1728. It was said he had actually drawn a water-cart. The finder of this foundation horse of the British thoroughbred was Mr. Coke, of Norfolk, who gave him to Mr. R. Williams, by whom he was presented to the Earl of Godolphin. He was a brown bay, standing about 15 hands, and died in 1753.

The better to show the influence of those three Eastern sires it should be understood that there are three outstanding families through the long history of the British racehorse They are known as the Eclipse, the Matchem, and the Herod lines. By far the most famous is that of Eclipse, whose name is probably familiar to all having even a superficial knowledge of the early thoroughbred horse. Let us glance at the breeding of these horses. Eclipse was sired by Old Marske, who was a grandson of the Darley Arabian. His dam Spiletta had for her grandsire on her own sire's side the Godolphin. Herod's great-great-grandsire was the Byerly Turk, and the name of the Darley Arabian commences the pedigree of his dam Cypron The grandsire of Matchem was the Godolphin, his dam having the Byerly Turk at the beginning of her pedigree. Other Eastern sires and mares are concerned with the breeding of Eclipse, Herod, and Matchem, but the three I have mentioned are pre-eminent and they were to remain predominant right through the generations. The vast influence of Eclipse cannot be too carefully noted. The ever-famous horse was foaled in 1764, the breeder being the Duke of Cumberland He was never beaten To this day the old saying is as fresh and as true as ever—"Eclipse first and the rest nowhere!" The horse won, or walked over for, 26 races and matches, including eleven King's Plates In 23 years at the stud he sired 344 winners of races worth £158,047-12-0 Think what a prodigious total it would have been in these days when stakes are many times bigger than they were in the days of Eclipse His stud fee varied between 20 and 50 guineas His great descendant, St Simon, was for nine years at the stud at a fee of 500 guineas, and there are sires at the stud to-day for which the same very high fee is paid

Two vitally important milestones stand out clear and distinct One was the publication of the first volume of the General Stud Book in 1781 and the issue of the first Racing Calendar in 1727 At the time of writing Volume XXVI. is the latest. In the first volume 387 mares were included because they were considered to be possessed of pure racing blood In 1891 that first edition was revised and revised again, and all but seventy-eight mares were eliminated To-day the Stud Book contains the names of over 6,000 The compiler of the first "Racing Calendar" was one named John Cheny, who lived at Arundel in Sussex, and it is said of him that in order to complete his book he rode all over the country to collect his accounts of race-meetings The title page, as here reproduced, is taken from C M Prior's most interesting history of the "Racing Calendar" This, then, is the reading of the title page of that historical first volume

"An hystorical list on account of all the horse-matches run, and of all the plates and prizes run for in England (of the value of ten punds or upwards) in 1727, containing the names of the owners of the horses, etc. that have run, as above and the names and colours of the horses also, with the winner distinguished of every match, plate, prize, or stakes; the conditions of running as to weight, age size, etc, and the plates in which the losing horses have come in with a list also of the principal cock matches of the Kingdom in the year above, and who were the winners and losers of them. London Printed in the year M D C C XXVII"

It has been made clear that the British thoroughbred of to-day had Eastern sires and mares of Eastern origin for his early ancestors. The singular thing is—at least it may appear singular to some people—that long before the present day the English racehorse, due to careful breeding and the marvellous effect of our climate and soil on constitution, bone and general development, would hopelessly out-match the best horse to be found in the East. Indeed, it has been demonstrated here and in India that no weight in reason will bring the two together in such a way as to give the Arabian horse even a remote chance of beating a very moderate thoroughbred In 1884 the Jockey Club were persuaded by an ardent admirer of the Arab horse to introduce a race for Arabs, which meant reverting to an experiment tried so long ago as 1771. A race entirely for Arabs was brought off at Newmarket and was won by Admiral Tryon's Asil. In the following year this same horse Asil, in receipt of 4st 7 lb. was beaten 20 lengths by Iambic, a very moderate horse owned by the Duke of Portland over a three-mile course at Newmarket One can understand how the Darley Arabian, the Godolphin and the Byerly Turk were marvels of their day, and no doubt they imparted quality and action to the native breed of the period, but after that our climate and feeding, which are unrivalled for horse-breeding and rearing, careful mating and rigorous compilation of the Stud Book have evolved such a horse to-day as could never have been dreamed of at the beginning of the history of the British thoroughbred Even in the days of that great dictator of the Turf, Admiral Rous, an Arab horse, according to him, would have had no chance even if it only carried an empty saddle!

Changes of Method and Outlook.—Looking back on Turf history one must be struck with the vast changes in methods, outlook and practices, for things are done now—as, for example, the racing of two-year-olds—that would not have been tolerated many years ago, and many things they did then have been long since abolished and would on no account be revived to-day. Stakes would be raced for in heats over four miles restricted to five-year-olds and upwards and were then opened to four-year-olds In 1831 they even had time to decide Mr. Osbaldeston's famous Match against Time. That sportsman had made a wager of 1,000 guineas that he would ride 200 miles in ten hours. The ground, forming a circle of four miles, having been marked out on and about the Round Course, he started about seven o'clock in the morning and performed the distance in 8 hours and 42 minutes, without apparent difficulty. He changed his horse every four miles, and rode 29 different horses. A bet of 1,000 to 100 pounds was laid that he did not perform the distance in 9 hours.

Let us look at the British Turf as it is to-day; and doing so it will not be without interest to examine its ramifications, the history of its five "classic" races, the great circle of racecourses which are part of its structure, the conditions under which the sport is conducted and the immensely enhanced value of the modern thoroughbred. We have the Jockey Club still supreme as the governing authority with its reputation as an institution never higher and more respected. It manages its own affairs at Newmarket as it always has done, while all racing elsewhere must submit to rules which have taken generations to perfect and make applicable to the evolution of the horse and the sport itself. Great names have had to do with administration from time to time. Admiral Rous has been mentioned. King Edward VII., the Earls of Derby, the late Duke of Westminster, the Duke of Portland, Sir Fred Johnstone, R. C. Vyner and the late Lord Chaplin have all played big parts and with them racing was essentially a sport rather than the business which in some cases it is tending to become to-day Mr. Lowther was fearless and even formidable, which is certainly true of Lord Durham, who died in 1928. They and others have at all times aimed at digging out the wrong-doer and ridding the Turf of those undesirables to whom it has ever been as a powerful magnet. When Admiral Rous died in 1877 there was brought into existence a Rous Memorial Fund, essentially a benevolent affair for the relief of the sick and needy connected with the training and riding of racehorses To this day there are Rous Memorial Stakes run for at Newmarket, Ascot, Goodwood and Doncaster in memory of the Dictator. There are Lowther Stakes, Jersey Stakes, Coventry Stakes, Durham Handicaps and Stakes, indeed many races are named after men who gave the weight of their influence and support to the general welfare of racing. What better example can be quoted than the Derby Stakes? The St Leger was so named out of compliment to the soldier and sportsman, Colonel St. Leger, who may be said to have founded the race (1776).

The five classic races are confined to three-year-olds, the Oaks and the One Thousand Guineas being restricted to fillies, the Two Thousand Guineas, the Derby, and the St. Leger being open to both colts and fillies It is unusual for the latter to be entered, and still less usual for them to run, but there are bright conspicuous instances on record of fillies winning the Derby, while they have with some frequency won the St. Leger. It has even happened that a filly has won both the Derby and the Oaks in the same week at Epsom. Signorinetta, bred and owned by an Italian, Chevalier Ginistrelli, who had for some years been settled in this country as an owner-trainer in a modest way, astonished the world in 1908, by winning the Derby at 100 to 1 and then the Oaks two days later. Eleanor in 1801 accomplished the rare feat, and the Yorkshire filly, Blink Bonny, did so in 1857. Fifinella won both in 1916 during the World War, when substitute races were decided at Newmarket. In the Two Thousand Guineas and the Derby colts must concede a sex allowance of 5 lb to fillies. The rule in other respects fixes the sex allowance at 3 lb. The "classics" are excellent examples of races which are confined to horses of a certain age Apart from them there are weight-for-age events in great numbers, handicaps, selling plates (some of which can be for horses of all ages on the weight-for-age scale), and races for two-year-olds from the time the season opens towards the end of March to when it finishes in November.

The weight-for-age scale is a fundamental principle in English racing. In a rough sort of way it obtained in the earliest days of racing. The scale was founded by Admiral Rous, and revised by him in 1873, but has been more than once modified in accordance with suggestions from the principal trainers and practical authorities. Horses are called upon to concede weight according to their ages, according to the month in which they race and according to the distance over which they are called upon to run. Thus a two-year-old in March or April over five furlongs would be entitled to receive 2st 4 lb. from a three-year-old, 3st 4 lb. from a four-year-old, and 3st 5 lb. from a five, six or aged horse. The reader will better grasp what is meant from the publication of the present day scale under the Jockey Club rules, which is as follows:

Horse Racing, 13

Age	March and April	May	June	July	Aug	Sept	Oct	Nov
Five furlongs—	st lb	st lb	st lb	st. lb	st lb	st. lb	st. lb	st. lb
Two years	6 0	6 2	6 7	6 10	7 2	7 7	7 9	7 12
Three years	8 4	8 3	8 5	8 7	8 9	8 12	8 12	8 13
Four years	9 4	9 0	9 0	9 0	9 0	9 0	9 0	9 0
Five, six and aged	9 5	9 0	9 0	9 0	9 0	9 0	9 0	9 0
Six Furlongs—								
Two years		6 4	6 7	6 11	7 0	7 6	7 9	7 13
Three years	8 5	8 6	8 8	8 10	8 12	9 0	9 2	9 3
Four years	9 7	9 7	9 7	9 7	9 7	9 7	9 7	9 7
Five, six and aged	9 9	9 8	9 7	9 7	9 7	9 7	9 7	9 7
One Mile—								
Two years						6 7	6 9	6 12
Three years	7 8	7 11	7 13	8 2	8 4	8 6	8 7	8 8
Four years	9 0	9 0	9 0	9 0	9 0	9 0	9 0	9 0
Five, six and aged	9 4	9 3	9 2	9 0	9 0	9 0	9 0	9 0
One Mile and a Half—								
Two years						6 0	6 4	6 7
Three years	7 7	7 9	7 11	7 13	8 1	8 3	8 5	8 7
Four years	9 0	9 0	9 0	9 0	9 0	9 0	9 0	9 0
Five, six and aged	9 5	9 4	9 3	9 2	9 1	9 0	9 0	9 0
Two Miles—								
Two years						6 0	6 2	6 2
Three years	7 8	7 11	7 12	8 0	8 3	8 4	8 5	8 5
Four years	9 4	9 4	9 4	9 4	9 4	9 4	9 4	9 4
Five, six and aged	9 10	9 9	9 8	9 7	9 6	9 5	9 4	9 4
Three Miles—								
Three years	7 1	7 4	7 5	7 7	7 9	7 11	7 13	7 13
Four years	9 0	9 0	9 0	9 0	9 0	9 0	9 0	9 0
Five years	9 8	9 7	9 6	9 5	9 5	9 4	9 3	9 3
Six and aged	9 10	9 8	9 7	9 6	9 5	9 4	9 3	9 3

A race like that for the Ascot Gold Cup is a good example of a weight-for-age race. Hundreds of others could be quoted, just also as examples might be given of races which have their basis on the weight-for-age scale but which are complicated by penalties for winners of certain sums, a "maiden" allowance for non-winners, and probably stallion allowances to those horses which have been sired by low fee sires as against those sired by the fashionable high fee horses. The tendency, however, is for stallion allowances to be cut out of the valuable races leaving special events to be created for the progeny of low fee horses. It follows that handicaps are close to the backbone of racing, if, indeed, they are not actually part of that backbone; just as handicaps are the mediums in every competitive sport which aims at bringing the good and the mediocre together. It has been pointed out how the racehorse of to-day would "smother" the Eastern horse from whom he has descended; that is to say, no weight in reason would bring them together. It is not so with the true thoroughbred. Racehorses do vary enormously in capacity, owing sometimes to

one and sometimes to a combination of causes; physique breeding, soundness, fitness and temperament are factors of the first importance, but it remains true that the clever adjustment of weights will bring the good, the moderate and the bad horses together. It is, therefore, on the many important handicaps of the year that betting is chiefly concentrated The Derby at Epsom, it is true, excites an amount of betting that is both enormous in extent and world wide in range; but then the premier "classic" is exceptional in every sense.

Handicap Races.—Handicap races which never fail to produce a vast amount of betting are the Autumn handicaps at Newmarket known as the Cesarewitch and Cambridgeshire; the former is for long distance horses and the latter for what is known as middle distance performers, for while the Cesarewitch is decided over two miles and a quarter the Cambridgeshire is a race of a mile and a furlong The Royal Hunt Cup at Ascot, the Stewards' Cup at Goodwood, the Jubilee Handicap at Kempton Park, the City and Suburban at Epsom, and the Lincolnshire Handicap at Lincoln are examples of handicap races which attract much speculation. Yet that speculation has changed, too, in its character In years past much of it was done at what was known as "ante-post rates," that is to say, betting would be opened days and weeks before the race—it is so to-day on the Derby and the Autumn handicaps at Newmarket—and long odds would be offered as a bait by the bookmakers If such odds were accepted the backer had to take a chance of the horse running. If it did not go to the post the wager would be lost In recent years, especially since the World War, ante-post betting has been steadily declining, probably owing to lack of enterprise on the part of the modern bookmaker, and perhaps also to the backer awaking to the fact that he can get practically as good odds on the day with the certainty of getting a run for his money With the coming into operation of the totalisator (*q v*) ante-post betting will be still further discouraged. The totalisator is essentially a machine that operates and governs the starting price

Mention, then, has been made of handicap races, which must closely approximate to half the races decided throughout the year. True, there are very few handicaps figuring in the four days' wonderful programme of an Ascot meeting The observation, therefore, must be accepted as having general application Let it be well understood there is, and always will be, a distinct gulf between what is accepted as "handicap form" and "classic form " Because of that gulf classic form is classic It is the best, and not unworthy of that description which has been applied to it for ages, certainly during the lifetime of the writer. Frequently are we reminded of what just a touch of classic form can bring about in the deciding of a handicap A horse that has even been thought good enough to run in a classic race, though unplaced, is regarded as having that "touch." If the records be searched examples will be discovered of horses that gained classic honours being successful in one or other of the important handicaps I think, as I write, of La Fleche, who won the Oaks, the St Leger, the Cambridgeshire and the One Thousand in the same year (1892), of Sceptre who won the Oaks, the St. Leger, the 2,000 Guineas and the 1,000 Guineas in 1902 and of Pretty Polly who won the Oaks, the St. Leger and the 1,000 Guineas in 1904. Rarely, however, in these days is the winner of a classic race exploited subsequently in a handicap. Such winner assumes too high a commercial value consequent on having gained classic honours for his or her future to be risked in a handicap, which is primarily concerned with betting There are exceptions, of course, but the common practice is for owners to retire fillies to the stud after their three-year-old careers. Such fillies have gained supreme honours, and there is danger to the stud career awaiting a filly if there should be anything in the nature of over-racing Certainly this is the policy adopted by the leading owner-breeders of whom the present Lord Derby may be quoted as an excellent example. The wonderful success of his breeding stud may largely be due to the consideration he has at all times shown to those high class fillies which have served him well up to the close of their racing careers. An instance is that of Toboggan, who won the Oaks and the Jockey Club Stakes in 1928. That race in any case was to have been the last of her career, and it was merely an incident, and not a deciding factor, that she broke down in the race for the Jockey Club Stakes although she won it

It is even more the custom to guard jealously the subsequent career of a Derby winner. To run the risk of defeat in these times is to accept a heavy responsibility. It has been thrust upon owners by the phenomenal jump in the values of high class bloodstock. It is no exaggeration to say that immediately a horse has passed the post as the winner of the Derby he becomes worth a minimum of £50,000. That is a modest enough figure; it would not be wrong to place it much higher. Felstead, the Derby winner of 1928, though his form preceding the victory had been anything but brilliant, was bid for from America up to £100,000. His owner, Sir Hugo Cunliffe-Owen, being, it need scarcely be said, a very rich man, preferred to keep his horse Solario did not win the Derby, but he won the St Leger and the Ascot Gold Cup as a four-year-old His owner, Sir John Rutherford, refused the Aga Khan's bid of £100,000 When the owner of the 1927 Derby winner, Call Boy, died the horse was subsequently sold privately to his brother for £60,000 and was forthwith sent to the stud rather than be raced as a four-year-old. The Derby had made his reputation to pass on to the stud and entitle him to command a high fee as a first-class sire Captain Cuttle, who won the Derby of 1922 for Lord Woolavington, was sold to Italy for a sum reported to be £50,000 after a short period at the stud in England He would not assume stud duties in Italy until reaching nine years of age. It was a wonderful price for a horse of that age

The post-war Derby winners have been Grand Parade, Spion Kop, Humorist (dead), Captain Cuttle, Papyrus, Sansovino, Manna, Coronach, Call Boy and Felstead Captain Cuttle, Call Boy and Felstead have been referred to The others won for owners who maintain studs and the horses, therefore, retired to them, each commanding a fee varying from three to four hundred guineas. While the owners of Derby winners realize the importance of preserving intact the laurels won at Epsom, and while stallion fees remain as high as they do, it will be the policy of such owners to fight shy of allowing their horses to run risks of endangering their reputations by incurring defeat as four-year-olds No Derby winner since the war has won the Ascot Gold Cup, which until modern times was looked upon as placing the seal on the racing career of a classic winner just as it did in the cases of King Edward's Persimmon, Isinglass, La Fleche, Bayardo, Prince Palatine and others Grand Parade, Manna and Call Boy were not trained as four-year-olds Only Spion Kop even ran for the Ascot Gold Cup, and he finished third to two handicap horses in a poor year The tendency is for Derby winners as four-year-olds to be concentrated on short distance races, such as the Coronation Cup, a mile and a half race at Epsom, and if entered—as they usually are—then run for the Eclipse Stakes (1½ m) at Sandown Park and probably the Jockey Club Stakes (1½ m) at Newmarket in the autumn The inference is that the stamina of the modern thoroughbred and the constitution to withstand a strenuous training for a Cup race of 2½ m at Ascot are doubted

VALUE OF THE HORSES

Nothing is more remarkable in the history of the British Turf in the 20th century than the enormous increase in the intrinsic value of the best bred and the highest class horses This applies to the fashionable stallion, the notable winner, the successful brood mare, the well-bred shapely foal boasting of immaculate parentage and promise for the future Let us examine the factors that have been at work. There were some five-figure prizes to be won before the century began but they were not associated with the classic races While such prizes have shown curtailment the values of the classic races have been enhanced For instance while in 1899 the Princess of Wales's Stakes and the Jockey Club Stakes, both decided at Newmarket, were each worth £10 000 their respective values to the winners in 1928 were £2,790 and £5,687. And the Eclipse Stakes at Sandown Park has more than held its position in that respect From being "merely" a ten thousand pounder in 1899, its value to Lord Derby who won the race with Fairway in 1928 was £13,306 When we examine the

increase in the values of the classic races, again taking 1899 as the closing year of the last century, we find that the Duke of Westminster's Flying Fox won what has always been called the "Triple Crown," that is to say the Two Thousand Guineas, the Derby and St. Leger and those races brought in respectively £4,250, £5,450 and £4,050. Lord M. Beresford's Sibola, winner of the One Thousand Guineas in the same year secured £3,800; Musa, the winner of the Oaks for Mr Douglas Baird, won £4,150. Compare those figures with the winnings of the classic horses of 1928 Flamingo (Two Thousand Guineas) £10,945; his Majesty's Scuttle (One Thousand Guineas) £8,470; Felstead (the Derby) £11,605, Fairway (St. Leger) £12,495.

These figures indicate one of the causes of the amazing advancement in the prices of bloodstock It may be true enough that the chief competing buyers in this country are only a comparatively few very wealthy men of whom the Aga Khan, Lord Woolavington, Lord Dewar, Lord Glanely, Lord Beaverbrook, the Hon. Esmond Harmsworth, Captain Arnold Wills, Sir Victor Sassoon and Major J. S Courtauld have been conspicuous since the war It is, however, also true that the demands from abroad, chiefly America and France, have grown Especially is this true of America to which country, with its extremely wealthy breeders and owners, have gone some of our best mares, yearlings and foals as well as a number of notable sires Flying Fox, on the death of his breeder and owner, the Duke of Westminster, was purchased by the French breeder, M E. Blanc, for the sum of 37,500 guineas. It was given at auction on the same day as a yearling by Persimmon from a mare named Ornament, to be known afterwards as Sceptre, which made 10,000 guineas as a yearling

When some years ago Tracery was sold to South America by his owner and breeder, the late August Belmont, who had bred and raced the horse in England, he received no less than £53,000. The price of Flying Fox may still be a record for the sale ring, but then no Derby winner has entered the sale ring since. Ard Patrick was sold to Germany for £21,000 in 1903, Rock Sand went to America for £25,000, Minoru went to Russia for a sum said to be under £20,000, and since then the only sale of a Derby winner was the one already related of Captain Cuttle to Italy. All these were private deals Nothing is more certain than that any Derby winner of modern times, or such high class St Leger winners as Solario and Fairway, would certainly fetch more than £50,000 if sent into the sale ring

In 1927 the Aga Khan paid 14,000 guineas for a yearling, afterwards named Aftab, by the Derby winner Papyrus from Sundart, but Aftab could not be raced as a two-year-old The same buyer is understood to have paid £21,000 in a private transaction for two yearlings bred at the National Stud in Ireland. One of them, a colt by Hurry On from Ecurie, is said to have represented £17,000 of the huge outlay It also could not be raced Whereas 172 yearlings were sold at Doncaster in 1910 for a total of 93,395 guineas the record total was reached in 1926 with the marvellous aggregate of 344,990 guineas for 325 yearlings, or about $5,400 each

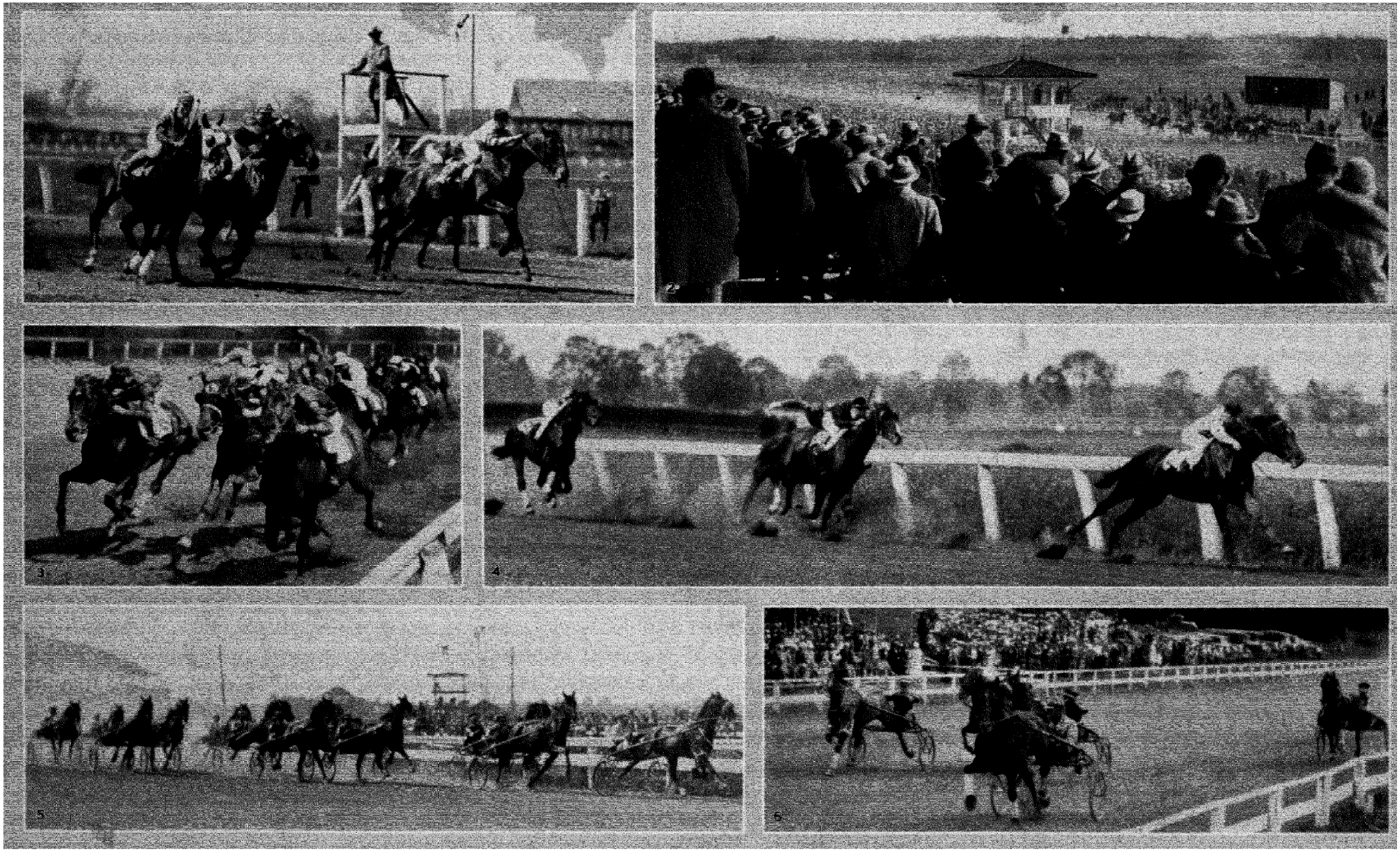
If the prices of yearlings have soared, so also have the prices of mares, which in addition to admirable records on the racecourse are well-bred and have been mated with those high class, high-fee stallions referred to. The climax, however, was reached for the sale of English bloodstock at the December sales at Newmarket in 1928 when a great new record was created. Five days of sales realised an aggregate of 474,594 guineas, which is by a long way the highest total recorded ever since the sales began in 1885. The young mare Dian made 14,500 guineas, and her own mother, Diadem, though fourteen years old, made 10,000 guineas. A third brood mare named Bracket, winner of the Cesarewitch in 1920, made 11,000 guineas, and in this case the buyer was Mr. Esmond. She was bought for France; the other two were retained by English buyers A record price at these sales in 1928 was paid for a foal, a colt by Solario, though one of the first crop of foals by that sire, fetching 5,000 guineas. The youngster's breeder was Sir Abe Bailey, who that year disposed of the whole of his big holding of mares, yearlings, foals and horses in training for an aggregate of 170,000 guineas, or about $867,000.

Developments in Training and Riding Methods.—During the nineteenth century, and especially in the first half of it, horses were able to race over much longer distances than are favoured to-day. They must have been horses of splendid constitution, soundness, courage, and, indeed, of all those virtues which have been transmitted through generations to the racehorse of to-day. They certainly had far more to endure. Their stabling would be comparatively crude and rough compared with the stabling of to-day. They seem to have been raced for endurance rather than for speed, though, if the times of races can be relied upon then, it is certain they did not lack the capacity to gallop fast as well as stay well In the very early days they had, of course, to be walked to distant meetings, and when walking was the only means of access they could not venture far beyond the borders of the county in which they were bred. That is an explanation of how there came to be so many meetings clustered in a recognized horse breeding "country" as for example Yorkshire.

The racehorse of to-day is a pampered creature whose individual tastes and whims are studied. Hygiene and sanitation enter into the construction and maintenance of up-to-date stables and studs, and one cannot doubt that while the thoroughbred racehorse in the process of evolution has put on height, he has also become speedier His temperament may be more highly strung, but in these days of vastly more racing, and greater competition, the call on the nervous reserves of horses is greater It is not the case that we have more bad tempered horses Rather is it true that they are more temperamental and susceptible to the big demands made on them.

It is more than probable that the revolution in the methods of jockeyship have been responsible for those calls on the natural nervous resources of the thoroughbred racehorse In the old days jockeys rode with long stirrup leathers, and while they were willing to make the pace a dawdle at the outset they would sprint home in the closing stages The most famous British jockeys, before the arrival of the Americans with their new methods, were Fred Archer, Johnny Osborne, Harry Custance and Mornington Cannon. The first mentioned rode 6 winners in one day and 257 winners in one year, and such was the impression made by Archer's skill that he was said to round the famous Tattenham corner in the Derby course with one leg over the rails The real revolutionary was the American Sloan, who came to England in the closing years of the last century to ride for Lord William Beresford He began to win a great number of races, some of them on horses that had been regarded as hopeless and on which leading English jockeys of the period had failed time after time What he did was to pull up the stirrup leathers and throw the weight of his crouching body forward onto the withers Then the horse, apparently liking the new distribution of weight, was permitted to race from the start and win without being robbed of that reserve necessary for the finish. From that time the great change-over came. English jockeys copied his example, and the first to do so were the first to benefit Other American jockeys came and so the method became general D. Maher was a particularly polished exponent of it, and, indeed, he rode three Derby winners and became the leading jockey of his day. Apprentices were taught to ride in this way, and so we have had champion jockeys in Frank Wootton, W. Higgs, S. Donoghue, Weston, Elliott and Gordon Richards who have never known any other way of riding a racehorse. There will never be a reversion to the old method for the handicap would be too enormous and the horse would have no chance; but we may be quite certain that the Sloan methods do take more out of a horse The fact of being expected to be racing at his top speed as soon as possible after the start and thereafter having to hold his place must take a lot out of horses, especially sprinters

It is scarcely possible in the space at the disposal of the writer to enumerate those famous horses which either on the racecourse or at the stud have done so much to make Turf history since, say, the days long ago of Eclipse. The names of Pot-8-os, Birdcatcher, St. Albans, Stockwell, Bend Or, Kendal, Ormonde, Cyllene, Gallinule, Lord Lyon, Hampton, Ayrshire, Newminster, Hermit, Galopin, St. Simon (all tracing back to Eclipse), the descendants of Herod (including The Tetrarch), and the progeny



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HORSE RACING IN THE UNITED STATES

1. Start of race, Jamaica racetrack, Long Island, N.Y. Starter's stand in background, with "barrier" above, marks position of start of the race. The horses are: right, in front, Tiger Gloss (second at finish); left, Circus Rider and Zero Hour (extreme left, first at finish)
2. First race in 1928 season at Bowie, Maryland, racetrack. View of the start, showing horses close together at the line between Judge's stand (centre) and scoreboard opposite. When starting race the horses are "jockeyed" into position behind the starting line. The starter gives the signal by raising the "barrier" line. Each jockey tries to obtain the position nearest the inside of the track
3. Jockeys settling for race after start (*see* fig. 2). Forward bend of jockeys, with weight on stirrups, is the characteristic position in horseracing, allowing maximum freedom of action to the horse, close control by jockey and lessened resistance to the wind
4. A decisive finish, showing the leading horse over a length ahead. Jockey of Marconi (first) is using the whip while the reins are gathered up in the left hand. Second horse, Quatrain, is being urged on to ensure retaining second place
5. Trotting race, showing drivers in pneumatic-wheeled sulkies, making the turn in first heat of race for the Hambletonian Stake, at Syracuse, N. Y., State Fair, 1927. Guy Dean-Cox leads, Guy McKinney-Ray, winner of the race, is second
6. Sam Williams-Cox (centre) winning third and final heat of $5,000 trotting race at Goshen, N. Y., 1927. Clara Bascom-Murphy (left) takes second place

of Matchem occur to the mind. The names of Ormonde and St Simon are familiar to the present generation because of their prowess on the racecourse, on which they were never beaten, and the rivalry of their ardent supporters. It is, however, beyond question that the name of St. Simon will endure the longer for the reason that he made a great and illustrious name for himself as a sire at the stud Among many famous breeding mares may be mentioned Lily Aques, the dam of Ormonde and ancestor of the famous family of racehorses bred and raced by the late Duke of Westminster. Famous sires of recent years include Spearmint, who sired Spion Kop, winner of the Derby of 1920, Flamboyant the sire of Flamingo, and Phalerns the sire of Fairway.

The Totalisator.—The Betting Act passed in 1928 enabled the Jockey Club and the National Hunt Committee to instal the Totalisator (or Pari-mutuel) system of betting on racecourses under their jurisdiction, the whole to be under the supervision of the newly created Betting Board of Control, on which are representatives of the Government, the Jockey Club, the National Hunt Committee, Tattersalls Committee and the Racecourse Owners' Association The Act was the outcome of years of agitation and clamour, mainly in consequence of the great good accruing to racing on the Continent and most other countries of the world which have controlled betting through the medium of Totalisators or the equivalent French methods of the Pari-mutuel The agitation was brought to a head when the Jockey Club conducted an inquiry into the causes of declining attendances on racecourses brought about, it was alleged, by the Government imposition, at the instigation of the Chancellor of the Exchequer (Winston Churchill), of a tax on the general turnover of betting It was alleged that this tax, of 2 percent on every wager on the racecourse and 3½ per cent on every wager at starting price away from the course, was steadily draining the resources of those betting people without whose support racing would not go on The Jockey Club's inquiry recommended in its findings the introduction of the Totalisator, and with the Government giving certain facilities for the passage of the necessary measure the Betting Act became a reality. The advocates of the Totalisator expressed the keenest enthusiasm, and obviously looked upon it as the only panacea for the decline which was exposed at the time of the Jockey Club inquiry

Stewardship.—All stewardship in connection with the administration and supervision of racing in England is honorary. Demands have been resisted for the appointment of stipendiary stewards or even advisory stewards without executive control. They have been resisted, but with some weakening which rather points to the principle of advisory stewards being accepted at some future date. Starting was made by the employment of a "gate" towards the end of the century, and in 1928 a decision was reached to adopt a barrier-like gate as used in France and Australia and which is calculated to prevent bursts through on the part of headstrong horses and over-zealous jockeys, resulting in a high percentage of unsatisfactory starts.

STEEPLECHASING AND HURDLE RACING

It was not until 1865 that returns of steeplechasing and hurdle racing came to be officially recorded in the "Racing Calendar," though the first Grand National won by a horse named Lottery was decided in 1839. This sport, which continues from about November to March, while flat racing occupies the rest of the year, is administered by the National Hunt Committee, of which there are about as many members as there are members of the Jockey Club, with six acting as Stewards for the period of their office. Rule 44 of the N. H. Committee is worth quoting as follows:—

"In all steeplechases Courses except at *bona-fide* hunt meetings there shall be:—

(A) In the first two miles at least twelve fences, and in each succeeding mile at least six fences, in all cases exclusive of hurdles.

(B) For each mile at least one ditch six feet wide and two feet deep on the taking off side of a fence, which ditch may be left open or guarded by a bank or rail, not exceeding two feet in height, and which fence must be at least four feet six inches in height, and if of dead brushwood or gorse, two feet in width.

(C) A water jump at least twelve feet wide and two feet deep to be left open or guarded by a fence not exceeding three feet in height

In all hurdle races it is stipulated there shall be not less than six flights of hurdles in the first mile and a half, with an additional flight of hurdles for every quarter of a mile, or part of one, beyond that distance, the height of the hurdles being not less than three feet six inches from the bottom bar to the top bar "

Though there are many instances on record of indifferent flat racehorses passing on to National Hunt racing to do well over fences, it is, nevertheless, as true to-day as it always was that the best steeplechase horses have been specially bred for jumping. The word "specially" is used advisedly, because such horses would be allowed to run to grass and no attempt would be made to break them until reaching three or four years of age Flat racers we know are put into training as yearlings Ireland has always been the great home of steeplechasers and it always will be Their best jumpers have been bred from mares owned by the small farmer to whom the ownership of a mare or two has been a business as well as a pleasure He has been able to mate his mare for a small fee, and when the offspring has arrived he could afford to turn it out in the paddocks, if not to make a 'chaser then to make a fair price as a hunter This method of rearing and late "breaking" is responsible for the strength and general development of the great steeplechasers of the past among whom such notable Grand National winners as Jerry M , Manifesto, Kirkland, Troytown, Sergeant Murphy, and Shaun Spadah

Liverpool, where the Grand National Steeplechase takes place towards the end of March every year, is, perhaps, the true home of steeplechasing in England, though the National Hunt Committee's own meeting extends over three days and takes place in March at Cheltenham Still the Grand National has world-wide fame The fences at Aintree are recognised as the most formidable anywhere, and no horse that stays the distance of 4 m 856 yd and jumps the thirty or so fences, including such notable obstacles as Becher's Brook and Valentine's Brook, is undeserving of his victory even if he be such a humble individual as Tipperary Tim, who in a record field of 42 starters in 1928 proved to be the only horse to escape a fall for which all sufficient reason he came in alone The value of the race increased until in Tipperary Tim's year (1928) it was worth £11,180 to the winner's owner.

At most racecourses on which flat racing takes place, notable exceptions being Newmarket, Ascot, Goodwood, Doncaster, York and certain others, National Hunt racing takes place in season The sport does not arouse such wide interest as flat racing, but, in spite of unpleasant English weather conditions, it is enormously popular It is a fact that both steeplechases and hurdle races are run at a faster pace to-day than twenty or fifty years ago Again the reason has to do with the change in jockeyship, for the revolution noted in jockeyship on the flat re-acted with the jockeys over fences and hurdles Especially is this true of hurdle racing The National Hunt jockey of to-day has pulled up his irons by several holes. He does not tarry when the start takes place, but races for the first fence or for the first hurdle as if there were no such obstacle there The result is that steeplechases and hurdle races are usually truly run throughout, but whether the standard of jockeyship can be the same, and certainly the standard of horsemanship cannot be as high, is doubtful

Racing in France.—Subsequent to the World War, because of the poor feeding of mares and their young stock and the comparative neglect of the stallions, French racing was in a bad way. It may explain why on three occasions horses sent from England were able to win the Grand Prix de Paris in successive years, Galloper Light (1919) Comrade (1920) Lemonora (1921). That horses from England have not won since 1921 is indicative of the remarkably fine recovery of horse-breeding and racing in France Not only so but horses have been sent from France to win some of our important races. Thus Sir Gallahad III and Tapin won the Lincolnshire Handicap; Epinard, one of the best horses foaled in France since the war, won the Stewards' Cup at Goodwood, and was rather unluckily beaten by a neck for the Cambridgeshire; Forseti won the Cesarewitch; Masked Marvel and Insight II. were Cambridgeshire winners for the American, Mr. Macomber, who races and breeds on a big scale in France; Asterus won the Royal Hunt Cup in 1927; and in 1928 Palais Royal II owned by the

Belgian, M. Wittouck, but bred and raced in France, won the Cambridgeshire after running second to Fairway for the St Leger.

It is recognised that the French breeders to-day are producing some high-class horses capable of winning races in any part of the world, for if they can win in England they certainly should be able to win anywhere else. That British breeders have recognized this as a fact is shown by their patronage of leading French stallions Mares have been sent over specially to be mated with them while yearlings have been purchased for England at the annual sales at Deauville Lord Derby, who races in France in partnership with the American, Mr Ogden Mills, has met with remarkable success The horses Kantar and Cri de Guerre were very important winners for the partnership in 1928. The latter won the Grand Prix, and, in all, horses owned by them won about two million francs in stakes in 1928, the same year as Lord Derby headed the list of winning owners in England with the wonderful total of £65,603.

Jockeys' and Entrance Fees.—According to the Rules of Racing, jockeys' fees, unless there is a private registered agreement between the jockey and the owner or trainer, are as follows. For flat racing £5 5 0 for a winner and £3 3 0 for a loser

For Steeplechasing Where a race under the National Hunt Club rules is worth £85 or more to the winner the fees are £10 10.0 for a winner and £5 5 0 for a loser If the race is worth under that amount, the fees are £5 5 0 for a winner and £3.3.0 for a loser.

The entrance fees for some less important races, such as selling plates, are as low as £1 to £2; but in some of the classics a system of forfeits prevails.

For the Grand National of 1929, the closing date was Jan 1, 1929 If the horse was not withdrawn by Jan 22, £5 had to be paid If left in the race after Jan 22, an additional £25 In 1928 a new ruling was passed enacting an additional £25 to be paid after Mar. 12 The fee for starters or horses not withdrawn after this date being an extra £20 making £100 in all, none of these fees or forfeits are collected until after the races have been run

(S. Gy)

THE UNITED STATES AND CANADA

The early history of horse racing in America still awaits adequate and systematic treatment, its records being scattered through a wide range of documents, often of a fugitive and fragmentary description. But the passion for the sport so highly developed in England seems to have been firmly implanted in the Colonies at a very early date. The Puritan regime in New England and the Dutch settlement of New York left racing to become established first in the south, notably Maryland, Virginia and the Carolinas, where the "cavalier spirit" prevailed among the leaders of both social and civic life. As soon as the Dutch dominance was succeeded by the English in New York, the turf began rapidly to develop there also, but in Pennsylvania the Quaker influence was a strong deterrent, resulting in restrictive legislation.

From such scanty records as survive it is evident that the horse known to modern times as "thoroughbred" was being established, as a breed, in the New World contemporaneously with his establishment in the Old, by the constant importation of choice specimens and their use for both racing and breeding purposes. Long before the *General Stud Book* was first published in England, the Jockey club was organized or any of the fixed events termed "classics" were instituted there, the colonial magnates, north and south, were constantly importing both stallions and mares of the best blood and individually famous. These, crossed upon the native stock or interbred among themselves, were the founders of the American thoroughbred of to-day So far as is known, the first truly thoroughbred horse ever brought over from England was Bull (or Bulle) Rock, a son of the Darley Arabian and a mare by the Byerly Turk, foaled 1718 and imported into Virginia about 1730 He seems to have initiated a period of tremendous expansion, as within the next 30 years Virginia, Maryland and the Carolinas were rapidly populated by a race of fast-multiplying thoroughbreds of the best British blood. The early racing had been at short distances, but the so-called "quarter horses" which supplied it were supplanted by an improved type, racing heats of 3 and 4 m., which, the latter especially, long remained the approved test.

The Revolutionary War naturally had a paralysing effect upon the sport. New York was much of the time in the hands of the British and the region round about it was one of uninterrupted warfare, while Virginia and the Carolinas were fought over incessantly

After peace came in 1783 it required several decades for recuperation on the part of the impoverished and exhausted combatants of the United States But re-importation soon became prevalent, and the establishment of new race courses and turf bodies all along the Atlantic coast from New York to Savannah progressed rapidly Meanwhile, the interest in the sport was spreading beyond the Allegheny mountains, and the pioneers of Kentucky and Tennessee were taking with them some of the best animals that the older States could provide This interest also extended farther west to Alabama, Louisiana and Mississippi New Orleans was destined by the middle of the 19th century to be the foremost racing point in America With the gradual centralization of wealth in and about New York it naturally became a focus for sport and for outdoor recreation, while Virginia and the Carolinas, owing to economic changes, were losing prestige; Virginia's long premiership in turf affairs, especially in breeding, passed to Kentucky, whose ascendancy, once gained, was to be permanent As the frontiers were continually pushed to the west, the racehorse followed or went with the "covered wagon" until at length the discovery of gold in California, in 1849, an impetus for a transcontinental migration, carried him to the Pacific coast itself

Effect of the Civil War.—For a second time war—the Civil War—intervened to disturb turf affairs, which went into almost total eclipse during this period With it the last traces of Virginian prominence on the course and at the stud were swept away, while the leadership of New Orleans was shattered for ever Kentucky suffered severely but temporarily only, while with the cessation of hostilities in 1865 the North took command of the affairs of the thoroughbred, never to relinquish them The great metropolitan racing plants began to dot the map, and the "absentee landlords" to acquire control of the great stud-farms of the "Blue Grass" region of Kentucky, the most prolific breeding ground of the champions of the 20th century At the dawn of the 20th century the skies were bright By 1912 the situation had become so disastrous that many courses were closed, hundreds of animals were being exported any and everywhere and sold for anything they would bring, and other hundreds, their identities destroyed, converted to the most menial uses Then came the turn of the tide A steady upward ascent was begun and in 1928 the sport reached a peak of prosperity previously undreamed of. During 1927 the sum of $13,935,610 was distributed at recognized meetings held in the United States and Canada, and at courses in Cuba and Mexico controlled by sportsmen of the States The enormous aggregate of 11,832 different races were run and nearly 8,000 different horses started in them

Modern Tracks.—The great centre of the sport is, however, New York, which supports four major tracks, those of Belmont park, Aqueduct, Jamaica and Empire City park During midsummer the scene shifts to Saratoga, to the northward, where also the annual yearling sales are held. Maryland, where a renaissance has occurred that has assumed huge proportions, supports four tracks, all contiguous to Baltimore—Pimlico, Laurel, Bowie and Havre de Grace Chicago also supports four major plants· Lincoln Fields, Arlington park, Washington park and Hawthorne, with a fifth near at hand, Aurora In Kentucky, at Lexington, is the oldest course in the country. Louisville has Churchill Downs, where the Kentucky Derby has been run annually ever since 1875, and Latonia, just across the Ohio river from Cincinnati, the last-named giving over $800,000 to be raced for in 1927 St Louis supports Fairmount park, just across the river (Mississippi) in Illinois, which distributes annually about $500,000. In Canada important meetings are given at Woodbine park, Toronto; at Windsor and Fort Erie, also in Ontario, and elsewhere.

Practically all American racing is over circular tracks from which the turf has been removed and the surface scientifically graded and expertly conditioned to ensure safety and a high

rate of speed. The track at Belmont park (the Westchester Racing Association, on Long Island) is the largest, being an oval somewhat more than 1½ m. in circumference, with a subsidiary special straightaway, the Widener course, of about seven furlongs, over which the Futurity, the leading annual event for two-year-olds, is decided. Its value in 1928 (gross) was $128,390, of which $97,790 went to the winner, High Strung, it being the most valuable prize ever run for in America. It is obvious that computations of money winnings no longer constitute a criterion of class in America, as it is possible for one lucky animal, though of mediocre calibre, to win more in a single effort than an absolute champion could in his entire career in former eras. The list of great money winners has grown by leaps and bounds and by the end of 1927 included no fewer than 52 credited with over $100,000 each Much controversy exists as to the real merits of latter-day horses as compared with those of the past. Man o' War, which raced in 1919–20, is by the consensus of opinion one of the supreme thoroughbreds of history; nor can there be any question of the real class of other modern heroes such as Crusader (son of Man o' War), Exterminator, Sarazen, Grey Lag or Reigh Count But their exploits have by no means dimmed those of such horses of the past as Hindoo and his son Hanover, Luke Blackburn, Salvator, Henry of Navarre, Sysonby and others; nor, to go even farther back, Longfellow, Ten Broeck, Harry Bassett, Norfolk, Asteroid, Kentucky or Iroquois, since 1881 the only American winner of the Epsont Derby. That no modern mare approaches the turf queens of earlier history—Miss Woodford, Firenze, Imp, Yo Tambien, Beldame or Thora—is admitted The vogue of the short-distance race, or sprint, is attributable wholly to commercialism in its various forms and, in particular, to the dominant desire for a quick "turn-over" of his money by the owner, the trainer, the speculator and the track manager alike. At best turf gains are problematical, the losses for the most part certain The expense of production has mounted to altitudes which formerly would have seemed fantastic. Hence the prevalence of two-year-old racing, which has become a positive abuse, and the gigantic stakes offered for that age, which in their turn have inflated yearling values enormously In the span of 20 years the differences shown are startling. In 1908 in the United States 745 yearlings were sold at auction for a total of $256,820, the average price per head being $344. In 1927 a grand total of 703 were sold for $1,939,425, the average per head being $2,758.78. The racing of two-year-olds begins on Jan. 1, at the winter meetings at Havana, New Orleans and Tia Juana (the Florida field in 1928 was idle)

Breeding.—Kentucky enjoys a practical monopoly of breeding prestige, and from her Blue Grass pastures come annually a large proportion of the season's best performers. No breeder of the present day operates on the unexampled scale of the late J. B. Haggin, who at one period, at his twin establishments, Elmendorf, in Kentucky, and Rancho del Paso, in California, was using 40 different stallions and over 600 brood mares—the nearest approach to "mass production" that the thoroughbred breed has known. But the number of large establishments is constantly growing and there has been a return to Virginia by several leading breeders. Imported—chiefly English, with a small quota of French and German—stallions and brood mares are constantly being brought into the country for stud purposes, but curiously enough, of the many horses imported since about 1880, none has been able to found what seems like an enduring line, the dominant ones of the day tracing to Australian, imported in 1858; Eclipse (son of Orlando), imported in 1858; and Bonnie Scotland, imported in 1857. Attempts to establish the St Simon line have been on the whole disappointing; likewise that of Bend Or. The earlier line from Glencoe is now almost extinct, as is that from Diomed. The latter reached its apogee in Lexington (1850–75), still, over a half-century after his death, the most famous thoroughbred ever produced in America. His male line has faded but his blood is everywhere throughout the fabric of the American racehorse, testifying to an influence in its way unprecedented. Leamington, brought over in 1865, with those progenitors just named, ranks as the greatest since the 18th century, but his blood has been incapable of carrying on directly after the passing of his sons, and is now no longer to be reckoned with The foreign attitude toward the American thoroughbred for breeding purposes has never been friendly, despite the successes that many American-bred horses have won abroad and the fact that foreign-bred horses brought to America have never, taken as a class, shown any superiority. Yet strains of American blood have, from time to time, cropped up in the classic stake winners of England, France, Germany, Italy and also the Antipodes, including more than one Derby winner.

Jockeyship Methods.—It seems to be conceded that American methods of jockeyship since the 19th century permanently revolutionized race riding, and the entire scope of the sport, throughout the world, has felt their effects. But America for years has suffered from a dearth of good riders, while great ones have become well-nigh unknown. Two reasons are advanced for this somewhat curious situation One is the prevalence of the sprinting distances, making judgment of pace, generalship and similar qualities ineffective amid the general scrambles that ensue The other is the fact that the American weight scale is so low that riders of matured skill and experience become virtually outlawed from the saddle just when their skill is growing most assured, because of their excess weight. Many of them have emigrated to Europe and there continued to ride for seasons with conspicuous success, the loss to their own country being proportionate.

Internationally the *entente cordiale* between America and the Old World is, however, closer than ever before, evidences of which were provided by the voyage across the Atlantic, in 1923, of Papyrus and his match race against the American colt Zev, run at Belmont park, of which Zev was the winner; and the three American appearances of the French colt Epinard, in 1924, in which he ran second, successively, to Wise Counsellor at Belmont park, to Ladkin at Aqueduct and to Sarazen at Latonia, the last-named race being perhaps the most brilliant seen on the American turf in the 20th century. (J. L. He.)

HURDLE RACING

The *American Turf Register* records a hurdle race at the Washington, D.C, Jockey Club races in Oct. 1834, "one mile out, leaping six fences, every gentleman riding his own horse for a piece of plate, value one hundred pounds. Mr. Stratton had a bad start; he gradually gained on the others; at the last barrier his horse leaped over one of the leading horses and the fence at one bound." In 1838, at Montreal, Canada, there was great encouragement in racing because of the Governor General's Cup given by the earl of Durham. On the third day, a hurdle race for horses hunted with the Montreal hounds was won by Black Prince. *Nimrod Abroad,* 1842, speaks of hurdle racing in New Brunswick

The sport in the States has had its ups and downs, but principally the latter, for the reason that, not needing any regular course, the races were run over hurdles placed on the track. These, not being permanent, were flimsy affairs, and when hit by the leaders would give way, bound back, and be difficult to judge by those following Then again, as the tracks in America are always dirt, the horses in front often made so much dust that those behind were unable to see the jumps and blundered through them This brought the sport into such great disfavour that hurdle racing was discontinued about 1900 but started again a few years ago.

Many horses raced over both hurdle and steeplechase courses. In 1872, Milesian won the Grand National Steeplechase with Johnny Hylands "riding like a great Captain," and immediately afterward a hurdle race Resolute, in 1876, won a "chase" at Baltimore, then defeated Deadhead and Bullet in a steeplechase at Jerome Park, and later beat Trouble over hurdles at Saratoga, making 17 brackets that year to his credit Lochiel, another grand hurdler of that period, held the record at Jerome Park of 2·26 for 1¾ m over seven hurdles. Forget, the property of F R. and T. Hitchcock, was one of the leading winners of her time (1898–99), coming first to the wire in 17 out of her 35 starts, and still held in 1928 the record for 2 m. at Coney Island

Bibliography.—C. J Apperley, *Nimrod Abroad* (1842); *The Toronto Herald; American Turf Register; The Spirit of the Times; The Turf, Field and Farm; The New York Sportsman.* (H. W. Sm.)

TROTTING HORSE-RACING

It is in America that the racing of horses in harness has reached its highest development. The standard-bred trotter enjoys the distinction of being the only variety of modern domestic animal which is an American product and occupies a position of recognized supremacy the world over It is in demand in all quarters of the globe, for breeding and racing purposes, where speed in harness is valued, as much as $60,000 having been paid for a single stallion (Allen Winter) for export to Europe Yet the standard-bred is by far the youngest of any sub-species of the equine race, its foundations having been laid little over 100 years ago, while the standard itself, under whose aegis it has reached so high a state of development, was not originated until 1879. It was then sponsored and placed in operation by the late John H. Wallace, the originator and long the compiler and publisher of the *American Trotting Register*, in 1928 in its 23rd volume. The number of stallions registered standard in this work is nearly 70,000, with more than double that number of mares The index of standard speed is 2 30 for 1 m for trotters and 2:25 for pacers, and there were in 1928, of official record, over 40,000 standard-record trotters and well on toward 35,000 pacers—the trot and the pace being to-day recognized as but two different forms of one fundamental habit of action

The American harness race horse was built up from the most heterogeneous elements, including all those which showed aptitude for speed at the trot in harness But to the imported English thoroughbred stallion Messenger, son of Mambrino, of the Darley Arabian line, belongs the credit of being the one horse whose blood brought order out of chaos and initiated the establishment of a genuine trotting family, destined to become universally dominant. Messenger, foaled 1780, was imported to America in 1788, made his first season that year at Philadelphia and died in 1808 on Long Island, his 20 years of service in America having been spent exclusively in and about Philadelphia and New York, then the two great urban centres of population in the United States While his progeny highly distinguished themselves on the turf and at the stud, as thoroughbreds, it was as a progenitor of game, fast and enduring trotters that he founded a family and remains for ever famous Both his sons and daughters handed on the gift of speed in harness, and as the generations multiplied, this speed increased rapidly in rate His blood began to submerge all other strains in which the trotting faculty was distinctive, the tribes of Just in Morgan and Henry Clay being the foremost.

The line from Messenger proved most potent through his son Mambrino, in turn the sire of Abdallah, he the sire of Hambletonian (Rysdyk's) The latter horse (foaled 1849, died 1876) is the great outstanding figure in the upbuilding of the breed, his influence having been so wide and deep that not even that of Eclipse on the English thoroughbred has equalled it. About 10,000 different harness race horses perform publicly every year in the United States and Canada, of which it would be safe to say that at least 90% trace directly to Hambletonian in the male line, while the vast majority of them have many collateral crosses to him.

Up to 1869, when the National Trotting Association, the first governing body known to the sport, was formed, harness racing was, while a popular pastime in the republic, especially its northern and eastern portions, unorganized, desultory and lacking in social status Thereafter it progressed rapidly, attracted prominent men in all walks of life and began to divide with the sport of thoroughbred racing the interest of those devoted to turf sports. The contrast between the two forms of racing remains, however, radical and inevitable. Thoroughbred race meetings are comparatively few in number, are held almost exclusively in or near the largest cities and are of lengthy duration. On the other hand, harness race meetings are diffused over the entire country, are of a few days only and many at which stakes and purses of large value are given are held in small towns, this being due to the fact that what may be termed the "amateur spirit" still largely prevails in the conduct of the sport.

Records.—From time immemorial harness racehorses have been handicapped according to their records (*i.e.*, their best official time) at a mile, though of late a new method of classifying them according to their money-winnings has been steadily gaining favour. The class of a trotter or pacer is largely established by his record and probably always will be. The first authentic instance of fast trotting in America was when Yankee, a gelding of unknown antecedents, trotted a mile in 2:59 at Harlem, N Y., in 1806. It was not until 1845 that 2 30 was reached by Lady Suffolk with 2 29½. Progress thereafter was steady as the breed became established and training methods improved Flora Temple scored 2.19¾ in 1859. The first 2.15 trotter was Goldsmith Maid (2·14 in 1874), which mare is notable as the largest money-winning animal ever on the turf of any sex, gait or breed, in any country. She was foaled in 1857, first appeared in public at the age of eight and trotted her last race at 20, her total winnings having been $364,200. She was by Alexander's Abdallah, son of Rysdyk's Hambletonian.

The 2·10 trotting list was begun by Jay-Eye-See, in 1884, when he trotted in just 2·10: The first 2·05 trotter was Nancy Hanks, which scored 2 04 in 1892, the year pneumatic-tired racing vehicles ("sulkies") were introduced, vastly accelerating speed Two minutes was at last reached in 1903 by Lou Dillon, she trotting in 1:58½ that season In 1928 the record-holding trotter was Peter Manning, which in 1922 placed the figures at 1 56¾ By a somewhat peculiar coincidence, the premier records that year at both the harness racing gaits were identical, the pacing mark being also 1.56¾, by Directum I in 1915. In 1905 Dan Patch paced a mile in 1 55¼, but with artificial assistance which was subsequently barred from official performances.

The introduction of the automobile exercised a momentous effect upon the status of the American harness race horse Previously the breed was taxed to its utmost to supply the demand for not only racing material, but the higher types of roadsters and private driving horses. As this demand no longer exists, the trotter and pacer of to-day approach the thorough-bred in that they are fast being relegated almost exclusively to the race track, for either professional or amateur use Owing to this turn of evolution, racing methods have likewise been altered Heat racing, as always, still prevails, but the length of the standard contest has been much curtailed, few races at the better meetings extending beyond the third heat The emphasis is more upon extreme speed than staying power, and whereas in former years colt racing was indulged in to but a slight extent, the aged performer being supreme, to-day the two and three-year-old occupy the centre of the stage and the most important and richest events are coming more and more to be apportioned to them

Thus far the most valuable trotting event given in America (or the world) has been the Hambletonian stake (named in honour of the great progenitor) of 1926, won by Guy McKinney, which fell but a trifle short of being worth $75,000. It is for three-year-olds No event exceeding $25,000 has as yet been given for pacers, and in recent years no event for aged trotters has been of larger value There are numerous futurity events for both two and three-year-olds and the leading money-winner of the season comes almost invariably from the futurity division. Early speed has become extreme The two-year-old trotting record is now 2.04, held jointly by Mr. McElwyn and Fireglow Mr McElwyn and Spencer jointly hold the three-year-old mark of 1·59¾ The two-year-old pacing honours are held by Silver Bells at 2:04¾, the three-year-old by Highland Scott at 1·59½

Breeding.—The Blue Grass region of Kentucky is the favoured region for the breeding of trotters, although their production goes on in all parts of the country, and many notable pacers are Canadian-bred. The principal speed nurseries and the premier sires are situated there. Trotting breeding to-day consists principally of the inter-breeding of the blood of four progenitors not long since disappeared from the stage—Axworthy, Bingen, McKinney and Peter the Great, all male-line descendants of Hambletonian. Of these the Axworthy line leads in the production of extreme speed, its chief representative being Guy Axworthy (2:08¾), which has sired no less than four different two-minute trotters, viz., Lee Axworthy (1:58¼), Guy McKinney (1:58¾), Mr McElwyn (1:59¼) and Arion Guy (1:59½). No other sire is credited with more than one. Peter the Great has been the most prolific sire of harness speed ever known and is credited

with no less than 661 standard-record performers, almost double the number by any other stallion. His son Azoff (2.14¼) is the sire of the trotting champion Peter Manning (1:56¼). The family of Bingen is, however, in its totality, larger than that of either Axworthy or Peter the Great and his son Uhlan (1:58), the trotting champion from 1912 to 1921, is considered the most finished, elegant and versatile harness performer yet produced McKinney's fame is due to a great racing daughter, Sweet Marie (2·02), and to a son Belwin (2:06¾) and a grandson, San Francisco (2:07¾), that are among the most successful sires of race horses of the present day

A grand total of 1,220 different harness race meetings were held in the United States and Canada in 1927, the same number as in 1926 The great majority of these were held in conjunction with State, County or other agricultural fairs and expositions, at which the thorough-bred has never been able to gain a foothold, owing to the fact that betting is prohibited In the United States harness racing reigns as their paramount entertainment feature. It has never been and never will be "the sport of kings," but as a democratic open-air diversion enjoys a popularity with the masses of the people that is secure (J. L. He)

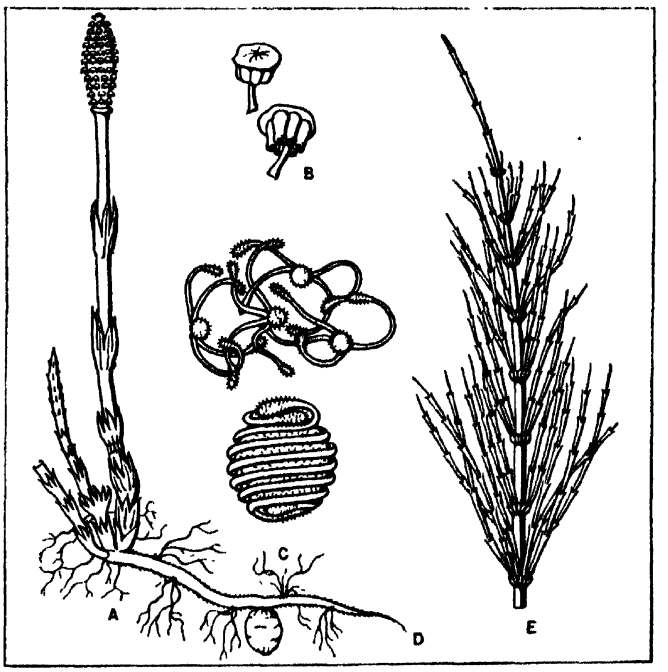
HORSERADISH, known botanically as *Cochlearia Armoracia*, a perennial plant of the family Cruciferae, having a stout cylindrical rootstock from the crown of which spring large radical leaves on long stalks, 4 to 6 in broad, and about a foot in length with a deeply crenate margin, and coarsely veined, the stem-leaves are short-stalked or sessile, elongated and tapering to their attachment, the lower ones often deeply toothed The flowers, which appear in May and June, are ⅛ in in width, in flat-topped panicles, with purplish sepals and white petals, the fruit is a small silicula, which does not ripen in the climate of England. The horseradish is indigenous to eastern Europe. Into western Europe and Great Britain, where it is to be met with on waste ground, it was probably introduced It has extensively escaped from cultivation in North America

The root, the *armoraciae radix* of pharmacy, is ½ to 2 in or more in diameter, and commonly 1 ft, sometimes 3 ft in length; the upper part is enlarged into a crown, which is annulated with the scars of fallen leaves, and from the numerous irregular lateral branches are produced vertical stolons, and also adventitious buds, which latter render the plant very difficult of extirpation From the root of Aconite (*q.v.*), which has occasionally been mistaken for it, horseradish root differs in being more or less cylindrical from a little below the crown, and in its pale yellowish (or brownish) white hue externally, acrid and penetrating odour when scraped or bruised, and pungent and either sweetish or bitter taste Under the influence of a ferment which it contains, the fresh root yields on distillation with water about ·05% of a volatile oil, butyl sulphocyanide, C_4H_9CNS In common with other species of *Cochlearia*, the horseradish was formerly in high repute as an antiscorbutic. The root was, as well as the leaves, taken with food by the Germans in the middle ages, whence the old French name for it, *moutarde des Allemands*.

HORSE-SHOES. The horny casing of the foot of the horse and other solidungulates, while quite sufficient to protect the extremity of the limb under natural conditions, is found to wear away and break, especially in moist climates, when the animal is subjected to hard work of any kind. This, however, can be obviated by the simple device of attaching to the hoof a rim of iron, adjusted to the shape of the hoof. The animal itself has been in a very marked manner modified by shoeing, for without this we could have had neither the fleet racers nor the heavy and powerful cart-horses of the present day. Though the ancients were sufficiently impressed by the damage done to horses' hoofs to devise certain forms of covering for them (in the shape of socks or sandals), the practice of nailing iron plates or rim-shoes to the hoof does not appear to have been introduced earlier than the 2nd century B.C., and was not commonly known till the close of the 5th century A.D., or in regular use till the middle ages. The evidence for the earlier date depends on the doubtful interpretations of designs on coins, etc. As time went on, however, the profession of the farrier and the art of the shoesmith gradually grew in importance. It was only in the 19th century that horse-shoeing was introduced in Japan, where the former practice was to attach to the horse's feet slippers of straw, which were renewed when necessary, a custom which may indicate the usage of early peoples.

In modern times much attention has been devoted to horse-shoeing by veterinary science, with the result of emphasizing that methods formerly adopted caused cruel injury to horses and serious loss to their owners. According to modern principles (1) shoes should be as light as compatible with the wear demanded of them; (2) the ground face of the shoe should be concave, and the face applied to the foot plain; (3) heavy draught horses alone should have toe and heel calks on their shoes to increase foothold; (4) the excess growth of the wall or outer portion of horny matter should only be removed in re-shoeing; care being taken to keep both sides of the hoof of equal height, (5) the shoe should fit accurately to the circumference of the hoof, and project slightly beyond the heel, (6) the shoe should be fixed with as few nails as possible, six or seven in fore-shoes and eight in hind-shoes, and (7) the nails should take a short thick hold of the wall, so that old nail-holes may be removed with the natural growth and paring of the horny matter.

HORSETAIL (*Equisetum*), the sole genus of the botanical class Equisetaceae, consisting of a group of vascular cryptogamous plants (*see* PTERIDOPHYTA) remarkable for the vegetative structure which resembles in general appearance the genera of flowering plants *Casuarina* and *Ephedra*. They are herbaceous plants growing from an underground much-branched rootstock from which spring slender aerial shoots which are green, ribbed, and bear at each node a whorl of leaves reduced to a toothed sheath. From the nodes spring whorls of similar but more slender branches Some shoots are sterile while others are fertile, bearing at the apex the so-called fructification—a dense oval, oblong conical or cylindrical



THE CORN HORSETAIL (EQUISETUM ARVENSE), A TROUBLESOME WEED
A. Fertile shoot, springing from the underground root-like stem, which also bears tubers; the vegetative shoots have not yet unfolded
B. A spore bearing leaf
C. Spore showing the two spiral bands of the perinium
D. Dry spores showing the expanded spiral bands
E. Sterile vegetative shoot

spike, consisting of a number of shortly-stalked peltate scales, each of which has attached to its under surface a circle of spore-cases (*sporangia*) which open by a longitudinal slit on their inner side The spores differ from those of ferns in their outer coat (*exospore*) being split up into four club-shaped hygroscopic threads (*elaters*) which are curled when moist, but become straightened when dry. In most species the fertile and sterile

shoots are alike, both being green and leaf-bearing, but in a few species the fertile are more or less different, *e.g.*, in *E. arvense* the fertile shoots appear first, in the spring, and are unbranched and not green Any portion of the underground rhizome when broken off is capable of producing a new plant; hence the difficulty of eradicating them when once established. There are 25 known species of the genus which is universally distributed, 9 of which occur in Great Britain

The common horsetail *E arvense*, one of the best-known species, is sometimes a troublesome weed in clayey fields The fructification appears in March and April, terminating in short unbranched stems It is said to produce diarrhoea in such cattle as eat it. The bog horsetail, *E. palustre*, is said to possess similar properties. It grows in marshes, ditches, pools and drains in meadows. The fructification in this species is cylindrical, and in that of *E. fluviatile*, which grows in similar situations, it is ovate in outline. The largest British species, *E maximum*, grows in wet sandy declivities by railway embankments or streams, etc , and is remarkable for its beauty, due to the abundance of its elegant branches and the alternately green and white appearance of the stem In this species the fructification is conical or lanceolate, and is found in April on short, stout, unbranched stems which have large loose sheaths. *E. hyemale*, commonly known as the Dutch rush, is much more abundant in Holland than in Great Britain; it is used for polishing purposes. *E. variegatum* grows on wet sandy ground, and serves by means of its fibrous roots to bind the sand together. The horsetails are remarkable for the large quantity of silica they contain in the cuticle (hence their value in polishing), which often amounts to half the weight of the ash yielded by burning them; the roots contain a quantity of starch.

In North America the majority of the known species of horsetail occur, several of which, as the common horsetail (*E arvense*), the bog horsetail (*E. palustre*), the swamp horsetail (*E. fluviatile*), the sedgelike horsetail (*E scripoidea*), the smooth scouring-rush (*E laevigatum*) and the tall scouring-rush (*E prealtum*) are found widely across the continent The giant horsetail (*E Telmateia*), widely distributed in the Old World, with sterile stems occasionally 10 ft. long, occurs in the Pacific States, sometimes in pestiferous abundance.

HORSHAM, a town in Sussex, England, 38 m S by W from London by the S R Pop. (1921) 11,406 Some early remains have been found at Horsham The town is not mentioned in Domesday Book, but the Rape of Bramber, in which it lies, belonged at that time to William de Braose. His descendants held the borough and the manor of Horsham, which passed to the family of Mowbray, afterwards dukes of Norfolk. Fairs are held on April 5, July 18, Nov. 17 and 27. Market days are Monday and Wednesday. "Glovers" of Horsham are mentioned in a patent roll of 1485. It is situated near the source of the Arun. The church of St. Mary is mainly Early English and Perpendicular, with remains of Norman work, having a lofty tower surmounted by a spire The grammar school was founded in 1532 and rebuilt in 1893 In the vicinity are several fine mansions Christ's Hospital (*q v*) at West Horsham was opened in 1902, the school being removed hither from London The town has industries of founding, carriage-building and the manufacture of bricks and pottery.

HORSLEY, JOHN (*c* 1685–1732), British archaeologist. There is evidence that he was settled in Morpeth as a Presbyterian minister as early as 1709. At Morpeth Horsley opened a private school. Respect for his character and abilities attracted pupils irrespective of religious connection, among them Newton Ogle, afterwards dean of Westminster. He gave lectures on mechanics and hydrostatics in Morpeth, Alnwick and Newcastle, and was elected F R S. on April 23, 1730 Horsley's great work, *Britannia Romana, or the Roman Antiquities of Britain* (1732), is one of the scarcest and most valuable of its class There is in the British Museum a copy with notes by John Ward (*c.* 1679–1758), biographer of the Gresham professors Horsley died on Jan. 12, 1732.

HORSLEY, JOHN CALLCOTT (1817–1903), English painter, was born in London on Jan. 29, 1817. He studied at Sass's academy and at the Academy schools. In 1844 he was selected as one of the six painters employed to decorate with frescoes the walls of the new palace of Westminster, where two of his large works, "The Spirit of Religion" and "Satan surprised at the ear of Eve," are to be found But his real gift was for domestic scenes conceived in the Dutch style. He also painted some portraits, notably an admirable one of Martin Colnaghi, now in the National gallery, London. Horsley became A R.A in 1855 and R A. in 1856 He died in London on Oct. 18, 1903.

See his *Recollections of a Royal Academician* (1903).

HORSLEY, SAMUEL (1733–1806), English divine, was born in London on Sept. 15, 1733 Entering Trinity college, Cambridge, he became LL B in 1758, and in 1759 succeeded his father as rector of Newington Butts, Surrey. Horsley was elected F R.S in 1767; and secretary in 1773, but, in consequence of a difference with the president (Sir Joseph Banks) he withdrew in 1784. In 1781 he became archdeacon of St Albans. Horsley now entered in earnest upon his famous controversy with Joseph Priestley, who, in his *History of the Corruptions of Christianity*, had included among those corruptions the orthodox doctrine of Christ's divinity. Horsley sought to show that Priestley was "altogether unqualified to throw any light on a question of ecclesiastical antiquity" (*Tracts*, 1789, p 85). The controversy was prolonged until 1790 when Priestley published his maturer book on the *History of Early Opinion*, which Horsley refused to read. In 1788 Lord Thurlow procured Horsley's promotion to the see of St. David's As a bishop, Horsley was energetic both in his diocese, where he strove to better the position of his clergy, and in parliament On Jan 30, 1793, a few days after the death of Louis XVI , he preached before the House of Lords a famous sermon at Westminster Abbey on the dangers of the revolutionary spirit. At his eloquent peroration the whole assembly rose involuntarily from their seats His support of the government was acknowledged by his successive translations to Rochester in 1793, and to St Asaph in 1802 With the bishopric of Rochester he held the deanery of Westminster. He died at Brighton on Oct. 4, 1806.

See H. Horsley Jebb, *Life of Bishop Samuel Horsley* (1909).

HORSLEY, SIR VICTOR (1857–1916), English physiologist and surgeon, was born in Kensington, London, on April 14, 1857 He studied medicine at University college, London, and, after qualifying in 1880, became house-surgeon to John Marshall He then became professor-superintendent of the Brown Institution in the university (1884–90), assistant surgeon at University college hospital (1885), F R S (1886), professor of pathology at University college (1886), surgeon to the National Hospital for the Paralysed and Epileptic, Queen square, London (1886). In the World War he served in the military hospitals in France, Egypt and Mesopotamia He put up a strong fight for better arrangements in the hospitals in the eastern theatre of war, and died at Amarah of heat-stroke on July 16, 1916

Few men worked harder than Horsley in the two departments of surgery and physiology, but he had many outside interests. He was a passionate reformer, and a leader in the campaign against intemperance. His famous *Alcohol and the Human Body* (1907) was written in collaboration with Dr Mary Sturge.

As a surgeon his most original work was done at Queen square. There he conducted successfully the first operation (June 9, 1887) for the removal of a tumour from the spinal cord; the paper on cerebral surgery read before the meeting of the British Medical Association at Toronto (1906) is one of the most important of his many writings. Before he went to the Queen square hospital he had made important researches in the localization of function in the brain and spinal cord in conjunction with Sir E Sharpley Schäfer, Sir Felix Semon and others. Other subjects of his investigations at the Brown Institution were the action of the thyroid gland and protective treatment against rabies, and he was secretary of the commission appointed by the Local Government Board in 1886 to study the adoption of the Pasteur treatment.

See Stephen Paget, *Sir Victor Horsley, a study of his Life and Writings* (1919).

HORSLEY, WILLIAM (1774–1858), English musician, was born in London on Nov 15, 1774, and died there on June 12, 1858 He was organist successively of Ely chapel, Holborn; the Asylum for Female Orphans, Belgrave chapel; and the Charterhouse. His compositions include three symphonies, but of greater importance are his delightful glees, such as "By Celia's Arbour," "O Nightingale," "Now the Storm begins to Lower"

HORST, the term used in geomorphology more definitely for a block of the earth's crust that has remained stationary while the land has sunk on either side of it, *e.g*, the Vosges The word is also applied to those larger areas, such as the Deccan of India, where the continent remains stable, with horizontal beds forming a table-land, in distinction to the folded region such as the Himalaya mountains.

HORT, FENTON JOHN ANTHONY (1828–1892), British theologian, was born in Dublin on April 23, 1828, and was educated at Rugby school and at Trinity college, Cambridge, where he was the contemporary of E. W. Benson, B F. Westcott and J. B. Lightfoot. The four men became lifelong friends and fellow-workers. In 1850 Hort took his degree, and two years later became fellow of his college In 1854, in conjunction with J. E. B. Mayor and Lightfoot, he established the *Journal of Classical and Sacred Philology,* and plunged into theological and patristic study. In 1857 he married, and accepted the college living of St. Ippolyts, near Hitchin, Herts, where he remained for fifteen years. In 1870 he was appointed a member of the committee for revising the translation of the New Testament, and in 1871 he delivered the Hulsean lectures before the university. In 1872 he became fellow and lecturer at Emmanuel College; in 1878 he was made Hulsean professor of divinity, and in 1887 Lady Margaret reader in divinity. In the meantime he had published, with his friend Westcott, the reconstructed Greek text of the New Testament. The Revision Committee had very largely accepted this text, even before its publication, as a basis for their translation of the New Testament. The text was vehemently attacked, but on the whole it was received as being the nearest approximation yet made to the original text of the New Testament (*see* BIBLE: *New Testament,* "Textual Criticism") Hort died on Nov. 30, 1892, worn out by intense mental labour Next to his Greek Testament his best-known work is *The Christian Ecclesia* (1897)

See A. F. Hort, *Life and Letters of Dr. Hort* (2 vols. 1896).

HORTA, the capital of an administrative district comprising the islands of Pico, Fayal, Flores and Corvo, in the Portuguese archipelago of the Azores Pop (1920) 5,718. Horta is a seaport on the south-east coast of Fayal. The harbour, a bay 2 m. long and nearly 1 m broad, affords good anchorage in 5 to 20 fathoms of water, but is dangerous in south-westerly and south-easterly winds. It is the headquarters of profitable whale, tunny, bonito and mullet fisheries Its exports include sperm-oil, fruit, wine and grain.

HORTEN, a seaport and watering place of Norway, in Jarlsberg-Laurvik, *amt* (county), beautifully situated on the west bank of the Oslo Fjord, opposite Moss, 38 m by water and 66 by rail S of Oslo. Pop. (1927) 11,000. It is practically united with Karl-Johansvaern, which is defended by strong fortifications, is the headquarters of the Norwegian fleet, and possesses an arsenal and shipbuilding yards. There are also an observatory and a nautical museum.

HORTENSE (EUGÉNIE HORTENSE DE BEAUHARNAIS) (1783–1837), queen of Holland, was born in Paris on April 10, 1783. She was the daughter of the empress Josephine by her first marriage, and in 1802 married Louis Bonaparte, who was proclaimed king of Holland on June 6, 1806. The marriage was an unhappy one, and Louis endeavoured unsuccessfully to obtain a divorce, but Napoleon at length agreed to allow them to separate. Hortense was involved in the fall of Napoleon, and wandered from country to country, finally settling in Arenenberg, Switzerland, where she died on Oct. 5, 1837

She was the mother of Napoleon Louis Charles, who died in infancy; Louis Napoleon (1804–31), crown-prince of Holland; and Charles Louis Napoleon afterwards Napoleon III (*q.v.*). She was the author of several songs, including "Partant pour la Syrie." Queen Hortense's *Mémoires* passed into the possession of Prince Napoleon who died in 1926 before he had finished editing them. The work was completed by Jean Hanoteau. *Les Mémoires de la reine Hortense* (3 vols, 1928; Eng trans., 2 vols, 1928).

See d'Arjuzon, *Hortense de Beauharnais* (3 vols. 1907), Taylor, *Hortense de Beaukarnais* (2 vols, 1927), C G. de Taurines, *La Reine Hortense en exil* (1914); J Turquan, *La Reine Hortense* (2 vols, 1927)

HORTENSIUS, QUINTUS, dictator of Rome 286 B.C. When the people, pressed by their patrician creditors, "seceded" to the Janiculum, he was commissioned to put an end to the strife. He passed a law (*Lex Hortensia*) whereby the resolutions of the multitude (*plebiscita*) were made binding on all the citizens, without the approval of the senate being necessary. He is said to have died while still dictator

See Aulus Gellius xv 27; Pliny, *Nat. Hist.* xvi. 15; Macrobius, *Saturnalia* i 16, Livy, *Epit.* ii

HORTENSIUS, QUINTUS (114–50 B.C.), surnamed Hortalus, Roman orator and advocate At the age of nineteen he made his first speech at the bar, and shortly afterwards successfully defended Nicomedes III of Bithynia, one of Rome's dependants in the East, who had been deprived of his throne by his brother From that time his reputation as an advocate was established As the son-in-law of Q Lutatius Catulus he was attached to the aristocratic party The senatorial control of the courts reintroduced by Sulla helped him, as many of his clients were ex-governors accused of extortion. He became quaestor in 81, aedile in 75, praetor in 72 and consul in 69. In the year before his consulship he came into collision with Cicero in the case of Verres, and from that time his supremacy at the bar was lost. But after 63 Cicero joined the party to which Hortensius belonged Consequently, in political cases, the two men were often engaged on the same side (*e.g.*, in defence of Rabirius, Murena, Publius Cornelius Sulla and Milo) After Pompey's return from the East in 61, Hortensius withdrew from public life and devoted himself to his profession. In 50, the year of his death, he successfully defended Appius Claudius Pulcher when accused of treason and corrupt practices by P. Cornelius Dolabella

Hortensius's speeches are not extant His oratory, according to Cicero, was of the Asiatic style, a florid rhetoric, better to hear than to read He had a wonderfully tenacious memory (Cicero, *Brutus,* 88, 95), and could retain every point in his opponent's argument His action was highly artificial, and his manner of folding his toga was noted by tragic actors of the day (Macrobius, *Sat* iii 13 4). He also possessed a fine musical voice, which he could skilfully command He was very rich, and noted for the luxury of his houses and table. He wrote a treatise on general questions of oratory, erotic poems (Ovid, *Tristia,* ii 441), and an *Annales* (Vell. Pat ii 16 3)

In addition to Cicero (*passim*), *see* Dio Cassius xxxviii 16, xxxix. 37, Pliny, *Nat. Hist.* ix. 81, x. 23, xiv. 17, xxxv. 40, Varro, *R.R.* iii. 13. 17.

HORTHY DE NAGYBANYA, NICHOLAS (1868–), Hungarian admiral and regent, was born June 18, 1868 at Kenderes, in the family mansion in the county of Szolnok (Eastern Hungary) His family belonged to the landed gentry, and from 1635 ranked amongst the nobility After studying at the naval academy at Fiume he entered the navy of the Dual Monarchy After considerable sea service he was appointed A D C to the Emperor Francis Joseph, and served in the naval department of the War Ministry in Vienna At the outbreak of the World War he was appointed to command the cruiser "Novara" After Italy joined the Allies Horthy distinguished himself in the naval raids on Porto Corsini and San Giovanni di Medua, and particularly at Otranto, where on May 14, 1917, with the cruisers "Novara," "Saida" and "Helgoland," he broke through the ship cordon blockading the Straits of Otranto. Horthy, although severely wounded, remained on deck and continued the fight until he succeeded in returning safely with his ships to his home port, despite the enemy's heavy fire He was awarded the military cross of Maria Theresa Near the end of the War Horthy was appointed commander-in-chief of the Austro-Hungarian fleet

After the collapse of the Monarchy and when revolution broke out in Hungary Admiral Horthy returned to organize the counter-revolutionary forces in southeastern Hungary, where his popularity added considerably to the influence of the unofficial counter-revolutionary Government formed by Count Julius Károlyi in Hungarian territory occupied by French troops When it became obvious that the fall of Bolshevism was imminent, the second "Szeged Government" appointed Horthy commander-in-chief of the national army, which, after the flight of the people's commissioners (Aug. 1919), entered Transdanubia, entering Budapest, with Horthy at its head, on Nov. 16, 1919, after the withdrawal of the Rumanian troops

The severity with which order was restored subjected Horthy to many attacks for failing to restrain the extremist leaders. The national assembly which met in Feb. 1920, however, elected Horthy, then still commander-in-chief of the Hungarian forces, to be regent of Hungary (March 1, 1920)

The only question on which opinion among influential Hungarian circles was sharply divided was that of the advisability or possibility of a legitimist restoration The two attempts of the ex-king Charles (*q v*) to recover his throne placed Horthy in a dilemma between his oath to his king as Admiral and Privy Councillor and his oath as regent. In April 1921 he refused to obey Charles's summons to hand over the government and persuaded him to leave the country by peaceful means In Oct 1921, when the king marched on Budapest with an armed force, Horthy employed Hungarian troops against him, disarmed and, under pressure, handed him over to the Entente representatives. As the Hungarian Government was then forced to declare the Habsburg dynasty forfeit of the throne, Horthy was placed in the peculiar position of regent to a legally non-existent king The legitimist question was, however, seldom raised openly by its partisans and Horthy, who invariably performed his duties with constitutional correctness, had an easier task to fulfill

HORTICULTURAL AND BOTANICAL SOCIETIES. For Linnean and other societies dealing with both zoology and botany, *see* LEARNED SOCIETIES The *Congrès International d'Horticulture* first met at Brussels in 1864, and the *Congrès International de Botanique* at Amsterdam in 1865

BRITISH ISLES: The *Royal Botanic Society of London* (inc. 1839) has gardens in the inner circle of Regent's Park and issues a *Quarterly Summary* (1880, etc.). The *Royal Horticultural Society* (1804, inc. 1809) has gardens at Chiswick, and publishes a *Journal* (1846, etc) Other London societies include the *Brit. Mycolog. Soc.* (1896), *Trans.*; and *Empire Forestry Assoc.* (1921), *Emp For. Journ* The chief provincial societies are: Birmingham, *Bot and Hort Soc.* (1829), gardens. Oxford, *Bot. Soc. and Exch. Club* (1836), *Rept.* (1856, etc.). Dublin, *Roy. Hort. Soc.* (1830) Liverpool, *Bot. Soc.* (1906), *Proc.* (1910, etc). Edinburgh, *Roy Scot. Arboricult. Soc.* (1854), *Scot. For. Journ.* (half-yearly); *Bot. Soc* (1836), *Trans. and Proc.* (1841, etc.) gardens est 1670. Corstorphine, *Scot. Soc for Res. in Plant Breeding* (1921), *Rept.* CANADA: Quebec, *Soc. pour la protec. des Plantes.* Ottawa, *Canad. Forestry Assoc., Canad. Forest and Outdoors* and *La Forêt et La Ferme* (both monthly). INDIA: Alipore, *Agric. and Hort. Soc. of Ind.* (1820).

UNITED STATES. New York, *Hort. Soc.* (1900, inc. 1902), *Journ., Mem., Horticulture; Torrey Bot. Club* (1865, inc. 1871), *Bull.* (1870, etc.), *Torreya* (1901, etc.), *Mem.* (1889, etc.); *Sullivant Moss Soc.* (1898), *Bryologist* (fortnightly). Washington, *Bot. Soc.* (1001); *Soc. of Am. Foresters* (1900), *Journ. of Forestry; Am. Hort Soc.* (1922, uniting w. *Nat. Hort. Soc.*, 1924), *Nat. Hort. Mag.; Am. Forestry Assoc.* (1875), *Am. Forests and For. Life* (monthly), *Am. Phytopath. Soc.* (1909), *Phytopathology* (1911–25). Charlottesville, Va, *Bot. Soc. of Am.* (1894). Boston, *Mycolog Club* (1895, inc. 1900), *Bull.; Mass. Hort. Soc.* (1829), *Horticulture, Yearbook* Chicago, *Am Soc. of Plant Physiologists* (1924), *Plant Physiology.* College Park, Md., *Am. Soc. for Hort. Science* (1903), *Ann. Rept.*

FRANCE: Paris, *Soc. bot. de France* (1854), *Bull.* (1854, etc.), *Mém.* (1905, etc.); *Soc. Mycol. de France* (1885), *Bull. trimestriel.* Annecy, *Acad florimontane* (1606), *Rev. Savois.* Dijon, *Soc. Mycol.* Le Havre, *Soc. d'Hort. et de Bot.* (1853), *Bull.* Limoges, *Soc. bot. et d'Etudes scient.* (1889), *Revue.* Lyons, *Soc. d'Hort.* (1920), *Horticole.* Marseilles, *Soc. d'Hort. et de Bot.* (1846), *Revue* (monthly).

GERMANY: Berlin, *Deutsch. Bot. Gesell.* (1882), *Berichte* (yearly), *Bot. Zentralbl.; Freie Vereinigung f. Syst. u. Pflanzengeog.* (1903), *Berichte; Vereinigung f. angewandte Bot.* (1902), *Angewandte Bot.; Gesell. z Förderung deutsch. Pflanzenzucht* (1908), *Beitrage z Pflanzenzucht.* Darmstadt, *Deutsch. Gesell. f. Pilzkunde, Zeitschr f Pilzkunde* and *Pilze Mitteleurop.* Dresden, *"Flora," Sachsische Gesell.* (1826), *Neu Folge* (yearly) and *Sitzungsberichte u Abhandlungen.* Kiel, *Arbeitsgemeinsch. f. Flor.* (1922) Königsberg, *Pr Bot. Ver.* (1862), *Jahresber. Flora v. O u W. Preussen.* Magdeburg, *Bot. Verein.* Munich, *Bayersiche bot. Gesell* (1890), *Berichte, Mitteilungen, Kryptogam Forsch*, with library and herbarium; *Deutsch Hortus.-Gesell. e V.* (1917), *Mitteilungen, Heil- u. Gewurzpfl.* Weimar, *Thuring. bot. Verein* (1883), *Mitteilungen*

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HORTICULTURE. This term is derived from the Latin, *hortus*—a garden, and *cultura*—cultivation; and horticulture originally meant the cultivation of a garden in contrast to agriculture or the cultivation of fields Field culture related originally to the production of cereals, grass and roots for fodder, while the garden was cultivated for the production of vegetables, fruit and nuts for use in the house and of flowers to beautify it. In early days, horticulture and gardening were synonymous terms, but horticulture has come to mean more than gardening. With the development of the town areas in the industrial ages, all the necessary fruits, flowers and vegetables could not be produced in the gardens, and in consequence these crops came to be grown in the fields, where they displaced cereals, roots or grass, in varying quantities. In places like England and Belgium, it would seem that this development increased simultaneously with the rise and intensification of industry; but it spread in advance of industry in North America, South Africa, Australia and New Zealand, for horticultural products, even for export, found a better market than the ordinary agricultural crops. Present day horticulture still means gardening, *i.e*, gardening in the home gardens, on the allotments and in the public parks, but the term also embraces the production of crops of fruit, flowers and vegetables wherever grown It has developed into an industry of magnitude in England, Belgium, France, the Netherlands, United States and Canada, New Zealand and Tasmania, while in other countries, such as the South American republics, it has barely secured a footing.

In all these countries the departments of agriculture deal with horticulture usually through a separate department. Admittedly horticulture deals with crop production, and therefore has a close relationship to agriculture, but yet there is a distinction which is officially recognised in many acts of parliament. In some acts

the term agriculture is defined specially as including horticulture, but where no such definition is made horticulture often has been deemed to be excluded. Horticulture, of course, is of intense interest to large numbers of people, and its work is seen everywhere. Fruit, flower and vegetable production in the fields, private gardens and allotments, floriculture in the public parks, gardens and wayside places; even in the hearts of the great towns it may be seen practised in window boxes or roof gardens.

The Nursery Trade.—One of the important branches of horticulture is the nursery trade, for it supplies the industry and the public with plants, shrubs and trees for growing The members of the trade have to be very skilled and technical, for theirs is the responsibility to choose and propagate the best varieties, true to name, to care for and develop the best strains, and to propagate and raise the baby plants until they reach the stage when they can leave the nursery grounds and fend for themselves in the fields of the market gardeners and fruit growers or in the private gardens of the public.

The nurserymen of to-day look far afield, making their purchases and selling their stocks in all countries where plant importation has not been forbidden At times they assist collectively in sending explorers to wild and remote places to collect new plants of beauty.

Plant Raising.—All plants may be raised from seed, though some may be propagated more easily in other ways The seeds of some yield a plant which flowers, produces seed and dies, all in the same year. Such one-year plants are called *annuals*, and include asters, balsam, calceolaria, candytuft, clarkia, cinerarias, eschscholtzia, annual delphiniums, linaria, annual lupins, mignonette, nasturtium, nigella, nemesia, annual poppies, sunflowers, stocks, sweet peas and zinnias. Seeds of these should be spring sown on good land For earlier plants seed may with advantage be sown in sandy loams during January in heat, a practise specially recommended for asters, stocks and zinnias

Other flowers, and for that matter vegetables, take one year to produce the plant, which gives flowers and seeds in the following year; these are known as *biennials* Canterbury bells, antirrhinums, scabious and wallflowers are well-known biennials Seed sown during the summer or autumn should be transplanted to single plants in the autumn to flower the following spring and summer.

There is a third class of plants which, after flowering, does not die; the foliage may ripen and die away in the autumn, but the roots persist so that with each spring and summer foliage and flowers are sent forth. Plants of this class are known as *perennials*, and they embrace most of our important plants of the herbaceous border. Aquilegia, auricula, begonia, calceolaria (bedding), campanula, carnations, Michaelmas daisies, delphiniums, peonies, lupins, phlox, perennial poppies, pyrethrums, are examples of perennial plants. Stocks of these may be raised from seed sown any time during the summer Transplanted single roots increase in size annually and these may be divided to make more plants, a form of propagation usually adopted for perennials

Some plants—antirrhinums, carnations, chrysanthemums, geraniums, calceolarias, arabis and aubretia, heaths, etc—are increased by planting stem cuttings in pure sand in heat under moist conditions. They soon take root and make fresh plants. For plants like the phlox and seakale it is preferable to use a root cutting which on planting develops aerial branches.

Some plants give of their best when grown on roots which are not their own. Thus, varieties of roses are grown on the dog rose, the *manetti*, or the *rugosa;* the rhododendron on the common *R. ponticum;* apple trees on the crab or paradise stock; pears on the quince; cherries and plums on the wild stocks. This is a very convenient method of increasing plants, for the stocks may be grown and got ready to receive the particular variety which is joined on by grafting or budding. Grafting is a spring operation usually done for apples, pears, rhododendrons and many flowering shrubs. Budding is done in mid-summer and is more commonly used for roses, plums, peaches, etc. Where plants are difficult to propagate from seed or from cutting or by budding or grafting they are often layered, *i e.*, a stem slightly cut is pegged down to the ground and the cut part covered with soil. The obstinate plants may be coaxed by such means to send out roots.

In England the land devoted to nursery work is estimated at 10,000 acres, with an annual output of stock valued at £1,000,000. Holland, France and Germany have very large and important nursery trades. Those of the United States and Canada are fast developing.

Seed Production and Harvesting.—To a very large extent the flowers and vegetables of the gardens and fields are raised from seed sown annually. The horticulturist needs supplies true and of good germination. To secure seed that when sown will give good germination, it must be grown in certain localities and harvested during special weather conditions; in consequence localities became famous for certain seeds. Home seed saving fell out of fashion, and a special horticultural seed industry has taken its place Horticultural seed firms of world-wide reputation exist in many countries Perhaps the locality of first importance as a horticultural-seed district is California The Californian climate is especially suitable for seeds of onion, lettuce, carrot, radish, sweet peas, zinnias and many flower seeds

Similarly France, and especially the south of France round St. Remis, is suitable for just the same kinds, and these are produced in considerable quantities The island of Vancouver, B.C., seems favourable for seeding flowers and a small industry has developed. There are many other places where the climate seems suitable and where important seed areas may develop, as for example South Africa. To seed the cauliflower a mild winter season is essential, for which reason Italy proves very desirable In the neighbourhood of the bay of Naples field upon field of cauliflowers are seeded, from whence supplies go to all parts.

In the Netherlands the climate is more suitable for seeding culinary peas, of which there is a large and important production. England's climate is none too kindly for seed production, but is suitable for seeding peas and sweet peas in some quantity and such vegetables as cabbage, savoys, broccoli and Brussels sprouts English raised seed of these vegetables enjoys a good reputation and finds markets in the United States, Canada, India and many other countries In England about 4,850 occupiers of holdings are engaged in producing crops for seed.

The seed is formed on the plant after the female portion of the flower has been fertilised, and it is important that the pollen should come from flowers of the same variety, for if they do not crossing will occur. Many vegetables and flowers are fertilised by wind blown or insect carried pollen, so that the difficulties in keeping stocks pure are many. In practice, blocks of the same kind are grown in isolation and far removed from any foreign source. In addition, the parent plants are rogued very carefully at the time when differences in growth disclose the intruders Seed saving of *Brassicae* present a most difficult feature, for all kinds of cabbage will fertilise each other and also the Brussels sprouts, savoys, broccoli and wild mustard; so that the isolation of each kind of these plants needs great care.

The seed has to be harvested ripe and dry, threshed from the haulm and stored under appropriate conditions or good germination is not retained Purity and good germination are the important essentials In consequence of this several countries, the United States, Canada, England, Scotland, Ireland, Switzerland, Denmark, France, Holland, etc, have established official seed testing stations where seeds have to be tested before they may be offered for sale to the public. Legislative measures compelling this are embodied in "seeds acts" which generally lay down standards of purity and germination for each class of seed. For England the standards of germination must not be less than: peas 70%, dwarf and broad beans 75%, runner beans 60%, turnips 75%, cabbage 70%, kale 70%, kohl rabi 60%, swede 70%, Brussels sprouts 70%, broccoli 60%, cauliflower 60%, carrot 50%, parsnip 45%, beet 50%, onion 60%. Somewhat similar standards are in existence in other countries. The Government of Canada has gone further with control measures, so that it is illegal to sell seed of any varieties unless the name has been registered by the Canadian Government as that of a distinct variety. Trial grounds are maintained at the central experimental farm at Ottawa for testing all kinds under the plant registration scheme.

THE PRIVATE GARDEN

The present forms of the private garden have been evolved from many greatly differing styles. Very formal gardening with its neat beds and trimmed hedges and trees, landscape gardening which removed walls and boundary fences and took gardening into the parks and fields, wild gardening, the Victorian gardens of geranium beds in green smooth lawns all surrounded with laurel hedges,—all have held sway in their time, and parts of each are embodied in the gardening of the twentieth century. Changes have occurred in that laurels and evergreen shrubs have largely given way to flowering shrubs; the lawn is still kept but often is in part set with groups of daffodils, crocuses and snowdrops, trees and hedges are no longer cut and trimmed to weird shapes; the geraniums have given way to herbaceous plants and often a rock garden finds place Sometimes provision is made for semi-aquatic plants.

In creating a good effect, the appearance of the lawn is all important The lawn should be well drained to remove surplus water, and constantly rolled and mown and kept free of daisies and plantains. Grass may be encouraged to grow by repeated applications of small quantities of sulphate of ammonia. The best time of the year to prepare for making a new lawn in England is directly after the hot summer weather ceases, about the middle of August, to ensure a sowing of grass seeds at the end of the month The soil is then warm, and heavy dews may be expected to help the germination of the seed The young grass will have plenty of time to develop roots, and become properly established before frosts come. It is advisable to sow between one and two ounces of seed to the square yard, so that the amount for a lawn the size of a tennis court—forty yards by twenty yards—would be one hundred pounds. Patches of snowdrops, crocuses, daffodils and scillas planted in the lawn make a delightful spring effect, but the grass in these patches cannot be cut till June or the bulbs become weakened.

Bulbs are exceedingly popular, especially those of the narcissi and daffodils; of these new and improved kinds are introduced annually Golden Spur, Emperor and King Alfred are really good yellow daffodils, whilst Orantus, Horace, Sunrise, Lucifer, Flame, Croesus are good narcissi. Crocus breeding has developed kinds that flower throughout the autumn, winter and spring

The Herbaceous Border.—This is now found in every garden and often takes the form of a long bed, not too wide, running the whole length at one side of the lawn or even surrounding it. Herbaceous borders should be dug in the autumn when roots can be lifted or if necessary new kinds planted. Herbaceous plants give the best effect when planted in groups. As each group comes into flower that part is a blaze of colour. Herbaceous plants die down in the autumn and old stems and leaves need clearing but the plants grow again in the spring and usually get bigger with age. When overcrowding occurs the roots may be lifted, divided and replanted Peonies, delphiniums, phloxes, campanulas, funkias (plantain lily), kniphofias (red hot pokers), Michaelmas daisies, lupins are valuable herbaceous plants for any garden border. Occasional spring dressings with bone meal give good results.

Flowering Shrubs.—Lilacs, laburnum, Jasmine and rhododendrons are old friends that for generations have found their places in gardens. This group of flowering shrubs has been much enriched by collectors, and a fine variety of beautiful flowering shrubs and trees is now available. Of the shrubs the best are *Berberis Lycium, Berberis stenophylla, Buddleia alternifolia, Ceanothus Gloire de Versailles, Ceanothus Veitchianus, Cistus Cyprius, Cistus purpureus, Cornus Mas, Cotoneaster frigida, C. horizontalis, C rotundifolia, Cydonica japonica, Cytisus albus, Deutzia scabra magnifica, Erica carnea, E. vagans, Escallonia langleyensis, Forsythia intermedia spectabilis, Genista virgata, Hammelis mollis, Jasminum nudiflorum, Magnolia stellata, Osmanthus Delawayi, Philadelphus grandiflora, Plagianthus Lyallii* (the best of all), *Prunus subhirtella, Pyracantha coccinea Lalandei, Pyrus floribunda, Rhododendron praecox, Ribes sanguineum, Rubus biflorus, Viburnum Carlesii* and *Viburnum fragans*

These desirable shrubs need protection from severe frosts during exceptionally cold winters, and very occasional dressings with dung or leaf mould. Some need careful pruning, others trimming; particulars can be obtained from any national horticultural society

Rock Gardening.—In modern rock gardens Alpine plants predominate; in fact the gardens are constructed to make suitable sheltered spots and crevices, dry patches and wet places for these plants, for Alpines only grow well if given just the right places, soil and shelter Some need peaty soil, others leaf mould and loam, while others need just scree or limestone rubble. The aim of the rock gardener must be to give each its natural environment Some of the most charming Alpine plants for a rock garden are *Alyssum saxatile citrinum* (sheet of sulphur yellow), *Androsace* (rock jasmine, should be planted on gritty soil), *Anemone angulosa* (blue) and *A Pulsatilla* (purple), *Aubrietia Dr. Mules* (purple), *Campanula Allionii, C. Alba* and *C. Miss Wilmott, Cotyledon simplicifolius, Cyclamen europaeum* and *C. neapolitanum, Daphne Cneorum, Dianthus alpinus, Gaultheria procumbens* (miniature shrub with white blossoms), *Gentiana acaulis, G Sino-ornata,* and *G verna, Iberis sempervirens*, Snowflake, *Iris pumila, Oxalis enneaphylla, Phlox stellaria, Primula auricula Bulleyana* (splendid bog species), *P a. Juliae* and *Ramondia pyrenaica, Saxifraga Cotyledon, S. Myra, S burseriana, Sedum acre, S murale, Sempervivum arachnoideum, Silene acaulis, Thymus nitidus, Veronica, Viola Bertoloni*

Of dwarf trees and shrubs the following are good, *Berberis Thunbergii purpurea, Cotoneaster horizontalis, Cupressus Fletcheri, Cytisus Kewensis, Daphne album, Erica carnea*

The seeds of Alpine rock plants should be sown in pots in the autumn and exposed to the winter's frosts and snows and then in the spring put in cold frames. They may be pricked out as soon as large enough to handle and planted in their permanent quarters.

The Rose Garden.—Roses do best in heavy soils, but they can be grown on the lightest if the surface is mulched with dung during hot and dry periods. Roses can be grown on pergolas or poles, as dwarf bushes in beds, or as standards There is now a form and kind suitable for almost every taste

Some of the best climbing roses are American pillar (pink), Paul's scarlet climber (scarlet), Tausendschoen (pink), Coronation (crimson), Blush rambler, Dorothy Perkins (pink), Minnehaha (deep rose) These climbing roses need tying to the poles on which they climb, and each year the old wood needs cutting leaving only the new growths

As bush roses the following kinds are noteworthy: *Polyantha varieties* (very dwarf): Crimson Orleans (crimson), Kirsten Poullsen (scarlet), Nurse Cavell (red), Coral Cluster (coral pink), Else Poullsen (rose pink) *Bush roses, semi-double and doubles*: Betty Uprichard (pink and carmine), Christine (yellow), Halmark crimson (crimson), Independence day (yellow), Lady Pirrie (salmon pink), Mme. Butterfly (pale pink), Mrs Herbert Stevens (white), Red Letter day (crimson-scarlet) *Singles*: Pink Delight (pink), Ethel James (bright pink), Irish Elegance (bright apricot), Irish Fireflame (orange pink). Good Roses for *Standards* are Mrs Henry Morse, Frau Karl Druschki, Lady Pierre, Mme Herriot, Ophelia, General McArthur, Hugh Dickson, Golden Emblem, Lady Hillingdon, Los Angeles, Caroline Testout, Mme Abel Chatenay

Young shoots give the best blooms, and these are encouraged by liberal manuring and by cutting well back in late spring when danger of frost has disappeared

Roses are propagated on many different types of stocks, the briar, the manetti, the *rugosa,* and the Seedling Polyanthus rose, but beyond doubt those on the briar give the best results and last the longest.

Roses need careful pruning, though each kind of rose needs different treatment. The rambler roses should be autumn pruned by cutting out the old shoots and leaving the young growth. The Wichuraianas (Dorothy Perkins, Minnehaha, etc) may be similarly treated as soon as flowering has finished The Noisettes (William Allen Richardson, Marechal Niel, etc) should be cut hard back in April. Bush roses should be left alone or just thinned when necessary The perpetual roses, the *rugosas,* should be trimmed into shape during February The hybrid perpetuals are cut back moderately in late March. The hybrid teas (Mrs. W. T. Grant, etc) may be pruned in mid-March Never prune roses until the kind has been ascertained

Vegetable Gardening.—The purpose of the vegetable garden is to supply the larder with fresh vegetables throughout the year as far as possible. In temperate climates it is possible to secure a full twelve months' supply, but where the winter and summer temperature vary greatly, the supply falls short. To secure successful crops there must be thorough and deep cultivation, intensified manuring, and a proper rotation of crops The soil at all times needs digging a good spade deep, and if done two spades deep or even three the results are much better for soil drainage and aeration is then better and roots penetrate deeper The manuring should be liberal, of the right kinds and properly balanced No doubt farmyard dung or green manure should form the basis, for when incorporated into the soil these work down to humus, and improve the physical properties of all soils. If sufficient dung is not available, it can be supplemented with artificials in much more generous quantities than is used generally A good annual dressing for the garden would be 5 cwt of dung per perch before digging and then an application of 3 lb sulphate of ammonia, 9 lb. of superphosphate and 2 lb of sulphate of potash, all scattered on the top of the soil as a spring dressing before planting or seeding is done All gardens need lime as the soil becomes acid Seedlings fare badly in soil short of lime and grow badly, especially when the drought comes Peas and beans are very sensitive and grow indifferently on acid soils. On the other hand, potatoes and beets are resistant Burnt lime, chalk or limestone should be applied in the spring, just before the garden soil is dug For the cultivation of the garden crops *see* articles on (a) GREEN VEGETABLES and (b) POTATOES

Fruit in the Garden.—However small the garden, there should be room for a few fruits such as strawberries, gooseberries, currants, plums, apples and pears. One hundred plants of strawberries of the Royal Sovereign variety should yield sufficient for a small household Lancer is the best gooseberry where only one kind is grown It is good to eat or cook and a regular cropper of large berries The Baldwin is the best garden currant, for its bushes are small and the crop large.

The tree fruits should be propagated on the dwarfing stocks, for only small trees are needed For pears the quince stocks should be used and for apples the Jaune de Metz stock If these stocks are used the trees never grow very large and begin early to give good crops of high quality fruits.

Gardening in the Public Parks.—The public parks of this generation are something more than public playgrounds of green fields, for in their management the horticulturist has secured a footing. Trees that bear beautiful flowering blossoms, such as the chestnut, acacia, tulip tree, catalpa and the beams now take the place of some of the commoner non-flowering trees Banks of flowering shrubs have been planted and in addition beds of flowers are now quite common.

The London parks (Hyde park and St James' park) have excellent trials each year of dahlias and tulips in which the public takes great interest. The Japanese flowering cherry trees in Washington park, U S A , are another striking example of the advance of horticulture in public parks The public parks of Edinburgh, Paris, Vienna, Berlin, Ottawa, Montreal, Sydney and Melbourne are similarly made attractive Each group of plants bears its name on a label. The park horticulturist in some instances has gone further, as for example in Hyde park and St. James' park, London, where notice boards displayed alongside the beds of trial dahlias and tulips set out the history of these particular flowers and the methods adopted for their classification

Horticultural Instruction.—Horticulture has now become a recognised subject for a degree course at many of the universities. In England, for example, horticultural courses for degrees are given at the universities of Leeds, London (South Eastern Agricultural college, Wye), Cambridge and Reading At the colleges, horticultural instruction courses are given at the Midland Agricultural college, East Anglian institute, Chelmsford, and at the farm schools of many county councils The Royal Horticultural Society have a horticultural school at their gardens at Wisley, where a two year course of instruction is given for male students. The society holds annually examinations in horticulture for the award of the national diploma in horticulture (N.D.H.). Women horticulturalists have special colleges for their instruction The Horticultural college for Women, Swanley, Kent, can accommodate 80 resident students. The Studley college, Warwickshire, also a residential horticultural college for women, has 340 acres. Each English county council employs one or more skilled horticulturalists to teach in the villages.

In France, Belgium, the Netherlands and Europe generally the land and agricultural schools also give special horticultural courses, though no special degree for horticulture is made.

A recent development has been made in New Zealand, where official recognition has now been given to the awarding of a national diploma in horticulture. In the United States progress in the development of horticultural courses and instruction has been very rapid, for many universities not only award degrees specially for horticultural subjects but some have on their staff professors of horticulture, floriculture, pomology and vegetable crops.

HORTICULTURAL RESEARCH STATIONS

Great Britain.—Many European and American countries have recently established special research stations for the study of some special horticulture crop In England the following are important

Cambridge University Horticultural Station.—This was established in 1924 under the direction of Sir R H Biffen for special research into vegetable crops.

Cheshunt Experimental and Research Station.—Started in 1915 by growers' associations, the station carries out research and experimental work concerning the production of glass-house crops Much research work in tomato, cucumber and chrysanthemum culture has been done and papers published

East Malling Horticultural Research Station—Started in 1912, this station now has extensive laboratories and over one hundred acres of land. Pomology, pathology and plant pests and hop culture have been made special features for study The station's work on the vegetative propagation and standardisation of root stocks for fruit tree culture is known the world over

John Innes Horticultural Institution—This institution primarily concerns itself with pure research, genetics and plant breeding. Fruit, flower and vegetable breeding has been done and pollination questions studied

Long Ashton Research Station—Started nearly thirty years ago as the National Fruit and Cider institute, the station has much developed its work on cider-making and taken up research in fruit culture generally. The fruit lands exceed two hundred acres. Cider making, fruit nutrition and pathology are important subjects

United States.—In the United States, the stations dealing with horticultural research are very numerous. That of New York State at Geneva has a world wide reputation primarily for its pomological work, and for the reports which give a complete classified and described list of fruits. In California, at the university and at the experimental farm at Davis, much good work is done Cornell university and the State universities of Oregon, Washington, Michigan and Pennsylvania have experimental farms and extension plots.

In Canada experimental work is being undertaken at the Dominion experimental farms at Ottawa where are located the offices of the Dominion horticulturist Linked up with this work are the branch farms and stations located in every province in Canada. In New Zealand, Australia and South Africa research departments have recently been created

Horticultural Organisation.—Organisation in the horticultural world is of three main types, (*a*) general, (*b*) official and (*c*) trade. The general organisation takes the form of national horticultural societies with their numerous smaller, local affiliated societies The Royal Horticultural Society, London, was founded in 1804 with a small following and now consists of over 25,000 fellows and associates Similar national bodies exist in most European countries. In the United States there are upwards of 1,500 horticultural societies, including many important State organizations, together with numerous county, city and other local societies In Canada, New Zealand and South Africa move-

ments are working in the same direction.

At intervals of from about three to five years, international horticultural congresses are held at which papers are read, discussions held and demonstrations made. In 1920 the first was held in the Netherlands. In 1927, a second was held at Vienna (Austria), following which arrangements were made to hold a third in London in 1930 Such congresses are planned and arranged by an international committee consisting of members nominated by the Governments of Austria, Belgium, England, France, Germany, Hungary, the Netherlands, Poland and Switzerland. Other countries have been invited to appoint representatives In 1928 Dr. M. J Sirks of Wageningen (Holland) was acting as secretary to the international committee. At the 1927 conference in Vienna there was some discussion in favour of establishing an international bureau for horticulture, a matter referred for consideration to the international committee.

(*b*) England, Canada and New Zealand have horticultural councils which have been officially set up and recognised as the proper bodies to give advice to the Government on horticultural matters. The Horticultural Advisory Council of England, which has been set up by the Ministry of Agriculture, is composed of members representing the Government, the scientific research workers, amateur horticulturalists, commercial growers and distributors with the Government horticulture commissioner as chairman. The Council holds not less than two meetings each year.

The Canadian Horticultural Council was formed in 1922. It consists of officers nominated by fruit growers, distributors, jam manufacturers and canners, together with officials from the Department of Agriculture. The *Canadian Horticulture Review* is published by the Council.

As to (*c*) horticultural traders in many countries have formed associations mainly for the purposes of local trade protection. By arrangement between the Horticultural Associations of Belgium, France, Great Britain, Holland, Luxemburg, an international body known as the *Fédération Horticole Professionnelle Internationale* has been established (general secretary, M Turbat, Orleans, France). This international body holds annual meetings in rotation in the different countries The F H P I. deals only with horticultural matters as affecting international trade.

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UNITED STATES (CHIEFLY FOR THE LATITUDE OF NEW YORK)

JANUARY

Flower Garden and Greenhouse.—Little is to be done in either. In the greenhouse care must be used to protect against frost. Ventilate little, and with care; raise the ventilating sash only high enough to let the heated air from the greenhouse drive back the outer air so as not to chill the plants To destroy the red spider, syringe the plants copiously at night, and splash the paths with water. The aphis, or "green fly," must also be destroyed, tobacco may be used Various new preparations are coming on the market for the destruction of greenhouse pests Several new effective preparations of tobacco have been brought into use. The white-fly is now a common pest in greenhouses, the nymphs being greenish scale-like objects on the under sides of the leaves, and adults very small white flies The remedy is to spray with kerosene emulsion or whale-oil soap; or, if on cucumbers or tomatoes, it is best to fumigate with hydrocyanic acid gas, using 1 oz of potassium cyanide to each 1,000cu ft. of space (This material is very poisonous.) Many greenhouse insects can be kept more or less in check by careful and effective hosing of the plants at proper times At this season roses, grape-vines and other plants are often affected by mildew; an effectual remedy is to paint the hot-water pipes with a mixture of sulphur and lime, put on as thick as ordinary whitewash, once each week until it is checked; but care must be taken not to apply it on any surface at a higher temperature than 212°. Hyacinths and other bulbs that have been kept in a cellar or other dark, cool place may now be brought into the light of the greenhouse or sitting-room, provided they have filled the pots with roots. If they are not well rooted, leave them until they are, or select such of them as are best, leaving the others. In the outside flower garden little can be done except that shrubs may be pruned, or new work, such as making walks or grading, performed, if weather permits. See that the ornamental plants and trees are not injured by heavy weights of ice or snow.

Fruit Garden.—Pruning, staking up or mulching can be done if the weather is such that the workmen can stand out. On all warm or comfortable days the fruit trees may be pruned.

Grapery.—Graperies used for the forcing of foreign grapes may be started, beginning at a temperature of 50° at night, with 10° or 15° higher during the day. The borders must be covered sufficiently deep with leaves or manure to prevent the soil from freezing, as it would be destructive to the vines to start the shoots if the roots were frozen; hence, when forcing is begun in January, the covering should be put on in November, before severe frosts begin.

Vegetable Garden.—But little can be done in the northern States except to prepare manure, and get sashes, tools, etc., in working order; but in sections of the country where there is little or no frost the hardier kinds of seeds and plants may be sown and planted, such as asparagus, cabbage, cauliflower, carrot, leek, lettuce, onion, parsnip, peas, spinach, turnip, etc. In any section where these seeds can be sown in open ground, it is an indication that hotbeds may be started for the sowing of such tender vege-

tables as tomatoes, egg and pepper plants, etc.; though, unless in the extreme southern States, hotbeds should not be started before the beginning or middle of February. Make orders for the spring seeds.

FEBRUARY

Flower Garden and Greenhouse.—The directions for January will in the main apply to this month, except that now some of the hardier annuals may be sown in hotbed or greenhouse, and also the propagation of plants by cuttings may be done rather better now than in January, as the greater amount of light gives more vitality to the cutting

Fruit Garden.—But little can be done in most of the northern States as yet, and in sections where there is no frost in the ground it is likely to be too wet to work, but in many southern States this will be the best month for planting fruit trees and plants of all kinds, particularly strawberries, raspberries, blackberries, pear and apple trees, while grape-vines will do, though they will also do well quite a month later. Continue the pruning Fruit trees for spring planting should be ordered

Grapery.—The graperies started last month at 50° at night may now be increased to 60°, with a correspondingly higher day temperature Great care must be taken to syringe the leaves thoroughly at least once a day, and to deluge the paths with water, so as to produce a moist atmosphere. Paint the hot-water pipes with sulphur mixture, as recommended in January

Vegetable Garden.—Leaves from the woods, kitchen manure or refuse hops from breweries may be got together towards the latter part of this month, and mixed and turned to get "sweetened" preparatory to forming hotbeds Cabbage, lettuce and cauliflower seeds, if sown early this month in hotbed or greenhouse, will make fine plants if transplanted into hotbed in March This is preferable to the use of fall-sown plants. Manure that is to be used for the crop should be broken up as fine as possible, for the more completely manure of any kind can be mixed with the soil, the better the crop will be, and, of course, if it is dug or ploughed in in large unbroken lumps it cannot be properly commingled.

MARCH

Flower Garden and Greenhouse.—The long days and bright sunshine will now begin to tell on the plants under glass. Examine all plants that are vigorous and healthy, if the roots have matted the "ball" of earth they must be shifted into a larger-sized pot. Plants from cuttings struck last month may now be shifted, and the propagation of all plants likely to be wanted should be continued Hardier annuals may be sown; it is best done in shallow boxes, say two inches deep.

Lawns can be raked off and mulched with short manure, or rich garden earth where manure cannot be obtained Flower-beds on light soils may be dug up so as to forward the work of the coming busy spring season Lawns may be benefited by a good dressing, in addition to the manure, of some reliable commercial fertilizer. If the lawn is thin in spots, these places may be raked over heavily and new grass seed sown

Fruit Garden.—In many sections, planting may now be done with safety, provided the soil is light and dry, but not otherwise. Although a tree or plant will receive no injury when its roots are undisturbed in the soil, should a frost come after planting, the same amount of freezing will, and very often does, greatly injure the plant if the roots are exposed.

Grapery.—The grapery started in January will have set its fruit, which should be thinned by one-third. The temperature may now be further advanced to 70° at night, with 15° higher in the daytime. The same precautions must be used against mildew and insects as given in January Graperies wanted for succession may be started in February or this month.

Vegetable Garden.—This is a busy month. In localities where the frost is out of the ground, if it is not wet, seeds of the hardier vegetables can be sown. The list of seeds given for the southern States in January may now be used for the northern, while for most of the southern States tender vegetables, such as egg plant, okra, sweet potatoes, melon, squash, potatoes, tomatoes, etc., may be sown and planted. All hotbeds must now be started. In March flower seeds and vegetable seeds may be sown in boxes or flats in the greenhouse, or in residence windows, or near the kitchen stove. Unless one has space under glass, or in hotbeds, in which the plants may be transplanted before they are set in the open ground, it is well not to start the seeds too early, inasmuch as the plants are likely to become too large or to be pot-bound, or to become drawn.

APRIL

Flower Garden and Greenhouse.—Window and greenhouse plants require more water and ventilation Due attention must be paid to shifting well-rooted plants into larger pots, and, if space is desired, many kinds of hardier plants can safely be put out in cold frames Towards the end of the month it may be necessary slightly to shade the glass of the greenhouse. All herbaceous plants and hardy shrubs may be planted in the garden The covering of leaves or litter should be taken off bulbs and tender plants that were covered up for winter, so that the beds can be lightly forked and raked Sow tender annual flower seeds in boxes inside

Fruit Garden.—Strawberries that have been covered up with straw or leaves should be relieved around the plants, leaving the covering between them Special care must be exercised that the mulch be not left on too long; the plants should not become whitened or drawn Raspberries, grape-vines, etc , that have been laid down may now be uncovered and tied up to stakes or trellises, and all new plantings of these and other fruits may now be made Fruit trees may be grafted

Vegetable Garden.—Asparagus, rhubarb, spinach, etc , should be uncovered, and the beds hoed or dug lightly Hardier vegetable seeds and plants, such as beets, cabbage, cauliflower, celery, lettuce, onions, parsley, parsnips, peas, potatoes, radishes, spinach, turnip, etc , should all be sown or planted by the middle of the month if the soil is dry and warm, and in all cases, where practicable, before the end of the month. It is essential, in sowing seeds now, that they be well firmed in the soil Any who expect to get early cabbage, cauliflower, lettuce or radishes, while planting or sowing is delayed until the time of sowing tomato and egg plant in May, are sure to be disappointed of a full crop. Frequent rotation of crops should be practised in the vegetable garden, in order to head off insects and diseases; and also to make the best use of the land Every three or four years the vegetable garden should be laid out in some new place; but if this cannot be done, the crops should be rotated on different parts of the old garden.

MAY

Flower Garden and Greenhouse.—Window and greenhouse plants should be in their finest bloom. Firing may be entirely dispensed with, though care must still be exercised in ventilating If weather is cold and backward, however (and in the case of very northern regions), care must be taken not to stop firing too soon, or the plants will mildew and become stunted. The air must be kept moist. "Moss culture" may be tried, the common sphagnum or moss of the swamps, mixed with one-twentieth of its bulk of bone-dust, being laid as a mulch on the top of the earth of the flower-pots, its effect is to shield the pots from the sun, and at the same time stimulate the roots to come to the surface By the end of the month all the plants wanted for the summer decoration of the flower border may be planted out, first loosening a little the ball of earth at the roots. If the weather is dry, water freely after planting. When the greenhouse is not to be used during the summer months, camellias, azaleas and plants of that character should be set out-of-doors under partial shade; but most of the other plants usually grown in the conservatory or window garden in winter may be set in the open border. Flower-beds should be kept well hoed and raked, to prevent the growth of weeds next month

Pelargoniums, pinks, monthly roses and all half-hardy flowering plants should be planted early, but coleus, heliotrope and the more tender plants should be delayed until the end of the month. Annuals that have been sown in the greenhouse or hotbed may be planted out, and seeds of such sorts as mignonette, sweet alyssum, Phlox Drummondii, portulaca, etc , may be sown in the beds or

borders. The china aster is now one of the most popular of summer and fall plants The seed may be sown in the north as late as the middle of May, or even the first of June, with good results for fall blooming. If the plants are started early in the greenhouse, they are likely to spend themselves before fall, and therefore a later sowing should be provided.

Lawns should be mown, and the edgings trimmed

Fruit Garden.—The hay or leaf mulching on the strawberry beds should be removed and the ground deeply hoed (if not removed in April in the more forward places), after which it may be placed on again to keep the fruit clean and the ground from drying Where it has not been convenient before, most of the smaller fruits may yet be planted during the first part of the month. Tobacco dust will dislodge most of the numerous kinds of slugs, caterpillars or worms that make their appearance on the young shoots of vines or trees Fruit trees may be planted this month, if not planted in March or April. If they have been kept fresh and dormant, they should still be in good condition The broken roots should be cut back to fresh wood, and the tops headed back in proportion

Vegetable Garden.—Attention should be given to new sowings and plantings for succession Crops sown last month will have to be thinned out if large enough. Hoe deeply all transplanted crops, such as cabbage, cauliflower, lettuce, etc Tender vegetables, such as tomatoes, egg and pepper plants, sweet potatoes, etc , can be planted out Seeds of Lima beans, sweet corn, melon, okra, cucumbers, etc., should be sown; and sow for succession peas, spinach, lettuce, beans, radishes, etc , every ten days.

JUNE

Flower Garden and Greenhouse.—Tropical plants can now be used to fill up the greenhouse during the summer months. The house should be well shaded, specimens of fancy caladiums, dracaenas, coleus, crotons, palms and ferns and other plants grown for the beauty of their foliage will make a very attractive show. If these cannot be had, common geraniums may be used. The "moss culture" will be found particularly valuable for these plants. Hyacinths, tulips and other spring bulbs may be dug up, dried and placed away for next fall's planting, and their places filled with bedding plants, such as coleus, achyranthes, pelargoniums, and the various white and coloured leaf plants It will be necessary to mow the lawn once a week, and sometimes oftener

Fruit Garden.—The small fruits should be mulched about the roots, if this has not yet been done If the fruit garden is large enough to admit of horse culture, it is best to keep the bush-fruits well cultivated during the season; this tillage conserves the moisture and helps to make a full and plump crop of berries. In small areas the mulching system is sometimes preferable.

Vegetable Garden.—Beets, beans, carrots, corn, cucumbers, lettuce, peas and radishes may be sown for succession. This is usually a busy month, as many crops have to be gathered, and, if hoeing is not promptly seen to, weeds are certain to give great trouble. Tomatoes should be tied up to trellises or stakes if fine-flavoured and handsome fruit is desired, for if left to ripen on the ground they are apt to have a gross earthy flavour.

JULY

Flower Garden and Greenhouse.—Watering, ventilating and fumigating (or the use of tobacco in other forms for destruction of aphides) must be attended to. The atmosphere of the greenhouse must be kept moist. Watch the plants that have been plunged out-of-doors, and see if any require repotting All plants that require staking, such as dahlias, roses, gladioli and many herbaceous plants, should now be looked to. Carnations and other plants that are throwing up flower stems, if wanted to flower in winter, should be cut back, that is, the flower stems should be cut off to perhaps five inches from the ground.

Fruit Garden.—If grape-vines show any signs of mildew, dust them over with dry sulphur, selecting a still, warm day The fruit having now been gathered from strawberry plants, if new beds are to be formed, the system of layering the plants in small pots is the best. In general, field strawberries are not grown from potted layers, but from good strong layers that strike naturally in the field. In the north, spring planting of strawberries is generally advised for market conditions; although planting in early fall or late summer is successful when the ground is well prepared and when it does not suffer from drought. Where apples, pears, peaches, grapes, etc , have set fruit thickly, thin out at least one-half to two-thirds of the young fruit.

Vegetable Garden.—The first ten days of this month will yet be time enough to sow sweet corn, beets, lettuce, beans, cucumbers and ruta-baga turnips Such vegetables as cabbage, cauliflower, celery, etc., wanted for fall or winter use, are best planted this month, though in some sections they will do later Keep sweet potatoes hoed to prevent the vines rooting at the joints.

AUGUST

Flower Garden and Greenhouse.—But little deviation is required in these departments from the instructions for July. See that sufficient water is applied, the walks may be wet in the houses.

Fruit Garden.—Strawberries that have fruited will now be making "runners," or young plants. These should be kept cut off close to the old plant, so that the full force of the root is expended in making the "crowns" or fruit buds for next season's crop If plants are needed for new beds, only the required number should be allowed to grow, and these may be layered in pots as recommended in July The old stems of raspberries and blackberries that have borne fruit should be cut away, and the young shoots thinned to three or four canes to each hill or plant. If tied to stakes and topped when 4 or 5ft. high, they will form three or four branches on a cane, and will make stronger fruiting plants for next year.

Vegetable Garden.—Hoe deeply such crops as cabbage, cauliflower and celery. The earthing up of celery this month is not to be recommended, unless a little very early supply is wanted. Onions in many sections can be harvested The proper condition is when the tops are turning yellow and falling down They are dried best by placing them in a dry shed in thin layers Sow spinach for fall use, but not yet for the winter crop. Red top, white globe, and yellow Aberdeen turnips should now be sown; ruta-baga turnips sown last month will need thinning, and in extreme southern States they may yet be sown

SEPTEMBER

Flower Garden and Greenhouse.—The flower-beds in the lawn should be at their best If planted in "ribbon lines" or "massing," strict attention must be given to pinching off the tops, so that the lines or masses will present an even surface. Tender plants will require to be put in the greenhouse or housed in some way towards the end of this month; but care should be taken to keep them as cool as possible during the day. Cuttings of bedding plants may now be made freely if wanted for next season, as young cuttings rooted in the fall make better plants for next spring's use than old plants, in the case of such soft-wooded plants as pelargoniums, fuchsias, verbenas, heliotropes, etc.; with roses and plants of a woody nature, however, the old plants usually do best. Dutch bulbs, such as hyacinths, tulips, crocus, etc., and most of the varieties of lilies, may be planted Violets wanted for winter flowering will now be growing freely, and the runners should be trimmed off. Sow seeds of sweet alyssum, candytuft, daisies, mignonette, pansies, etc Visit the roadsides and woods for interesting plants to put in the hardy borders.

Fruit Garden.—Strawberry plants that have been layered in pots may yet be planted, or in southern districts the ordinary ground layers may be planted. The sooner in the month both are planted the better crop they will give next season; and, as these plants soon make runners, it will be necessary to trim them off. Attend to raspberries and blackberries as advised for last month, if they have not already been attended to. All fruit trees should be gone over for borers before cold weather sets in; they also should have been gone over for the same purpose in May and June.

Vegetable Garden.—If cabbage, cauliflower and lettuce are wanted to plant in cold frames, the seed should be sown from about the 10th to the 20th of this month; but judgment should be exercised, for, if sown too early, cabbage and cauliflower are apt to run to seed The best date for latitude of New York is Sept 15. The main crop of spinach or sprouts that is wanted for winter or spring use should be sown about the same date The earth should be drawn up to celery with a hoe preparatory to earthing up with a spade. Onions not harvested and dried last month must now be attended to. Turnips of the early or flat sorts may yet be sown the first week of this month in the northern States, and in the south from two to four weeks later

OCTOBER

Flower Garden and Greenhouse.—In northern sections of the United States, tender plants that are still outside should be got under cover as early as possible. Delay using fire heat as long as possible, unless the nights become so cold as to chill the plants inside the house. Roses, carnations, camellias, azaleas, pelargoniums and the hardier plants will do better in a cold frame or pit until about the middle of November than they would in an ordinary greenhouse Look out for insects. Fall bulbs of all kinds may be planted Take up summer-flowering bulbs and tubers, such as dahlias, tuberoses, gladioli, cannas, caladiums, tigridias, and dry them off thoroughly, stowing them away afterwards in some place free from frost and moisture during the winter. Before winter sets in see that the lawn is freely top-dressed Be careful not to mow the grass too short in the fall

Fruit Garden.—Strawberries grown from pot-grown layers may yet be planted in southern States; keep the runners trimmed off. Fruit trees and shrubs may be set out; but, if planting is deferred to the last of the month, the ground around the roots should be mulched to the thickness of 3 or 4in. with straw, leaves or rough manure, as a protection against frost The fruit garden must be protected from the ravages of mice in winter Mice will nest about the plants if there is straw or other litter around them Before winter, all tall grass and loose litter should be taken away; if this is not done, then the first snow should be tramped heavily around the plants, in order to destroy any nesting-places

Vegetable Garden.—Celery will now be in full growth, and will require close attention to earthing up, and during the last part of the month the first lot may be stored away in trenches for winter All vegetable roots not designed to be left in the ground during the winter should be dug up, such as beets, carrots, parsnips, sweet potatoes, etc The cabbage, cauliflower and lettuce plants grown from seed sown last month should be pricked out in cold frames If lettuce is wanted for winter use, it may now be planted in the greenhouse or cold frame, and will be ready for use about Christmas. If asparagus or rhubarb is wanted for winter use, it should be taken up and stowed away in pit, frame, shed or cellar for a month or two. It may then be taken into the greenhouse and packed closely together under the stage, and will be fit for use from January to March, according to the temperature of the house Vegetable gardens often become infested with diseases carried over from year to year in the old plants and litter; this is especially true of watermelons and of some diseases of tomatoes It is well, therefore, to burn the tops of the plants in the autumn, rather than to plough them under or to throw them on the compost heap

NOVEMBER

Flower Garden and Greenhouse.—All plants intended to be grown inside should now be indoors. Keep a sharp look-out for cold snaps, as they come very unexpectedly in November, and many plants are lost thereby. In cases where it is not convenient to use fire heat, 5° to 10° of cold can be resisted by covering the plants over with paper, and by using this before frost has struck the plants valuable collections may be saved. When fire heat is freely used, be careful to keep up the proper amount of moisture by sprinkling the paths with water. Little can be done in the flower garden, except to clean off all dead stalks, and straw up tender roses, vines, etc., and, wherever there is time, to dig up and rake the borders, as it will greatly facilitate spring work. Cover up all beds in which there are hyacinths, tulips and other bulbs with a litter of leaves or straw to the depth of 2 or 3 inches A good sprinkling of thoroughly decayed manure spread over the lawn may help towards a finer growth next spring.

Fruit Garden.—Strawberry beds should be covered (in cold sections) with hay, straw or leaf mulching, to a depth not exceeding 2 inches Fruit trees and grape-vines generally should be pruned; and, if the wood of the vine is wanted for cuttings, or scions of fruit trees for grafts, they should be tied in small bundles and buried in the ground until spring They may be taken in December or January if preferred

Vegetable Garden.—Celery that is to be stored for winter use should be put away before the end of the month in all sections north of Virginia; south of that it may be left in most places where grown throughout the winter if well covered up The stalks of the asparagus bed should be cut off, and burned if there are berries on them, as the seeds scattered in the soil sometimes produce troublesome weeds. Mulch the beds with 2 or 3in. of rough manure All vegetable roots that are yet in the ground, and not designed to be left there over winter, must be dug up before the middle of the month or they may be frozen in Cover up onions, spinach, sprouts, cabbage or lettuce plants with a covering of 2 or 3in of leaves, hay or straw, to protect them during the winter Cabbages that have headed may usually be preserved against injury by frost until the middle of next month by simply pulling them up and packing them closely in a dry spot in the open field with the heads down and roots up On approach of cold weather in December they should be covered up with leaves as high as the tops of the roots, or, if the soil is light, it may be thrown over them, if leaves are not convenient. Cabbages will keep this way until March if the covering has not been put on too early Plough all empty ground if practicable, and, whenever time will permit, do trenching and subsoiling. Cabbage, cauliflower and lettuce plants that are in frames should be regularly ventilated by lifting the sash on warm days, and on the approach of very cold weather they should be covered with straw mats or shutters In the colder latitudes, and even in the middle States, it is absolutely necessary to protect cauliflower in this way, as it is much more tender than cabbage and lettuce plants

DECEMBER

Flower Garden and Greenhouse.—Close attention must be paid to protecting all tender plants, for it is not uncommon to have the care of a whole year spoiled by one night's neglect. Vigilance and extra hot fires will have to be kept up when the thermometer falls to 34° or 35° in the parlour or conservatory. It is well to set the plants under the benches or on the walks of the greenhouses, if they are in the parlour move them away from the cold point and protect them with paper; this will usually save them even if the thermometer falls to 24 or 26 degrees Another plan in the greenhouse is to dash water on the pipes or flues; this causes steam to rise to the glass and freeze there, stopping up all the crevices. With plants outside that require it, strawing up or mulching must now be finished

Fruit Garden.—In sections where it is an advantage to protect grape-vines, raspberries, etc , from severe frost, these should be laid down as close to the ground as possible, and covered with leaves, straw or hay, or with a few inches of soil. Grapes may be pruned. Fruit trees may be pruned from now till March in the north

Vegetable Garden.—Celery in trenches should receive the final covering for the winter, which is best done by leaves or light stable litter, in the latitude of New York it should not be less than 12in. thick. Potatoes, beets, turnips or other roots in pits, the spinach crop in the ground, or any other article in need of protection, should be attended to before the end of the month; manure and compost heaps should be forwarded as rapidly as possible, and turned and mixed so as to be in proper condition for spring. Remove the snow that accumulates on cold frames

or other glass structures, particularly if the soil which the glass covers was not frozen before the snow fell; it may remain on the sashes longer if the plants are frozen in, since they are dormant, and would not be injured if deprived of light for eight or ten days. If roots have been placed in cellars, attention must be given to ventilation, which can be done by making a wooden box, say 6 by 8in., to run from the ceiling of the cellar to the eaves of the building above. (L. H. Ba; P. H.)

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HORTON, ROBERT FORMAN (1855–), British Nonconformist divine, was born in London on Sept 18, 1855 He was educated at Shrewsbury school and New college, Oxford, where he was president of the Union in 1877 He became a fellow of his college in 1879, and lectured on history for four years In 1880 he became pastor of the Lyndhurst Road Congregational church, Hampstead He delivered the Lyman Beecher lectures at Yale in 1893; in 1898 he was chairman of the London Congregational Union; and in 1903 of the Congregational Union of England and Wales In 1909 he took a prominent part in the 75th anniversary celebration of Hartford Theological seminary. His numerous publications include books on theological, critical, historical, biographical and devotional subjects

HORTON, a city of Brown county, Kan., U S A., near the north-east corner of the State, in a rich agricultural and stock-raising region. It is on Federal highway 73, and is served by the Rock Island railroad The population in 1925 (State census) was 4,212. The Rock Island has large repair and manufacturing shops here. The municipal water supply has been obtained by damming Mission Creek, near the city. Horton was founded in 1886.

HORUS, the name of an Egyptian god, if not of several distinct gods. To all forms of Horus (Egyptian *Hōr*), the falcon was sacred; the name Hōr, written with a standing figure of that bird,  is connected with a root signifying "upper," and probably means "the high-flyer." The tame sacred falcon on its perch  is the commonest symbol of divinity in early hieroglyphic writing; the commonest title of the king in the earliest dynasties, and his first title later, was that which named him Horus Hawk gods were the presiding deities of Pot (Pe) and Nekhen, which had been the royal quarters in the capitals of the two primeval kingdoms of Upper and Lower Egypt, at Buto and opposite El Kab A principal festival in very early times was the "worship of Horus," and the kings of the prehistoric dynasties were afterwards called "the worshippers of Horus." The Northern Kingdom in particular was under the patronage of Horus He was a solar divinity, but appears very early in the Osiris cycle of deities, as son of Isis and probably of Osiris, and opponent of Sēth

As a sun-god Horus not only worsted the hostile darkness and avenged his father, but also daily renewed himself He was thus identical with his own father from one point of view In the mythology, especially that of the New Kingdom, or of quite late times, we find the following standing epithets applied to more or less distinct forms or phases Harendotes (Ḥar-ent-yotf), *i.e.*, "Hōr, avenger of his father (Osiris)", Harpokhrates (Har-p-khrat), *i.e.*, "Hōr the child," with finger in mouth, sometimes seated on a lotus-flower; Harsiesis (Har-si-Ēsi), *i.e.*, "Hōr, son of Isis," as a child, Har-en-khēbi, "Hōr in Chemmis," a child nursed by Isis in the papyrus marshes, Haroeris (Har-uēr), *i.e.*, "the elder Hōr," at Ombos, etc., human-headed or falcon-headed, Harsemteus (Har-sem-teu), *i.e.*, "Hōr, uniter of the two lands," and others

See Egypt *Religion*; Meyer, art "Horos" in Röscher, *Lexicon der Griech. und Rom. Mythologie*

HORWICH, urban district, Westhoughton parliamentary division, Lancashire, England, 18 m N W of Manchester by L M S. railway Pop. (1921) 15,621 Rivington reservoir of Liverpool corporation is near It has important locomotive works for the L M S. railway as well as large stone quarries Other industries are cotton spinning, bleaching and finishing and the manufacture of fire-bricks and tiles

HOSANNA. A word cried in salutation of Christ when He entered Jerusalem (Mk. xi 9 *sq*; Mt xxi 9, 15; John xii 13) We find in Ps cxviii 25 *Hōshī'āh nā*, "Save, Oh!" and in Ps lxxxvi 2 the shortened form *Hōsha'*. In Zech ix 9 the Messiah is said to be *nōsha'* "saved" or "victorious," and thus to enter Jerusalem on an ass Perhaps the multitudes, and certainly the primitive Christians (Matt. xxi 5, 9), connected the cry of Hosanna with this In John xii 13 it may have to do with the palm branches in the hands of the multitude who went out to meet Him For the term Hosanna is used (Bab. Talmud *Sukka* 30 b) of the festive posy (*lulab*, a palm-shoot, myrtle and willow) carried with a citron (*ethrog*) on the Feast of Tabernacles, and possibly at the original Feast of the Dedication (2 Macc x 7). The origin of this custom is unknown, and perhaps goes back to a primitive celebration in nature-worship.

See further F. C. Burkitt, *J. Th. St.*, xvii (1916), pp. 139–152 (A. L. W)

HOSE, the name of an article of dress used for various forms of a long stocking, covering both the foot and leg (*see* Hosiery)

HOSEA, a Hebrew prophet of the 8th century B.C., whose oracles are addressed to the northern kingdom (Israel), to which he seems to have belonged (vii. 5). The Old Testament book bearing his name is the first in order of "the twelve prophets," a unity from at least the beginning of the 2nd century B.C (Ecclus xlix. 10). The (editorial) title dates his work as done under Jeroboam II. (d. 743) and subsequently; there is no evident reference to the Syro-Ephraimitic war of 734, and the fall of Damascus in 732, though some would find one in v. 8 *et seq.* The general character of the book seems to reflect the closing

decades of the northern kingdom, so that we may regard Hosea's work as belonging to the third quarter of the 8th century. The book, in its present form, consists of three introductory chapters, the first and third being biographical and autobiographical respectively, followed by eleven chapters of short "oracles," more or less detached, so that no marked sequence of thought can be discerned, except that the closing chapter describes Israel's repentance, in response to the passionate appeal of the prophet. The text is often corrupt, and this is one of the most difficult books of the Old Testament to interpret in detail, though the main themes are sufficiently clear.

Hosea's Marriage.—The most interesting and important problem of the book relates to the marriage of Hosea, which is closely related to the form and content of his message. According to the first chapter, Hosea is commanded to take a harlot for his wife and children of harlotry; he therefore marries Gomer bath Diblaim, who subsequently has three children, to whom the prophet gives symbolic names that he may make them the texts of prophetic messages concerning Israel. According to the third chapter, Hosea is commanded to love an unnamed woman, loved by a paramour, and an adulteress. He obeys by purchasing her, apparently from some kind of undescribed servitude, and by setting her apart for what seems to be a probationary period. There is no reason to doubt that these events actually happened, though they were interpreted as "prophetic symbolism"; Ezekiel similarly employs actual events (the death of his wife, xxiv. 15 *et seq*.). The phrase "wife of whoredom and children of whoredom" is sufficiently explained by the supposition that Hosea eventually discovered his wife's infidelity; it does not require us to suppose that she was unchaste before her marriage. But what is the relation of the first and third chapters? The natural and *prima facie* view is that the unnamed woman of the third chapter is still Gomer of the first, that after leaving her husband she has passed into other hands, possibly of the priests of a local sanctuary, at which she may be serving as a "religious" prostitute. On this view we are left with the idea that Hosea means to take Gomer back to his home after the necessary period of probation. It is, however, argued that the third chapter is really parallel to the first, since Gomer's departure from her husband ought not to be left to the imagination, and Gomer ought to be definitely named, if this were a sequel; whereas the use of the third person in the first chapter and the first person in the third suggests that they come from different hands. Against this view, however, the dissimilarity of the two narratives is a strong argument. Even if this be evaded by making the third chapter a prelude to the first (Lindblom), the supposition of a double unchastity is artificial and confuses the allegorical application. The ordinary view, therefore, seems justified, with the important consequence for exegesis that the record of Hosea's experience closes optimistically and not pessimistically, and leaves us free to credit him with such oracles of hope as those of the closing chapter of his book. There is no ground for supposing that Hosea was made a prophet by this experience of domestic sorrow; we should rather say that, being a prophet, he was led to interpret it as a divinely ordained "parable" of the relation of Yahweh to Israel. His oracles are deeply coloured by the experience, and he employs throughout the figure of a wife's infidelity to describe and condemn the sin of Israel. It may even be, as Professor Hans Schmidt has recently argued (*Zeitschrift fur alttest. Wissenschaft*, 1924, pp. 245 *sqq*.) that the bitterness of the prophet's attack on the immorality of the high places and of the priests connected with them is due to a personal element—that it was from one of these sanctuaries that he had, in the literal sense, to "redeem" the temple-prostitute, Gomer, because she had left her husband for professional connection with a sanctuary, after having been first led astray by the licensed sexuality of its festivals (*cf.* iv. 8 *et seq.*). There is certainly a depth of personal emotion in this book which can be paralleled nowhere else save in the greater prophet so like Hosea—Jeremiah, who knew the sorrows of a lonely life as Hosea did those of an unhappy marriage. Hosea is the first to make a profoundly ethical application of the figure of marriage to the relation between God and man. Of course, the sex element had already taken a great place in primitive religion, including the Canaanite. But the moral side of the sex relation, the higher principles which lead to its sublimation in human experience, so that human love becomes capable of reflecting the love of God and preparing man to understand and respond to it—all this great line of thought was initiated by Hosea, with the result that it transformed an anthology of love lyrics (Song of Solomon, *q.v.*) into an allegory of the history of Israel, and culminated in the Gospel of the New Testament and the Pauline figure of the Church and her divine Bridegroom. The most moving passage of the book of Hosea (xi. 8, 9), "How shall I give thee up?", ascribes to God a human sympathy that suffers and cannot rest until it redeems a love as passionate as Hosea's for Gomer.

Hosea's Message.—Hosea ascribes the contemporary moral corruption of Israel to the neglect of true religion, and to priestly encouragement (iv. 1–19); priests and rulers have misled the people (v. 1–7); hence the coming punishment, though it is intended to produce penitence (v. 8–15). Israel's return to Yahweh (vi. 1–3), however, is too shallow for the depth of her sin (vi. 4–11). The capital city and its rulers are wicked, and their foreign policy will deservedly fail (vii.). The punishment will be the absorption of Israel by the nations (viii.). These coming sorrows of desolation and exile will be due to the false worship of Yahweh, as at Gilgal (ix.). Israel's altars and idols will be overthrown, and the harvest of wickedness will be reaped (x.). But Yahweh is Israel's father, unable to destroy utterly (xi. 1–11). How different is Israel from the ancestral figure, Jacob (xi. 12–xii.)! The ingratitude of Israel for Yahweh's providential care fully warrants His anger (xiii.). The book closes with Israel's promise to abandon other aids and gods (xiv.). We have seen that the final attitude of Hosea towards Gomer warrants us in ascribing to him this expression of hope; the temper of the prophet is different from that of Amos, in whose experience there is no ground for a similar view of the closing section of *his* book. In fact, the logic of Hosea's position, if we have rightly construed his personal history, requires us to regard his message as finally optimistic. He penetrated more deeply than Amos into the idea of religion as a right "spirit" (iv. 12, v. 4), *i.e.*, a right relation of loyalty to God; such an emphasis makes "repentance" at once more fundamental and more conceivable.

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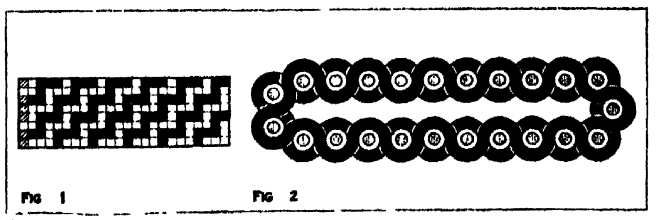
(H. W. R.)

HOSE-PIPE, or simply "hose," the name given to flexible piping by means of which liquid (generally water but occasionally petrol etc.) may be conveyed. One end of the pipe is connected to the source of the water, while the other end is free, so that the direction of the stream of water which issues from the pipe may be changed at will. The method of manufacture and the strength of the materials used depend naturally upon the particular use to which the finished article is to be put. Simple garden hose is often made of india-rubber or composition, but the hose intended for fire brigade and similar important purposes must be of a much more substantial material. The most satisfactory material is the best long flax, although cotton is also extensively used for many types of this fabric.

The flax fibre, after having been carefully spun into yarn, is boiled twice and then beetled; these two processes remove all injurious matter, and make the yarn soft and lustrous. Several threads may be twisted together to secure uniformity and strength, and then the compound yarns are wound on to large bobbins, and made into a chain or warp; the number of threads in the chain depends upon the size of the hose, which may be anything from half

an inch to 15 in. or even more in diameter. When the chain is warped, it is beamed upon the weaver's beam, and the ends—either double or triple—are drawn through the leaves of the cambs, healds or heddles, passed through the reed and finally tied to the cloth beam The preparation of the warp for any kind of loom varies very little, but the weaving may vary greatly In all cases the hose fabric is essentially circular, although it appears quite flat during the weaving operation

There are very few hand-made fabrics that can compete with the machine-made article, but the very best type of hose-pipe is



FIGS. 1 AND 2.—COMMON DESIGNS IN WEAVING SEAMLESS HOSE-PIPES
Point-paper design (left) and (right) diagrammatic section of cloth

certainly one of the former class The cloth can be made much more cheaply in the power-loom than in the hand-loom, but, up to the present, no power-loom has been made which can weave as substantial a cloth as the hand-loom product; the weak part in all hose-pipes is where the weft passes round the sides from top to bottom of the fabric or vice versa, that is, the side corresponding to the selvages in an ordinary cloth, the hand-loom weaver can draw the weft tighter than is possible in the power-loom, hence the threads at the sides can be brought close together, and by this means the fabric is made almost, but not quite, as perfect here as in other parts; in addition, the ends of weft can be made to overlap in hand-loom weaving—thus preventing a weak spot It is essential that the warp threads be held tightly in the loom, and to secure this, they pass alternately over and under three or four back rests before reaching the heddles or cambs, which are almost invariably made of wire Although the warp yarn is made very soft and pliable by boiling and beetling, the weaver always tallows it in order to make it work more easily

Structure of Fabric.—The commonest type of hose-pipe is made on the double-plain principle of weaving, the cloth being perfectly plain but woven in such a manner that the pipe is without seams of any kind Fig 1 is a design showing two repeats or eight shots in the way of the weft, and six repeats or 24 threads in the way of the warp, consequently the weave is complete on four threads, or leaves, and four picks Fig 2 illustrates the method of interlacing the threads and the picks this figure shows that 23 threads only are used, the first thread—shown shaded in fig. 1—having been left out. It is necessary to use a number of threads which is either one less or one more than some multiple of four—the number of threads in the unit weave The sectional view (fig 2), although indicating the crossing of the warp and the weft, is quite different from an actual section through the threads. the warp is almost invariably two, three or more ply, and in addition two or more of these twisted threads pass through the same heddle-eye or mail in the camb, moreover, they are set very closely together —so closely, indeed, that the threads entirely conceal the weft; it is, therefore, impossible to give a correct sectional view with satisfactory clearness, as the threads are so very rank, but fig 3 gives some idea of the structure of the fabric This view shows ninety-nine threads and one complete round of weft; this round is, of course, equal to two picks or shots—one pick for the top part of the cloth and one for the bottom part A comparison of this figure with fig. 2 will, perhaps, make the description clearer The weft in fig 3 is thinner than the warp, but, in practice, it is always much thicker, and may consist of from two to seventy threads twisted together

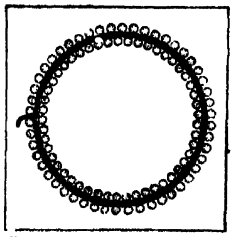


FIG. 3.—SECTION THROUGH WARP OF HOSE-PIPE SHOWING 99 THREADS AND ONE COMPLETE ROUND OF WEFT

Hose-pipes are also woven with the three-leaf twill on both sides, and occasionally with the four-leaf twill. These pipes, woven with the twill weaves, are usually lined with a pure rubber tube which is fixed to the inside of the cloth by another layer of rubber after the cloth leaves the loom. Such pipes have usually, but not invariably, a smoother inner surface than those which are unlined, hence, when they are used, less friction is presented to the flow of water, and there is less tendency for the pipe to leak They are, therefore, suitable for hotels, public buildings and similar places where their temporary use will not result in undue damage to articles of furniture, carpets and general decoration

The greatest care must be observed in the weaving of these fabrics, the slightest flaw in the structure rendering the article practically useless After the cloth has been woven, it is carefully examined, and then steeped in a chemical solution which acts as an antiseptic. The cloth is thus effectively preserved from mildew, and is, in addition, made more pliable. Finally the hose-pipe is dried artificially, tested for strength and resistance to pressure of water, and finally, fitted with the necessary couplings and nozzles.

See T. Woodhouse and T. Milne, *Textile Design: Pure and Applied* (1912). (T W)

HOSHANGABAD, a town and district of British India in the Nerbudda division of the Central Provinces. Founded by Hoshang Shah, a Malwa king in the 15th century, the town came into prominence after its capture by Bhopal in 1720. Between then and 1818, when it came under British rule, it was the scene of many conflicts between the Mahrattas and the Bhopal rulers It has never been a big trading centre, but has enjoyed some importance as a district headquarters, and its position on the Nerbudda River and on the G I.P. Railway (Indian Midland section) is a favourable one. Pop. 12,048, is a decline of some 3,000 on 1901, due to serious epidemics of plague and the influenza mortality of 1918.

The District of Hoshangabad, area of 3,681 sq m., lies in the Nerbudda valley between the Vindhyas on the north and the Satpura range on the south. The central plain contains rich black soil, wheat being the principal crop. The G.I P. Railway from Bombay to Jubbulpore runs up the valley and at Itarsi, near Hoshangabad two branches take off, the northern to Delhi through Bhopal and Gwalior, the southern to Nagpur across the Satpuras

The population was 445,000 at the last census, Hindus predominate, but there are 40,000 Animists and only 20,000 Mohammedans The district had a wheat boom in 1888, and in 1891 its population was 493,000, but bad years followed by plague and influenza caused a serious temporary decline; the people are, however, now generally prosperous and very fond of litigation Cotton is grown in the west, and in the poorer tracts in the south and east there are millets and oil seeds. Apart from these it is one of the principal wheat-growing districts of the Province.

Wheat, cotton and oil seeds are largely exported Dyeing, brass work and weaving are the chief local industries There is a large area of Government forest on the south and the Bori teak forests are very valuable. The town of Harda, in the west, which had a population of 16,000 in the wheat boom, has since declined to 11,000

HOSHEA (Heb. for "deliverance"), the last king of Israel, in the Bible The attempt of his predecessor Pekah to take Jerusalem with the help of his ally Rasun (Rezin) of Damascus was frustrated by the intervention of Tiglath-Pileser III. (*see* AHAZ), who attacked Gilead, Galilee and the north frontier, and carried off some of its population (*cf.* 1 Chron v. 26). Pekah's resistance to Assyria led to a conspiracy in which he lost his life, and Hoshea the son of Elah became king (2 Ki. xv. 27–30). The Assyrian king held him as his vassal (and indeed claims to have set him on the throne), and exacted from him a yearly tribute. After the death of Tiglath-Pileser, Israel regained confidence (Isa. ix. 8–x. 4) and took steps to recover its independence. Its policy vacillated —"like a silly dove" (Hosea vii. 11)—and at length negotiations were opened with the Egyptian So, possibly Shabaka or one of the Delta princelets. The annual payment of tribute ceased and Shalmaneser V (who began to reign in 727 B.C.) invaded Israel, imprisoned Hoshea, and laid siege to Samaria, which fell at the end

of three years (722 B.C.). The achievement is claimed by his successor Sargon. The land was again partly depopulated and a governor appointed (2 Ki. xviii. 9–12; *cf* xvii. 1 *seq.*). For other allusions to this period *see* HOSEA, ISAIAH.

HOSHIARPUR, a town of British India, in the Punjab Pop. (1921), 21,285. It was founded, according to tradition, about the early part of the 14th century. In 1809 it was occupied by Ranjit Singh. The maharaja and his successors maintained a considerable cantonment 1 m. S.E. of the town, and the British government kept it up for several years after the annexation of the Punjab in 1849. There are manufactures of cotton goods, inlaid woodwork, lacquered ware, shoes and copper vessels.

The DISTRICT OF HOSHIARPUR comprises an area of 2,247 sq m ; pop (1921) 927,419 It falls into two nearly equal portions of hill and plain country. Between the two chains of hills on the east, stretches a valley of uneven width, known as the Jaswan Dun Its upper portion is crossed by the Sohan torrent, while the Sutlej sweeps into its lower end through a break in the hills, and flows in a southerly direction till it turns the flank of the central range, and debouches westwards upon the plains. This western plain consists of alluvial formation, with a general westerly slope owing to the deposit of silt from the mountain torrents in the sub-montane tract. Rice is largely grown in the marshy flats along the banks of the Beas Several religious fairs are held, at Anandpur, Mukerian and Chintpurni, all of which attract an enormous concourse of people. Cotton fabrics are manufactured, and sugar, rice and other grains, tobacco and indigo are among the exports

The country around Hoshiarpur formed part of the old Hindu kingdom of Katoch in Jullundur The state was eventually broken up, and the present district was divided between the rajas of Datarpur and Jaswan. They retained undisturbed possession of their territories until 1759, when the rising Sikh chieftains commenced a series of encroachments upon the hill tracts By the close of the year 1818 the whole country from the Sutlej to the Beas had come under the government of Lahore, and after the first Sikh war in 1846 passed to the British government.

HOSIERY. This familiar term originally referred to articles worked in the knitted stitch used for footwear and underwear, but it has come gradually to embrace a much larger range of knitted products than those specified. The knitted stitch has greatly extended its field of usefulness and through all those developments hosiery has stood as the main generic term which covers all classes The hosiery trade includes generally the production of all classes of articles worked in the knitted stitch Knitted fabric is used to an increasing extent for intermediate and outer garments and there is an increasing tendency to subdivide hosiery into footwear to denote stockings and socks, underwear for articles worn next to the skin; intermediate knitted wear is applied to articles worn under the outer garment but not next the skin, outerwear is used to indicate articles such as coats and costumes In America the term hosiery has been retained as referring to articles of knitted footwear only, the other classes just mentioned being often known as knitwear

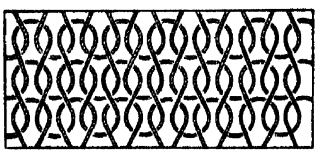


FIG. 1.—RIGHT SIDE OF PLAIN KNITTED FABRIC, SHOWING SLACK TEXTURE

Plain Knitted Fabrics.—There is probably no class of textile which has undergone greater recent development in its scope and uses, and the knitted texture is supplying an ever-increasing proportion of our textile requirements

Basically, knitted fabrics fall into two groups: weft and warp fabrics These are again divided into the classes of plain stitch and rib or ribbed stitch. A third group, one which is not so widely used as the first two, is the tuck stitch, which can be better considered as a modification of plain stitch, being a repetition of needle loops forming half stitches to the front and to the back of the fabric. The plain knitted fabric is constructed from a single thread which runs crosswise and is intersected into a series of loops which hang upon each other in sequence Fig. 1 gives a diagrammatic view of the right side of a plain knitted fabric employed for the vast majority of hosiery articles and the stitch in black shows one convolution of a loop of which all the other loops are simply repeats. In following this crosswise, we have what is termed a course of loops, hence this type of knitted fabric is termed a weft texture as it is formed by looping a thread which runs horizontally in the fabric, similar to the weft of a woven fabric But it has another dimension, which is the loop regarded in the width, a wale representing an upward plus a downward curve of the stitch These wales are measured in the width and each wale is formed on one needle, so that in the machine the needles per inch give the wales per inch. For a well-balanced knitted fabric the courses per inch should in general exceed the needles or wales per inch by 40% to 50% An examination of fig. 1 will show that the looped structure has a characteristic elasticity in the width, as a pull in this direction has the effect of straightening out the courses and the knitted fabric can in some varieties of stitch be increased from 75% to 80% in width by stretching. This extreme stretch is found particularly in the rib stitch fabrics. In the length the normal stretch seldom exceeds a 25% increase, but there is much greater tensile strength in the direction of the length than in that of the width In the width the strain comes on to the individual threads in the course, whilst in the length the succeeding layers of loops support each other. Knitted fabric sold in lengths for cutting into garments is often termed stockinette or tubing; if it is of especially firm or dense structure, it is loosely described as a "cloth"

Texture.—In hosiery there are three types of texture. (*a*) A lean variety which is gauzy in appearance and lacks consistency and stability due to the fact that the yarn is too thin for the gauge or allotted space, and the available space is too open for the thickness of the yarn employed Fig 1 illustrates a fabric which would come into this category (*b*) Fabrics which are correct for the gauge have the spaces between the needles adequately filled with yarn, but the spacing still allows for the natural elasticity of the fabric to operate Fig 2 shows a fabric worked in the same sett or gauge of needles as fig 1 but with the yarn much thicker to fill out the interspaces of the loops (*c*) A full fabric is one where the yarn is too thick for the available loop space, so that the texture is stiff and stodgy in nature Such a fabric although thicker and heavier in weight will give less satisfactory service in wear as it lacks resilience, and when strain is applied the stitches soon wear each other out and holes appear.

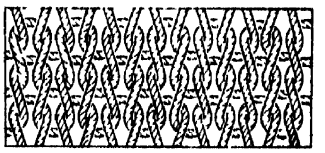


FIG 2.—RIGHT SIDE OF PLAIN KNITTED FABRIC, SHOWING FULL TEXTURE

This interdependence of loops is at once a great advantage and a considerable drawback It is a benefit to have elasticity for such articles as underwear when the stretch adds to the comfort as the garment yields to the movements of the limbs It is a disadvantage to have those loops so intimately dependent on each other, because when a thread breaks the loops connected with it give way all round and a large opening is created. This accentuates what is known as the laddering tendency, for if a stitch gets broken strain will cause this loop to unravel and run right down the fabric. The elasticity of the knitted fabric is a great asset in sports' wear, when free action of the limbs is required; it has also another advantage in that articles can be made in a smaller range of sizes, for the material within certain limits stretches to fit an ample figure and contracts to drape a more slender form. In the more rigid woven cloth the garments have to be much more accurately cut to fit each wearer The fact that large numbers of wearers can be accommodated with the same size of garment accounts for the readiness with which those articles are taken up by the public; they can secure the article on the spur of the moment, without the tedium of fitting-on.

The plain knitted fabric owes much of its versatility to the fact that it has a different appearance on the wrong side and on the right, for this is used in many ways to vary the stitch, increase its weight and give ornamental results The characteristic of back or wrong-side fabric is that the stitches form a series of intersecting semi-circles Fig. 3 illustrates the well-known rib stitch so

indispensable on knitted articles. The vertical rows of stitches marked 2, 3, 6 and 7 show two needles or wales with their stitches of right-side fabric. Alternating with those two wales are two (4 and 5), which have their stitches reversed to show the back or wrong side of the fabric. The whole setout in fig. 3 would be termed a 2-and-2 rib stitch, and machines can be arranged to give 1-and-1, 2-and-1, 3-and-3 and so on rib stitches. The 1-and-1 or plain rib stitch is the best known as being largely used for the rib tops or bottoms of garments. This stitch has a greatly increased latent elasticity or stretch over the plain fabric, and it grips the limb more firmly so as to retain the sleeves and garment extremities in position But the rib stitch gives articles of heavier weight and bulkier to handle, because a larger amount of material can be absorbed by this type of loop than the plain variety Rib stitch imparts to the fabric an enormously increased elasticity in the direction of the width, and certain grades of hosiery base their appeal to the public to this feature What is known as the "Swiss" vest for example is cut from continuous lengths worked in a slack rib stitch, which has such an enormous elasticity as to fit the body without shaping the parts. It is thus possible to produce the material in circular form at high speed of production at one uniform width The plain rib is employed largely for cuffs or legs of men's underwear, while the 2-and-2 rib, as shown in fig 3, is often used for the cuffs of knitted gloves The famous Derby rib is usually a 6-and-3, that is 6 face stitches alternating with 3 back fabric stitches in the direction of the width This style of rib is often used for stockings, ribbed hosiery being an important branch of the trade Children's hosiery are often made in the rib stitch on account of the greater grip which is exerted, and also because rib knitting lays more yarn into the body of the fabric which makes for greater durability It is also largely used in stout textures for men's socks The rib stitch and its derivatives are also most useful for outer garments; what is known as the half-cardigan is a variation of the 1-and-1 rib stitch, where on one side two threads are drawn into the same loop thus decreasing the intersections and allowing a greater weight of yarn to be inserted This is the stitch of the well-known cardigan jacket, and whenever it is required to increase the weight and bulk of a fabric over what is possible with the plain stitch, the cardigan principle is employed

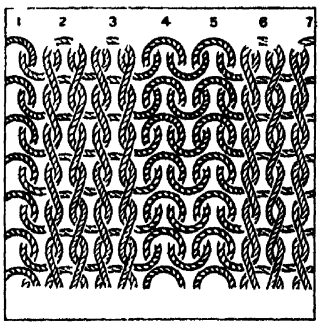


FIG. 3.—TWO-AND-TWO RIB STITCH

Purl Stitch.—Fig. 4 gives an illustration of what is known as the pearl or purl variety of stitch, where the same principle of right-side and wrong-side loops is adopted to produce the pattern, but this occurs in the horizontal direction. This is the 2-and-2 purl stitch where the upper and lower pairs *A*, *B* and *E*, *F* are set in wrong-side stitches and the centre pair *C* and *D* are face fabric loops Now this change in direction produces quite a different appearance in the fabric to either the flat or the rib. The needles build needle loops on the front bed or on the back bed of the machines to form the design instead of shifting continuously from front to back as in knitting plain purl stitch The manner in which purl stitches erect themselves on the face of the fabric accounts for the great effectiveness of designs wrought on this principle, for quite a small disturbance in the loop direction produces a striking result in the fabric, and very ornamental designs can be made by arranging these wrong-side stitches in some simple pattern. Variation in the levelness of the texture naturally debars this type of fabric from being worn next to the skin, but for outer garments these raised effects yield embossed designs where the surface shows an effect in light and shade, the high portions being the needle loops forming the pattern with the plain fabric in the base. The interesting play of light on the surface of the knitted fabric accounts for its popularity in such mediums as artificial silk The plain stitch on the face side resolves itself into a series of thread sections which hang towards the left alternating with a series which have a bias towards the right. This variation in direction gives an interesting and attractive sheen to the fabric, and in fine gauges creates twilled and satin-like effects with the delicate play of reflected light.

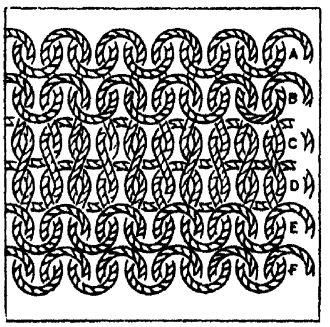


FIG. 4.—TWO-AND-TWO PURL OR PEARL STITCH

Fabric Grades.—Knitted fabrics are classified into two grades: (*a*) fabrics produced on machines using the bearded or spring needle, and (*b*) those knitted by means of the latch needle. A view of the bearded or spring needle is shown at fig. 5 and is seen to consist of a piece of wire flattened at the upper end and turned round to form a beard or spring; the stem and grooves into which the spring is pressed are shown. The term beard was given to the needle in the old handframe, but this is gradually giving place to the term spring in the modern power knitting frame In the handframe days of the industry there was a pronounced tendency to give the parts of the machine names which corresponded to parts of the body. Can this be wondered at when one considers the arduous nature of the work on the handframe, when every limb was brought into use at each course of loops; the machine in fact became part and parcel of the worker, hence there are such parts as the sinker nose, the belly of the sinker and its throat The fashioning points were the ticklers, whilst the sinker had its

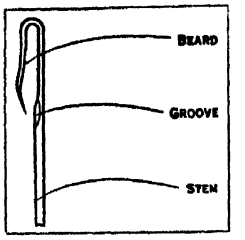
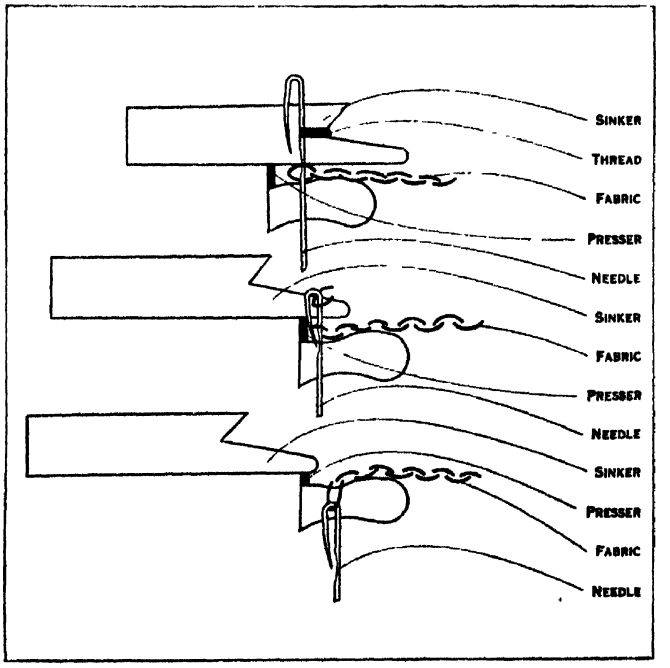


FIG 5.—BEARDED OR SPRING NEEDLE USED FOR MACHINE KNITTING

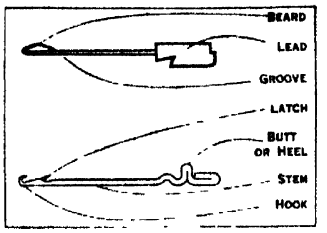


FIGS. 6, 7 AND 8.—CHIEF STAGES IN THE PROCESS OF KNITTING A COURSE OF LOOPS BY THE SPRING NEEDLE

tail. It is remarkable that with all the advances in modern knitting practice as regards speed of production, the products of the spring needle machines are still held in the highest esteem as regards quality of texture and fineness of mesh. This needle can work thicker yarns relatively to the latched needle, and the texture is close and therefore, less liable to run and ladder. The term "spring" knit indicates goods made on spring needle machines. Until recently the making of spring needles was a typical European industry, while latch needle manufacture was an American invention and product. In 1928 large quantities of spring

needles were made in America. The world's largest producer of full-fashioned hosiery knitting machines, located in America, makes its own spring needles

The Spring Needle.—The system of making a course of loops by means of the spring needle may be learned from examination of figs. 6, 7 and 8 which represent successive stages in the process The needle is there shown, on the lower stem is the fabric with the last-made loop hanging on the needle, the new thread is indicated, just passing under the spring or beard of the needle. To the left is shown a member usually known as the presser, which must always figure in any system of making loops by means of the spring needle In fig 6 the needle has just received its new yarn, at fig 7 the needle has descended and the new thread reaches the extremity of the needle inside the needle spring. The needle at this stage is being acted upon by the presser, which is pushed forward to force the spring into the groove carved out for it in the needle stem. In this position the needle slides still further downwards, so that in fig 7 the old stitch is noticed to be sliding on to the needle spring and over it This is called the landing of the stitch and is the crux of the whole knitting action, for in fig 8 the needle has descended to its lowest extremity, drawing through the new thread, and discharging the former loop from the needle which now takes its place normally in the fabric



FIGS 9 AND 10—(TOP) SPRING NEEDLE CAST IN ITS LEAD (BOTTOM) TYPICAL LATCH NEEDLE USED FOR MACHINE KNITTING

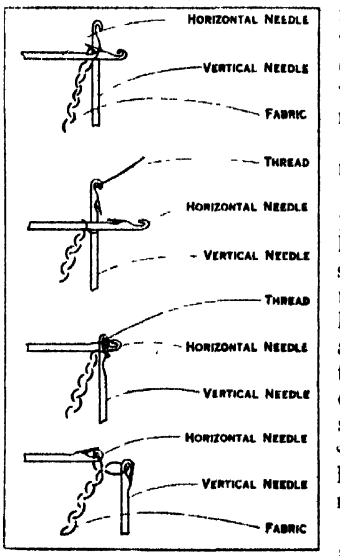
The two needle types spring and latch are shown in comparison in figs 9 and 10, where the spring needle is shown cast in its lead, and this is the usual form in which this needle is housed in the machine Each frame has its mould according to the sett of the needles, which are laid in pairs in grooves of the mould, molten lead is then poured into the shape shown above This forms a convenient way of handling the needles in the machine, and it is by counting the number of such leads in a space of 3 in which constitutes the gauge in flat machines using the spring needle Thus a 21 gauge frame would have 21 such leads, each with two needles =42 needles on three inches = 14 needles per inch Spring needles are made with butts at the lower end to fit into the machine and are thus locked into place in the needle bar instead of being leaded In working fabrics "to the gauge," therefore, this system enables one to say 24 gauge has 24 courses per inch, 18 gauge has 18 courses per inch, which corresponds to the general dictum regarding texture that the courses per inch should number 50% more than the needles or wales per inch

Latch Needle.—Examination of fig 10 will show the details of a standard type of latch needle, the various parts, viz, the latch, hook, stem and heel or butt being illustrated The hook is used to take the thread from the guide, and the hook is closed and opened by the latch, which hinges on a rivet The heel or butt, is that part of the needle to which the movement is imparted in the needle tricks of the machine, moving it up and down during the stitch formation To form the stitch the old stitch rests on the lower stem of the needle, whilst the new yarn is taken by the needle hook The needle is then drawn towards the right, which brings the latch against the old stitch to close the hook The needle proceeds still further in the same direction, and the old loop slips off the needle end with the new thread drawn through the old one Examination of the latch needle will show that there are many fine points to be mastered in its manufacture The provision of the latch and its hollow or spoon to fit over the hook is a very delicate piece of engineering, whilst the poising of the latch on its rivet presents a number of problems in minute measurement. The butt, with its curious bend, also presented many difficulties in tempering of the metal, owing to the proneness shown by the wire to break at the peak of the butt In many types of needles this bending is now eliminated by constructing a different form of butt, whereby the wire is flattened out at that end to give a heel which can be acted upon in the required manner

Examination of the needles shown in fig 9 and 10 explains many of the defects which are to be found in hosiery goods In the spring needle a delicate point is the spring, which after many pressings loses its potency and becomes flattened. This gives rise to defects known as "split" stitches, where half of the yarn goes over the spring and another half gets underneath during stitch formation. Machines are being built of 54 gauge with the spring needle, which means they have to be set with 36 needles to the inch They have to stand at exact distances apart in the machine, or what are known as needle lines will appear and irregular stitches will be formed where one narrow loop is seen side by side with one which is correspondingly larger, the narrowness of the one contrasting markedly with the wideness of the other The secret of success in producing level meshed goods from the spring needle is constant pliaring of the needles into perfect alinement in every direction, in which operation the mechanic develops a very fine sense of judging minute distances Any mixing of needles so that finer or coarser gauge needles merge is reflected in the regularity of the fabric Latch needles are subjected to expert examination by the manufacturer on the following points, (*a*) size of hook, (*b*) length of latch, (*c*) the needle backs are examined for sharp corners of the rivet which may project, (*d*) the height and breadth of the butt Latches which project at the back cause what are known as "whiskered" wales, because the tiny latches act as small scissors to cut the filaments or fibres of the yarn as it passes over the needles When these severed fibres occur on the same needle right down the material they constitute a serious defect, and stitches weakened in this way easily go into holes at early stages of wear

On any particular gauge of wire there are several sizes of head which may be made according to the type of fabric which it is sought to produce The needle manufacturers produce a standard size for their needles according to gauge, but particular manufacturers obtain needles with heads larger or smaller than the standard type The larger head allows greater space in the fabric, whilst a smaller head allows the yarn to be packed more closely in the cloth to give a denser texture

Rib Fabric.—In figs 11 to 14 the process of making rib fabric through the agency of the latch needle is illustrated, the needles representing the relative positions they would occupy in a machine such as a circular rib frame where the vertical needles are arranged round the circumference of a cylinder and the horizontal needles are set around the circumference of a dial, these two parts acting together during the knitting process. The fabric is so seen to be passing down the inside of the machine on the left, and in fig 11 the needles are in the act of moving into their respective positions to receive the new yarn to form a stitch In so doing the old stitches open the latches, the horizontal needle moves to the right, the vertical, upwards.



FIGS 11, 12, 13 AND 14—FOUR STAGES IN THE PROCESS OF MAKING THE RIB STITCH BY USING THE LATCH NEEDLE

In fig 12 the thread makes its appearance and is taken into the hook of the upright needle, which begins to slide downwards. At the same time the adjoining piece of yarn is laid over the stem and in the hook of the horizontal needle In fig 13 the two needles are in possession of the thread and the old stitches on both sets of needles have closed their respective needle latches In fig 14 the movement is complete; the horizontal needle has moved left to draw its new stitch through, the vertical having made a similar movement by dropping lower down If the vertical needles are arranged two and two with the horizontal needles, then a fabric as illustrated in fig 3 would be

the result, the vertical needles giving the face-fabric stitches and the horizontal needles the back-fabric stitches

Trade Divisions.—The hosiery trade is divided into sections such as the full fashioned, circular knit or seamless and the cut, according to the manner in which the articles are constructed and assembled Similar divisions hold in the underwear and in the knitted outerwear industries. In the latter two, however, most goods are made of the cut type, and by comparison not much of the full-fashioned type. In the underwear trade most of these goods are made of the tubular knitted fabrics which are tailored to shape by cutting and sewing The sweater and knitted outerwear industry employs similar methods in the fabrication of garments, excepting fabrics made on flat knitting machines which are also largely employed In making full-fashioned goods fashioning is done in the same way at the needles of the machine as in the hosiery industry, the difference being, however, that single unit or section machines which are more satisfactory are usually employed

In the full-fashioned trade the garments are made in flat pieces and afterwards joined together with a perfect selvedge, as the edge loops can be used to connect the seaming thread With goods cut from tubular web the cut edge is raw and the stitching needle has to penetrate a little way from the edge to obtain a hold, which gives a rather rough seam, although great improvement has been effected in this respect by the invention and widespread adoption of flat seams. Here the cut edges abut on each other or slightly overlap and are annealed in a manner by close intersection of from five to nine threads with a seam of some neatness. The perfecting of this method of seaming has contributed enormously to the greatly enhanced status which such cut-up goods now enjoy on the market. The fabric for this trade is produced on the latch or spring needle circular web machines, and in cutting out many plies of fabric can be dealt with at one and the same time on the lines of mass production for garments for wearers of moderate means The great virtue of the full-fashioned article is that exact interpretation can be given to any size, dimension or physical abnormality and the fabric texture is identical all the way through the garment.

The seamless trade is also a most important one, particularly in the production of knitted footwear and gloves. By the modern seamless automatic machine a hose can be produced in a few minutes entirely seamless except for a small seam, which has to be made across the toe In the case of stockings, the leg is shaped from calf to ankle by altering the size of the stitch; the top is worked in an open stitch to give greater width, whilst from the calf to the ankle the fabric is worked in degrees of increasing smallness of loop to give a constricted shape to the stocking. This method of shaping, the article suits an average wearer of moderate dimensions, but it does not stretch to fit a more ample figure In seamless hosiery the same number of needles are in the knitting of the leg proper as in the calf of the stocking. In the full-fashioned stocking the decreased width is obtained by reducing the number of stitches in action, and the foot of the stocking is made at right angles to the leg which insures a better fit at that point Variation in width is obtained by reducing the number of stitches in work so that the texture remains identical throughout

Warp Loom Knitted Fabrics.—Warp loom fabrics may be regarded as taking an intermediate place between the knitted and the woven texture They resemble the woven fabric in having a warp arranged in with parallel threads side by side on a beam or roller, but these threads are given a sidewise shogging motion so that the threads interloop with each other A view of this type of texture is given in fig. 15, where the pattern is arranged one black, one white, and five threads are shown intersecting and marked 1 to 5, whilst the needles are given from *A* to *E* Crosswise the courses of loops are marked from 1 to 6 and tracing thread number 1; it will be noted that it makes a loop on needles *A* and *B* alternately, thread number 2 moves alternately from needle *B* to needle *C* and back again; thread number 3 moves from needle *C* to needle *D* and back again alternately, and so on throughout the entire fabric. This is the simplest form of warp loom stitch, termed the "Denbigh" lap, and these threads are accommodated in a single bar. The lap of the thread guide bars can be greatly diversified, and the lap in one direction may be extended to a large number, say 40 or 50 needle spaces, which gives the characteristic zig-zag edge which is so attractive for the extremities of garments The side-to-side lap of the threads also gives a unique intermingling of the colours of the warp, and, using black and white, one can obtain intermediate blends of grey by the manner in which the sidewise movement melanges the colours. Greater diversity of pattern is obtained by the use of two or more bars as each bar can be given a different kind of lap The warp loom is constructed with spring and latch needles and what is known as the "Raschel" type is built with latch needles after the manner of a rib machine, in that there are two needle bars differently set so as to give contrary knock-over to the threads similar to a rib effect The two bars do not act together, however, but rise to knit alternately. In this branch of the industry practically any type of fabric can be produced, as the two needle bars enable the texture to be greatly increased in bulk or density and in stiffness. By this means also double face fabrics can be made as for mantle fabrics, plain style on the face with fancy tartan patterns on the back Men's suiting and overcoating fabrics as well as muffler and necktie fabrics have also been largely worked on this machine to the required density and firmness The warp loom, by reason of its lap at an angle, is specially adapted for making diamond styles of patterns where the figure stands on its edge, and quite a simple form of design arrangement produces a maximum of effectiveness Imitation lace styles, cellular fabrics and openwork designs can be made in this style of fabric, and by having the bars crossing in the direction of their motion, two stitches can be worked on the same needle which greatly reduces the laddering propensity of the fabric and practically makes it run-proof. In fact various types of two-bar work having this form of lap are definitely placed on the market under a guarantee that the fabric will not ladder, as the threads in the two bars are made to lock each other The jacquard machine is readily adaptable to the use of the jacquard harness for controlling the individual yarn ends and is accordingly used extensively for making lace fabrics of several types and weights The tricot type of warp knitting machine is used for the production of glove silk fabrics for the glove and silk underwear trades. This particular cloth is referred to as tricot and differs from Milanese in that it stretches in only one direction.

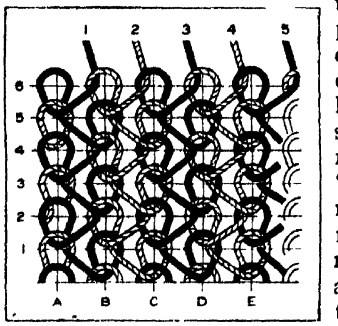


FIG 15.—WARP LOOM FABRIC ARRANGED 1-BLACK 1-WHITE IN THE PLAIN ONE-AND-ONE LAP

Another interesting variety of the warp loom fabric is known as the elastic stitch, also referred to as "Swiss" muffler stitch, which is worked in cellular form and possesses a wonderful elasticity, particularly in the length. This is a suitable fabric for such items as hat bands, and it is also used largely for scarves. The fabric is worked at full width, and afterwards divided by severing a thread which is drawn down leaving the fabric with a perfect selvedge at the scarf widths. Warp loom fabrics have limitless scope as regards colours, as each thread can be of a different colour if desired.

Milanese Texture.—One of the most famous warp loom fabrics is the Milanese texture, which is figuring more and more in textile requirements. It is made on the special loom of the same name, and there is no other textile fabric exactly like it. The Milanese machine has one warp, wound on large spools which are mounted in a carriage in the bottom of the machine and which travel around a flat elliptical track in unison with the transference of their respective warp ends to the neighbouring needles in stitch progression of courses. There are two tiers of threads, one on the face and another on the back; the face threads lap

needle by needle from left to right continuously from one side to the other, whilst the back threads similarly lap needle by needle at succeeding courses towards the left on the lower tier Thus in a fabric with 4,000 threads it would require 4,000 courses for thread number one to travel to the 4,000th needle. At each course one thread reaches the last needle on the right, and is promptly transferred to the leftward-moving needles underneath; similarly one thread in the lower tier arrives at its last needle moving leftwards at each course, and is promoted from the lower to the upper tier to repeat its journey. At every course each needle holds two stitches, so that if one gets broken the remaining thread holds the loop and prevents laddering. This is a great asset in such fabrics when made into garments and accounts for its increasing popularity A further advantage is that the edge is more stable than the plain knitted fabric when cut, and a smaller seam can be made, as one does not require to take such a large bite from the fabric on either side. Thinner seaming threads can also be used which gives a small neat join very much prized in a cut undergarment. The fabric is made in gauges with about 30 face stitches per inch, which, counting the back, gives actually 60 stitches per inch, and Milanese lends itself to working in the popular artificial silk. This is also the texture adopted for the well-known fabric glove which is usually worked in fine counts of single cotton, and the already dense mixture is rendered more so by a shrinking process, which consists in steeping the material in caustic soda so that it swells and fills out the loop interspaces, thus giving it, when finished, a fine dense skin-like fabric referred to as cotton suede, ideal for gloves A Milanese fabric is usually heavier than a tricot fabric and, therefore, usually more expensive

Multi-feed Machines.—Fig 16 gives a view of what is known as the multi-feed frame, which is provided with latch needles and is set to give a colossal production of fabric, in fact the multi-feed knitting machine ranks as the fastest textile-producing machine in existence It owes its high speed to the circular

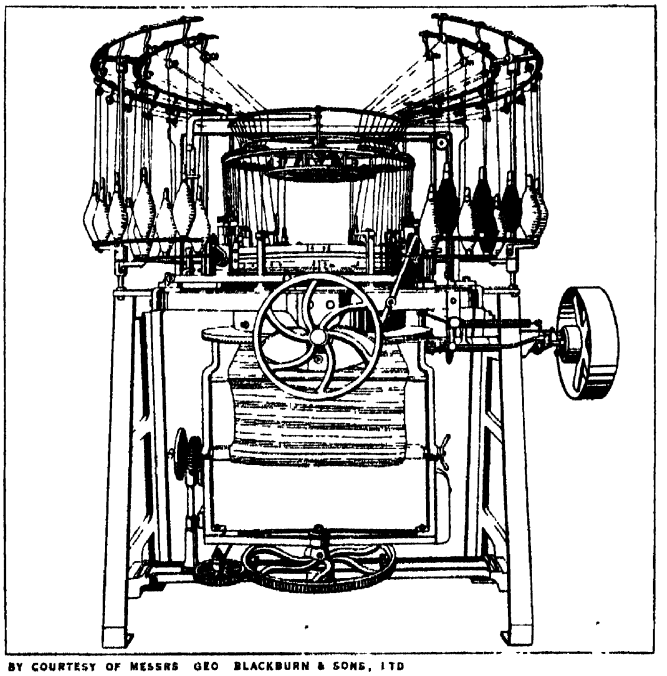


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FIG. 16.—MULTI-FEED FRAME FOR MAKING MEAT-BAG FABRIC AND NIGHTWEAR FABRICS

principle of construction, which provides for a large number of stitching-forming units being housed round the circle. They follow each other in close succession right round, so that in the large diameter machines 80 feeds are arranged, which means that for every revolution of the needle cylinder 80 courses of loops are inserted, and if there are 10 courses of such loops per inch, this gives 8 in of fabric at each turn of the cylinder If there are 10 cylinder revolutions per minute, this gives 80 in. of fabric produced per minute, and allowing for stoppages this would yield about 2 yd per minute Naturally, with such a large number of stitch-producing setts round the circle the texture is not of the most regular description, but such gauzy fabric is useful for many purposes, notably for meat bags in which the carcases of animals are wrapped for transport, particularly in connection with the meat-packing trade In lesser number of feeds than described above it is also a machine well adapted for the football jersey trade where bold cross stripes are required, and the threads are arranged in due colour order on the machine platform

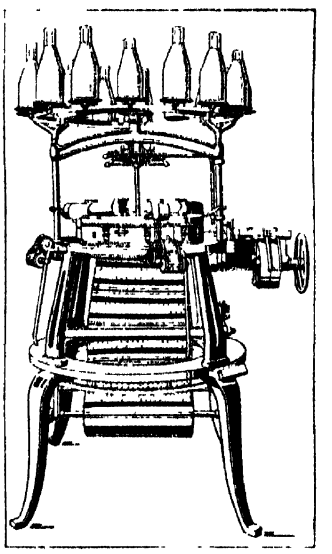

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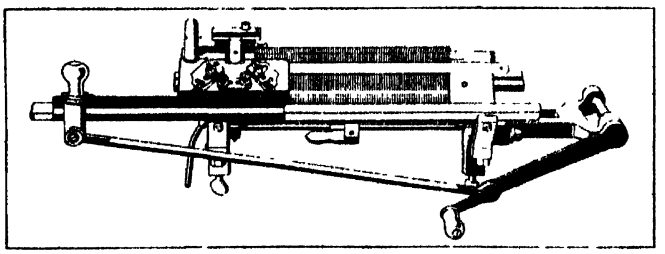
FIG. 17.—LATCH NEEDLE CIRCULAR KNITTING MACHINE FOR FANCY STRIPED FABRICS OR ARTIFICIAL SILK GOODS

Fig 17 gives a view of another circular machine, where the number of stitch-forming elements are greatly reduced to provide fabric of perfectly regular texture suitable for the outer garment trade. The usual number of feeders for such machines runs from 8 to 12 in the circle, and the adjustments are specially designed to make each course of loop equal in length and tension. This machine is specially designed to provide for fancy coloured stripes and for the taking of several colour feeders in the circle. It has played a vital part in developing the knitted artificial silk fabrics For stripes and pattern effects design wheels are added which are provided with bits to make selection of needles in the circle in accordance with the pattern

The Flat Knitting Machine.—Fig 18 gives a view of the flat knitting machine, as it is termed, which in some ways is one of the most remarkable types of knitting mechanism It was invented by the Rev J W Lamb in 1863 and is also known as the Lamb knitter The machine shown in the figure is a hand type, and it is remarkable for its versatility, as most types of articles can be produced on it From its simplicity of construction and ease of manipulation it has proved a valuable asset to the small manufacturer, particularly for the production of knitted outer garments. The machine can also produce circular fabric, which is a useful point in the production of knitted gloves, in that the small bags or pockets for the hand and fingers can be made entirely seamless and in a perfect circle of loops. The



BY COURTESY OF MESSRS LIVESEY & CROWTHER, LTD

FIG 18.—THE LAMB HAND FLAT KNITTING MACHINE

needles can be arranged to give all kinds of rib patterns, and these can be shogged or given a zig-zag appearance producing the rack stitch, which is a desirable feature of designs used for sweaters and sports goods. The hand operator can make the articles shaped as required by moving stitches to increase or decrease the width, and this facility enables novelties to be more readily produced than is the case with the larger and more cumbersome machines. It is also largely employed for knitted coats and costumes. This industry is found in many places far from the recognized centres, and is a suitable occupation for seaside resorts and for mining communities where the normal labour conditions allow little scope for the activities of women.

Miscellaneous Knitted Articles.—The circular principle of knitting is adapted to many purposes of smallwear. For example, in the making of ribbons and tapes a circular machine having only a few needles in the circumference is employed For cords there may be only three or four needles in the circle, for narrow bands and tapes 16 to 20 When colours are introduced, attractive trimmings and millinery adjuncts are produced With the circle a little larger, gas mantles are worked in the knitted stitch in the ramie or China grass yarn, and slightly greater widths bring in fabrics suitable for knitted ties, where a number of colour feeders are added along with patterning devices to give attractive motives From 3 in to 4½ in diameter the circular machine is used for the production of hosiery on the seamless principle, and the gauge is given as the number of needles in the circumference of the cylinder. The leg, foot, heel and toe can be produced entirely automatically except for a short join across the toe, the time required for a pair of full-length stockings of medium gauge being about ten minutes One operator minds eight to ten of these machines, and this unit will produce from 40 to 50 dozen pairs of stockings per day Taking 3¾ in as a normal diameter, the gauges range from 68 needles in the cylinder to 300 A number of mills are now operating 300 and 320 needle 3½ and 3½ in machines

Cotton's Frame.—Fig 19 gives a view of the Cotton's patent frame where the articles are made exactly to size and shape This frame can be built to make 12 full-width garments at one and the same time, or 28 full-fashioned stocking legs It has acquired a remarkable number of attachments to produce cross stripes of colours, vertical lines and patterns after the manner of added embroidery, openwork or imitation lace designs. Tuck patterns are also made, so-called because of the way in which certain stitches are tucked into the fabric unintersected by a new loop In hosiery manufacture, the machines are divided into those which are adapted for producing the leg portions termed "leggers" and another set, the "footers," are specially equipped to produce the foot These are usually grouped in "sets" of three leggers and one footer, as the footer having a lesser amount of knitting to do produces relatively three times as fast Production of normal goods (not lace clocks or fancy effects) is from 40 to 45 dozen pairs per day per set

The French Foot.—In the hosiery trade two divisions arise under the term of English foot and French foot In the English type, the foot is made in two pieces, one-half covering the upper foot and the second portion the under foot, these being joined by seams along each side of the hose In the making of this type of hosiery a sole machine is employed instead of a footer The French foot portion is made on the footer in one piece, which is wrapped round the foot with a seam or join along the centre of the foot. By this system the pattern can be continued right round the foot, whilst in the English style the pattern formed in the rest of the hose is interrupted by this join at the side. Nearly all of the full-fashioned hosiery produced in America is of French foot type, which allows greater production. Splicing is a term adopted to indicate the extra thread of hard-wearing yarn inserted as an extra yarn at the heel and toe and along the foot bottom This splicing also extends in many types about 2½ in up the back of the heel, and is often found halfway round the circle This begins in a straight line which rather spoils the effect, and what is known as the tapered splicing has been introduced after the manner of a pyramid standing on its base, so that what is normally an objectionable feature is transformed into an item of ornamentation Many variations of this pointed high splice are in use

Circular Frames.—The English loop-wheel circular frame is constructed with spring needles arranged with the springs facing outwards round the circumference, and the fabric proceeds upwards to be coiled round winding-up rollers. This machine is specially adapted for making what is known as fleece-lined fabrics, as it has facilities for making fabrics where a thick thread floats on the back and is afterwards brushed and rendered fleecy. The machine can also be adapted for working imitation astrachan and fur-like fabrics, and it is also used for the thicker and denser textures suitable for suitings and overcoatings, the fabric having the knitted origin obscured by the brushing operation

The French or German circular frame is another type of spring needle circular, where the needles radiate from a centre and are set in a circle with the fabric proceeding downwards This machine has been adapted for the production of plush and velvet fabrics, mostly in artificial silk, where the lustrous yarn is brought to the surface with a longer length of loop which forms itself into a pile which can be cut or left uncut as desired American machine builders have worked steadily forward production of both spring and latch needle machines of finer gauge or cut The results are borne out by the 30, 34 and even 40 cut machines in use—the latter having 40 needles to the inch Due to the wide-spread use of rayon, or artificial silk, and the resultant tendency toward finer fabrics, machines, such as 32 and 36 gauge are considered obsolete while the 42 gauge (28 cut) machine ranks supreme for underwear fabrics of quality These fabrics have a wide popularity for dress goods, and they afford one more instance of the way in which the knitted fabric is invading the realm of the older woven texture The finer denier of artificial silk combined with the delicately set mesh of the fine-gauge knitting machine make it possible to produce fabrics of gossamer-like consistency for every textile use In the newer adaptations of the Jacquard principle to the circular machines all limits to the scope of knitted design have been broken down, and it is now possible to produce fabrics with a repeat extending the full width of the fabric.

Development of hosiery machinery in America was principally along the lines of circular machines of the automatic type An example of such machines is found in one type which starts knitting, and after finishing the garter welt, turns, knits it into the body of the stocking, knits in an imitation seam at the back (in simulation of full-fashioned goods), enters the splicing yarns in heel, sole and foot, and automatically knits in gores in the heel and toe sections The stocking leaves such a machine fully completed except the toe join or seam and dyeing and boarding Fully automatic hosiery machines, although imported in large numbers, are manufactured in America in two plants, one of them being the largest manufacturers of this type of machines in the world

(W Ds)

HOSIUS or OSIUS (*c* 257–*c* 359), bishop of Cordova, was born probably at Cordova He was elected to that see before the end of the 3rd century and narrowly escaped martyrdom in the persecution of Maximian (303–305) In 305 or 306 he attended the council of Illiberis or Elvira, and upheld its severe canons concerning the treatment of the lapsed and clerical marriages In 313 he appears at the court of Constantine, and 10 years later, as the bearer of Constantine's letter to Bishop Alexander of Alexandria and Arius his deacon, bidding them cease disturbing the peace of the church He was present at the council of Nicaea in 325, and powerfully influenced the judgment of the emperor in favour of the orthodox party Hosius presided in 343 at the fruitless synod of Sardica, which showed itself so hostile to Arianism; and afterwards he supported Athanasius in such a way as to bring upon himself a sentence of banishment to Sirmium (355) From his exile he wrote to Constantius II a letter now his only extant composition Under pressure, he signed the formula adopted by the second synod of Sirmium in 357, which involved communion with the Arians but not the condemnation of Athanasius He was then permitted to return to his diocese, where he died in 359

See S Tillemont, *Mémoires*, vii. (1700); Hefele, *Conciliengeschichte* (2nd ed, 1873, etc), vol i; H. M Gwatkin, *Studies of Arianism* (1882, 2nd ed, 1900); A W W. Dale, *The Synod of Elvira* (1882), Duchesne, *Histoire ancienne de l'Eglise* (1908), and Herzog-Hauck, *Realencyklopädie* (3rd ed, 1900)

HOSIUS, STANISLAUS (1504–79), Polish cardinal, was born in Cracow on May 5, 1504. He studied in his native town, in Padua and Bologna, and, entering the church, became in 1549 bishop of Kulm, in 1551 bishop of Ermland, and in 1561 cardinal Hosius had Jesuit sympathies and actively opposed the Protestant reformation, his *Confessio fidei christiana catholica* being adopted by the synod of Piotrkow in 1557. He was, however, supreme as a diplomatist and administrator. Besides carrying through

many difficult negotiations in Brussels, Prague and Vienna, he founded the lyceum of Braunsberg, which still exists He died at Capranica near Rome on Aug 5, 1579.

The best edition of his works appeared at Cologne in 1584 Hipler has published separately his letters (1879, 1oll) and his sermons (1885). *See* his *Life* by A. Eichhorn, 2 vols. (Mainz, 1854)

HOSKINS, JOHN (d. 1664), English miniature painter. His finest mihiatures are at Ham House. Montagu House, Windsor castle, Amsterdam and in the Pierpont Morgan collection Veitue stated that Hoskins had a son, and Redgrave added that the son painted a portrait of James II. in 1686 and was paid £10, 5s. for it, a statement for which there must have been some evidence, although it is not supported by any reference in the State Papers. Some contemporary inscriptions on the miniatures at Ham House record them as the work of "Old Hoskins," but the fact of the existence of a younger artist of the same name is settled by a miniature in the Pierpont Morgan collection, signed by Hoskins, and bearing an authentic engraved inscription on its contemporary frame to the effect that it represents the duke of Berwick at the age of 29 in 1700 The elder Hoskins was buried on Feb 22, 1664, in St Paul's, Covent Garden, and, as there is no doubt of the authenticity of this miniature or of the signature upon it, it is evident that he had a son who survived him 36 years and whose monogram we find upon this portrait

See Roger de Piles, *The Art of Painting, and the lives of the painters* (3rd ed., with additions by B Buckeridge, 1750); J L Propert, *A History of Miniature Art* (1887), Horace Walpole, *Anecdotes of Painting in England* (ed R. N Wornum, 1888). (G C. W.)

HOSMER, HARRIET GOODHUE (1830–1908), American sculptor, was born at Watertown (Mass), on Oct 9, 1830 She early showed an aptitude for modelling, and studied anatomy with her father, a physician, and afterwards at the St Louis medical college She then studied in Boston until 1852, when she went to Rome From 1853 to 1860 she was the pupil of the English sculptor, John Gibson, and lived in Rome until a few years before her death There she was frequently associated with Nathaniel Hawthorne, Thorwaldsen, Flaxman, Thackery, George Eliot, George Sand and the Brownings Among her works are "Daphne" and "Medusa," ideal heads (1853), "Puck" (1855); "Oenone" (1855), now in the St Louis Museum of Fine Arts; "Beatrice Cenci" (1857), for the Mercantile library of St Louis; "Zenobia, Queen of Palmyra, in Chains" (1859), now in the Metropolitan Museum of Art, New York city, "A Sleeping Faun" (1867), "A Waking Faun", a bronze statue of Thomas H Benton (1808) for Lafayette park, St Louis, bronze gates for the earl of Brownlow's art gallery at Ashridge Hall; a fountain for Central park, New York city, a monument to Abraham Lincoln, and for the Columbian exposition, Chicago, 1893, statues of the queen of Naples as the "heroine of Gaeta," and of Queen Isabella of Spain Miss Harriet Goodhue Hosmer died at Watertown (Mass.), on Feb. 21, 1908.

HOSPICE, the name frequently given to the guest-houses established for the reception of pilgrims and travellers within the precincts or upon the property of religious houses It is specially associated with the hospices of the Great and Little St Bernard Passes in the Alps; but the word *hospitium,* as used in the middle ages, had no exclusively religious connotation, and was applied to any kind of lodging or inn, not only to houses of public entertainment, but to the "inns" or mansions of noblemen, prelates and bodies of lawyers in London and on its outskirts

HOSPITAL, a term now in general use for institutions in which medical treatment is given to the sick or injured The place where a guest was received was in Lat *hospitium* (Fr *hospice*), but the adjective *hospitalis* came into use in the same sense. Hence were derived on the one hand the Fr. *hospital, hôpital,* applied to establishments for temporary occupation by the sick for the purpose of medical treatment, and *hospice* to places for permanent occupation by the poor, infirm, incurable or insane; on the other, the form *hôtel,* which became restricted (except in the case of *hôtel-Dieu*) to private or public dwelling-houses for ordinary occupation. In English, while "hostel" retained the earlier sense and "hotel" has become confined to that of a superior inn (*q v.*), "hospital" was used both in the sense of a permanent retreat for the poor infirm or for the insane, and also for a regular institution for the temporary reception of sick cases; but modern usage has gradually restricted it mainly to the latter, other words, such as almshouse and asylum, being preferred in the former cases.

The Origin of Hospitals.—In spite of contrary opinions the germ of the hospital system may be seen in pre-Christian times (*see* CHARITY). The temples of Saturn are known to have been in existence some 4,000 years before Christ, and that these temples were medical schools in their earliest form is beyond question But though hospitals cannot be claimed as a direct result of Christianity, no doubt it tended to instil humanitarian views, and as civilization grew men and women of many races came to realize that the treatment of disease in buildings set apart exclusively for the care of the sick was, in fact, a necessity in urban districts As the knowledge of hygiene increased hospitals were found to be of even greater importance, if that is possible, to the healthy in crowded communities, than to the sick So the history of the world shows, that, whereas a few of the larger towns in most countries contained hospitals of sorts, up to and including the middle ages, it was not until the commencement of the 18th century that towns of from 50,000 to 100,000 inhabitants began to provide themselves with hospitals for the care of the sick. Thus, 23 of the principal English counties appear to have had no general hospital prior to 1710, while London itself at that date was mainly, if not entirely, dependent upon St Bartholomew's and St Thomas's Hospitals

In Great Britain hospitals for the treatment of general and special diseases are generally maintained upon what is known as the voluntary system On the European continent, hospitals as a rule are maintained by the state or municipalities, and this system is so fully developed in Sweden and elsewhere that the poor-law and voluntary institutions are brought into intimate association, although they may be managed by separate governing bodies The plan pursued is to demand payment from all patients who are admitted to the hospital under a scale of charges graduated according to their means In the United States most large towns have city hospitals, administered and mainly supported by the municipality Many such institutions have pay wards and they are rapidly being instituted in Great Britain. The great argument for their establishment is that whereas the very rich and very poor can command the best of medical treatment, the middle classes are unprovided for As a result many persons who could afford to pay for medical advice and treatment used the hospitals without payment, and it became necessary early in the present century for the larger hospitals to appoint almoners who should question the patients or their friends as to their financial fitness to receive hospital relief without payment While necessitous patients are treated as formerly without payment, others pay according to their means, the actual weekly sum being arranged between the almoner and the patient or his friends Since national insurance came into force the funds for sickness benefit have accumulated till they amount to many millions of pounds The hospitals maintain that they should receive a substantial portion of this sum in return for the services they render to the insured and the question is still under discussion between the interested parties. In 1923 the Hospital Saving Association was formed in London whereby for threepence a week contribution full medical treatment in hospital was assured In 1926 it had attracted 370,000 persons, had an income of over £200,000 a year, had paid to the hospitals over £127,000 for treatment given to 100,000 persons and had a surplus on the hospital budgets of £250,000.

Comparison of Voluntary and Rate-supported Systems.—As to the relative merits and demerits of the systems of government of municipal hospitals and voluntary hospitals a few words may be useful The voluntary hospital in Great Britain has had a remarkable effect for good upon all classes in modern England The management is frequently representative of all classes, while the Hospital Sunday and other similar collections unite all creeds in the good work of caring and providing for the sick and injured members of each community Again, the voluntary system makes

for efficiency in administration; an ill-managed voluntary hospital is sure to disappear in due course. Each voluntary hospital has to live by competition, a fact which guarantees that everything in the way of new treatment and scientific development shall find its proper place within its walls. Open as they are to the full inspection of everybody whose knowledge and presence can promote efficiency, they have shown, especially since the last quarter of the 19th century, a continuous development and improvement.

The voluntary hospitals are attended, however, by certain disadvantages which do not attach to municipal institutions A municipality which undertakes the provision of hospitals for the entire community is largely able to plan out the urban area, and to provide that each hospital site selected shall not only be suitable for the purpose, but shall contribute to make the whole system of hospital provision easily accessible to all classes who may require its aid. The voluntary hospitals, on the contrary, have grown up without any comprehensive plan of the districts or any real regard to the convenience or necessities of their poorer inhabitants. The best municipal systems provide a central office where the number of vacant beds in each hospital is known, so that the average of occupied beds in all the hospitals can be well maintained from an economical point of view. This inter-communication between all rate-supported hospitals in a city, which might be secured under the voluntary system, prevents delay in the admission of urgent cases, and makes for economy by keeping the average of beds occupied in each establishment high and uniform. On the other hand, the absence of competition, and the freedom from continuous publicity and criticism such as the voluntary hospitals enjoy, make for inefficiency and indifferent work. Of course it is essential to have rate-supported hospitals where cases of infectious disease and the poorest of the people can be cared for, and of late years the administration of both these types of rate-supported hospitals has greatly improved, largely owing to the importance now accorded to medical officers of health The poor-law infirmary in large cities, so far as the buildings and equipment are concerned, very often leaves little to desire. Poor-law infirmaries lack, however, the stimulus and the checks and advantages which impartial criticism continuously applied brings to a great voluntary hospital.

The Evolution of the Modern Hospital.—The evolution of the modern hospital affords one of the most marvellous evidences of the advance of scientific and humanitarian principles which the world has ever seen. Formerly the hospital was merely a building or buildings, very often unsuitable for the purposes to which it was put, where sick and injured people were retained and more frequently than not died The hygienic condition, the methods of treatment and the hospital atmosphere were all so relatively unsatisfactory as to yield a mortality in serious cases of 40% At the present time in all large cities, great hospitals have been erected upon extensive sites which are so planned as to constitute in fact a village with many hundreds of inhabitants. This type of modern hospital has common characteristics A multitude of separate buildings are dotted over the site, wards for male and female patients, residential blocks for medical officers, nurses, servants, administration block, store-rooms, kitchens, etc , and the whole institution may cover 20 acres or upwards. In one such institution, within an area of 20 acres, there are 6m. of drains, 29m of water and steam pipes, 3m. of roof gutters, 42m. of electric wires.

Classification of Hospitals.—Hospitals may be described as general or special. At the larger institutions of both kinds there are more or less extensive facilities for education in medicine and in nursing The general hospital should be fully equipped in all respects to cope with any variety of disease or injury, even though early transference of the patient to a special hospital may be found necessary in some cases. Special hospitals began to come into existence about 1860. Some of these; *e.g.*, for cancer, diseases of women, consumption, diseases of children, etc , have fully established themselves by reason of their efficiency. Others have been, and are being, grouped or merged into larger special hospitals of the same kind. At the same time the large general hospitals are extending their special departments so that the present tendency is towards centralization At the present day the largest special hospitals are those for infectious fevers and for mental disease.

Cottage Hospitals.—A particular variety of general hospital is that introduced in England in 1859. It contains a small number of beds, and although originally pre-existing buildings were adapted for hospital purposes, nowadays a cottage hospital is built for the purpose and usually is efficient, though small. The local medical practitioners, as a rule, constitute the visiting staff, and often one or more consultants are appointed from the great general hospitals who operate when requested. Cottage hospitals are on a voluntary basis but they may receive financial help from the local authority or from the great hospital funds.

Convalescent Homes.—The disadvantages of treating patients in a building situated, as are most great general hospitals, in the working part of a city, together with the pressure on their accommodation, has led to the founding of ancillary convalescent homes in the country or at the seaside. Many of the chief hospitals in England have such convalescent homes. An extension of the idea consists in the provision of country hospitals for open-air and sunlight treatment, especially for chronic diseases; *e g.*, surgical tuberculosis. Some eminent authorities favour the removal of hospitals to the country altogether, small first-aid centres alone being kept up in the working city and an efficient ambulance system being set up between them and the hospitals It is difficult to see how such a system could work satisfactorily in a city the size of London or New York, but for far smaller communities it has much to recommend it.

The Problem of Hospital Administration.—A study of the hospital problem in various countries, and especially in different portions of the English-speaking world, indicates that, apart from local differences, the features presented are everywhere practically identical A number of hospitals under independent administration, dependent in whole or in part on voluntary contributions, administered under different regulations originally representing the idiosyncracies of individual managers for the time being, without any standard of efficiency or any system of co-operation, must mean in practice overlapping and wastage on economical, scientific and other grounds. These evils are present almost everywhere, despite many and varied attempts to grapple with and remove them Amongst these attempts are the assembling of hospital conferences, the establishment of special funds and committees and the holding of enquiries of various kinds in London and other British cities and also in the United States. One of the most valuable contributions towards their solution is insistence by the great distributing funds that institutions wishful to receive grants in aid shall keep their accounts on a uniform specified plan

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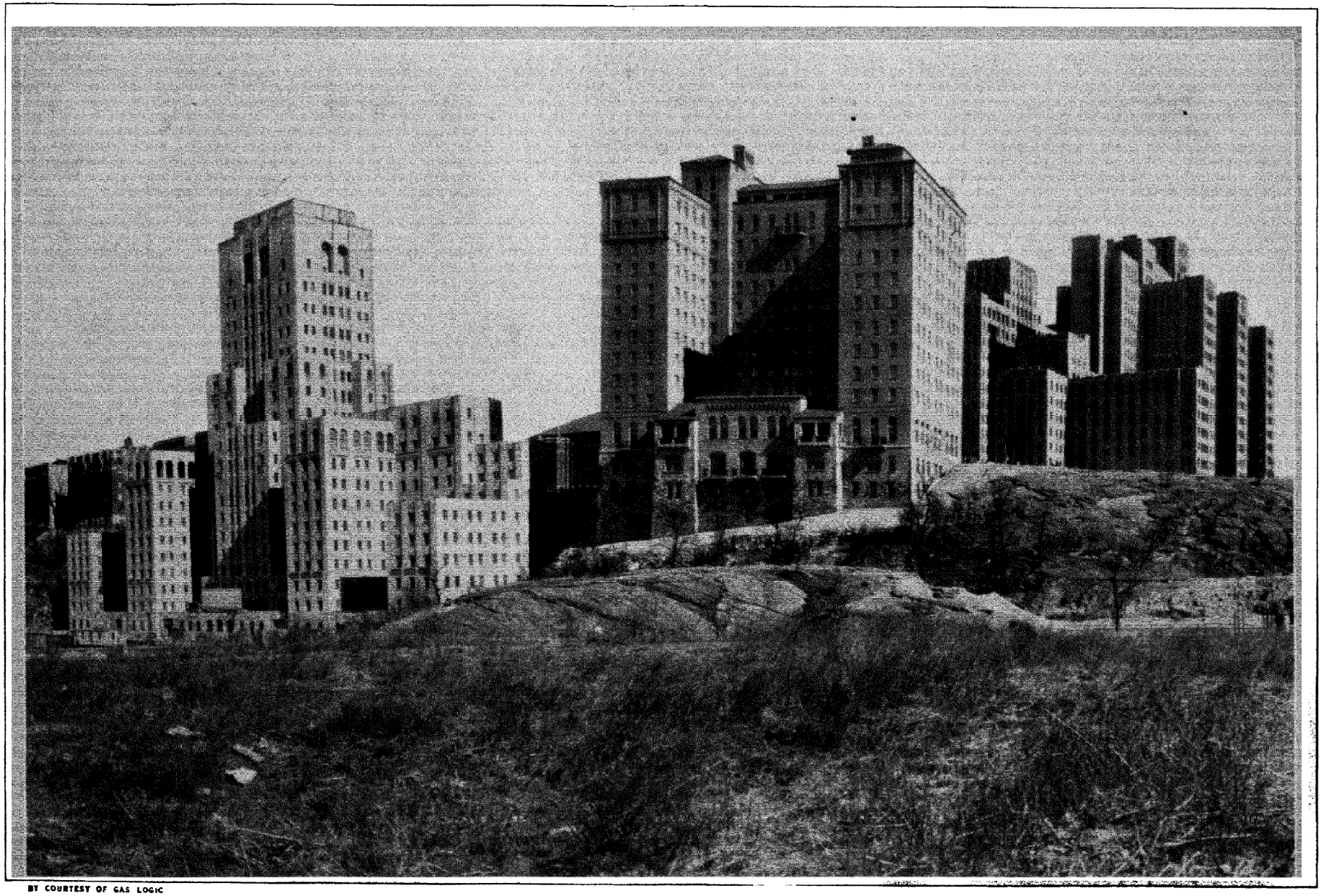
(W. S. L.-B.)

Twentieth Century Development.—At the beginning of the century two special points are to be noted:—

1. The development of operating and clinical methods led to an increasing specialization in the departments of general medicine and surgery in hospitals.

2. From the architectural point of view, simplicity and comfort were being increasingly sought and buildings and hospital premises were being to an increasing extent adapted to the necessities of sanitation and hygiene.

General Features.—Attempts to create large hospitals outside urban centres and in favourable climatic conditions have been to a large extent successful. In the case of old hospitals, where it was difficult to make rapid changes, the various services have been installed in special buildings and annexes, divided one from another, each dealing with a special subject; *e.g.*, surgery, clinical



BY COURTESY OF GAS LOGIC

MEDICAL CENTER, NEW YORK CITY

View of the Medical Center in New York, a group of buildings in which eleven schools and hospitals are associated. The plan was proposed in 1921 by the Presbyterian Hospital and the Columbia University College of Physicians and Surgeons, which were the two original units in the enterprise. The buildings were designed by James Gamble Rogers, and show a fine mass treatment, and a modern emphasis on perpendicular line. They were completed in 1928. On the left of the illustration is the New York State Psychiatric Institute, in the centre, the Nurses' home, and on the right, a rear view of the main group

work, ophthalmic work, otolaryngology, children's diseases, gynaecology, epidemics, etc. Whereas in Anglo-Saxon hospitals the principle of placing hospitals under independent management maintained by voluntary aid has been adhered to, in continental countries there has been an increasing tendency to centralize hospitals by placing them under municipal, local or national authority

Statistics.—Hospitals were more frequented in 1912 than in previous years This fact must be attributed not to the increase in the tendency to disease, but to the addition of a large number of buildings and wards which allowed of a larger number of patients being received. The dissemination of the principles of hygiene has familiarized the public with medical methods and has caused a marked increase in the number of patients under treatment. Various statistics show the movements of patients in hospitals during the years preceding the war. In 1913, 106 hospitals in London (general hospitals, children's clinics, gynaecological hospitals, anti-tubercular hospitals, etc), with 9,171 beds, dealt with 134,749 patients and were attended by 1,329,567 persons

In 1912, the Paris Department of Public Relief (*l'administration générale de l'assistance publique*) admitted to its general hospitals (Andral, Beaujon, Boucicaut, Broussais, Charité, Cochin, Hôtel-Dieu, Laennec, Lariboisière, Necker, Pitié, St Antoine, St Louis and Tenon) 147,828 patients, and 46,601 patients to the special hospitals (St. Louis, Maternité, Broca, etc). Germany, in 1912, had 9,054 hospitals with 535,579 beds This figure includes general hospitals, military and naval hospitals, lunatic asylums, sanatoria, maternity homes, special clinics, children's hospitals, homes for the blind, etc. In 1912, the medical institutes of Vienna dealt in all with 82,939 patients. In the United States there was a noticeable increase in the number of hospitals and clinics, and there was a considerable development of the specialization of medical and surgical departments

In 1924, the number of hospitals in London was 118, the number of beds, 13,460, the number of patients treated 177,300 and the number of consultations 6,677,000 (as against 5,020,000 in 1913). Among the principal hospitals included in these general figures, St Thomas's Hospital alone received 10,139 in-patients and gave 488,600 consultations; St Bartholomew's Hospital received 8,648 in-patients and had 344,226 out-patients, the London Hospital 17,331 in-patients and 553,965 out-patients, Guy's Hospital 9,495 in-patients and 487,452 out-patients. In Paris, the number of sick persons received was 238,912 in 1923, of whom 153,794 were in the general hospitals, 43,403 in the special hospitals, 29,329 in the children's hospitals, 2,071 in the mental hospitals and 10,315 in various homes and asylums.

War Conditions.—The World War of 1914 compelled hospitals to adapt themselves rapidly to new requirements. Existing hospitals were transformed, large numbers of extra establishments were improvised and various other special measures were adopted:—

(*a*) Permanent military hospitals, already existing in time of peace, were specially adapted for the reception of sick and wounded soldiers;

(*b*) Civil hospitals were placed, together with their staff, under the direction of the military authorities;

(*c*) Hospitals were installed in public or private buildings, such as hotels, schools, private houses, etc., to receive and deal with the flow of wounded from the front

(*d*) Hospitals in the zone of military operations were carried on in permanent premises or under canvas, even underground, nursing posts and relief posts dealing with first aid to the wounded before their evacuation to the rear;

(*e*) As described in the article MEDICAL SERVICE (ARMY), ambulances of every type were employed. Trains, barges, liners and even aeroplanes, specially built or converted and equipped, were used for the transport of sick and wounded to base and home hospitals.

(*f*) Special hospitals for orthopaedic, tuberculous, neurasthenic, paralysed and gassed cases were organized. Electro-therapeutical, hydro-therapeutic, helio-therapeutic, massage and special sections were also developed.

(*g*) Convalescent homes were set up and many private mansions were used for this purpose. Convalescent camps were formed near the base hospitals overseas

(*h*) Temporary hospitals were erected to receive influenza patients, and malaria camps were organized

Quarantine Stations.—Quarantine stations, which before the war were limited to maritime ports, were, after the war, set up on the borders of Poland, Czechoslovakia, Rumania, Hungary and the Baltic States, for the supervision of travellers arriving from countries contaminated by exanthematic typhus and relapsing fever Three model stations, set up by the International Red Cross Committee at Narwa in Estonia, Riga in Latvia and Inió in Finland, dealt with the reception, supervision and disinfection of thousands of prisoners arriving from Russia on the convoys of repatriated prisoners between 1919–22.

Special Hospitals.—The Italian Red Cross has been most active in districts affected by malaria, and with this end in view has organized the anti-malaria sanatorium of Massalubrense, together with a number of motor ambulances In Georgia, the tropical institute of Tiflis is engaged in centralizing the work of the various clinics and hospital stations. In 1913 12,500 malaria patients were treated in the hospitals of Tiflis In the case of Oriental countries may be mentioned the leper hospitals (the Indies and Siam), hospitals for the treatment of snake bites (Siamese Red Cross at Bangkok), and the anti-epidemic and summer hospitals of the Chinese Red Cross at Shanghai. Hospitals have been supplemented by dispensaries, preventive homes, consulting offices, convalescent homes and mountain sanatoria and seaside hospitals. Venereal disease and dermatological hospitals have considerably developed Cancer hospitals have been improved, especially as regards radio-therapeutic services

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UNITED STATES

During the 20th century, and more particularly in the period from 1914 to 1925, the development of hospitals in the United States has been unprecedented. This development may be considered under the heads of (*a*) the present trend of hospitals as a social factor, (*b*) the present day construction, (*c*) specific examples and (*d*) statistics of 1925 and the increase during the period in question

Hospitals as a Social Factor.—While there is a continued development and refinement of the care of the sick in the hospital to-day, the conception of the function of this institution has materially broadened, with a rapidly increasing tendency to regard it as a community health centre from which to radiate all health activities, particular emphasis being placed upon the development of out-patient departments (this as a means of teaching and practising preventive medicine and thereby obviating the necessity of the hospital bed), district nursing and social service In the larger cities medical centres are being developed, in which case the foregoing community functions are associated with the instruction of student bodies in various branches, including medicine, nursing, public-health work, social service, and, in many instances, dentistry. The tendency to develop isolated speciality hospitals is being replaced by provisions for the specialities as departments of the general hospital or by the affiliation of already existing speciality hospitals with existing general hospitals. The different types of schools teaching health work, with the various hospitals, form these medical centre groups, in which are included convalescent homes as an integral or co-ordinated part.

Present-day Construction.—While in the earlier period hos-

pital development in the United States was largely patterned after the developments in Europe, the present trend of large institutions is toward the "skyscraper hospital"—as St. Luke's Hospital Annex, in Chicago, with 19 storeys; the Jefferson hospital in Philadelphia, with 17 storeys; and the new Presbyterian hospital of the medical centre (opened March 16, 1928) of New York city, with 22 storeys. This tendency is extending even into the country districts where the value of land is not a factor, for example, the University hospital at Ann Arbor, Mich., with its nine storeys, and the Charlotte Hungerford hospital at Torrington, Conn., with its eight storeys, the former being a teaching hospital and the latter a community hospital serving 35,000 people.

Economy and effectiveness of administration is claimed by the promoters of the multi-storey hospital movement. This type of construction and administration, which is distinctly American, is not being followed in the United States to the entire exclusion of the methods commonly pursued in Europe. The hospital movement in the large American cities is typified in the medical centre in the City of New York, in which the Columbia university College of Physicians and Surgeons, Columbia University School of Dental and Oral Surgery, Presbyterian hospital, Sloane hospital for women, Squier Urological Clinic, Vanderbilt Clinic, The Babies' hospital, Neurological institute, State Psychiatric institute and hospital, Presbyterian Hospital school of nursing and the Harkness Pavilion for Private Patients have reconstructed their institutions on a single plot of ground, having jointly undertaken all the branches of medical teaching, research and care of the sick, their simultaneous constructional programmes involving $25,000,000.

Increase in Recent Years.—At the close of the year 1927 a complete census of all the hospital facilities in the United States, however owned and controlled and for whatever type of patient, showed that there were 6,807 hospitals. Of the total number of institutions of this character in the world, approximately 50% are in the United States. These hospitals provided a total of 895,279 beds, of which 41,961 were bassinets. This represents an increase of 59,000 beds and bassinets in two years. Of the total number specified 373,364 beds were devoted to the care of mental and nervous diseases,—an increase of 32,000 since 1925. This would seem to indicate that more than half of the increase in hospital beds in the past two years has been for mental cases. The total figures given for 1927 should be compared with those of 1914 which were: 5,037 hospitals with 532,481 beds.

There have been omitted from the foregoing figures 462 institutions with a bed capacity of 11,379 which, for one reason or another, have not come in the class of so-called "registered hospitals."

While the development of the large institutions has made unusual progress, the growth of the small institutions in the smaller communities seems to have a special significance and to be indicative of the popularisation of the hospital in the public mind. In 1920 44% of the 3,027 counties in the United States had community hospitals; the record for 1925 shows an increase to 56%. Nearly 52% of all the hospitals in the United States are of 40 beds or less. The close of 1927 finds recorded 408 new buildings planned, with $109,179,000 involved in a year's construction; the total value of hospital properties being variously estimated between $4,000,000,000 and $5,000,000,000.

In the year 1926 the 55 privately owned hospitals of all types in New York city receiving partial support from the United Hospital Fund reported 11,978 hospital beds of which 78% were used, 232,157 cases, 3,446,176 days of hospital care, the average number of days' stay being 14·1; treated 710,297 cases in out-patient departments and had a total of 2,616,226 out-patient department visits,—this being independent of the State and municipal hospitals in New York city. All types of hospitals in New York city, excepting those for the insane, proprietary and United States Government hospitals, provided 32,097 beds of which 76% were used, treated 519,222 patients and gave 8,881,763 days of hospital care, the average number of days' stay being 17; treated 1,151,871 cases in out-patient departments and had a total of 3,960,204 out-patient department visits.

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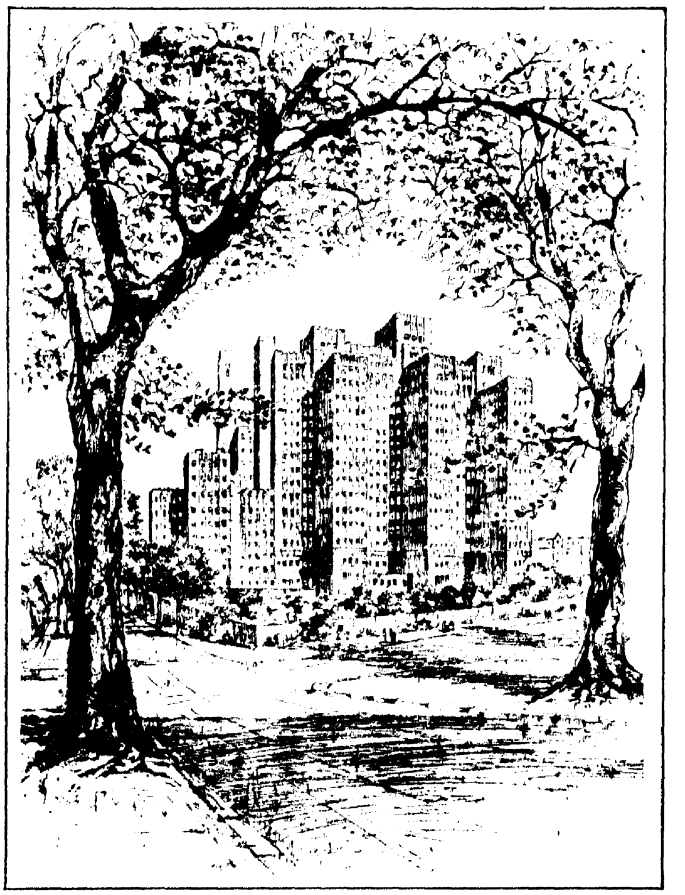
HOSPITAL PLANNING. The world-wide advance in medical science and public health in recent years has effected a similar growth in the scope of hospital work and the demand for adequate hospital service. The more varied and complex requirements of diagnosis, treatment and research, and medical and nursing education have also complicated the architectural problem. England, since 1926, has erected many new buildings—the Guardians at Manchester, the Woolwich Memorial and the Torquay General are good examples. Australia and New Zealand have advanced hospital programmes. In Scandinavia, the Ulleval Sykehauser in Oslo, Norway, is a noteworthy example of balanced hospital organization and architectural conception. Denmark, with its progressive social programme for public relief, has supplemented its widespread health insurance with exceptional hospitals. The Bispebjerg in Copenhagen, a group of charming vine-clad buildings in a spacious park, within and without, is one of the most beautiful modern institutions for the sick in the world. Holland and Sweden have many fine hospitals of post-war construction.

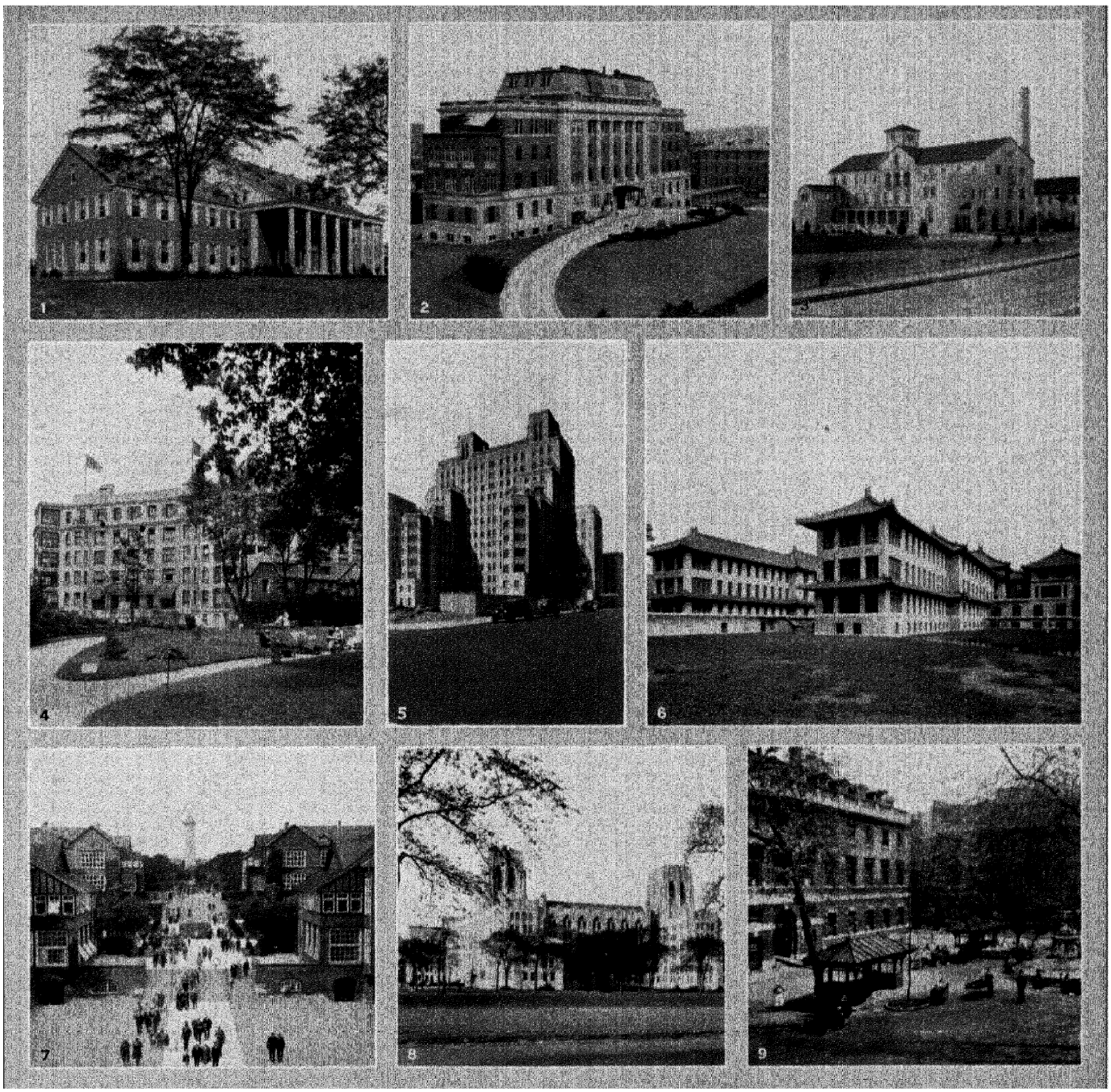


AFTER AN ETCHING BY A. SCHUTZ

NEW YORK MEDICAL CENTRE, AN EXAMPLE OF THE SKYSCRAPER HOSPITAL ARCHITECTURE THAT HAS BEEN DEVELOPED IN AMERICA

America, too, has contributed somewhat of its hospital experience to Europe. The maternity pavilion of the University of London hospital, a gift of the Rockefeller Foundation, is a fine example of dignified design. The American hospital in Paris transplants American organization, policies and standards, and its beautiful buildings represent an interesting architectural transition between the modern compact type of multi-storey hospital of the United States and the spacious Continental tradition. Western influence has likewise spread into the Orient. In China, the Peking Union Medical college, the Yale Medical school and hospital, the new Country hospital in Shanghai, and many splendid

HOSPITAL PLANNING



BY COURTESY OF (1) SAMUEL HANNAFORD AND SONS, (2, 7) CHARLES F. NEERGARD, (3) SCHMIDT, GARDEN AND ERIKSON, (5) JAMES GAMBLE ROGERS, ARCHITECT, (6) PEKING UNION MEDICAL COLLEGE; PHOTOGRAPHS, (4) CHEVOJON, (8) UNDERWOOD AND UNDERWOOD

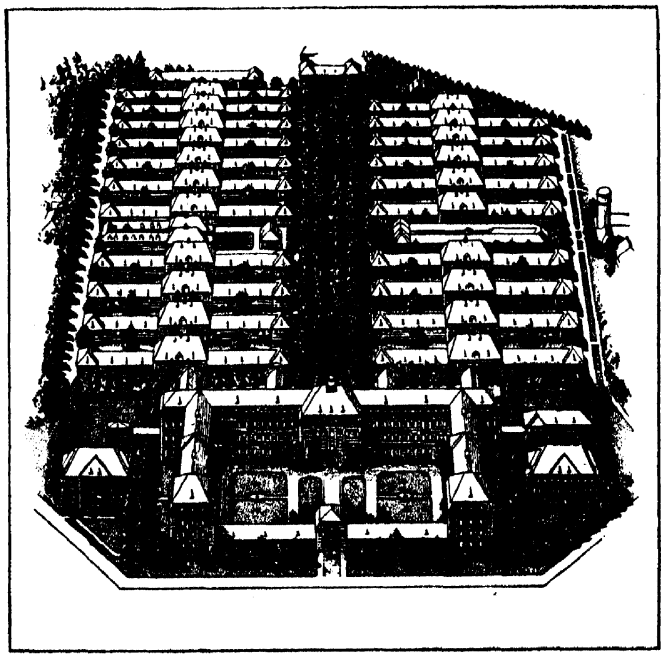
MODERN HOSPITAL ARCHITECTURE

1. Children's Home and Hospital, Covington, Kentucky. Samuel Hannaford & Sons, architects. Showing successful adaptation of domestic Colonial architecture to a small hospital
2. Carson C Peck Memorial Hospital, Brooklyn, New York. Ludlow and Peabody, architects. A hundred-bed community hospital, highly modern in its plan and equipment
3. The Ponca City Hospital of the Sisters of St. Joseph, Ponca City, Oklahoma, showing the influence of Spanish tradition. Schmidt, Garden & Erikson, Chicago, architects
4. American Hospital in Paris. Charles Knight, architect. An interesting combination of American and European types of design
5. The Neurological Institute, a unit of the Columbia and Presbyterian Medical Center in New York; a two-hundred-bed, self-contained building with nurses' home on the three upper floors. James Gamble Rogers, architect
6. Pekin University Medical College. Shattuck and Hussey, architects. Showing the adaptation of oriental architecture to modern hospital purposes
7. Bisperbjerg Hospital, Copenhagen. Martin Nyrop, architect. Famous for beauty of its architecture and the colour and charm of its interior
8. Billings Memorial Hospital, University of Chicago. Coolidge and Hodgdon, architects. Gothic in character to harmonize with the University group
9. St, Bartholomew's Hospital, London. "Barts," famous in English history and the Empire's oldest hospital. View of the Square

mission hospitals; in Japan the new St. Luke's, Tokyo, among others, harmonize the spirit of oriental architecture with modern hospital efficiency. Outstanding among the many new hospitals in India are the Mirraj hospital in west India, an American missionary institution, and the Neve Brothers' in the Vale of Kashmir, a private English enterprise.

In America itself the trend in hospital architecture has been away from the dreary institutional type to buildings symbolizing a greater aesthetic blending of warm colours in walls and furnishings; fire-proof construction is almost universal; in the mass the tendency is from the horizontal to the vertical, from the pavilion type of Europe to the multi-storey. The Rudolph Virchow hospital in Berlin, with some 36 two-storey pavilions housing more than 2,500 beds, and the Columbia Presbyterian Medical centre in New York, some 20 storeys high with 1,700 beds, represent the two poles.

Social and Economic Changes.—As a result of social and economic changes, the demands of the private and semi-private patient have come increasingly to the fore and brought about an administrative revolution. The public hospital, where poverty as well as sickness has been the basis for admission, is being supplemented by the community hospital where the patient is given such degree of privacy and individual attention as he needs or can afford. The economic middle class, requiring moderate-priced service with no stigma of charity, has become a large and important group. Since 1913 the cost of building hospitals in the United States has increased more than 100%, the cost of operation over 135%. This has made economy imperative, and challenged the ingenuity of the architect, engineer and hospital consultant. Hospitals of the past have been notorious in their extravagant proportions, with high ceilings, broad corridors and spacious rooms, frequently averaging from 10,000 to 12,000 cu.ft. for each patient bed. The compact hospital of to-day makes possible the accomplishment of more varied work with an average of from 7,500 to 9,000 cu.ft. per bed. The mechanical plant has been simplified; labour saving methods have been adopted from industry; more consideration is being given to economy in operation and maintenance.



THE RUDOLPH VIRCHOW HOSPITAL, BERLIN

The flexible plan of the modern hospital, with its small wards and semi-private rooms, represents a major step in operating economy; the broader scope of hospital service and the impelling necessity for economy have effected many radical changes in the traditional plan. The 24-bed ward with its service and utilities at one end no longer meets requirements. Instead, four, six and eight-bed wards, with doubled service units to save nursing effort, are becoming common. Beds must be arranged, yet without rigid lines, so that medical patients may be treated apart from the surgical, and maternity apart from both, with separate provision for the contagious, the noisy, the delirious and the dying. Formerly new patients were placed wherever there was a vacant bed. New practice, for convenience in nursing, groups the acutely ill together and places those recovering where they will not be disturbed by very sick neighbours. The modern hospital bed, which is easily and silently moved on its large casters, makes this possible.

The needs of the general service also are being more carefully studied, so that the nurse is not compelled to walk long distances to accomplish frequent routine tasks. With small wards a utility room seems justified for every ten patients. Nor is it generally realized how relatively small is the proportion of floor space devoted to the actual housing of patients. In one compact 100-bed hospital, out of a total available floor area of 62,000 sq.ft., less than 20% was used for patients' rooms, wards and solaria; 6% for professional units, operating, delivery and treatment rooms, laboratories and X-ray department; while the balance, 74%, was required for the general service—corridors, elevators, kitchen, laundry, engineer's department and housing of personnel. Ideal provision also calls for open porches and enclosed solaria to which all patients can be conveniently wheeled in their beds.

BIBLIOGRAPHY.—The best sources of information on hospital planning are the various magazines devoted to hospitals; among these may be mentioned *Hospital Management* and *The Modern Hospital* (Chicago), *Hospital Progress* (Milwaukee), and *The Hospital Gazette* (London). (*See* article HOSPITAL.) (C. F. N.)

HOSPODAR, a term of Slavonic origin, meaning "lord" (Russ. *gospodar*). It is a derivative of *gospod*, "lord," and is akin to *gosudar*, which primarily means "sovereign." In Little Russian the title *hospodar* is specially applied to the master of a house or the head of a family. The rulers of Walachia and Moldavia were styled *hospodars* from the 15th century to 1866. At the end of this period, as the title had been held by many vassals of Turkey, its retention was considered inconsistent with the growth of Rumanian independence. It was therefore discarded in favour of *domn* (*dominus*, "lord"), which continued to be the official princely title up to the proclamation of a Rumanian kingdom in 1881.

HOST. (1) One who provides another with lodging and entertainment (Lat. *hospes*, a guest or host). In biology, an animal or plant upon which a parasite lives. (2) An army, and generally any multitude (Lat. *hostis*, a stranger or enemy). In biblical use the word is applied to the company of angels in heaven; or to the sun, moon and stars. (3) The sacrifice of Christ's body and blood in the eucharist, the consecrated wafer used in the service of the mass in the Roman Church (from Lat. *hostia*, a victim or sacrifice). (*See* EUCHARIST.)

HOSTAGE, a person handed over by one of two belligerent parties to the other or seized as security for the carrying out of an agreement, or as a preventive measure against certain acts of war. The practice of taking hostages is very ancient, and has been used constantly in negotiations with conquered nations, and in cases such as surrenders, armistices and the like. The Romans were accustomed to take the sons of tributary princes and educate them at Rome, thus holding a security for the continued loyalty of the conquered nation and also instilling a possible future ruler with ideas of Roman civilization. This practice was also adopted in the early period of the British occupation of India, and by France in her relations with the Arab tribes in North Africa. The position of a hostage was that of a prisoner of war to be retained till the negotiations or treaty obligations were carried out, and liable to punishment (in ancient times), and even to death, in case of treachery or refusal to fulfil the promises made. The practice of taking hostages as security for the carrying out of a treaty between civilized states is now obsolete. The last occasion was at the treaty of Aix-la-Chapelle in 1748 when two British peers, Henry Bowers Howard, 11th Earl of Suffolk and Charles, 9th Baron Cathcart, were sent to France as hostages for the restitution of Cape Breton to France.

In modern times the practice may be said to be confined to

two occasions: (1) to secure the payment of enforced contributions or requisitions in an occupied territory and the obedience to regulations the occupying army may think fit to issue, (2) as a precautionary measure, to prevent illegitimate acts of war or violence by persons not members of the recognized military forces of the enemy (*See* REPRISALS.) The Franco-Prussian War of 1870–71 and the 2nd Boer War saw many instances of the holding of hostages while the Germans took the same precautions in invaded territory early in the World War

See W. E Hall, *A Treatise on International Law* (1880, 8th ed., by A. P. Higgins, 1924); F. L. Oppenheim, *International Law*, 2 vol. (1905–06, 4th ed, by A. D. McNair, 1926, etc)

HOSTE, SIR WILLIAM (1780–1828), British naval captain, was born on Aug. 26, 1780 at Ingoldsthorpe, and entered the navy in April 1793, under the special care of Nelson, who had a lively affection for him He served in the naval campaigns of the Napoleonic wars. His most brilliant feat was performed on March 13, 1811. A Franco-Venetian squadron of six frigates and five small vessels, under the command of a French officer named Dubourdieu, assailed Hoste's small force of four frigates near the island of Lissa. The French officer imitated Nelson's attack at Trafalgar by sailing down on the English line from windward with his ships in two lines But the rapid manoeuvring and gunnery of Hoste's squadron proved how little virtue there is in any formation in itself Dubourdieu was killed, one of the French frigates was driven on shore, and two of the Venetians were taken He died on Dec 6, 1828

See Lady Harriet Hoste, *Memoirs and Letters of Sir William Hoste* (2 vols. 1833, abridgment entitled *Service Afloat*, 1887).

HOSTEL, the old name for an inn (*see* HOSPITAL, *ad init.*); also employed at Oxford and Cambridge to designate the lodgings which were in ancient times occupied by students of the university. In some of the English public schools the "hostel" system provides the lodging accommodation under separate masterships.

HOSTIUS, Roman epic poet, probably flourished in the 2nd century B C He was the author of a *Bellum Histricum* in at least seven books, of which only a few fragments remain. The poem is probably intended to celebrate the victory gained in 129 B C. by Gaius Sempronius Tuditanus (consul and himself an annalist) over the Illyrian Iapydes (Appian *Illyrica*, 10; Livy, *epit.* 59). Hostius is supposed by some to be the "doctus avus" alluded to in Propertius (IV. 20, 8); the real name of Propertius's Cynthia, according to Apuleius (*Apologia* X) and the scholiast on Juvenal (vi. 7), being Hostia (perhaps Roscia).

Fragments in E. Bährens *Fragmenta poetarum Romanorum* (1884); A. Weichert *Poetarum Latinorum reliquiae* (1830).

HOSUR, town, British India, in the Salem district of Madras, 24 m. E. of Bangalore. Pop (1921) 5,519. It contains an old fort, frequently mentioned in the history of the Mysore wars. Close by is a large remount depôt.

HOT BLAST. The apparently insignificant idea, introduced by Neilson in 1828, of sending hot air instead of cold into a blast furnace created a revolution in smelting practice, for it enabled a much greater quantity of ore to be smelted for a given amount of fuel, while furnaces could be made of larger size than hitherto. The air temperature employed was at first low, but now ranges from about 650° F to 1,500° F Hot blast stoves for the heating were originally fired with coal, but now the waste gases from the furnaces are utilized by means of combustion chambers in the stoves. These are of regenerative type, tall structures containing a mass of brick checker-work.

Stoves vary considerably in regard to the interior arrangement. (*See* IRON AND STEEL)

HOTCH-POT or **HOTCH-POTCH,** in English law, the name given to a rule of equity whereby a person, interested along with others in a common fund, and having already received something in the same interest, is required to surrender what has been so acquired into the common fund, on pain of being excluded from the distribution. The same principle is to be found in the *collatio bonorum* of the Roman law: emancipated children, in order to share the inheritance of their father with the children unemancipated, were required to bring their property into the common fund It is also found in the law of Scotland.

HOTEL. There is no legal definition in Great Britain of the word "hotel," and the term is loosely applied to a wide variety of establishments having very little in common—to the more pretentious public-house and to the larger type of boarding-house, as well as to the luxuriously appointed, fully licensed house affording sleeping accommodation and catering facilities for hundreds of visitors.

The law recognizes the existence of houses licensed for the sale of intoxicating (or, in the Scottish terminology, "excisable") liquor; and recognizes, too, the existence of "inns" But a licensed house may or may not have sleeping accommodation, and an inn may or may not have a licence An inn has been judicially defined as "a house where a traveller is furnished with everything he has occasion for while on his way."

In the eyes of the British law, the proprietors and general managers of the greatest of modern luxury hotels are but "innkeepers," and the licence by virtue of which they conduct that part of their business concerned with the sale of liquor is the ordinary publican's licence This failure of the law to recognize the existence of the modern hotel and to differentiate between it and the public-house is bitterly resented by those who direct and conduct what, for want of an accurate term, we must call the legitimate hotel industry

The unsatisfactory state of the law in this respect has a direct and adverse bearing on the condition of the *bona fide* hotel industry of Great Britain. Both directly and indirectly the efficiency of the industry is impaired. Hotel operation is hedged about by antiquated laws and modern restrictions. The latter are, for the most part, legacies of the World War and of the Defence of the Realm Act regulations; the former are an anachronism, being laws passed centuries ago and framed to meet conditions infinitely removed from those which we know to-day. In the words of the earl of Bessborough, who is president of the Hotels and Restaurants Association, the law regards even the highest class of hotel as "little more than an inn and little less than a disorderly house"

Higher Status in America and Continental Europe.—In other European countries and in the United States the status of hotels is very much higher; and Governments have been quick to recognize the national importance of the industry, and the fact that highly efficient hotels are indispensable to the development of the ever-growing tourist traffic, and are closely associated with a country's commercial prosperity.

The direct bearing of unfavourable laws on the development of the hotel industry is seen in the discouragement to the investment of new capital in an enterprise so hampered by obsolete laws, and so much at the mercy of the casual occupants of licensing benches. By-laws, also, do not, for the most part, encourage hotel development in England. The limitation of building heights and the regulations which apply to bathroom design and to the placing of lavatories may be alluded to as typical of conditions which impose on British hotel construction more severe restrictions and heavier obligations than are encountered by hotel designers in America or elsewhere in Europe. When comparing British hotels with hotels in other lands these facts should not be overlooked; nor should it be forgotten that, in comparison with the hotels of the United States (which are in a class by themselves), the great majority of hotels in Great Britain are "elderly." It is much more difficult entirely to "modernize" an old hotel than to build a new one embodying all the most up-to-date ideas. On the other hand the cost of building is to-day so greatly in excess of pre-war charges that the old hotel—despite its lack of modernity—has a very big economic advantage over its new competitor. That fact again tends to discourage competitive building.

British provincial hotels suffer by comparison with the provincial hotels of France in their lack of hot and cold water laid on to the bedrooms and of central heating. The catering in the smaller and more remote British hotels is also frequently of poor quality by comparison. It is only fair, however, to bear in mind, when considering the former criticism, that, under a Government sub-

sidized scheme, French provincial hotels have of late years enjoyed special credits enabling them to spend large sums on reconstructions and on modernizing equipment. The Credit National Hôtelier, as it is called, is responsible very largely for the high rate of efficiency of the average French country hotel. No corresponding benefits are enjoyed by provincial hotels in Great Britain.

National Characteristics.—The leading authorities on the subject incline to the view that hotel design will continue to be influenced by the aim not to evolve a standard "international" form of hotel which would render the *de luxe* hotel in London an exact replica of those in Paris, New York, Berlin and Rome, but rather to develop national distinctions which are already apparent. Whereas the luxury hotels of France and Austria, for example, are of what is known as the "palace" type, aiming at sheer magnificence, and those of the United States are gigantic buildings designed for the mass ministration of standardized services, organized on highly scientific and largely mechanical lines, the ideal of the great British hotel is to reproduce, while greatly extending, the characteristic amenities of the private town mansion or country house, and to recapture its traditional air of culture, courtesy, quiet dignity and hospitality. Certain new hotels in Mayfair exemplify how successfully that ideal may be expressed by British architects and a management policy imbued with those principles.

The typical American hotel tends to become vaster and vaster. The 2,000 room caravanserai is succeeded by others of 3,000 rooms, and the accommodation of even those giant erections is already greatly exceeded by yet more recent building In Great Britain and Ireland the 500 room hotel is deemed a large one It is questionable whether the resources of any single hotel in Great Britain exceed 1,000 rooms; nor is any tendency towards building very much larger hotels apparent The huge American style of hotel is also unknown on the Continent of Europe. Anywhere in Europe a hotel containing as many as 600 rooms is regarded as very large indeed.

Kitchen Design.—There can be no uniformity in the lay-out of hotels, but certain widely approved principles may be noted. Ideally, the actual kitchen should, most hotel authorities are agreed, be on the top floor, both for hygienic reasons and to obviate any odour of cooking penetrating into the public or private rooms. Considerations of rapid and efficient service, however, incline the *chef-de-cuisine* to regard the ideal arrangement as being both kitchen and restaurant on the same level In point of fact all the kitchen departments are usually found in the basement, where the "brigades" work by artificial light and in conditions of artificial ventilation Economy of space on the floor devoted to the public rooms is the governing factor. A compromise is often effected by placing the kitchen in the basement, the dining room on the ground floor, and a service room adjacent, on the same level, and served directly by service lifts from the kitchen. Grill rooms are often placed in the basement.

The chef's domain, over which he rules as an autocrat, comprises not only the kitchen proper, but also the larder, pastry-cook's department, vegetable preparation corner, pantry, scullery and service room. Each sub-division of the kitchen proper, where are carried on the preparation of sauces, fish, roasts, etc , is in the immediate charge of a *chef-de-partie.* The lay-out of the kitchen department and the arrangement of the apparatus call for skilful and experienced treatment by the specialist kitchen engineer, in consultation with the chef, the aim being to secure the maximum co-ordination possible, visible to the chef's watchful eye, to keep check of all outgoings, to facilitate the work of the cooks, and to expedite the service to the dining room. Good ventilation and lighting are of prime importance.

Public Rooms in British Hotels.—Almost invariably, the ground floor of a modern hotel is divided between the vestibule, in which are placed the various offices, reception, cashier, hall porter, enquiry, etc., and a series of public rooms. There is increasingly noticeable a tendency for the elimination of corridors on the ground floor, and the arrangement of commodious lounges *en suite* with no dividing walls. The old style of separate drawing rooms, reading and writing-rooms and the rest, is rapidly becoming obsolete. The bar, if any, is, or should be, kept as separate as possible from the ordinary residential part of the hotel. Billiard-rooms are at a discount; and, except in definitely "commercial" hotels, travellers' stock-rooms and the old-time "commercial rooms" are becoming scarce. In the lay-out of the ground floor of a modern hotel revolving doors to the street, an installation of central heating in the entrance hall and public rooms, and provision for a passenger lift are indispensable features.

It is a well-established principle of hotel design to keep private rooms entirely apart from public rooms From the first floor upward the house is usually devoted entirely to private rooms and suites, with, of course, the necessary provision of bathrooms and lavatories, chamber maids' service rooms, and, usually, on the top floor, sleeping quarters for the resident staff.

Modern Bedroom Design.—Visitors' private accommodation is either in the form of single bedrooms or double bedrooms, or suites of rooms including a sitting-room and private bathroom. The proportion between the number of each of these classes of accommodation will depend on the class and style of hotel In double bedrooms there is a tendency to substitute "twin" single beds for the large double bed The well-equipped bedroom has, in addition to the usual furniture and fittings, a writing table, a telephone, electric lights over the dressing table and the bed, a radiator under the window and either a gas or electric fire controlled by a coin-meter, and a basin bracketed to the wall, with hot and cold water laid on. The last mentioned convenience, in particular, is coming to be regarded as a *sine qua non* in the modern hotel.

Bathrooms and Sanitary Equipment.—The American ideal of a private bathroom to every bedroom is impracticable in the majority of existing British hotels, although several recently built hotels in London are equipped in this manner There can be no doubt, however, that in many British country hotels the bathroom accommodation is insufficient. Where private bathrooms are provided it is usual to place a water-closet in the bathroom By-laws in many places, however, forbid the architect to allow the "complete" bathroom to lead directly out of a bedroom, thus necessitating the construction of a lobby into which both rooms must open Moreover, water-closets must be affixed to an external wall of the building, and bathrooms must be ventilated by being given direct access to the open air. The net result of these admittedly hygienic requirements is to confront the hotel owner who wishes to modernize an old hotel with a set of almost impossible conditions, compelling such a sacrifice of space where it is most valuable, that he simply cannot afford to make provision for numerous additional bathrooms On the European Continent the conditions imposed are much less onerous. The built-in tub bath and the "bidet" or sitz-bath are now found in the private bathrooms of leading British hotels.

Hotel Organization.—The organization scheme of a typical great modern hotel follows approximately the following lines. At the head is the managing director, the link between the executive officers and the board The manager is the chief executive officer of the organization; the assistant-manager helps and deputizes for him when required, but has no specified independent function. The organization is divided into three main departments, house, food, drinks All are controlled ultimately by the manager

House.—This comprises three distinct but related sub-departments, viz., reception; housekeeper; hall porter. The reception clerks are responsible for the letting of rooms, cash transactions, letters, keys, safe-deposits, enquiries, telephones, and keep all appropriate records The housekeeper is responsible for the condition of rooms, public and private, corridors and staircases, and all equipment in her department; she supervises bedroom service, valets, vacuum cleaning and window cleaning; controls the linen room, and orders supplies of linen and house cleaning material The hall porter supervises all uniformed staff, including footmen, liftmen, luggage porters, parcel porters, pages and cloakroom attendants.

Food.—The *chef-de-cuisine* is in charge of the kitchen and orders food supplies. The restaurant manager supervises the service for restaurant, grill room, floors and banqueting rooms, and orders supplies for those departments.

Drinks.—The cellar manager is responsible for stock of wines,

spirits and minerals; supervises service of the dispense bars and American bar, and orders supplies for those departments.

Directly responsible to the management on the administrative side are also the following special departments and services. These exercise control over, or perform services for, the house, food, or drinks departments.

Accounting—Keeping of visitors' accounts and general bookkeeping.

Control.—This department checks all bookkeeping; controls all financial transactions, checks all goods received; handles accounts with suppliers; takes periodically stock of food, drinks and equipment; places orders for supplies of food, drinks and equipment, stationery and printing; supervises receiving clerks, storemen and cashiers; and keeps all connected records

Engineering and Maintenance.—Responsible for mechanical plant; supervises electrician, plumber, carpenters, painters, upholsterers, French polishers, is responsible for maintenance of building and equipment; keeps all connected records; and orders supplies for these departments.

Staff Manager.—Engages staff, except where this function is performed directly by heads of departments, keeps all connected records

House Detective.—Protects house and guests' property; supervises firemen, watchmen and timekeepers

As illustrative of the complexity and comparative size of the organization of a big first-class hotel it may be mentioned that a hotel with accommodation for 500 visitors may have a staff of 600 or 700 employees.

Hotels and Social Life.—The place of the hotel in social life has increased greatly in importance As a rendezvous of business men, as a headquarters of conferences, as the setting for social gatherings and for "bazaars" and banquets, the well-appointed, well-managed hotel to-day enters very largely into the life and activities of the community Most first-class hotels have ballrooms, and dances and even cabaret performances are now normally provided for the entertainment, not only of their resident visitors, but of the general public. Orchestras of a high order play in the restaurant or lounge and for dancing; and by the wizardry of broadcasting they also provide free entertainment for millions of listeners who have neither the opportunity nor the means of seeking their amusement in a sumptuous hotel

See also INN; LICENSED VICTUALLER; RESTAURANT.

(W. B. CA.)

UNITED STATES

A hotel in America is defined as a residence building which is occupied as a temporary abiding place by individuals who seek lodging, with or without meals. The hotel building contains a general public dining room, a café or both, and a general kitchen. An apartment hotel is a building in which the apartments are rented in suites, usually for periods of not less than one month, and in which a common dining room may be provided Hotels never permit cooking or the preparation of food in their guest rooms. Apartment hotels on the other hand may provide within the living suite a small room for the preparation of meals. In America this is known as a kitchenette or pullman kitchen and is equipped with a stove, refrigerator, sink and storage space. Tenants of an apartment hotel look upon the building as their permanent home, and the introduction of commercial features is considered an intrusion tending to destroy its privacy and domestic qualities. The problems of designing apartment hotels are so different and so much simpler than those of transient or commercial hotels that they need not be considered here

Hotels may be classified as: (1) country and resort hotels, (2) club hotels, (3) working men's and working women's hotels, (4) community hotels, (5) hotels of 300 rooms or less, (6) hotels of 300 to 600 rooms, (7) hotels of more than 600 rooms.

Country and Resort Hotels.—This classification includes those catering entirely to a seasonal business. Their needs are highly specialized. In these days of enormous tourist shifts of population during seasons, a single management will operate seasonal hotels in the larger tourist centres in conjunction with hotels in the all-year centres. By shifting their employees, they are able to reduce overhead considerably during the off-season. Then there is the type of resort hotel depending entirely on the tourist seasons for its business and catering only to seasonal guests. By operating a chain of hotels, located entirely according to climate, the same help may be retained and sent from one hotel to another, thus avoiding the necessity of building up a new organization each season. From June to October, the management operates a hotel at some popular northern summer resort. The summer season over, this hotel is closed and the organization shifted to the far south or the northern winter resorts.

The summer resort hotel should be built where the location can be featured as an attraction. The guest bedrooms must be spacious and airy, ceilings high, corridors wide and public spaces large and roomy. Operation of this type of hotel includes a social manager who plans sight-seeing parties, dances, concerts, athletic meets and various other social functions much as on an ocean voyage. The country hotel is really an Apartment Hotel with club features such as accommodations for golf, tennis and other leisure sports.

Club Hotels.—This classification includes buildings that are primarily designed to give university, athletic or other clubs, society or fraternal bodies, both headquarters and sleeping rooms Fraternal organizations of a national character find that buildings of this type in the larger cities increase the friendliness of their members and help them to live congenially while visiting strange cities. Due to the club's other revenues, the rates of rooms to members are reasonable. Hotels in this classification can offer their members facilities that the commercial hotel cannot. Site and location are not essential and large profits are not expected, but membership dues are needed to assure the financial success of club hotels.

However, few club or fraternal hotel buildings can support themselves financially without additional revenue than that derived from bedrooms In transient hotels the public or non-revenue space rarely exceeds one-third of the total floor space of the building, while in the club hotel non-revenue producing spaces will frequently be 75% of the total area The prohibition law in the United States has taken away from Club Hotels one of their greatest sources of income. Non-religious clubs are able to augment income from card rooms, but this must not be confused with unlawful gambling. Hotels of the fraternal type cannot be big income producers, unless the guest bedrooms are sufficiently numerous to carry most of the financial fixed charges.

Working Men's and Working Women's Hotels.—Buildings designed to meet the requirements of people whose incomes are limited These hotels are graded according to the scale of wages of the middle class, and a worker can almost always find one of these hotels to suit his purse. In the higher class may be placed the Y.M.C.A, semi-philanthropic and kindred organizations Below these are the rooming or lodging houses, with the minimum of accommodations and containing the greatest possible number of rooms in the smallest space

The Y.M.C.A hotels are really modified club hotels. So much of their space is given over to club, social, and religious phases that it is very difficult for them to be self-supporting without outside financial aid. Bedrooms average 70 to 80 sq.ft. in area, and have a closet, but few rooms have private baths or private toilet facilities. Yearly membership dues and voluntary contributions help defray maintenance costs.

Under this classification may also be placed what is known as the "white collar" hotels. This type of building is highly successful financially. They contain almost all the usual conveniences of a transient hotel except a Ball Room and the larger open spaces. The rooms are comfortable, and average from 90 to 110 square feet. Numerous bath rooms are provided, though they are reduced in area to an absolute minimum. It is possible to place this type of building in close proximity to business centres and rent rooms at ten to fifteen dollars per week. The architecture is good and the maintenance is on a high plane.

Community Hotels and Hotels of 300 Rooms or Less.—Hotels of this class are grouped together in this article because their problems are identical. The community hotel is financed

by the citizens of the city in which it is to be placed, while the other may be privately financed to meet a community's special needs The committee in charge of building usually has in mind a hotel to meet certain local conditions, but beyond that point things are usually hazy and only an unbiased expert hotel consultant can suggest definite methods of procedure In general it may be said that no corner in any small city is too expensive for a community hotel Proximity to the railroad station is important but far more so are store rentals The more people that pass in front of the hotel the greater becomes the value of rental space. Street noises do not disturb the average guest No hotel has ever been known to close its doors because it was on the most prominent and busiest street It is advisable to consider the possibility of future expansion, and if land values are not prohibitive additional space should be purchased

The number of guest bedrooms depends on the number of similar modern hotel rooms already existent. Consideration must be given to the city's social activities and needs, and its recreational facilities It is unsound finance to project a hotel of this classification of less than one hundred guest bedrooms, or one in which the active income producing rooms do not equal a minimum of 65% of the total floor area.

Hotels of 300 to 600 Rooms.—In this class come those types of hotels that are in cities of a population up to 250,000 The problems involved are a combination of the community and the largest hotels

Hotels of More Than 600 Rooms.—This class of hotel is found only in the cities of large population where the competition is keen City and State building, zoning labour and other ordinances are continually confronted, limiting and designating the type of construction, light and air, courts and yards, fire regulations, and other similar restrictions The problems involved in the design of this type of hotel call for the highest skill for their solution and involve many difficult features

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HÔTEL DE VILLE, the town hall of a French municipality The most ancient example still in perfect preservation is that at St Antonin (Tarn-et-Garonne) dating from the middle of the 12th century Other fine town halls are those of Compiègne, Orléans, Saumur, Beaugency and St Quentin. The Hôtel de Ville in Paris, built in the 16th century, burnt by the Commune in 1871, has since been rebuilt on an extended site, the central portion of the main front being a reproduction of the old design. There is only one town hall in a French town, those erected for the mayors of the different arrondissements in Paris being called *mairies*. (*See* GOVERNMENTAL ARCHITECTURE)

HÔTEL-DIEU, the term applied in France to any hospital in the middle ages, now reserved to those whose history goes back to mediaeval times Many examples from the Gothic period still remain, notably that of Angers (1153–84), the so-called *salle des morts* at Ourscamps (early 13th century), and that of Tonnerre (*c.* 1300) In all of these, the most important feature is a vast hall in which were placed the beds for the sick. In the two earliest the hall is divided into three aisles by pillars and vaulted so that four rows of beds on either side of the pillars were possible. At Tonnerre the great hall, nearly 60 ft. wide and 300 ft. long, was roofed with wooden trusses and had a wooden barrel vault ceiling The beds were in little chambers along the sides, open to supervision from a gallery that ran continuously around the side-walls immediately below the window sills At Beaune, the Hôtel-Dieu, founded in 1443, is of quite different character, occupying three sides of a courtyard, in two storeys In addition to the halls for the sick, various other rooms for the use of the nuns were furnished. The whole is a picturesque Gothic timber construction.

HOTHAM, WILLIAM HOTHAM, 1ST BARON, cr 1797 (1736–1813), British admiral, son of Sir Beaumont Hotham (d 1771), was educated at Westminster School and at the Royal Naval Academy, Portsmouth He entered the navy in 1751 and served with distinction through the Seven Years' War In 1776, as a commodore, Hotham served in North American waters, and shared in the brilliant action in the Cul de Sac of St Lucia (Dec 15, 1778). In 1781, when he was sent home in charge of a large convoy of merchantmen, he fell in with a powerful French squadron off Scilly, against which he could effect nothing, and many of the merchantmen went to France as prizes In 1782 Hotham was with Howe at the relief of Gibraltar As Hood's second-in-command in the Mediterranean he was engaged against the French Revolutionary navy, and when his chief retired to England the command devolved upon him On March 12, 1794, he fought an indecisive fleet action, in which the brunt of the fighting was borne by Captain Horatio Nelson, and some months later, now a full admiral he again engaged, this time under conditions which might have permitted a decisive victory; of this affair Nelson wrote home that it was a "miserable action" He died in 1813

See Charnock, *Biographia navalis*, vi 236

HOTHOUSE: *see* HORTICULTURE

HOTI-MARDAN or **MARDAN,** a frontier cantonment of British India in the Peshawar district of the North-West Frontier Province (*q.v.*), situated 15 m. N of Nowshera Pop (1921), 10,930 It was long famous as the permanent headquarters of the Corps of Guides, now placed in the Line of the Army

HOTIN, a fortified town and capital of a department of Bessarabia, Rumania, situated on the right bank of the Dniester, on the frontier of the Ukraine and near that of Poland Pop (1928) 19,400 Hotin possesses manufactures of leather, candles, beer, shoes and bricks, and does an export trade in local products, but its main importance has always been as a military post defending a much-frequented crossing of the Dniester It was a mediaeval Genoese colony, and has been held by Moldavians, Poles, Austrians, Russians and Turks The population of the department of Hotin is mainly Ukrainian

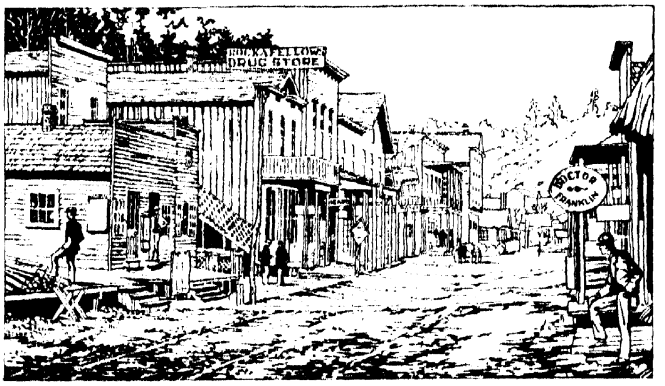
HOTMAN, FRANÇOIS (HOTOMANUS) (1524–1590), French jurist, was born on Aug 23, 1524, in Paris, of a family of Silesian origin He took his doctorate in law at Orleans practised for some time at the Paris bar, and in 1546 became professor of Roman law in the university But in 1547 he was converted to the Reformed church, and left Paris for Lausanne, where, on the recommendation of Calvin he became professor of belles-lettres and history, and married Claudine Aubelin, a Huguenot refugee Returning to Geneva in 1584 he dabbled in alchemy and the research for the philosopher's stone He died in Basle on Feb 12, 1590, and was buried in the cathedral

Hotman did much for 16th-century jurisprudence, having a critical knowledge of Roman sources, and a fine Latin style He broached the idea of a national code of French law His numerous works include *De gradibus cognationis* (1546), *Anti-Tribonien* (1567), a treatise arguing that French law could not be based on Justinian, a life of Coligny (1575); *Brutum fulmen* (1585), a polemic directed against a bull of Sixtus V. His most important work, the *Franco-Gallia* (1573), was in advance of his age, and found favour neither with Catholics nor with Huguenots in its day; yet its vogue has been compared to that obtained later by Rousseau's *Contrat Social* It presented an ideal of Protestant statesmanship, pleading for a representative government and an elective monarchy It served the purpose of the Jesuits in their pamphlet war against Henry IV

See R. Dareste, *Essai sur F Hotman* (1850), Blocaille, *Étude sur François Hotman* (1902).

HOT SPRINGS, a city of Arkansas, U S A, at the eastern base of the Ozark mountains. 55m W S W of Little Rock. It is on Federal highway 70, is served by the Rock Island and the Missouri Pacific railways; and has a municipal airport The resident population was 11,695 in 1920 (24% negro), and was estimated locally at 23 000 in 1928 The transient population numbers 300 000 in the course of a year The city lies amid scenery of great beauty, and the climate is delightful The environing hills reach an altitude of 1,200ft above the sea The economic

life of the city is centred in providing for the thousands of visitors who come seeking health or recreation. On the border of the city is the Hot Springs National park, a tract of 912ac. enclosing all the 46 curative hot springs which issue from the slope of Hot Springs mountain, and many cold-water springs also of medicinal value. There are 9 bath-houses on "Bath-House Row" and 12 more in the city all under government regulation, and the govern-



BY COURTESY OF THE NATIONAL PARK SERVICE

VIEW OF CENTRAL AVENUE, HOT SPRINGS, IN THE EARLY DAYS OF WESTWARD EXPANSION

ment maintains an army and navy general hospital in the reservation. The waters are tasteless and odourless, and contain over 20 chemical constituents. Tradition says that their curative properties were known to the Indians long before the Spanish explorations; that they warred for their possession, finally making an agreement whereby all tribes had access to them. Probably the springs were known to De Soto. They were visited about 1800 by French hunters, and by members of the Lewis and Clark expedition in 1804, under instructions from President Jefferson. Permanent settlement here began in 1828. In 1832 Congress created a reservation (classified as a National park since 1921) to prevent exploitation of the healing waters for private gain, but litigation ensued, which was not ended until the U.S. Supreme Court made its decision in 1876. Hot Springs was incorporated as a town in 1876; was almost destroyed by fire in 1878; and was chartered as a city in 1879. In the suburbs are an alligator farm and an ostrich farm.

HOT SPRINGS, a village of Bath county, Va., U.S.A., near the western boundary of the State, in a lovely valley of the Allegheny mountains, 2,200ft. above sea-level. It is served by the Chesapeake and Ohio railway. The population was about 1,100 in 1928. It has long been a health and pleasure resort. The medicinal springs contain magnesia, soda-lithia and alum, and some of them have a temperature as high as 106°F. Other resorts in the vicinity are Warm Sulphur Springs (98°F), 5m. N.; Healing Springs (85° F), 2·5m. S.; and Rockbridge and Jordan Alum Springs, a few miles south-east.

HOTTENTOTS, a nomadic pastoral people inhabiting the western half of South Africa. They are closely allied to the Bushmen (*q.v.*) in racial characteristics and in language, but seem to have been affected in culture and in certain features of language by Hamitic admixture. They comprise a number of tribes, each occupying its own territory under its own chief. They all keep cattle and sheep, and also practise hunting. Socially they are organized into exogamous patrilineal clans, and they practise cross-cousin marriage. Their religion consists mainly in the worship of mythical heroes, derived partly from animistic beliefs and partly from the personification of the natural forces producing rain.

See L. Schultze, *Aus Namaland und Kalahari,* 1907. (I. S.)

LANGUAGE

Hottentot is the name given by Europeans to the languages known to their speakers as Nama, !Kora, etc., to the number of 14 or 15 subdivisions of the main Hottentot speech. Of these, the Nama is the most important and will be taken as illustrating all the others.

The Hottentot tongue has the five vowels *a e i o* and *u*. They are long and short; when a small circle appears below a vowel (ọ) the letter is almost elided in pronunciation. The consonants are as in English without *c,q,v,x,* a true *d, l, f, y,* and a true *r;* there are compound letters *gh* and *kh* and the sound represented usually by *r* is one intermediate between *l, d* and *r*. Vowels are nasalized by the mark ¯ written above them.

The outstanding characteristics of the Hottentot languages are (*a*) the presence of clicks (*q.v.*), (*b*) the monosyllabic nature of the vocabulary and (*c*) the presence of tones (*q.v.*). The clicks are represented in most works hitherto published by the following signs: / (dental, old *c*); ≠ (palatal, old *v*); ! (cerebral, old *q*); // (lateral, old *x*). These clicks are initial and begin 75% of the Hottentot words.

The languages are remarkably regular and the nouns show considerable latitude in their origin. Word-building is simple and regular; gender is marked by the terminal letter, *e.g.,* masc. *-b,* (*Khoib,* a man); fem. *-s* (*Khois,* a woman); com. *-i* (*Khoii,* a person), etc. Nouns have singular, dual and plural forms and undergo declensions for objective and vocative cases only. Adjectives are not inflected and can be formed from nouns.

Numeration is decimal and the first ten numbers are; (1) */gui,* (2) */gam,* (3) *!nona,* (4) *haga,* (5) *goro,* (6) *!nani,* (7) *hũ,* (8) *//khaise,* (9) *goisi,* (10) *disi.* The form *disi* for ten is interesting to the Indo-Aryan philologist.

The languages are rich in pronouns and have suffixed forms in singular, dual and plural, in masc., fme. and common genders. The verb is simple, the root is the infinitive; */nam,* to love; *mũ,* to see; *!ku,* to go. The relative form is made by the addition of *-ba* to the root *//nãu* to hear, *//nãuba,* to hear for somebody, etc. The reflexive adds *-sin, //nãu-sin,* to hear oneself; the causative adds *-kei, //nãu-kei,* to cause to hear; the reciprocal adds *-ku, // nãu-ku,* to hear one another; the diminutive adds *-ro,//nãu-ro,* to hear a little; the negative is formed by adding *-tama, -dama, //nãu-tama,* not to hear; the potential adds *-//kha, //nãu-//kha,* to be able to hear, and the optative adds, *-≠kau, //nãu-≠kau,* to wish to hear.

The verb has present, past, perfect, pluperfect, future and future perfect tenses. There are no irregular verbs and no exceptions to grammatical rules.

Adverbs, prepositions, conjunctions and interjections are numerous and are not declined. Adverbs of manner are especially numerous and are largely derived from adjectives. *See* C. Meinhof, *Lehrbuch der Nama-Sprache* (1909). *See* BUSHMAN LANGUAGES. (A. N. J. W.)

HOUBRAKEN, JACOBUS (1698–1780), Dutch engraver, was born at Dort, on Dec. 25, 1698, the son of Arnold Houbraken (1660–1719). In 1707 he settled in Amsterdam. He commenced the art of engraving by studying the works of Cornelis Cort, Suyderhoef, Edelinck and the Visschers. He devoted himself almost entirely to portraiture. Among his best works are scenes from the comedy of *De Ontdekte Schijndeugd,* executed in his eightieth year, after Cornelis Troost, who was called by his countrymen the Dutch Hogarth. He died on Nov. 14, 1780.

See A. Ver Hull, *Jacobus Houbraken et son oeuvre* (Arnhem, 1875), in which 120 engraved works are fully described.

HOUDENC or **HOUDAN, RAOUL DE,** 12th-century French *trouvère,* takes his name from his native place, generally identified with Houdain (Artois), though there are other places bearing the name in one or other of its variants. It seems probable that he followed the trade of jongleur and recited his chansons in the houses of the great. He seems to have spent a great part of his life in Paris. His undoubted works are *Le Songe d'enfer, La Voie de paradis, Le Roman des eles* (pr. by A. Scheler in *Trouvères belges,* new series, 1897) and the romance of *Méraugis de Portlesguez,* edited by M. Michelant (1869) and by Dr. M. Friedwagner (Halle, 1897). Houdenc was an imitator of Chrétien de Troyes; and Huon de Méri, in his *Tournoi de l'antéchrist* (1226), praises him with Chrétien in words that seem to imply that both were dead.

See Gaston Paris in *Hist. litt. de la France,* xxx. 220–237; W. Zingerlé, *Über Raoul de Houdenc und seine Werke* (Erlangen,

1880); and O. Boerner, *Raoul de Houdenc. Eine stilistische Untersuchung* (1885).

HOUDETOT, a French noble family, taking its name from the lordship of Houdetot, between Arques and St. Valéry. Louis de Houdetot went with Robert, duke of Normandy, to Palestine in 1034, and the various branches of the family trace descent from Richard I. de Houdetot (*fl* 1229), who married Marie de Montfort. Charles Louis de Houdetot received a marquisate in 1722, and on his son Claude Constance César, lieutenant-general in the French army, was conferred the hereditary title of count in 1753. His wife (*see* below) was the Madame de Houdetot of Rousseau's *Confessions*. Their son César Louis Marie François Ange, comte de Houdetot (1749–1825), was governor of Martinique (1803–1809) and lieutenant-general (1814) under the Empire. His son Frédéric Christophe, comte de Houdetot (1778–1859), was director-general of indirect imposts in Prussia after Jena, and prefect of Brussels in 1813. He acquiesced in the Restoration, but had to resign from the service after the Hundred Days. He became a peer of France in 1819, and under the Second Empire he was returned by the department of Calvados to the Corps Législatif.

HOUDETOT, ELISABETH FRANCOISE SOPHIE DE LA LIVE DE BELLEGARDE, Comtesse de (1730–1813), married the comte de Houdetot (*see* above) in 1748. In 1753 she formed with the marquis de Saint Lambert (*q.v.*) a connection which lasted till his death Mme. de Houdetot has been made famous by the chapter in Rousseau's *Confessions* in which he describes his unreciprocated passion for her When questioned on the subject she replied that he had much exaggerated. A view differing considerably from Rousseau's is to be found in the *Mémoires* of Mme. d'Épinay, Mme. de Houdetot's sister-in-law

See Bussenoir, *La comtesse d'Houdetot* (1901).

HOUDON, JEAN ANTOINE (1740–1828), French sculptor, was born at Versailles on March 18, 1740. At the age of twelve he entered the École Royale de Sculpture, and at twenty, having learnt all that he could from Michel Ange Slodtz and Pigalle, he carried off the Prix de Rome and left France for Italy, where he spent the next ten years of his life. His brilliant talent, which seems to have been formed by the influence of that world of statues with which Louis XIV. peopled the gardens of Versailles rather than by the lessons of his masters, delighted Pope Clement XIV., who, on seeing the "St. Bruno" executed by Houdon for the church of S Maria degli Angeli, said "he would speak, were it not that the rules of his order impose silence." In Italy Houdon had lived in the presence of that second Renaissance with which the name of Winckelmann is associated, and the direct and simple treatment of the "Morpheus" which he sent to the Salon of 1771 bore witness to its influence.

Houdon executed busts of Catherine II., Diderot and of Prince Galitzin which were remarked at the Salon of 1773; and at that of 1775 he produced, not only his "Morpheus" in marble, but busts of Turgot, Gluck (in which the marks of smallpox in the face were reproduced with striking effect) and Sophie Arnould as Iphigeneia (now in the Wallace Collection, London), together with his well-known marble relief, "Grive suspendue par les pattes." He took also an active part in the teaching of the academy, and executed for the instruction of his pupils the celebrated Écorché still in use. To every Salon Houdon was a chief contributor; most of the leading men of the day were his sitters; his busts of d'Alembert, Prince Henry of Prussia, Gerbier, Buffon (for Catherine of Russia) and Mirabeau are remarkable portraits; and in 1778, when the news of Rousseau's death reached him, Houdon started at once for Ermenonville, and there took a cast of the dead man's face, from which he produced the grand and life-like head now in the Louvre. In 1779 his bust of Molière, at the Théâtre Français, won universal praise. The draped statue of Voltaire, in the vestibule of the same theatre, was exhibited at the Salon of 1781, to which Houdon also sent a statue of Marshal de Tourville, commissioned by the king, and the "Diana" executed for Catherine II This work was refused; the jury alleged that a statue of Diana demanded drapery; without drapery, they said, the goddess became a *suivante de Vénus*, and not even the proud and frank chastity of the attitude and expression could save the "Diana" of Houdon (a bronze reproduction of which is in the Louvre) from insult

Three years later Houdon made an important visit to America, there to carry out a statue of Washington. With Franklin, whose bust he had recently executed, Houdon left France in 1785, and, staying some time with Washington at Mount Vernon, he modelled the bust, with which he decided to go back to Paris, there to complete the statue destined for the capitol of the State of Virginia. After his return to his native country Houdon executed for the king of Prussia, as a companion to a statue of "Summer," "La Frileuse," a naive embodiment of shivering cold, which is one of his best as well as one of his best-known works The Revolution interrupted the busy flow of commissions, and Houdon took up a half-forgotten project for a statue of S Scholastica He was immediately denounced to the Convention, and his life was saved only by his instant and ingenious adaptation of S Scholastica into an embodiment of Philosophy. Under Napoleon, of whom in 1806 he made a nude statue now at Dijon, Houdon received little employment; he was, however, commissioned to execute the colossal reliefs intended for the decoration of the column of the "Grand Army" at Boulogne (which ultimately found a different destination); he also produced a statue of Cicero for the senate and various busts, amongst which may be cited those of Marshal Ney, of Josephine and of Napoleon himself, by whom Houdon was rewarded with the Legion of Honour He died in Paris on July 16, 1828.

See Hermann Dierks, *Houdons Leben und Werke* (Gotha, 1887); H. Giacometti, *Le statuaire J A Houdon et son époque* (1918–19).

HOUFFALIZE, a small town nearly 1,100 ft above sea level in the extreme south-east of the province of Luxemburg, Belgium. It is a summer resort with fine bracing air There are the ruins of an old castle, and some remains of the still older abbey of Val des Ecoliers The parish church dates from the 13th or 14th century. Houffalize is on the eastern Ourthe, and is connected by tramway with Bourcy on the line of Libramont to Bastogne, Spa and Liége Pop (1920) 1,355

HOUGHTON, ALANSON BIGELOW (1863–), American diplomat, was born at Cambridge, Mass., on Oct 10, 1863. He was educated at Harvard (B A 1886), subsequently studying at Göttingen, Berlin and Paris He associated himself with the Corning Glass Works, N Y., in 1889, becoming successively vice-president and president, and, in 1918, chairman of the board of directors. He was elected a member of Congress in 1919 and re-elected in 1921, resigning in 1922 on his appointment by President Harding as U S ambassador to Germany, a position which he held until 1925, when he was appointed ambassador to Great Britain in succession to F B. Kellogg. In 1928 he was nominated Republican candidate for senator of the State of New York

HOUGHTON, ARTHUR BOYD (1836–1875), English illustrator and engraver, was the leader of a group of artists who drew their inspiration from the pre-Raphaelite movement in its second period The bulk of his work is in black and white, although he also painted. He was the son of Captain M Houghton.

He is among the first British artists to give a vivid and colourful interpretation of the mystery and poetry of the East His line is delicate, direct, and sure, and his illustrations full of dramatic power and imagination From boyhood he had the sight of one eye only, and he suffered considerably from the weakness of the other In spite of this disability he was a quick and tireless worker, drawing invariably straight upon the wood with a wonderful knowledge of the engraver's technique. The British Museum and the Art gallery of Melbourne both possess one engraved woodblock by the master. The Victoria and Albert museum contains one oil picture, "Don Quixote," and two water-colours, "An Oriental with Performing Monkeys" and "The Transformation of King Beder"; also a number of drawings The Tate gallery has an oil picture, "Punch and Judy"

See *Arthur Boyd Houghton, A Selection from his Work in Black and White*, with introd by Laurence Housman 1896

HOUGHTON, RICHARD MONCKTON MILNES, 1ST BARON (1809–1885), English poet and man of letters, son of Robert Pemberton Milnes, of Fryston Hall, Yorkshire, and the Hon Henrietta Monckton, daughter of the fourth Lord Galway, was born in London and educated privately and at Trinity college, Cambridge There he became a member of the famous "Apostles" Club, which then included Tennyson, Hallam, Trench and others. After taking his degree, Milnes travelled in Germany, Italy and Greece. He returned to London in 1837 and was in that year elected M P for Pontefract. In the House of Commons he interested himself particularly in the question of copyright and the conditions of reformatory schools He left Peel's party over the Corn Law controversy, and joined Palmerston, at whose instance he was made a peer in 1863. His chief title to remembrance rests on the part he played in moulding public opinion on literary matters and on the assistance he gave to many young writers. He secured a pension for Tennyson, helped to make Emerson known in Great Britain, and was one of the earliest champions of Swinburne. He helped David Gray (*q.v.*) and wrote a preface for *The Luggie*. Milnes married in 1851 the Hon Annabel Crewe (d. 1874). He died at Vichy on Aug. 11, 1885 His son, the second Baron Houghton, was created earl of Crewe (*q.v.*) in 1895

See Sir T. Wemyss Reid, *The Life, Letters and Friendships of Richard Monckton Milnes, first Lord Houghton* (1890).

HOUGHTON, WILLIAM STANLEY (1881–1913), English playwright, was born at Ashton-upon-Mersey, Cheshire, on Feb 22, 1881, and was educated privately and at the Manchester grammar school. He became a cotton-broker, employing his leisure in dramatic criticism for the *Manchester Guardian*, and in writing plays *The Dear Departed* was played in Manchester on Nov. 2, 1908, and afterwards in London In 1912, with the success of *Hindle Wakes*, which had a long run in London, he left his business career and went to London, settling in Paris in the following year. His other plays include *The Younger Generation* (1910), *The Master of the House* (1910), *Trust the People* (1911), *Fancy-Free* (1911) Houghton's early death in Manchester on Dec. 11, 1913 cut short a career of much promise. His *Works* were edited by H Brighouse in 1914

HOUGHTON, a town of Michigan, U S A, in the productive copper region of the Upper Peninsula, on Portage Lake, opposite Hancock, a port of entry, the county seat of Houghton county, and the seat of the Michigan school of mines (opened 1886). It is on Federal highway 41, and is served by the Chicago, Milwaukee, St. Paul and Pacific, the Copper Range, the Duluth, South Shore and Atlantic, and the Mineral Range railways, and by steamboats through the Portage Lake ship-canal. The population was 4,466 in 1920 (82% native white) and was estimated locally at 5,000 in 1928 Houghton was founded in 1841 and incorporated in 1867.

HOUGHTON-LE-SPRING, market town, urban district, in the Houghton-le-Spring parliamentary division, Durham, England, 6 m north-east of the city of Durham. Pop. (1921) 10,203 It is situated at the head of a small tributary of the Wear. St Michael's church is an Early English and Decorated building, with an embattled rectory. Bernard Gilpin was rector from 1556 to 1583, and founder of the grammar school Houghton Hall is a fine mansion of the late 16th century. The main road from Durham to Sunderland here passes through a cutting in the limestone 80 ft. deep. The population is mainly dependent on the neighbouring collieries, and on limestone quarrying.

HOUMA, a city of southern Louisiana, U.S A., on Bayou Terrebonne, 50m S.W. of New Orleans, in a natural gas field; the parish seat of Terrebonne parish. It is served by the Southern Pacific railway and by water transportation. The population was 5,160 in 1920 (27% negroes) and was estimated locally at 7,600 in 1928. It is primarily an agricultural centre (sugar-cane and potato crops predominating), and is a large muskrat-fur market. It has shrimp, oyster and vegetable canneries, a cypress planing-mill and an oyster-shell crushing plant. Three-fourths of the world's supply of dried shrimp comes from the parish. Houma was founded about 1810, was incorporated in 1846, and became a city in 1898. The name is an Indian word, meaning "mound."

HOUND, a dog; now used only of dogs of the chase, and especially of fox-hounds Other breeds have a defining word prefixed; *e.g.*, boar-hound, stag-hound, etc. (*See* Dog)

HOUND'S-TONGUE (*Cynoglossum*), a widely distributed genus of the family Boraginaceae, including several species native to Great Britain and North America The common hound's-tongue or gypsy flower (*C. officinale*), a native of Europe and Asia and found in waste grounds in the British Isles, is widely naturalized as a weed in eastern North America. It is an erect biennial, 1½ ft to 3 ft. high, with large, oblong, pointed leaves, purplish-red flowers, ¼ in across, and a conspicuous burlike fruit, which splits into four prickly nutlets. The wild comfrey (*C. virginianum*) or dog-bur, native to woods in the south-eastern United States, is a similar but slenderer plant with blue flowers. The western hound's-tongue (*C. grande*), also with blue flowers, grows in woods from California northward to Washington. (*See* BORAGINACEAE and FLOWER)

HOUNSLOW, a town in Middlesex, England, 12½ m W. by S of St Paul's Cathedral, London Pop. (1921) 23,506 It is a residential suburb of London at the junction of two great roads from the west of England and was an important coaching station. A priory of friars of the Holy Trinity was founded at Hounslow in 1296 Hounslow Heath had, according to the survey of 1546, an area of 4,293 ac. It was the site of Roman and British camps and a few centuries ago was a resort of highwaymen In 1784 the base-line of the first trigonometrical survey in England was laid down on the heath It began to be enclosed towards the end of the reign of George III In Osterley Park, north-east of Hounslow, Sir Thomas Gresham built a mansion in 1577, and this was rebuilt about 1770 Hounslow is divided between the parishes of Heston and Isleworth. Pop. (1921) of this urban district, 46,664

HOUR, the 24th part of a civil day, a space of time of 60 minutes' duration The word is derived through the O.Fr. *ure*, from Lat *hora*, Gr ὥρα, season (*see* CALENDAR).

HOUR ANGLE, the angular distance of a heavenly body from the meridian, as measured around the celestial pole. It is equal to the angle at the pole between the hour circle through the body and the meridian, but is usually expressed in time.

HOUR-GLASS, a device for measuring intervals of time, also known as sand-glass, and as log-glass when used in conjunction with the common log for ascertaining the speed of a ship. It consists of two pear-shaped bulbs of glass, united at their apices and having a minute passage formed between them A quantity of sand (or occasionally of mercury) is enclosed in the bulbs, and the size of the passage is so proportioned that this sand will completely run through from one bulb to another in the time it is desired to measure—*e.g.*, an hour or a minute. Instruments of this kind, which have no great pretensions to accuracy, were formerly common in churches. In the British House of Commons, as a preliminary to a division, a two-minute sand-glass is still turned, and while the sand is running the "division bells" are set in motion in every part of the building, to give members notice that a division is at hand.

HOURI, the term for a beautiful virgin who awaits the devout Muhammadan in Paradise The word is the French representative of the Pers. *ḥūrī*, Arab. *ḥawrā'*, a black-eyed virgin, from *ḥawira*, to be black-eyed, like a gazelle. *See* J. Horovitz, *Das koranische Paradies* (1923, bibl)

HOURS, CANONICAL, certain portions of the day set apart by rule (canon) of the church for prayer and devotion. The Jewish custom of praying three times a day, *i.e.* at the third, sixth and ninth hours, was perpetuated in the early Christian Church (Acts ii. 15, iii. 1, x. 9), and to these were added midnight (when Paul and Silas sang in prison), and the beginning of day and of night. Ambrose, Augustine and Hilary commended the example of the psalmist who gave praise "seven times a day" (Ps. cxix. 164). The seventh (Compline, *Completorium*) was added by Benedict. These hours were adopted especially in the monasteries as a part of the canonical life, and spread thence to the cathedral and collegiate chapters.

Since the 6th century the number and order of the hours have

been fixed thus: matins, lauds, prime, terce, sext, none, vespers, compline *See* BREVIARY

HOURS OF LABOUR. The apprentice of the middle ages was bound under the terms of his indenture to obey his master in all things and to devote, if need be, all his time to his master's interests. When he became a journeyman he was little better off, except that he was free to seek a less exacting master at times, which as apprentice he was not But in general the only restrictions on the working hours of either journeyman or apprentice were the possibilities of the physical body and the absence of an adequate artificial light, and the only alleviations were the frequent holy days (much restricted later as holidays)

The advent of the factory system at once intensified the evil and initiated the revolt against it. Soon after the grouping of workers in factories came first the machine, which had no special reason for ceasing to work at any point of the 24-hour day, and then a satisfactory artificial light It was probably the invention of gas and its use in factories which precipitated the movement for restricting the working day

The revolt began not with, but for, the victims The factory system massed together machines and *children*, with effects well-known to the student of the early 19th century in England There was no cry from them; they were dumb in their factory prisons They were plentiful in the workhouses of the agricultural south, whence they were taken by lorry loads to the industrial north, there was no particular economic reason for conserving them, the supply was ample

It was for the children that the cry was made, by Shaftesbury, Oastler and others The movement was in its first stages purely humanitarian, seeking to ameliorate the lot of the factory lads and lassies It was slow in action "Laissez-faire" economic doctrine questioned the wisdom of interfering with "the laws of supply and demand", the children came from that stratum of society that as yet was hardly recognised as a part of the nation in a political or social sense, and there remained the hard fact that a machine can run 24 hours a day, and that when it does not it represents waste

The humanitarian appeal was heard, however, and in the early 19th century the hours of children in factories were restricted by law, and somewhat later, those of women also, though these, being adult, and capable of the "free bargaining" that was considered to be so important a factor in securing the most fruitful economic results, were legislated for with much hesitation As for men, they remained outside the scope of restrictive legislation until the century was three-quarters through.

Not that they had waited for legislation. The factory system and large scale industry had rendered them service in getting them together; they became vocal and unitedly powerful, and their defensive trade union movement took new roots and a new orientation From the first they protested against the long working day, and by the thirties had formulated (largely under Robert Owen's influence) their demand for 8 hours From then onwards the movement kept the 8-hour day in the forefront of its programme, both in Great Britain and on the Continent. Progress, however, was slow until public opinion had been educated firstly by a gradual realisation of the importance of the social welfare of the working portion of the community, and secondly, by the experience of the World War of 1914–18 This latter gave an enormous impetus to the movement, and the expressed ideals of the workers as to the hours of labour were very rapidly approached in the years following 1914. This was due to three causes in the main Firstly, the workers realised as never before their importance in the community, and the community as a whole realised it; consequently, their demands fell on less inattentive ears. Secondly, the huge demands made upon labour brought into high relief a matter hitherto little considered, namely, the necessity of husbanding labour resources; though some thought had been given to the question of productivity in relation to working hours, it was only now for the first time that the question of preserving the labour available and making the most economic use of it became a serious problem Hours of labour, after being inordinately lengthened after the outbreak of war, were later reduced to limits calculated to conserve the efficiency of labour, and the doctrine that production varied directly with hours was definitely killed. In its place in general acceptance came the notion, often previously advocated, it is true, that the efficiency of labour depended upon the general welfare of the workers, and in that general welfare the daily working hours played a large part

The rapidity of the change in opinion may be illustrated from the resolutions of international congresses interested in the question Down to 1913, international conferences of workers and the successive Socialist internationals adopted resolutions calling in general terms for the 8-hour day They were little more than expressions of an aspiration, and when such resolutions hardened out into precision in later years they scarcely seemed to be indicative of any rapid advance In 1916, for instance, the congress of inter-allied trade unions at Leeds asked for the 10-hour day, and the international trade union congress at Berne in 1917 demanded merely a gradual reduction to 8 hours.

The semi-official International Association for Labour Legislation (in which certain continental governments were represented, as well as groups of workers, employers and private persons interested in social matters) proposed in 1912 an 8-hour day for certain of the more laborious or dangerous trades, but the official delegates at the 1913 conference arranged by this association contented themselves with the suggested limitation of the working hours of women and children to 10 daily Between the conclusion of the war and 1921, however, many of the European industrial states adopted legislation laying down the 8-hour day and the 48-hour week as normal, and since that year, though the extension of the movement has been less rapid, it has continued, and of the many attempts again to lengthen the working day none has been more than temporarily successful.

Limitation by Law.—National legislation for the limitation of the hours of labour has taken various forms In some cases, *e.g.*, France, Spain, Portugal, acts or decrees have prescribed a *general* limitation for all workers, or for all workers in large groups of occupations such as "industry," or "commerce," whilst the detailed application has been left to be elaborated by administrative decrees or orders Usually these decrees are issued after consultation with the organized workers and employers concerned In other cases (*e.g.*, Netherlands, Czechoslovakia, Belgium) the act itself is made to apply to a detailed list of industries, and the exceptions are usually indicated Again, as in the case of Great Britain (Coal Mines Act) a special act may regulate the hours worked in a particular industry.

Another group of legislative measures deals with the hours of labour of specified classes of workers, women and children, and men engaged in hazardous occupations. In Great Britain the Factory Acts have attempted to regulate the hours of women and children, who were regarded as being less favourably situated for "free bargaining" than men, but it was not until 1908 that legal restrictions were directly placed upon the working hours of the latter, and then only in the case of a single industry, coal-mining.

A third type of legislation secures the aim of limiting hours of labour by indirect means. In the commonwealth of Australia, for example, and in its constituent states, the arbitration laws provide for the settlement of disputes in labour matters (including disputes about the hours of labour) by a process of arbitration and the legal enforcement of arbitration awards Again, in the case of Germany and some other countries, collective agreements arrived at voluntarily between employers' and workers' organizations may under certain conditions be given the force of law.

There remains to be noted the huge mass of collective agreement upon hours of labour which, though not always possessing the force of law, does in fact regulate hours very successfully in many countries This is the method adopted for most industries in Great Britain, but the practice is common even in countries where legislative limits are enforced. In these cases the collective agreement is usually an advance, from the workers' point of view upon the provisions of the existing legislation

Exceptions to the General Rule.—All national legislation on the subject of hours provides for exceptions of a general nature, affecting the whole field of application of the legislation, as well as for exceptions in particular cases.

To provide for the former class of exceptions, which may be classified as those arising from national necessity, clauses are usually inserted which give the administration power to suspend or relax temporarily the regulations normally in force In the case of the draft international convention (*see* later) it is provided that "the operation of the provisions of this convention may be suspended in any country by the Government in the event of war or other emergency endangering the national safety" (Article 14). Exceptions in particular cases may be classified as those which arise (1) from considerations of the *worker* himself or herself, (2) from the *size of the industrial undertaking*, (3) from the *nature of the work*, (4) from the *situation of the country concerned* with regard to climatic conditions, character of population, or other factor rendering it abnormal from an industrial point of view, and (5) from *exceptional circumstances.*

(1) In the first class may be placed those exceptions which are provided for domestic industries and small establishments where only members of the same family are employed Managers and persons holding posts of responsibility or of confidence are generally exempt.

(2) As to the *size of the industrial undertaking*, different standards have been adopted. Whilst in Sweden concerns employing not more than four workers are exempt from the application of the Eight-hour Act of 1919 (save where such concerns are situated in towns with a population of over 1,500) in Japan 15 is the number of employees requisite to bring an undertaking within the scope of the Factory Act, and in India it was 20 until 1921, when the number was reduced to ten

(3) The third class of exceptions is connected with the *nature of the work*. The case which appears to have presented most difficulty in national legislation is the *continuous process*. In many industries processes are employed which take long periods for their completion, and which cannot be intermitted without damage to or total loss of the material operated upon In such cases a shift system is adopted, and a certain elasticity is required to facilitate changes In other cases the process, whilst not being continuous in the strict sense of the word, is yet longer than the normal working day of 8 hours The arrangement of shifts for such cases presents further difficulties for which exceptions must be provided.

The international convention on hours permits a 56-hour week in "those processes which are required by reason of the nature of the process to be carried on continuously by a succession of shifts."

The opposite case is where the work is of so *intermittent a nature* that it is felt that a longer day may be worked without injury to the worker It is difficult to define exactly what is meant by this "intermittence" The work of a gatekeeper or watchman who has no other duties may be instanced, but there are borderline cases which are treated differently in different legislations. The Washington meeting of the International Labour Conference tried to meet such cases by permitting the legislative authorities, under certain safeguards, to allow permanent exceptions where the work is "essentially intermittent"

Seasonal industries form a further category under this heading. Both national and international legislation permit extension of the working day in industries engaged upon material susceptible of rapid deterioration, or material which is available at certain seasons only and which must be treated immediately. Similarly, industries dependent upon weather conditions are usually allowed considerable elasticity in the daily or weekly total of working hours. In this connection a device of averaging the weekly hours over a period is fairly common, and has been adopted in international legislation.

Exceptions are usually provided in connection with what is known as *"preparatory and complementary"* work. There is frequently the necessity of the earlier attendance in factories of a certain number of the personnel whose work must be done before the general work can commence; there are others, similarly, who must continue after the conclusion of the general work Cases in point are the engineers and other workers in the engine-room of a factory. In some national legislation and in international legislation, exceptional provision is made for such workers.

(4) The fourth class of exceptions arises in international legislation, where it has been found necessary, in order to attempt a rough equation between countries dissimilarly situated with regard to climate, character of population or other industrial factor, to permit a longer working day in the one than in the other. Thus in the Washington Convention, a 57-hour (60 hours in the raw silk industry) week is permitted for Japan, and a 60-hour week for British India, and elasticity is provided in the application of the Convention to "colonies, protectorates and possessions not fully self-governing" for "such modifications as may be necessary to adapt its provisions to local conditions."

(5) The circumstances which, under national and international legislation, permit of the temporary suspension of the general application of the limitation of hours have already been treated Some national legislations consider that the danger to an industry arising from the pressure of foreign competition is a sufficient warrant for the relaxation of rules in its particular case

The existing position in the more important industrial States, including those of the British empire, may be summarised as follows:

I. Working Hours in Industry. *Great Britain*.—The working hours of certain classes of workers are restricted by the Coal Mines Regulation Act of 1908 and the subsequent amending Acts, the Factory and Workshops Consolidation Act (1901), the Shops Act (1912), the Employment and Closing Order Act (1912), and by regulations issued under the Trades Boards Act. Outside the mines, a relatively small proportion of the industrial population is touched by this legislation; the factories in general are governed, as regards hours, rather by collective agreement than by law, which permits a 56-hour week, a figure not often attained Under the Trade Boards Act the hours laid down in regulations appear never to exceed 48 per week

In all other organised industry, hours are regulated by collective agreement. With small exceptions, affecting relatively few workers, the weekly hours are 48 or less (railways, 48; railway workshops, 47; building, 44, constructional engineering, 49½ summer, 44 winter; shipbuilding, 47; thread manufacture, chocolate, 44). In one or two specially trying occupations the hours are even less (*e g*, glass-blowing, 35 to 37; kaolin quarries, 42) and there are a few unimportant cases where the hours by agreement exceed 48 per week

Since Aug. 1919, when a bill for the general introduction of the 8-hour day was introduced, successive attempts to legislate on the question have been defeated. In 1927 a Government bill for the amendment of the Factory Acts which would have had the same effect in so far as the factory population is concerned was, for political reasons, not introduced.

Australia.—The 8-hour day and 48-hour week, or less, are practically universal in industry, and are secured by a series of Factory Acts, Early Closing Acts, special mining legislation, and, in the case of New South Wales, a more general Eight-hours Act (1916). In addition, hours are regulated under awards of arbitration courts and boards (first established in 1912). In Nov 1920 for example, the Federal arbitration board awarded the 44-hour week to a large group of industries. A special court set up under the New South Wales Eight-hours (Amendment) Act of 1920 reported in favour of the 44-hour week for most employees in the building, furniture and iron trades, the manufacture of food, and in printing This report was given effect in the following year.

Canada.—The 48-hour week is, by legislation or collective agreement, the rule in mining, on railways, in the public utility services, building, the manufacture of chemicals, tobacco, food-stuffs, paper, textiles, oil, in printing, in shipbuilding, carriage building, and, with minor exceptions, in the metal trades.

India.—The hours question in India is of first rate importance not only by reason of its repercussion on Indian social conditions, but because of the continual discussion, at times somewhat

bitter, between the workers and employers in India and those in her great industrial rival in the East, Japan

In certain organised industries, including factory industries, mines and plantations, hours are regulated by law. The Factories Act of 1911 (amended 1922, 1923 and 1926) defines a factory as any establishment in which mechanical power is used and where 20 or more persons are employed, and further gives the local Government powers to extend the definition to cover establishments employing more than 10 persons, whether mechanical power is used or not In 1926, 7,251 establishments, employing over a million and a half of persons, were classed as "factories" in the meaning of these acts

Following upon the special clause adopted for India in the international convention on hours of labour at Washington in 1919 (a convention which India has ratified) hours in factories are limited to 11 per day and 60 per week for adults, and to 6 per day for children between ages of 12 and 15 These legal maxima, however, are not reached in many cases. In 1926, for instance, 40% of factories employing men and 43% of those employing women worked 54 hours per week or less, and 30% of the establishments employing children worked 30 hours per week or less

The law provides further for rest periods, and for the weekly rest day. Overtime is not permitted for children and women (except, for the latter, in fish-curing and canning). Nor are children and women (with the same exception) permitted to work at night between 7 P.M. and 5.30 A.M.

Hours in mines are governed by the Mines Act of 1901, amended in 1923. About a quarter of a million workers are covered, including 120,000 underground workers, over thirty thousand of whom are women Their legal hours are 54 per week underground and 60 on the surface, but as in the case of factories these maxima are not general. On the other hand, the fact that there is no restriction on the *daily* working hours means that at times inordinately long "shifts" are worked. A bill to remedy this, and to check the night work of women in mines is under consideration.

Tea, coffee and rubber plantations employ roughly a million persons, whose hours were, until recently, regulated by the law concerning contracts of labour Since the abolition of these contracts, the hours have remained approximately the same, namely 9 per day for a 6-day week But the prevalence of task-work in this industry renders it impossible to give any exact account of the hours actually worked

There is no general legislation governing hours in transport work, but they appear to be influenced by the hours worked in factories especially in the larger ports, and to follow them fairly closely. In Government service the postal and telegraph workers' hours are regulated in the same manner as those of other lower grade Government employees, and are approximately the same as in factories. With regard to the railways, the Government has expressed its intention of applying the 60-hour week principle to all workers except the running staff.

New Zealand—By successive Factory Acts, the working hours of men were fixed at 8¾ per day and 48 per week, of women and boys at 8¼ per day and 45 per week Awards of the court of arbitration, or collective agreements have reduced these to 8 per day and 48 or less per week, and in many cases (gold-mining, bricklaying, brewing, electricity, furniture, plastering, stone-work, tailoresses, wharf-labourers, etc.) the maximum week is 44 hours. Coal-miners work an 8-hour day ("bank to bank") and an 11-day fortnight. Bootmakers have a 45-hour week, typographers 42.

South Africa—Legislation here provides for the working hours of *white* employees only. The Mines and Works Act of 1911 lays down the 8 and 48 rule for underground workers in gold mines. The Factory Act of 1918 prescribes limits of 9½ hours daily and 50 weekly for adults, 45 weekly for young persons. As in other countries, agreements with trade unions have modified these hours, and surface workers in gold mines, underground workers in coal and other mines, have secured the 48-hour week. Generally speaking, however, working hours in South Africa are probably longer than in other members of the British empire.

Belgium—Belgian legislation on working hours is probably the most complete and detailed in existence The fundamental act of June 14, 1921 (which in point of fact did little more than give legal sanction to the existing situation) provides for the application of the 8 and 48 rule to practically all industrial and to most commercial undertakings, and by subsequent royal orders it has been even still further extended. The student of these matters will find in the act and orders the best material for the study of the application of the limitation of hours in all exceptional circumstances. Especially noteworthy are the provisions made to ensure that in almost all cases, including continuous processes and seasonal industries, the average hours *over the year* shall not exceed 8 and 48 For example, in the royal order of May 15, 1923, applicable to the automobile and bicycle industries, it is permissible to work 9 hours per day during the busy months from December to March, but only on condition that the daily hours from June to September inclusive are reduced to 7 Similarly (royal order of May 22, 1923) increases are permissible in the hand manufacture of firearms between April 1 and Sept. 30 on condition that an equivalent reduction is made during the rest of the year. Analogous detailed regulation, which in Belgium appears to be more than usually well applied, covers practically every branch of industry.

Czechoslovakia.—An ambitious act established the 8 and 48 rule in this important industrial State very soon after the cessation of the European war Subsequent experience has shown that some of its provisions were too rigid for certain branches of industry, and more elasticity has been introduced without, however, impairing the rule of an *average* 8 and 48 Practically the whole of industry is covered by the act (Dec 19, 1918) as well as most branches of commerce and even agriculture. (*See* below) So far as industry is concerned, the act appears to be well-administered, and permits for overtime are issued only when justification is shown.

France—The Eight-hour Act of April 23, 1919 laid down that "the effective working time of work people or employees of either sex and of any age shall not exceed 8 hours per day or 48 hours per week, or an equivalent limitation based upon a period of time other than the week, in industrial and commercial establishments or in business premises of any kind connected with them, whatever their nature, whether public or private, secular or religious, even where they are of a technical educational or religious nature." The application of the law was to be by administrative decrees. A considerable number of these, applying the act usually to certain industries, have been issued The one of Dec. 12, 1919, in reference to the textile industries will serve as a type. It allows the weekly total of 48 hours to be so distributed as to permit of a shorter working day on Saturdays. To achieve this, a maximum of 9 hours per day may be worked. In the bleaching, dyeing and finishing branches of the industry it is possible to distribute the 48 hours over 5 days only, with a maximum of 10 hours per day. The decree goes on to make provision for the extension of hours to make up for lost time due to slackness of trade (for which a maximum of 100 additional hours per year may be worked), for exceptional pressure of work (maximum 150 additional hours), and for the provision of rest periods. All important trades are now covered by similar orders, but a recent tendency to abolish the additional permissible hours must be noted.

Germany.—The legislation of the revolutionary period rapidly established the 8 and 48 rule in most industries and attempted further to limit hours in agriculture Collective agreements, generally speaking, tended to reduce hours even below the legislative limits. This movement was however checked by the serious economic situation of 1921 onwards, when the workers generally agreed to work longer hours (*Mehrarbeit*) in an attempt to meet reparations payments. The legislation of 1918 became thus for a time non-effective, but a reaction set in a little later, and from 1923 onwards new collective agreements almost invariably went back to the old standards. In 1926 an enquiry showed that less than a half-million of the twelve million workers covered by collective agreements were working longer than a 48-hour week. Since that time the authorities have been preparing new legislation covering not only hours but labour conditions in general. It is understood that the hours provisions were to be drafted

carefully in accord with the Washington 8-hours convention Hesitation as to what other countries, and particularly Great Britain, intended to do in regard to the ratification of this convention apparently delayed the progress of general legislation, but a number of recent measures have instituted or provided for the institution at an early date of the 8-hours rule fixed by the legislation of 1918 and temporarily abandoned since that date In the important case of the metallurgical workers, the ordinance of July 16, 1927 led to the threat of a lock-out, but the Government nevertheless persisted in its action, and the whole of the major industries were under the 8 and 48 rule by 1928

Italy—The Corporations Law of 1927 under the Fascist régime put an end to the effectiveness of all previously existing law on the question of hours, and led to a revision of collective agreements which were by far the most important regulating instrument. Under the new system the "corporations," which comprise workers and employers, are to conclude agreements covering hours among other conditions of labour. The first of these agreements, applicable to over two hundred thousand metal workers, establishes the 8-hour day

Japan—The controversy between the two leading industrial states of the East has been mentioned above, in relation to India The restriction of hours in Japan virtually begins with the adoption of the Washington convention in 1919, when Japan was given the privilege, if she ratified the convention (which she has not done) of working a 57-hour week (60 hours in the raw silk industry) Since that event Japan has moved rapidly in regard to social legislation, but appears to have followed British practice in dealing first with the conditions of labour of women and children. As to hours, the most important legislation is the act of March 29, 1923, which amends the original Factory Act of 1911 By it the working hours of women and young persons under 16 are limited to 11 daily, though an extension of two hours beyond this maximum is permissible, "according to the nature of the work in each instance" These terribly long hours are roughly equivalent to those obtaining in India In some other industries, though relatively few, they have been reduced by collective agreements, but the rapid expansion of the trade union movement has as yet hardly touched the factory women, and the agreements do not affect their hours. Statistics of actual hours worked are available in certain cases and for limited areas See *e g* the *Monthly Report* of the Osaka chamber of commerce, which shows the daily working hours during 1927 to vary from 8 to 12 in that town with an average of about 10

Netherlands—Dutch legislation on the question of industrial hours comprises a general act of Nov. 1, 1919, amended in 1920, and a number of special acts dealing with particularly dangerous or unhealthy trades The general act of 1919 laid down maxima of 8 hours per day and 45 per week. The amending act of 1920 extended these to 8½ and 48 respectively, with detailed exceptions on the usual lines There is a special system of permissible temporary exceptions to meet cases of exceptional stress of work, recourse to which appears to be diminishing under pressure from the workers' unions Collective agreements in increasing numbers are more narrowly limiting hours of work than does legislation: certain of them still maintain the 45 hour week Netherlands statistics on hours of labour, it may be pointed out, are amongst the best and most reliable issued. (See *Statistical Year Book of the Netherlands.*)

Switzerland—The Federal Act of June 27, 1919 on hours of work in factories still form the basic law. Railway hours are governed by an act of March 6, 1920. The former establishes the 48-hour week for factories, and the latter the average 8-hour day over a period of not more than 14 days Smaller establishments (employing less than 6 workers, or less than 11 if mechanical power is used) are excluded from the scope of the law, owing chiefly to the difficulty of supervising them, and the building industry generally is also not covered. To some extent the defect in the latter case is made up by collective agreements. An attempt to amend the law on hours of work in the direction of permitting a general extension to a 54-hour week "in times of grave economic crisis," or for individual industries for serious reasons even in the absence of such a crisis, was heavily defeated at a referendum in 1924 (H A. Gr.)

The United States.—The legal regulation of the hours of labour, like most other forms of labour legislation in the United States, has been tardy and shows a considerable degree of diversity. This has been due to several, not wholly unrelated, causes. the general spirit of individualism that has prevailed in a newer country; the imperfect organization of the wage-earners themselves, both industrially and politically, and their consequently feeble voice in legislative matters; the Federal form of government with its multiplicity of jurisdictions; State and sectional differences and rivalries and the fear, if labour laws are too advanced, of interstate competition, and, not least of all, written constitutions often strictly interpreted by courts of last resort

The Federal Government naturally has control over the working conditions of its own employees and of those of contractors doing Government work. An act passed by Congress in 1868 set a standard of eight hours per day for this group, and, by amendments added in 1892, 1912 and 1913, this has gradually been made more effective for both direct and indirect employees of the Government

Congressional authority over interstate and foreign commerce has also been belatedly extended to the limitation of hours for railroad employees and seamen By an act passed in 1907 the maximum hours for men operating trains on railroads in the District of Columbia, in the territories or on interstate lines were fixed at 16 per day, with provision for consecutive hours of rest between work-periods; and the hours of telegraphers and train despatchers, whose functions were regarded as still more intimately connected with the public safety, were limited to nine per day in all places kept open day and night The Adamson Law of 1916, passed to forestall a general strike of the railway brotherhoods, went still further and established eight hours as the standard working-day for the operating force with overtime pay when this number of hours is exceeded The hours of officers and seamen when their vessels are in port, by acts passed in 1913 and 1915, have been limited to nine. The efforts, however, of Congress to extend Federal authority over labour conditions in manufacturing establishments within the confines of the respective States, either under the power over interstate commerce or under the taxing power, as in the child-labour laws of 1916 and 1920, have been quashed by the Supreme Court; and the child labour amendment to the Constitution, submitted in 1924, has so far made little headway toward approval by the States

More than half of the States and a large proportion of the municipalities have adopted laws or ordinances fixing the eight-hour day for public work, often with certain exceptions for firemen, policemen and certain workers in public institutions The States have likewise availed themselves in varying degrees of their unquestioned power to regulate the hours of minors; and, principally within the past 15 years, the eight-hour day and the 48 hour week, usually with a total prohibition upon night work, have been set as the standard for all children under 16 in about three-fourths of the States The right to limit the hours of women has not been so readily admitted by the courts and has been less fully exercised, although there are now only five States wholly without such laws. The movement for shorter hours for women antedated the Civil War and was taken up again in earnest in the '70s when the Massachusetts ten-hour law was passed A severe set-back was given in 1895 when the Illinois supreme court decided that an eight-hour law for women in factories was a violation of freedom of contract and hence unconstitutional. But all doubts as to the reasonableness and legitimacy of such measures would seem to have been removed by the favourable decisions of the U S. Supreme Court in a case involving the Oregon ten-hour law in 1908 and another involving the California eight-hour law in 1915. Some States content themselves with fixing the length of the working-day, while a considerable number also limit the hours per week Some nine States, together with the District of Columbia and the territory of Porto Rico, several of them admittedly of slight industrial importance, have eight-hour laws for women; and six States, including Massachusetts and New York

of the first industrial rank, require the 48 hour week The New York law of 1927 is weakened by troublesome exceptions. Fifteen other States provide for a working-day of less than 10 hours, while 18 States in 1926 permitted women to be employed for 10 hours or more per day, North Carolina setting the generous limit of 11 hours per day or 60 per week. More than 12 States forbid night work for women in some occupations, several others place stricter requirements respecting hours upon night work and a few, like Wisconsin, Oregon and Kansas, have delegated this and some other features of labour law to their industrial commissions.

State legislation upon the hours of labour for men, aside from that regulating public employment, already mentioned, is still in a much more dubious constitutional position. Where men, women and children work in the same establishments the adult male contingent has benefited from restrictions upon the hours of the other two parties More than half of the States place limitations upon the hours of men engaged in transportation similar to those in the Federal act of 1907 (a 16 hour maximum for the operating force and usually eight hours for telegraphers and train despatchers). The courts have held that where Federal and State regulations come in conflict State legislation must give way About 12 States also have limited the hours of street-car motormen and conductors (usually to 10 or 12) and fix the maximum time during which these hours shall fall Next to railroading mining is the industry most often regulated; and some 16 States now have eight-hour laws applying to some or all classes of workers in and about mines and smelters That of Arizona, a great copper-producing State, is probably the broadest, and that of Pennsylvania, where coal and iron predominate, is probably the narrowest in its scope Colorado in 1927 followed Arizona and Nevada in extending the eight-hour limit to cement and plaster mills. Beginning with the Utah case in 1898 such laws have been upheld by the Supreme Court because of the dangerous character of the work and because of the inequality of bargaining power between employers and employees The decision of the Supreme Court in 1917 in a case involving the Oregon ten-hour law also appears to establish the right of State legislatures to restrict in some degree the hours of all workers in factories But whether judicial leniency would extend to general eight-hour laws is not yet determined

The principle of one-day-of-rest-in-seven had by 1926 been recognized for one or more industries by six States. The most effective acts are those of Massachusetts (1913), New York (1913) and Wisconsin (1919) and the latter State has since sought to secure greater elasticity by transferring this power to the State industrial commission.

The hours actually worked in American industries vary somewhat less widely than do the laws attempting to regulate them and are commonly fewer than would be permitted by the letter of the law. The relative scarcity of many grades of labour as compared with resources and the demands of industry, especially in periods of prosperity, has made for both shorter hours and higher wages The Census of Manufactures in 1923 indicated that over 46% of all workers in this group of occupations enjoyed the 48 hour week or better, and this was a slight drop-back from the more prosperous conditions represented by the previous census in 1921. Although neither Alabama nor Iowa has legal restrictions upon the hours of women, the Women's Bureau in 1925 found that only one-sixteenth of the women workers covered in their survey in Iowa were employed as much as ten hours per day, and that Alabama had less than half as many ten-hour women workers as South Carolina with its ten-hour legal limit. The labour laws of North Carolina permit a 60 hour week but a study of the cotton goods manufacturing industry by the Federal Bureau of Labour Statistics in 1926 showed that North Carolina women were actually working only two hours longer per week than the women of Maine under the protection of a 54-hour law.

In well-organized trades, such as printing and publishing, the building industry and men's clothing, the method of collective bargaining rather than resort to legislation has been dependent upon and a majority of the workmen have the 44 hour week—an eight-hour day with Saturday half-holiday. Several of these trades, notably the painters, the fur workers and others in the clothing trades have already made great progress toward a 40-hour week of five days, and this is now the announced goal of all organized labour. That neither strong organization nor legislation is always necessary to secure shorter hours is proved by the week of approximately 50 hours that generally prevails in the thriving motor industry. Here, also, Mr. Ford in 1926 declared his adherence to the five-day week In the iron and steel industry, where formerly the 12 hour day and the seven-day week were prevalent, the average full-time hours for all departments in 1926 were 54·4 per week and those in the blast furnace department, which had previously been the worst offender, were 59 8 as compared with 76·9 in 1913 These reductions, made chiefly in 1923, were in part the result of popular pressure and criticism, in part a concession to manifestations of discontent among the workers, and in part due merely to enlightened self-interest (W B. Cn)

II. Working Hours at Sea.—The seafarers' hours are still more difficult to regulate and relatively little national legislation on the question exists

The vast majority of seamen, including the British, have obtained regulation of hours by means of collective agreements, but in some cases the legislatures have intervened The most interesting, and probably the most successful interventions, are the acts of Finland (1924), Norway (1919) and Sweden (1919) These divide the personnel of a vessel according to the nature of its work: the engine-room staff is required to do not more than 16 hours work in two consecutive days, whilst the ordinary seaman works not more than 24 hours in the same period Other arrangements are made for small vessels, for cases where the crew is not divided into watches, for coastal traders and for work whilst in port. These acts seem to have been fairly satisfactory in application, though the seamen concerned demand a reduction of the hours prescribed A French decree of 1925 extending the application of the 1919 general act to the sea service provides alternative methods: either an 8-hour day may be worked, or a 48-hour week, irregularly divided as regards the daily limit, or an averaging of hours over a month, the 8-hour average being conserved These hours are subject to exceptions to meet sea emergencies In Greece, Portugal, Spain and the Argentine legislation prescribes the 8-hour day with varying details of application

In Great Britain the matter is dealt with solely by collective agreements, which are exceedingly complicated and not universally applicable They are not so much intended to limit the hours of labour directly as to secure that overtime rates are paid after a daily "normal" has been reached, and thus to penalise employers who exact the longer day Emergency cases are not usually affected by these overtime pay arrangements. In general, the agreements provide for overtime rates when the working day in port exceeds eight hours, with special arrangements for Saturday (five or six hours) and Sunday (ordinary necessary routine work up to four hours), and for days of arrival and sailing. At sea the ordinary system of watches results in a longer day being worked, except for the categories known as day-workers (*ie*, those who normally work only during the day) who have similar hours to those detailed above

This may be taken as fairly typical of the terms arranged by collective agreement, not only in Great Britain but elsewhere in countries where legislation has not been adopted The Australian and New Zealand seamen however have secured better terms. By agreement they have a strict 8-hour system which is probably the most favourable to the workers yet obtained anywhere; the question of its consecration in legislation is stated to be under consideration.

III. Working Hours in Commerce.—The regulation of working hours in commerce is less complete and general than in industry. Among European States, however, Austria, Czechoslovakia, Finland, France, Germany, Italy, the Netherlands, Poland, Portugal and Russia have adopted general legislation on hours which covers commercial workers also. In Belgium most classes have been gradually brought under the law. In all the above cases the normal working week is limited to 48 hours,

with the exception of the Netherlands, where the limits are 10 daily and 55 weekly. But it should be noted that whilst 48 hours is the "normal," in almost all cases a great variety of exceptions is permissible and the hours actually worked are certainly longer. In Czechoslovakia complaints have been put forward that the law is not respected. The great difficulty is of course the control of small establishments, including shops The latter are dealt with in many countries by means of closing regulations—the only method so far employed in Great Britain. The Shops Act of 1912 for example fixes a maximum week of 72 hours for young persons under 18 employed in shops. Similar legislation exists in many States of the United States As in the case of industry, collective agreements have secured terms in many countries much more favourable than those fixed by legislation.

IV. Working Hours in Agriculture.—In a few countries only are hours of labour in agriculture directly limited by law, and it would appear that in the majority of cases the experiments made have not been particularly successful, at least in the object primarily aimed at In Czechoslovakia (act of Dec 19, 1918), for instance, the provisions of the law have been overridden by collective agreements, which permit a day of longer than eight hours, provided that overtime rates of wages are paid for the excess In this sense the act has been beneficial to the workers. In Germany a scientific attempt has been made to meet the difficulty of the seasons by dividing the year into three periods, during which the normal daily hours vary The Italian system of collective agreements and the decree of Sept 10, 1923, which limited hours (in the latter case to 8 per day except during 3 months yearly, when the maximum was 10), have come to an end under the Fascist régime, and new agreements are under negotiation The Agricultural Wages (Regulation) Act of Aug. 7, 1924, indirectly regulates the hours of agricultural workers in Great Britain, since the district committees set up under the act have the power to fix weekly wage rates, and have usually done so upon a basis of a week of 48 to 52 hours, any hours worked in excess being paid for as overtime, and consequently tending to be reduced to a minimum.

International Action.—The "labour part" of the treaties of peace which followed the World War gave international sanction to a number of "principles," among which was "the adoption of an 8 hours' day or a 48 hours' week as the standard to be aimed at where it had not already been attained" The most important task of the first conference of the International Labour Organization created by this part of the treaty was the application of this principle. In the preparatory work for the conference, which was held at Washington in 1919, of the 35 Governments consulted the great majority indicated their readiness to adopt a convention on the question, and of the States not consulted it was known that Finland, Germany, Austria and Russia had already legislation enforcing the 8-hour day The evidence therefore tended to the conclusion that the general adoption of a convention on the question was possible, and the Washington Conference proceeded to elaborate such a convention. Its discussions turned for the most part on the exceptional cases which have been treated above.

The draft convention was adopted on Nov. 28, 1919. Since a large number of the industrial States had already adopted, by legal enactment, or otherwise, the 8-hour day, it might have been expected that the ratification of the draft convention would be rapid and practically universal. But this was not the case. For some time, difficulties of procedure delayed progress An international labour convention was a new diplomatic instrument and the conservatism of certain Foreign Offices, notably Downing Street and the Quai d'Orsay, raised difficulties of procedure which were eventually overcome easily enough, but which delayed ratification of the hours convention until the enthusiasm of post-war public opinion had cooled and the economic slump of 1922 and onwards had set in. Up to that time, the countries which had ratified were not those of the highest industrial importance. The movement however continued under the pressure of trade union action and of the more liberal sections of public opinion, and by May 1928 Belgium, Bulgaria, Chili, Czechoslovakia, Rumania and India had ratified unconditionally, whilst Austria, France, Italy and Latvia had ratified conditionally upon the ratification of other countries.

This system of conditional ratification, begun by Italy, had resulted in making the attitude of Great Britain the key to the situation. Recognising this and evidently somewhat uneasy in mind, the Government of J. R. MacDonald in 1925 and that of Stanley Baldwin in 1926 convoked meetings of the ministers of labour of Great Britain, Belgium, France and Germany at Berne and again (with the addition of Italy) in London with a view to the examination of matters in the convention alleged to be susceptible of diverse interpretation and, if possible, to the conclusion of an agreement upon them. At Berne no insuperable difficulty appears to have been raised, and the more important meeting in London settled a number of matters considered to be decisive. (See *Times*, March 20, 1926) This meeting was prepared for by the circulation by the British Government of the points considered to be under doubt, and it appears, from the *Times* report, that the same Government raised further points during the course of the meeting. On all these points but one agreement was unanimous, but on the question as to what was to be understood by the article of the convention which permitted its suspension "in the event of war or other emergency endangering the national safety," the British minister reserved approval pending consultation with his Government. No final decision on this matter has been made public.

The proceedings of the meeting of ministers were private, but it is possible to deduce from the official communication to the press that every minister of labour present had conceded some point in his national legislation or practice to meet the British difficulties, and it might have been considered therefore that the "London agreement" gave the British Government all it wanted in the way of guarantees and that its ratification would follow, and thus bring about the general effective ratification by the European industrial States which the network of conditional ratifications had made to depend upon Great Britain

Of the States represented at London, Italy had already ratified conditionally. Belgium proceeded at once to unconditional ratification (her existing legislation permitted that course), France ratified in 1927 contingent upon the ratification of Germany and Great Britain Germany, in course of codifying and amending her labour legislation in general, was adapting her hours legislation to the requirements of the convention, and making reductions in existing working hours where they were not in accord with it In Great Britain, an amended Factory Act was in preparation, and it was understood that a general bill for the enactment of the 8-hour day was to be introduced At that stage, however, the employers' organisations undertook a campaign in the public press and elsewhere, the cabinet appears to have been impressed, and neither bill saw the light Questioned in the House of Commons, the minister of labour and the under-secretary cited as reasons for the inaction of the Government the same objections which had been raised at London in 1926 and which, it was thought, had been overcome, and stated that the question of the revision of the convention would be raised at Geneva.

In effect, one clause of the convention provides that the Governing Body "at least once in ten years . . . shall consider the desirability of placing on the agenda of the conference the question of its revision or modification," and in Feb. 1928 the under-secretary of State, representing Great Britain on the Governing Body, demanded that the latter should take the question of revision into consideration. Accusations of bad faith, under these circumstances, may be mistaken, but are easy to understand. The Governing Body refused to decide at that session; in the May following it rejected the British proposal and decided that the procedure for the revision of conventions should follow its normal course.

Working Hours at Sea.—The Washington draft convention was applicable to "industrial undertakings," and the question of the application of the 8 and 48 rule to maritime and inland navigation was deferred for the consideration of a special meeting of the conference. The principal maritime countries, con-

sulted beforehand, replied unanimously in favour of international regulation of the hours of labour on board ship, but in most cases with considerable caution with regard to the 8 and 48 rule, which is clearly more difficult of application under sea conditions. On the whole, however, the evidence was again in favour of the possibility of the conclusion of a convention upon the subject.

The special meeting of the conference took place at Genoa, June 15–July 10, 1920. The draft prepared by the International Labour Office was referred as at Washington to a special commission, and after being amended was submitted to the full conference, which approved it by a vote of 48 to 25; the two-thirds majority necessary for formal adoption thus was not attained, though by a very narrow margin

The questions of the hours of labour in the fishing industry and in inland navigation were dealt with separately by the conference In both cases a recommendation was agreed upon, by the terms of which the States members were urged to adopt legislation limiting in the direction of the 8-hour day and 48-hour week the duration of the labour concerned

Working Hours in Commerce.—The question of international regulation of the hours of salaried workers in industry and commerce has been raised and was examined by the Governing Body of the International Labour Office in 1928 It has not yet been discussed by the International Labour conference

Working Hours in Agriculture.—The International Labour conference decided in 1923 that the time was not ripe for the international regulation of hours in agriculture

Bibliography.—The texts in English, French and German of most of the acts cited above, and in general of acts relating to hours of labour, are published by the International Labour Office in its *Legislative Series* Monographs on the hours situation in a number of important countries have been issued from the same source For the general situation in regard to the Convention of Washington, *see* the directors' *Reports* to the successive sessions of the International Labour conference since 1919 (H. A. Gr.)

HOUSE, EDWARD MANDELL (1858–), American statesman and diplomat, was born at Houston, Tex., July 26, 1858, the seventh son of Thomas William House and Mary Elizabeth Shearn His father, who had left England as a boy, came to Texas when it formed part of Mexico, joined the revolution, helped to free it and bring it into the Union The younger House was educated at the Hopkins grammar school and Cornell university, and returned to Texas in 1880, where he lived for more than 30 years as planter His chief interest, however, was public affairs. He took an influential part in the successful campaigns of Governors Hogg, Culberson, Sayers and Lanham, and during the period 1894–1904 his political influence in Texas was regarded as decisive.

He refused invariably to become a candidate for office himself, but acted as the intimate adviser of the several governors named Although frequently urged to participate in national politics he remained aloof from the disastrous Democratic campaigns that followed the Bryan candidacy of 1896; but in 1912 he played a major rôle in securing the nomination of Woodrow Wilson, and at the time of the election Wilson had come to put full trust in him, offering him a choice of cabinet positions. Following his custom, House refused any office, but politically as well as personally he remained closer to the President than any member of the official family It was upon his recommendation that Wilson chose a number of his cabinet; after the inauguration both President and cabinet utilized his wide knowledge of men and his shrewd estimate of political effects to help them in meeting legislative and administrative problems; he exercised a great influence in the framing of the Federal Reserve Act and also played an important part in the organization of the original Federal Reserve Board. Wilson spoke of him as his "independent self"

House's chief interest lay in foreign affairs, and through close contact with American ambassadors abroad and his intimacy with European statesmen, as well as the confidence of the President, he was able to influence the course of American foreign policy. In 1913 he helped to tide over the crisis in relations with Great Britain over the Panama tolls exemption until Wilson secured the repeal of the exemption In 1914 he undertook informal negotiations with the diplomatic representatives of Argentina, Brazil and Chile, which led to the drafting of a pan-American pact designed to guarantee peace in the Western Hemisphere In the spring of 1914, House, apprehensive lest war should break out in Europe, sailed for Germany to offer the assistance of the United States in reaching some arrangement between England and Germany which might avoid war. He talked with high officials of the civil Government, the army and navy, and had a conference with the Kaiser, in which he received some encouragement William II. later said.—"The visit of Colonel House to Berlin and London in the spring of 1914 almost prevented the World War." At London he found Sir Edward Grey ready to entertain any feasible plan to preserve peace This, House wrote to the Kaiser on July 7, 1914 The murder of the Archduke Francis Ferdinand, however, precipitated war before the plan could be developed

Returning to the United States, House maintained close intimacy with the British and German ambassadors and thus helped to smooth American relations with the belligerents. In Jan 1915 Wilson sent him abroad to study the possibility of American mediation He suggested the principle of the "Freedom of the Seas," after visits to London, Berlin and Paris, as a possible step towards a compromise; but the sinking of the "Lusitania" ruined all chances of success. In the autumn, House proposed that Wilson suggest to the Allies that a peace conference should be summoned, if Germany refused the conference or rejected terms calculated to ensure a just settlement, the United States would enter the war on the side of the Allies to enforce such terms House left for Europe again in Dec 1915, visited England, Germany and France, and finally made the aforesaid offer to the British, the substance of which was incorporated in a memorandum drafted by Grey and himself. The Allies, however, refused to take advantage of it.

In the summer and autumn of 1916 House took an influential part in the campaign which led to Wilson's re-election. After the United States entered the war, he kept in close touch with the chiefs of the war-making agencies, and was in consultation with the special envoys of the Allies Balfour, Northcliffe, Tardieu, Reading In the autumn of 1917 Wilson named him chief of the special American mission designed to co-ordinate Allied war needs, especially the problems of finance, supply, tonnage and man-power. The conferences in London and Paris which he attended proved to be the turn of the tide. After his return he was intimately concerned in Wilson's drafting of the Fourteen Points, and at the request of the President he drafted a tentative covenant for a League of Nations, which formed the basis of Wilson's later plan In Oct. 1918 Wilson sent him to Paris to represent the United States at the Allied Council, which granted an armistice to Germany

After some difficulty, House succeeded in pledging the Allies to Wilson's Fourteen Points as a programme for peace He had previously organized "the Inquiry," a body of experts for collecting authentic data for the use of the Peace Conference House was one of the U.S. peace commissioners signing the Treaty of Versailles, and although ill at the opening of the conference he played an important rôle by reason of his intimacy with European statesmen He was a member of the commission that drafted the League of Nations' Covenant, and ultimately most of the details connected with the formation of the League were settled with his co-operation. In July and Aug 1919 he represented the United States in the organization of the Mandates system. After his return to the United States he urged President Wilson, by letter, to compromise with the Senate so as to secure ratification of the Versailles Treaty and the entrance of the United States into the League A serious illness, coming at the same time as the physical breakdown of Wilson, combined with other factors to interrupt the close relations between the two men which had persisted since 1911.

Col. House had won a reputation for such sagacity and disinterestedness that his advice was continually sought by political leaders even after the overthrow of the Democratic Party in

1920. He continued his interest in international questions and maintained close relations with the chief statesmen of Europe.

In 1912 House published, anonymously, a political romance, *Philip Dru;* in 1921 he edited (with Charles Seymour) *What Really Happened at Paris,* a series of essays on the Peace Conference written by members of the American Delegation. He also wrote, after 1920, a number of articles upon contemporary politics and political leaders for *The Philadelphia Public Ledger, Foreign Affairs, Harper's* and *The Encyclopædia Britannica.*

BIBLIOGRAPHY.—*The Real Colonel House,* by A. D. Howden Smith (1918), a brief but accurate biography covering House's career to 1918; *The Intimate Papers of Colonel House,* arranged as a narrative by Charles Seymour (Boston, 1926–28). (C. SEY)

HOUSE, HOMER DOLIVER (1878–), American botanist, was born at Oneida, N.Y., on July 21, 1878. He graduated at Syracuse university in 1902 and pursued further study at Columbia university from which in 1908 he received the degree of doctor of philosophy. He was professor of botany and bacteriology at Clemson Agricultural college (S.C.) 1906–07, and associate director and dendrologist of the Biltmore Forest school in 1908–13. In 1913 he became assistant State botanist and in 1914 State botanist of New York. Besides numerous papers, chiefly on systematic botany, oecology and dendrology, his writings include *Wild Flowers of New York* (1918) illustrated with colour plates and *Annotated List of the Ferns and Flowering Plants of New York State* (1924), a valuable floral catalogue.

HOUSE, originally any structure built for human habitation; by extension the word is used at the present time in a much wider sense, as of a building which is the centre of activity of an organization (*e.g.*, houses of parliament). Thus in certain universities, schools and colleges, dormitories are sometimes known as houses, and the term house mother or house doctor is used of the matron or physician of any group of people resident together. Owing to the close association, in feudal times, of a family with its place of residence or fief, the word house is frequently used of a family (*e.g.*, house of Habsburg), and by a still further transference, of any group of people gathered together for any specific purpose (*e.g.*, a theatre audience).

Prehistoric Dwellings.—The origins of the house as a human habitation can only be surmised. It is obvious that Stone age man, at least in the temperate climates, dwelt frequently in natural caves, and even at this early time, made distinct attempts to decorate his residence as the cave paintings along the Garonne in France and some in northern Spain prove. There are evidences, also, that forest dwelling tribes and those in tropical countries early developed some sort of hut construction, probably by planting sticks in the ground, in a circle, binding their tops together to form a cone, and covering the framework with thatch or leaves. Such primitive constructions are still used in many parts of the world, as in Central Africa; the wigwam type, common to many American Indian tribes, in which the covering was of skins rather than brush or leaves, or the dome shaped huts of the Indians of Tierra del Fuego preserve the same forms.

At some ancient time the primitive cave dweller discovered that his cave could be enlarged and strengthened by constructing in front of it a wall of piled rocks, and roofing the space between the cave and the wall with logs or skins. Growing skill in this type of construction led to the development of such elaborate cave dwellings as those found on certain river banks in the south-west of the United States, whose date is unknown, but which are obviously far earlier than the pueblo culture. Viollet-le-Duc (*Histoire de l'habitation humaine,* 1875) hypothecated similar combinations of cave and masonry dwellings as one of the universal primitive forms of Aryan houses. Thus the hut is the parent form of all timber houses, and the cave dwelling of those of masonry. Most of these houses were of one room, but with the development of a more complex civilization, sub-division became necessary and the plan was articulated. At first this seems to have been accomplished by merely combining several hut units within a single enclosure. Many remains of floors and foundations of such groups of round huts, probably of straw in some cases and of unbaked brick in others, dating from the Neolithic age, have been found throughout the Aegean world. Later, elliptical forms with sub-dividing partitions appeared, like that at Chamaizi in Crete, of about 2000 B.C., and the so-called *tholos* of the lowest stratum at Tiryns, perhaps even earlier. It is noteworthy that the richest tombs of the Mycenaean culture were of the *tholos,* or beehive type, and there is a universal tendency to make house forms follow contemporary or earlier culture.

Another form of development characterizes late Stone and Bronze age villages of northern and Central Europe, the so-called lake dwelling in which many rectangular houses, some of two or more rooms, were built upon a pile-supported platform over a lake. Modern examples of precisely similar types occur along many of the rivers in Siam, Cambodia and the neighbouring countries. In European lake dwellings, not only does primitive frame construction, a development of the hut type, appear, but also the use of crossed logs overlapping at the corners—the typical log cabin construction.

Egypt and Western Asia.—In the much more civilized culture in the vicinity of the Aegean two types of house plan made their appearance. The first is the block house, with all of the rooms under one roof and in a compact block; the second is the house with a court, in which the rooms open on to a court with or without a colonnade or open corridor. Egyptian models of houses dating back to the early empire show both types, but in Egypt the court type seems never to have been developed as it was in Europe and China, and the court appears most frequently as a garden or stable yard enclosed by walls on two or more sides, with the house proper often forming an L-shaped mass on the other two sides. Outside stairs to a flat roof are frequently shown in these models, and it is probable that houses of two or more storeys were common in the cities. Excavations of various town sites in Egypt, particularly in the Fayoum, have proved the accuracy of these models, and are continually revealing new details. The larger houses of the country-dwelling aristocracy are shown in many tomb paintings which reveal a general type in which a central residential block, with or without a colonnaded court, is surrounded by a formal garden, around whose enclosing walls are built the stables and storehouses. There is much use of large windows, columns, awnings and a great luxuriance of decoration; the construction seems to have been largely of clay or unburned brick reinforced with a framework of timber or reeds.

In the Aegean culture, both court houses and those in a single block are found. The great palaces of Cnossus, Phaistos (both *c.* 2000–1500 B.C.), like the more highly developed and architectural palace at Tiryns (*c.* 1200 B.C.) all have a court as their most important feature, but the plan of the town of Gournia shows simply a maze of crowded, close built rooms. Moreover, many paintings and terra cotta placques show Cretan houses as cubicle blocks, often in two storeys, with flat roofs and many windows.

The early Mesopotamian house, which remained fairly constant in form over at least 2,000 years, and probably more, throughout the Chaldean and Assyrian periods, was of three types. The first, represented frequently in Assyrian bas-reliefs, is a development of the conical hut, constructed, apparently, in unburned brick, and consists of a tall, narrow, dome form, sometimes set on a small square base. The second, also known from the reliefs, was probably the country residence of the well-to-do and is shown as a rectangular building or group of buildings with flat roofs, battlemented parapets, arched doorways and many long, low windows close to the roof, sub-divided by colonnettes. The third type, the city house, consisted of an assemblage of long, narrow rooms, with walls of immense thickness arranged around one or more courts. Some of these rooms may have been barrel vaulted in brick. Architectural decoration is of the simplest. What richness they possessed must have been produced by a lavish use of textiles.

The most complete idea of early Semitic houses is given in the description of Solomon's palace in the Bible (I. Kings, vii.). Timber was much used. Flat roofs were universal, and in the larger chambers they were supported by rows of wooden columns. Decoration was by means of *repoussé* metal work applied to the wooden surfaces.



PHOTOGRAPHS, (1) G. SOMMER, (2) ALINARI, (3, 4) EWING GALLOWAY, (6) DONALD MCLEISH, (5) FROM "STUDIOS VIE A LA CAMPAGNE" LIBRAIRIE HACHETTE

DEVELOPMENT OF HOUSE DESIGN

NOTE: THE CAPTIONS HAVE BEEN ARRANGED IN THEIR HISTORICAL SEQUENCE

1. A model of the House of the Tragic Poet, Pompeii, restored; a medium sized Roman house of the early 1st century. The upper view shows the entrance corridor at the left; then the simple, high, two-storeyed atrium; then the reception room, or tablinium; and lastly, at the right, the garden in the private court with colonnade on three sides, and a little niche fountain. Model in the Naples Museum. 6. The so-called Jew's House, Lincoln, England; a wealthy man's town house of the 12th century, late Norman Romanesque. The house as shown is much altered; the shop fronts are comparatively modern, and the windows are new. The left window on the upper floor shows the original window scheme—two small lights divided by a colonnette, under one large richly moulded arch. 3. The Palazzo Cavalli (Franchetti), Venice. Venetian freedom from civil disturbances during the late middle ages is reflected in the open and lavish exteriors of the great Gothic palaces, of which the 15th century Palazzo Cavalli is representative. The chief feature is usually, as here, the decorative enrichment of the large windows of the important central rooms. 5. A characteristic farm house in Normandy. Half-timber work, with the posts, beams and braces exposed, and the spaces between filled with bricks or stucco, was a frequent material for these houses, particularly in Germany, northern France, and England, in the 15th and 16th centuries. 4. Azay-le-Rideau, near Tours, France. This exquisite little château is but one of many built in the reign of Francis I. (1515–47) which show the gradual transition from fortified castle to rich country mansion, and from Gothic to Renaissance. Here moat, machicolations, battlement-like windows and general scheme are traditionally mediaeval in spirit, but large windows and Renaissance detail show alike a new sense of security and the court's love of classic forms. 2. Villa Rotonda, near Vicenza, Italy. The developed classicism of the later 16th century is well expressed in the palaces and large country houses or villas designed by Andrea Palladio (1518–80) in and near Vicenza. The Villa Rotonda designed by him and completed by V. Scamozzi (1552–1616) is characteristic. Perfection of proportion and unwonted delicacy of detail distinguish its austere form



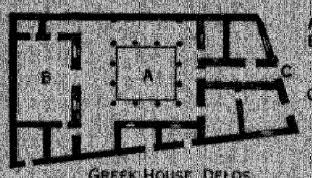
MENOMINI INDIAN BARK HOUSE, U. S. A.



CHIPPEWA HOUSES, MINNESOTA, U. S. A.

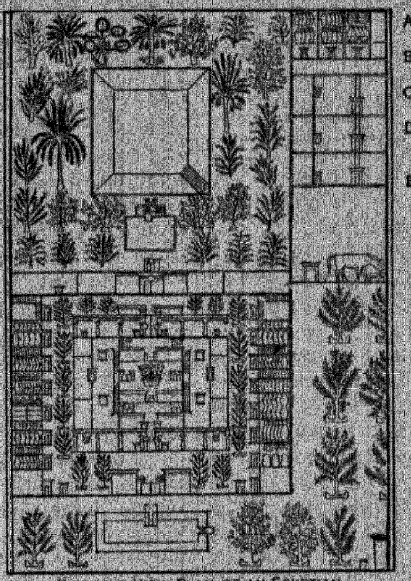


12TH DYNASTY MODEL OF AN EGYPTIAN HOUSE, RIFEH

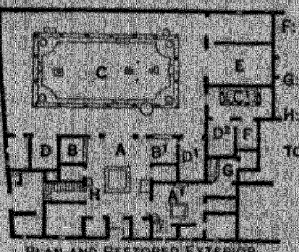


A: COURT
B: CHIEF ROOM OR THALAMOS
C: MAIN ENTRANCE

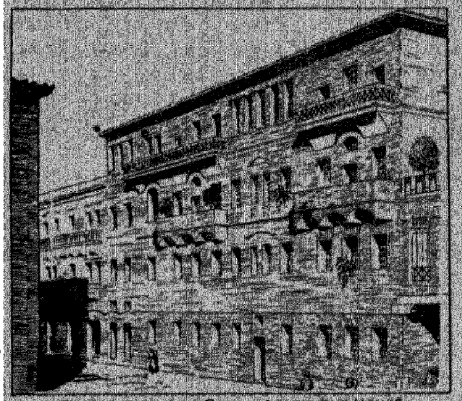
GREEK HOUSE, DELOS



A,A¹: ATRIUMS
B,B¹: ALAE
C,C¹: PERISTYLES
D,D¹,D²: DINING ROOMS
E: RECEPTION OR LIVING ROOM

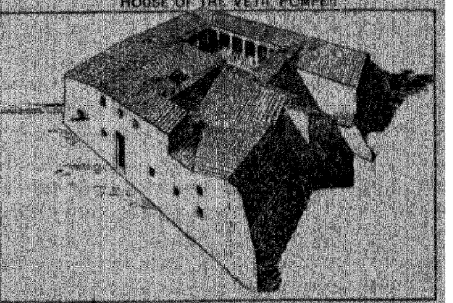


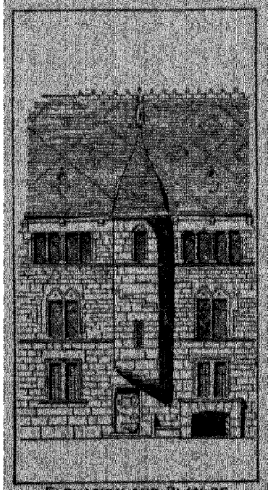
PLAN AND RESTORED EXTERIOR, HOUSE OF THE VETII, POMPEII



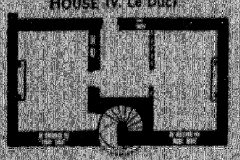
RESTORATION OF A ROMAN APARTMENT HOUSE, OSTIA

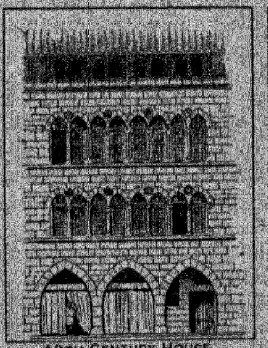
BIRDSEYE VIEW PLAN OF AN EGYPTIAN COUNTRY HOUSE FROM A TOMB AT TEL-EL-AMARNA





ELEVATION AND PLAN OF 13TH CENTURY BURGUNDIAN HOUSE (V. Le Duc)

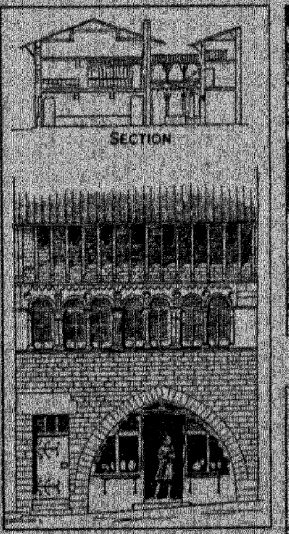




13TH CENTURY HOUSE AT ST. ANTONIN, FRANCE



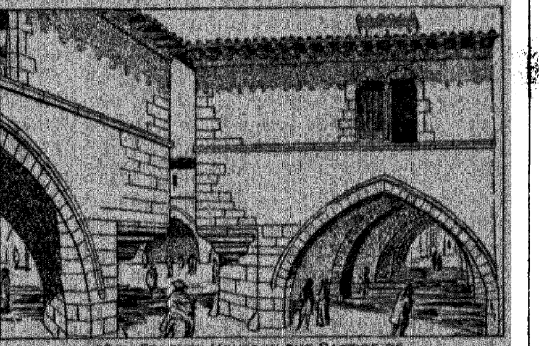
A ROMAN FARM HOUSE (VILLA RUSTICA) AT BOSCOREALE





PLAN

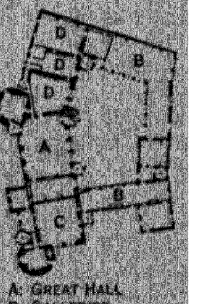
EARLY 13TH CENTURY HOUSE AT MONTREAL (YONNE) FRANCE



13TH CENTURY HOUSE IN THE BASTIDE OF MONPAZIER, FRANCE



THE 15TH CENTURY HOUSE OF JACQUES COEUR BOURGES, FRANCE



BY COURTESY OF (MENOMINI HOUSE) THE MUSEUM OF THE AMERICAN INDIAN, HEYE FOUNDATION; (CHIPPEWA HOUSES) THE SMITHSONIAN INSTITUTION; (EGYPTIAN HOUSE) THE METROPOLITAN MUSEUM OF ART; (GREEK HOUSE, DELOS) FROM MARQUAND, "GREEK ARCHITECTURE," (MACMILLAN); TOMB AT TEL-EL-AMARNA FROM PIERROT & CHIPIEZ, "HISTORY OF ART IN ANCIENT EGYPT," (CHAPMAN & HALL); (HOUSE OF THE VETII & ROMAN FARM HOUSE) FROM MAU, "POMPEII, ITS LIFE AND ART" (MACMILLAN); (BURGUNDIAN HOUSE, HOUSE AT ST. ANTONIN, HOUSE AT MONTREAL, HOUSE IN THE BASTIDE, HOUSE OF COEUR) FROM VIOLLET-LE-DUC, "DICTIONNAIRE RAISONNE L'ARCHITECTURE FRANCAISE"

PRIMITIVE TYPES OF DWELLINGS ARE ILLUSTRATED IN THE AMERICAN INDIAN HUTS AND CONICAL TEPEES; THE DEVELOPMENT OF THE HOUSE WITH A COURT, IN THE SERIES STARTING WITH THE EGYPTIAN, EMBRACING THE GREEK AND ROMAN TYPES, AND SUCH A MONUMENTAL GOTHIC STRUCTURE AS THE HOUSE OF JACQUES COEUR. THE ROMAN APARTMENT HOUSE IS STRANGELY MODERN IN APPEARANCE; THE SIMPLE MEDIAEVAL EXAMPLES STARTED A TRADITION THAT IS STILL ALIVE

Classical.—In both classic Greece and Rome, the court type of house, that had appeared in Assyria, was brought to its highest point of development. Extensive remains of Greek houses have been investigated, especially at the Peiraeus, Priene and Delos. In almost all of these the house consisted of a group of rooms around a central colonnaded court or peristyle. In some there is indication of the existence of an upper storey. In the larger houses there was frequently a gallery across the front. There are only few evidences of the division between the *andron* and the *gynaeceum,* the men's and women's quarters; either the women's apartments were on the second floor, or else the division was only architecturally expressed in the largest houses through the existence of two or more courts. The most important position, at the end of the court opposite the entrance, was reserved for the reception room and the chief bedroom or the *thalamos,* the official centre of the house life The remains of a large house of late Greek date exist at Palatitza in Macedonia. Here, not only were there multiple courts, but also long wings, or ranges of rooms, with colonnades along the front

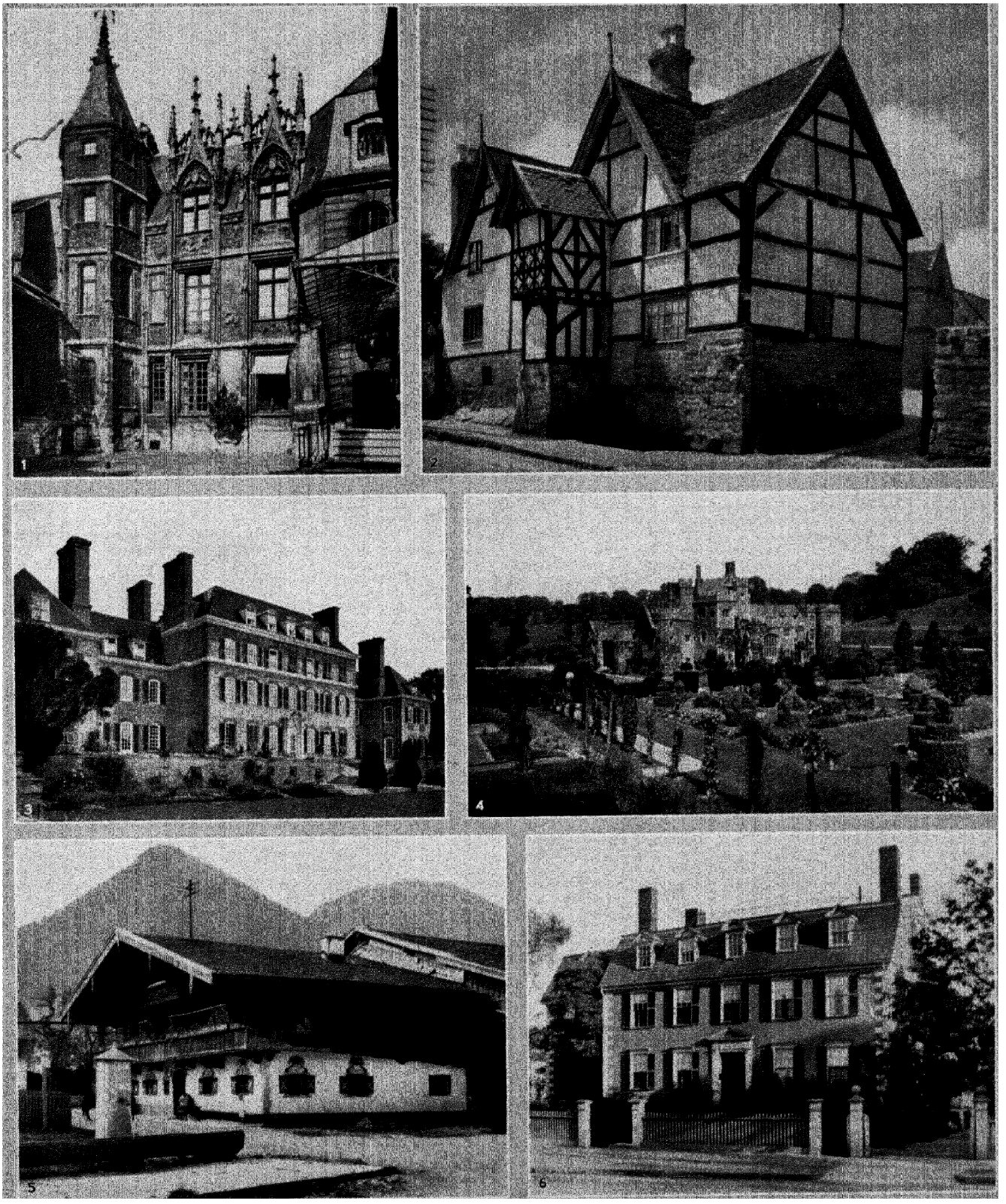
In the Roman house the court idea was superimposed upon an earlier tradition of a single room dwelling with a hole in the centre of the roof for the emission of smoke—the primitive atrium (*q v*) Prehistoric cinerary urns in the shape of these early houses have been found in various places in Italy, particularly in the Alban hills In the historic period, the atrium had already become primarily a court, with the living rooms around it, and the excavations at Pompeii have proved that by the 2nd century B.C., at least in southern Italy, the typical Roman house comprised a colonnaded court as well. In the imperial period, the atrium, with its surrounding rooms, was reserved for business and official functions. Family life centred in the peristyle. Apart from detail, the general appearance of the large Roman house of the imperial era is almost perfectly reproduced in many of the cities of northern and central China to-day Indeed, so close is this resemblance that Münsterburg (*Chinesische Kunstgeschichte*) claims the presence of definite classical influence.

Variant types of Roman houses were the great country houses or villas, so well described in the famous letters of Pliny the Younger concerning his villas at Tusculum and Laurentium, of which many restorations have been brought together by H. Tanzer (*The Villas of Pliny the Younger,* 1924). Remains of such buildings are found frequently throughout the Roman empire Another type is the farm-house, such as that discovered at Boscoreale, in which barns, oil and wine presses, storage rooms and the house proper were in one building around one main court. A vast provincial farm establishment in N. Africa, that of the Laberii at Uthina (dating from various periods from the 1st to the 4th centuries) shows a palatial central residence with many wings to take advantage of the view and prevailing winds, and separate small buildings for the farm. Another variant form was the great apartment house of several storeys which was the usual residence of the poorer free classes, not only in Rome, but in many of the more crowded centres. Indications on the marble plan of Rome which was prepared under Septimius Severus suggest that these structures frequently surrounded a court in which was placed the stair tower that gave communication to the various storeys The fronts of these buildings were surprisingly modern in appearance; usually there were shops on the ground floor and rows of simple windows, often with projecting balconies above. The whole was usually faced with brick, unstuccoed, with the mouldings, etc, worked on the face of the brick itself Recent excavations at Ostia have at last rendered possible definitive restorations (*see* G. Mars, ed., *Brick Work in Italy,* 1925)

Roman tradition continued unbroken through the Gallo-Roman time up to the Merovingian empire, and at Martres-Tolosanes, in south France, remains of large villas of this date, similar to those of Roman times, have been studied. Other interesting provincial derivations from the Roman stem are seen in the stone houses of Syria, vast numbers of which exist, dating from the 3rd to the 7th centuries, when the villages and towns seem to have been suddenly abandoned at the time of the Mohammedan conquest. These Syrian houses are sometimes roofed in stone and all of them are remarkable in the extent to which stone is used, not only for walls, but for doors, railings, screens, etc. There is generally an enclosing wall around a forecourt, with the house in a block at the rear, fronted with a colonnaded gallery.

Mediaeval.—In Europe the growth of towns and villages during the 11th and 12th centuries produced a new development of house planning. Country house design, on the other hand, outside of feudal castles and manors (*see* CASTLE), remained almost stagnant; as far as is known the serfs' dwellings were mere huts with low walls, perhaps of masonry, or banked with earth and sods, and the roughest kind of thatched roofs. This type, evidently once common, persisted into the 19th century in the huts of transient workers like charcoal burners or bark peelers in England, and the sod house or dug-out of the western plains of America. By the 13th century this condition was beginning to change, at least in France, and the hut was replaced by stone farmhouses and cottages, often divided into two or more rooms, with chimneys and fire-places and roofs sometimes of slate and sometimes of thatch. The further feudalism retreated the more the country house developed, and by the late Gothic period, all over north Europe, the wealthier peasants lived in highly developed farms, usually taking the form of a rectangular enclosure, entered by a gateway and bordered by barns, storage sheds and the house proper which was often in two storeys and well finished with windows and chimneys. In France such buildings were usually of stone, but in Switzerland, Germany and Scandinavia wood was the common material, either in half-timber (*q v*) or in "log cabin" or chalet (*q.v.*) construction. In towns the smallness of the lots forced an early development of compact planning in several storeys. Existing houses of the 12th century in Cluny show the scheme. Each floor is divided into two rooms separated by a light court and connected by a gallery. On the first floor was a shop with the kitchen behind, and stairs leading directly to the living quarters above. On the next floor was the main living room, with sleeping quarters behind, and above this, attics, under the roof. Usually there was a well in the courtyard and toilet accommodations are frequently found. In general standard of comfort, these houses of the 12th and early 13th centuries compare well with any built during the next 500 years, and it is noteworthy that the development during the 13th, 14th and 15th centuries was merely one of increased size and greater elaboration of the façade. Examples of such houses with masonry fronts exist in France in many of the fortified towns of Gascony, such as the Bastide at Mon Pazier, and at Amiens, S. Antonin, Avalon, Provins; and in England at Lincoln, the rectory at West Dean in Sussex and elsewhere. Especially noteworthy are the Musicians' House at Rheims (*c.* 1240), famous for its niched statues of musicians and the simple elegance of the treatment throughout, with tall, mullioned windows and an arcaded cornice, and the 12th century Jews' House at Lincoln with delicate Norman detail.

In Italy, where cities were more highly developed, town houses were even further advanced, and it was during this period that the typical north Italian city palace, built around an arcaded court, with enormously high storeys, and many small coupled windows, and frequently with a projecting battlemented parapet, took form. The special conditions of Venice produced there a more open type of design, with a great use of long ranges of windows under Gothic tracery, rich projecting balconies and walls sheathed in coloured marbles. These, like the French houses, were often long and narrow in plan, but one or two rooms deep, with a court at the back. In all Italian examples, and in most of those in France, the main living floor was one storey above the entrance and the ground floor was reserved for shops and service rooms. In north Europe, in the 14th and 15th centuries, more and more houses, both city and country, were being built of half timber (*q.v.*), so that although stone or brick seemed to predominate in the 13th century town it was half timber which predominated in the 15th century town, as may be seen to this day in portions of Rouen, Beauvais, Strasbourg, Hildesheim and Chester. The same period, moreover, saw the origin of the great burgher or wealthy free peasant's house, and the development of types for the nobility which were no longer mere castles or



BY COURTESY OF (3) COUNTRY LIFE FROM WEAVER, "HOUSES AND GARDENS BY SIR EDWIN LUTYENS," (6) ESSEX INSTITUTE; PHOTOGRAPHS, (1) LEVY AND NEURDEIN, (2) EDGAR AND WINIFRED WARD, (4) F. FRITH AND COMPANY, (5) EWING GALLOWAY

EUROPEAN AND AMERICAN HOUSES

NOTE: THE CAPTIONS ARE ARRANGED IN THEIR HISTORICAL SEQUENCE

1. Hôtel de Bourgtheroulde, Rouen, France; a flamboyant Gothic town house, late 15th and early 16th c. 2. Chantrey House; Castle Donington, England. Gabled composition and half-timbered work characterized English town and village houses of the 16th c. 4. Compton Winyates (*c.* 1520), a larger manor house of Tudor England. 5. A house in Ruhpolding, Bavaria. Spreading low-pitched roofs and balconies are found in many country houses of the last three centuries in Switzerland and southern Germany. 6. The Cabot-Endicott-Low House, Salem, Mass., an 18th century American example of an English and colonial type; the gambrel roof is characteristically American. 3. Great Maytham, Kent, Sir Edwin Lutyens, architect; a modern recreation of a large Georgian manor house

châteaux, but like the English manor houses, designed primarily for comfort. Of the important town houses, two still exist in perfect preservation, that now used as the Cluny museum at Paris (1485–90), and the house of Jacques Coeur at Bourges (*c.* 1450). In both of these there is to be observed a growing subdivision of the areas to give greater privacy and to separate the various functions of eating, sleeping and the social life. The planning is still, however, embryonic, with no grasp of corridor circulation and many stairs.

The same sub-division and the same struggle for convenience and privacy characterizes the entire history of the English house from 1400 to 1700. At first merely a great hall (*q.v.*) with service rooms at one end and private rooms at the other, the house rapidly developed into a plan which in all main respects is modern, with parlours, dining rooms, sleeping rooms, etc., all carefully differentiated The beautiful manor of Compton Winyates (*c.* 1520) shows the type; Kirby hall, by John Thorpe (begun 1570), and Hardwick hall, Derbyshire (early 17th century, John Smithson architect), show the complexity and growing symmetry of the English plan as well as the introduction of Renaissance ideas, and Speke hall, near Liverpool (17th century), shows the similar type treated in half timber In all of these, lavishness of interior finish, by means of plaster and wood panelling, is a noteworthy feature.

The Renaissance.—The Renaissance house throughout Europe was a compromise between two conflicting influences; the traditional development of convenient plan ideas and the desire for classic symmetry. In Italy, where the mediaeval large house had always been designed on monumental lines, the conflict was not strong, but in north Europe late Gothic plans were definitely asymmetrical, and the conflict was bound to lead to compromise. The best of the compromises was that achieved by the English during the late 17th and 18th centuries under the influence of Inigo Jones and his followers In France, through the craze for classicism and the influence of the court, convenience markedly suffered, so that there the average large 14th or 15th century house had infinitely more real comfort than that of the 17th or 18th century. There was, however, a corresponding gain in elegance, and individual staircases, rooms, etc., reached a standard of excellence of design, charm of detail and beauty of execution which has seldom been equalled. There was also an enormous ingenuity in planning, a growing elimination of waste space and a remarkable integration of interior arrangement and exterior effect. The greater number of these large houses, or *hôtels*, which give the character to so many French towns, were built between the street and a large garden, with an impressive gateway leading to a courtyard and the house rooms beyond. The Hôtel d'Amelot, in Paris, by Boffrand and the Hotel Lambert, Paris, by Levau (1640), are examples of the typical "Louis" house. The finest of the interiors, outside the royal palaces, are those of the Hôtel Soubise (early 18th century) and the Hôtel de Sévigné (*c.* 1660), now respectively the National Archives and the Carnavalet museum, both in Paris.

Meanwhile, in America, different conditions were developing from English precedent a slightly different type of house, more compact, and usually less monumental. In the north, the house of a single block, with two or four rooms to the floor and a central chimney (*e.g*, Capen house, Topsfield, Mass., 1693), or the larger houses with end chimneys (*e g.*, Warner house, Portsmouth, N.H., *c.* 1720) became the accepted type. In the south, where social conditions were more like those in England, the houses more closely resembled those of the mother country. Thus Mt. Airy, Va. (1758), of cut stone, and Westover, Va. (*c.* 1730), could be almost duplicated in many English counties, and Washington's home at Mt. Vernon, Va., with its multitude of service outbuildings, slave quarters, etc., is but a version in wood of a common English type. Close contact with France during and after the American Revolution, French architects working in America (*e.g.*, l'Enfant), and the fact that many early American architects travelled widely in France (*e.g.*, Bulfinch), led to the development in America of the French monumental house plan, as in Woodlands, Philadelphia (remodelled 1788), and the Gore house, Waltham, Mass. (1799–1804, possibly by Bulfinch).

Modern.—The industrial revolution produced a synchronous revolution in house design all over the western world, especially in towns and cities. The influences at work were confused—increased land values, due to sudden city growth, congestion of population and a generally rising standard of comfort, with the additional facilities provided by the coincident development of plumbing, lighting systems, etc. Up to the middle years of the 19th century the house of western civilization had been but a development in a direct line going back to the 12th century Since the industrial revolution ideals and aims have been totally different (*see* SOCIAL ARCHITECTURE) In general, the area for each family has diminished, while the number and differentiation of rooms has increased. An inevitable result has been the complete alteration of the appearance of modern cities as apartment or tenement dwellings have, to a large extent, replaced the individual house Equally significant is the development in the outskirts of all great industrial and commercial centres of suburbs characterized by the crowding together of small individual houses on small lots.

In the design of these houses (*see* HOUSE PLANNING) as well as in the industrial housing surrounding many factories, and in the larger country houses of the more well-to-do, there has been a general advance Waste spaces have been reduced and the problem of furnishing adequate communication, and at the same time preserving privacy, has been to a great extent solved. Moreover, the service arrangements have been simplified and perfected so that every possible waste of time may be avoided in serving meals or caring for the house. The lack of an inhibiting tradition in much of America has remarkably aided this development and, more and more, such originally American ideas as a multiplicity of bath rooms, the use of a central heating system, and the evolution of space-saving kitchens and kitchenettes are appearing in the newer houses, not only of England, but of the entire continent of Europe. No such development or standardization of architectural treatment has occurred. A chaos of varying styles is evidenced in contemporary American building; colonial, "English," "Italian" and modernist houses stand on the same street. In England, the stronger traditionalism characterizes the greater number of modern houses, with Georgian or Tudor forms predominating, but both frequently coloured by a modern style freedom. On the continent of Europe, generally, the present (1928) tendency seems to be almost universally towards the most radical and modernistic treatment, with cubicle directness and simplicity replacing any search for a more esoteric or sentimental beauty. In apartment house design (*see* SOCIAL ARCHITECTURE) the stringent limiting conditions have exerted a controlling influence that is more and more producing a similarity of type, whatever the architectural style.

In areas not deeply affected by the industrial revolution, as in most of the Mohammedan world (*see* MOHAMMEDAN ARCHITECTURE), and in Asia generally, house design carries on traditions frequently centuries old. Thus the modern Moroccan house, with its colonnaded court and flat roof, is a direct descendant of the court type of ancient Rome and Syria. Even the separation of the house into a public and private portion, or harem, bears a similarity to the old double centre in the atrium and peristyle of Rome. In Egypt and Turkey, however, the court type has largely gone out of existence, and has been replaced by the single block type of house, frequently with a large central hall, often containing a fountain which recalls the use of water in ancient courts. In Japan, also (*see* JAPANESE ARCHITECTURE), the single block type of house is found to be universal; the house is usually a long and rambling structure, tile-roofed, sometimes in several storeys. The sliding interior partitions, the matting floors, and the exquisite use of wood make interiors of delicate and sophisticated charm. In China, on the other hand (*see* CHINESE ARCHITECTURE), the court type is the rule where European influence has not modified native ways. The use of colonnaded galleries and large symmetrical halls often gives a markedly classic appearance *See* also ARCHITECTURE, ATRIUM, HALL, HOUSE PLANNING, PERISTYLE, SOCIAL ARCHITECTURE, and the various articles on the history of architecture, described under the heading ARCHITECTURAL ARTICLES.

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(T. F. H.)

HOUSE BOAT. In its simplest form a house boat consists of a cabin of one or two rooms built on a flat bottom scow, drawing only from 12 to 24 in of water, and usually with a platform or porch at either end. In the East wherever water is found the house boat is an established institution as the residence for a number of inhabitants, owing to overcrowding In the West such boats are found in great numbers on small rivers or streams especially where there is good fishing and shooting, on the shallow waters of inland lakes and on the numerous harbours along the coasts. When used as summer homes, house boats have been developed into quite elaborate craft, having four or more rooms, with a broad porch or veranda on top protected by awnings, the hull construction still retaining the characteristics of a flat bottomed scow, having great stability In this form the boats have no motive power and have to be towed from place to place when it is desired to change their position With the introduction of the internal combustion engine, power house boats have been developed and have become very popular by reason of the facts that they can be moved from place to place easily and combine the roominess and comfort of the house boat with the convenience of the power cruiser They are for the most part screw driven, and range in length from 45 to 100 ft or over Being of shallow draft the living quarters are in the superstructure, with large windows giving plenty of light and ventilation, and they have broad decks, making ideal summer homes In the United States many of these power house boats are used in northern waters during the summer months and taken South under their own power, to be used in Florida or along the Gulf coast during the winter months. (H. L. St)

HOUSE-FLY (*Musca domestica*), a two-winged insect belonging to the family *Muscidae* of the order Diptera (*q v.*), common in dwellings and practically cosmopolitan, being found wherever man has established himself. It is most abundant during the hotter parts of the year, and in Europe and North America attains its greatest numbers from July to September. Its chief breeding place is in accumulations of horse manure, but it also utilizes various kinds of fermenting animal and vegetable matter, including the contents of ash bins, etc., where the eggs are laid and the larval life is passed. A single female usually lays 600–1,000 eggs in her life-time, but higher numbers are known. The cycle, from egg to fly, varies in different parts of the world with temperature and other factors. Under favourable conditions it may only occupy 10 or 12 days, and there is opportunity for a number of successive generations in a season. During the winter house-flies disappear: a few, however, maintain themselves in warm buildings, and perhaps continue to reproduce, but further information is needed on this point. The house-fly has an important bearing upon human welfare since it acts as a carrier of the germs of summer diarrhoea, typhoid and other diseases; consequently its suppression is of great significance in public health. The omnivorous nature of its diet contributes to its efficacy as a germ-carrier. The treatment or abolition of all material wherein it can breed and the destruction of the flies by adhesive fly-papers, poison baits or other means is very important.

See C. G. Hewitt, *The House-fly* (1914); also W. B. Herms, *Medical and Veterinary Entomology* (1923). (A. D. I.)

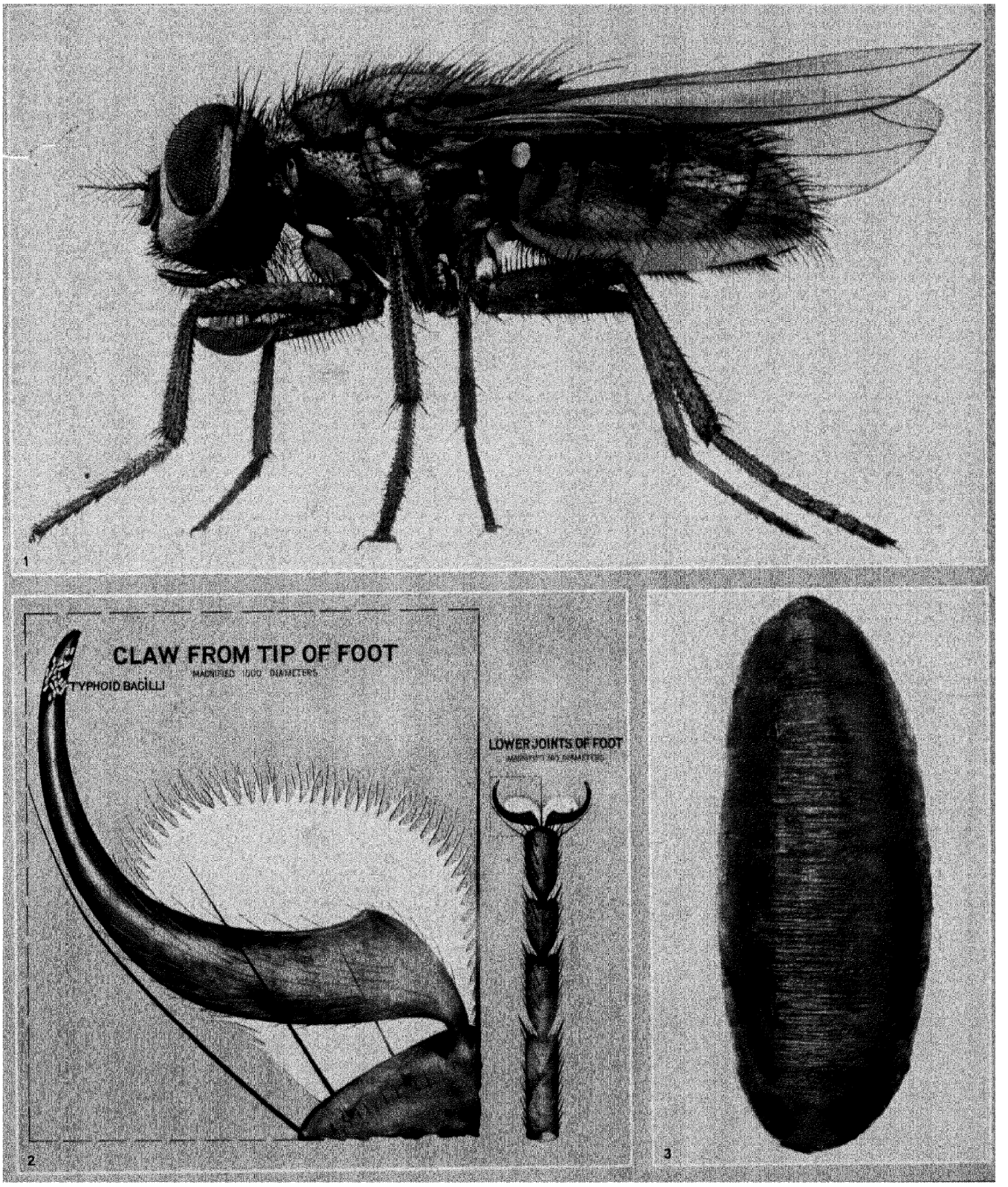
HOUSEHOLD, THE ROYAL, or **CURIA REGIS** (king's court), was the source of most English offices of State, for the early kings, like their continental neighbours, did not discriminate between public and private business, but used the same means to rule both home and kingdom. Their household system, on which the households of their greater subjects were modelled, was no insular invention. It showed traces of Carolingian, papal and imperial influence. The king's *familiares*, members of his household, were by turns domestic servants and ministers of State with advisory, secretarial, financial, judicial and military functions. The first extant list of them, with their wages and perquisites, occurs in the *Constitutio domus regis* (1135). The chief dignitaries were the chancellor, master of the scriptorium, chaplain, master dispenser, stewards, chief butler, master chamberlain, treasurer, tallycutter, constables and master marshal. In addition to the menials of pantry, buttery, spicery, kitchen, larder and mews, there were intermediate clerks, chamberlains, stewards, marshals, serjeants, ushers, huntsmen, archers and watchmen While the demands of the State were light a simple organization sufficed, but when they grew heavier some division of labour was imperative From the king's chamber (*q v.*) in the 12th century there sprang the Exchequer (*q v*) to deal with public finance Between the 12th and the 15th centuries the chancery, wardrobes, king's council and parliament, king's bench and common bench, king's chamber as the privy purse, privy seal, signet and secretary (*q.v*) similarly differentiated themselves. Yet the separation of departments was rarely absolute, and there was constant overlapping of national and domestic offices During the 15th century the household, no longer a *camera clericorum* (chamber of clerks) or a training ground for the civil service, but superseded by its greater offspring, relapsed into its primitive condition, content to busy itself with the sovereign's domestic welfare only. In addition to the *Constitutio domus regis*, regulations for the better direction, economy and security of the household have been passed periodically since at least 1279. Besides being the mainspring of government, the royal household, in the middle ages, was the king's most effective weapon against aristocratic and popular opposition, largely because wardrobe and chamber had the use of the king's small seals (*q v.*). The royal household of to-day is a modification of its mediaeval prototype, for even Burke's act of 1782 did not destroy continuity Two of the three chief departments, the lord chamberlain's and the lord steward's, are direct links with the past, while the third, that of the master of the horse, can claim importance from Tudor days and descent from a mediaeval minor office.

See Society of Antiquaries, *Collection of Ordinances and Regulations made for the Government of the Royal Household from Edward III to William and Mary* (1790), W Stubbs, *Constitutional History of England* (1873); H. Hall, *Red Book of the Exchequer*, iii. (1896); L. M. Larson, *King's Household in England before the Norman Conquest* (1904); T. F Tout, *Place of the reign of Edward II. in English History* (1914, bibl), *The English Civil Service in the Fourteenth Century* (1916), *Chapters in the Administrative History of Mediaeval England* (1920, etc, bibl.); J. C. Davies, *Baronial Opposition to Edward II.* (1918, bibl.). (D. M. B.)

HOUSEHOLD APPLIANCES. Domestic help, previously plentiful and cheap in most countries, is now, especially in the industrial centres, difficult to obtain. As in industry, when labour is difficult to obtain, more efficient methods must be introduced to obtain the same volume of work Labour- and time-saving appliances must be employed if homes are to be run smoothly under changed social conditions.

Modern household appliances developed to meet this need can be divided into two main headings, electrical and non-electrical appliances. Under the classification of electrical appliances are grouped: irons, toasters, waffle irons, heaters, coffee percolators, vacuum cleaners, washing machines, floor polishers, refrigerators, dish washing machines, cookers and stoves, ventilators, water heaters. In the non-electric group may be noted: gas cookers, stoves and furnaces, gas refrigerators, hot water heaters, kitchen cabinets and tables, fireless cookers, pressure cookers, service lifts, tray wagons, tradesmen's service ways, aluminium ware, steam cookers, oven cooking glass, oil burning furnaces. Under the spur of necessity and demand, inventors, manufacturers and house-

HOUSE FLY



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE COMMON HOUSE FLY (*MUSCA DOMESTICA*)

1. Adult house fly; greatly enlarged
2. Detail of the foot, showing a cluster of typhoid germs on the claw; highly magnified
3. Pupa; greatly enlarged. The mature insect emerges from the pupa in about six days, except in the case of the autumn brood which remains over winter as puparia

holders are devoting their energies to the elimination of unnecessary work.

The movement commenced in the United States about 1910, where it has enjoyed its greatest popularity. A discussion of conditions in America is given below and constitutes the more general treatise on the subject of household appliances In Great Britain and European countries it was not until after the World War that any particular progress was made in household efficiency. A description of the progress in Great Britain follows that of America. (G E W C)

UNITED STATES

The general adoption of improved working equipment for the home has been relatively slow, even in the United States, and dependent upon social and economic factors which have exerted their chief influence only since 1918. Essential to the use of mechanical home equipment is electric or gas service and it was not until 1908 that electricity began to be generally adopted for home use. Even by 1918 the use of domestic appliances employing electricity had made no substantial progress, being confined mainly to electric irons and minor cooking devices; although the electric washing machine had been on the market since 1905 and the electric vacuum cleaner since 1909 From 1918, the adoption of household appliances utilizing power, as well as heat, increased rapidly. One reason for this is to be found in the educational and marketing activities of light and power companies. With increasing generating capacity, these companies felt the need of developing a domestic market for their service. By the aid of advertising and selling methods hundreds of thousands of old and new homes were yearly wired for electricity.

Gas appliances were at the same time being energetically marketed Although gas had by 1928 practically passed from use for illumination in America, it had become the most generally used fuel for cooking The successful result of these marketing activities were partly due to the rising standards of living An American study of the weekly money earnings in 25 industries over a period from July 1914 to July 1927 compared with the cost of living over the same period, shows clearly that the increase in the sale of mechanical home devices follows the increase of the family income in the wage and salaried classes.

The virtual disappearance of the domestic servant, in all but the homes of the wealthy, is a factor of less importance in the increasing use of mechanical housekeeping appliances Equipment has had its greatest acceptance and use in localities where a part at least of the domestic service has always been performed by the housewife herself. In the cities an important factor in the adoption of these devices has been the apartment house and the resultant necessity for utilizing space to the greatest possible advantage. A modern apartment offers gas or electric ranges of an improved type, automatic refrigeration, an electric dish washer built into the sink, incinerators and an adequate provision of wall outlets for the connecting of portable electrical devices in every room. Education in the use of mechanical housekeeping equipment has been a necessary part of its public acceptance. Gas and electric companies, manufacturers, schools, colleges and government departments have all given this matter a place in their programme. Another factor of great importance has been the educational work by home magazines and newspapers which have established bureaux where domestic equipment is tested for electrical and mechanical design and construction and where experiments with a wide variety of equipment in practical use are continually carried on

Standardization of Electric Wiring.—The virtual standardization of electric service voltage and frequency has been important to the sale and use of motor-driven electrical equipment. In all but a few large cities, where direct current is economically practicable, alternating current at 60 cycles, 110 to 120 volts, is the standard for domestic use. A standardized attachment plug with parallel blades and standardized wall or baseboard receptacles also have been important factors in promoting the use of portable types of electrical appliances. With this type of attachment plug now almost universally employed, electrical heating and motor-driven appliances are as completely interchangeable as the incandescent lamp. The increase in the use of all kinds of electrical equipment has had a pronounced effect on electrical wiring in the home The wiring in all but a small proportion of dwellings provided with electricity is inadequate Due to the restrictions of regulatory bodies in the interest of safety, facilities for wiring—once installed—cannot be easily or cheaply expanded. A majority of homes have been wired for the single purpose of providing light from permanently installed fixtures. To provide for the convenient use of either portable lamps or appliances, additional wall outlets have to be provided or makeshifts, not always of a safe character, contrived. Organizations within the electrical industry are attempting to improve this condition by educational means. Through a national body, the Society for Electrical Development in the United States, a standard for adequate wiring has been developed.

Small Electrical Devices.—The flexibility and safety of electric heating has brought the small electrical appliance into great popularity. The electric iron, one of the first home electrical devices, has long led the list The electric toaster is only second in popularity. Coffee percolators, waffle irons and small stoves or grills permit an entire meal to be cooked at the table For room heating in spring and autumn, the portable electric heater has met wide favour. Wall heaters are permanently installed in bathrooms where the climate is mild and a small amount of quick heat is required.

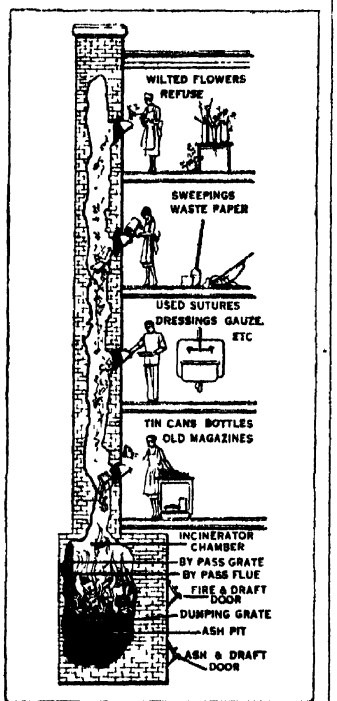
The development (about 1910) of resistance wires of nickel and chromium gave an impetus to the manufacture and use of these devices since this alloy can be heated to redness in the air without oxidation. Prior to that time heating units had to be sealed or enclosed. A recent development is the automatic operation of many small appliances. By means of thermostats irons are maintained at a constant temperature; toasters shut off the heat and eject the toast after a predetermined interval; warming pads limit the heat to a desired temperature. The extent and use of the more common of these appliances in the United States is shown by the following figures. Appliances in use as of Jan. 1929 (estimated): irons, 17,700,000, toasters, 5,325,000, heaters, 2,985,000

Small Motor Applications.—Small motors of a high degree of reliability and good efficiency have played an essential part in developing the application of domestic power Simplicity and operation over long periods, with little attention, are characteristic of small motors in use in 1929 Lubrication is cared for by grease cups or oil wells of large capacity, providing for extended use without replenishing. In addition to the vacuum cleaner, washing machine and refrigerator, motors are applied to a wide variety of household uses. The sewing machine equipped with electric motor has largely replaced the older type of foot-operated machine in America. Electric sewing machines are light in weight, portable and easy to operate General utility motors, with a variety of attachments, are applied to buffing and polishing silver, sharpening knives, freezing ice cream, operating a coffee mill, mixing and grinding food and many other culinary operations.

Kitchen Equipment.—The plan of the kitchen has come to depend on the relation, arrangement and proportions of refrigerator, range, sink and working-cabinet. Architects, educational and government institutions and manufacturers have all influenced the design of the modern kitchen. The height of working surface has been given much study; sink and range cabinet have been raised to the height best adapted to the worker; 34 in. measuring from the working bottom to the floor has been found most suitable for the height of the sink. The kitchen cabinet has grown steadily in favour. Providing food storage and a place for utensils, it brings the work table and materials into the most convenient working relation Increasingly used in a built-in form, they often provide space for refrigeration, for storage and broom cupboard.

The modern electrical dish washer, as a part of the sink, has overcome much of the indifference felt toward the earlier types of this appliance It is easily filled and drained and the washing action is provided by a motor-actuated propeller throwing hot water into and over the suitably arranged china and glassware.

Less expensive means for dishwashing is provided by a rubber tube with spray, dependent on water pressure from the tap, over wire baskets in which the dishes are arranged. The electric heating and mixing machine has many uses in the kitchen In modern apartments and in many homes, the garbage incinerator has become important In its most highly developed type this is a small furnace built directly under a wide chimney This chimney is provided at each kitchen level with a door through which trash and garbage are dropped directly to the furnace below Periodically fire is kindled and the accumulated mass burned. Along with the transformation of the old kitchen into a new laboratory has come a demand for decoration Until recently white or light shades of gray and blue have been considered most suitable for this room. There was in 1928, however, an active demand for kitchen equipment in the most brilliant of primary colours. Enamelled small utensils are of solid colour. Nickel-plated appliances have coloured handles of wood or bakelite, while ranges, refrigerators and kitchen cabinets have their flat surfaces relieved with bands of colour.



BY COURTESY OF THE MORSE-BOULGER DESTRUCTOR CO

SECTIONAL VIEW OF DESTRUCTOR, SHOWING FLUE AND COMBUSTION CHAMBER

Ranges.—There have been marked improvements in gas, electric and oil ranges within recent years In oil ranges these improvements have been mainly the construction of the burners making for better combustion In gas ranges the development of controlled oven temperatures and the insulated oven have been most notable. The electric range has developed both an automatic temperature control and an automatic time control. This time control is a clock which can be set to turn the heat on or off in the oven at any pre-determined hour. Both gas and electric ranges use porcelain enamelled iron for the frame and exterior of the ranges. Some have ovens lined in enamel; aluminium is frequently used for the oven interiors of electric ranges. In general, both have the oven at the same level as the cooking top. In some electric ranges a fireless cooker forms a part of the range. The oven also can be used as a fireless cooker since its construction is heat retaining. (*See* GAS STOVES.) Gas for fuel in movable metal containers is a recent development These containers are stored outside the house and connected by an approved piping system to a range similar to the ordinary gas range, but with special burners suitable to the combustion properties of the fuel gas The electric range has made relatively slow progress toward general use One reason has been the cost of installing the heavy wiring necessary. A smaller type electric range has been developed which can be operated on the ordinary house lighting circuit. This range contains an oven and one or two surface heating units and is so designed that it cannot at any one time employ more than the permissible limit of current from a wall outlet.

Electric cookers of the fireless and pressure types are also used to a considerable extent. These are valuable mainly as auxiliaries to other cooking equipment An improvement over former fireless types, these cookers not only give an oven heat for baking, but can within limits perform a wide variety of other cooking. Because of double walls, on the vacuum bottle principle, they maintain food at high temperatures for some hours. In the pressure cooker the steam is confined within the utensil and by increasing the pressure raises the boiling point of the liquid. This cooker is chiefly used for canning and for cooking in high altitudes.

In spite of the development of these improved types of cooking ranges a large number of families still employ coal and wood as cooking fuel. The following figures as of Jan. 1, 1929 (estimated) show the primary cooking methods of the United States; cooking by gas (manufactured) 9,500,000 families; by gas (natural) 3,470,000 families; by coal and wood 8,290,000 families; by oil 6,000,000 families; by electricity 725,000 families.

Refrigeration.—The adaptation of mechanical refrigeration to the home has been an outstanding development of recent years Research and mechanical development have been carried on for many years; units successful in operation were marketed as early as 1917. In 1925, in America, intensive marketing methods were applied and domestic refrigeration has since shown a great and increasing popularity. (*See* REFRIGERATION AND ICE MANUFACTURE and REFRIGERATION, HOUSEHOLD for a description of various types.) The electrically operated type has met with the widest favour, but gas refrigerators are also very popular. Mechanical domestic refrigeration is also available in a model actuated by oil heat This device is water cooled and is not completely automatic

In addition to the wide use of automatic refrigerators with a self-contained operating unit, there are several systems where one or more units, located at a central point, operate freezing units in a number of cabinets throughout an apartment house. This multiple type of installation sometimes follows the design of the individual electrical units, and in other systems is an adaptation of the brine circulation refrigeration systems in use commercially.

One of the results of the introduction and development of automatic refrigeration has been a general improvement in the type of refrigerator cabinets. Wooden cabinets, unless of exceptionally high-class construction, have been found to be less desirable than metal cabinets for use with electrical or other automatic units.

Vacuum Cleaners.—The electric vacuum cleaner of to-day had as predecessors the hand-operated carpet sweeper with two or more roller brushes and the hand-operated pump type cleaner Practically all modern vacuum cleaners divide themselves into two classes—those relying on suction or air movement only, and those depending on a motor-driven brush, as well as a degree of suction. (*See* VACUUM CLEANER) All types of cleaners are provided with attachments, consisting of flexible tubing, 6 or 8 ft in length, with suitable nozzles for cleaning tufted furniture, cushions and other surfaces. Very small cleaners, so light in weight as to be in effect suction brushes, are coming into use Vacuum cleaners and suction sweepers are among the most popular household appliances and were sold in 1929 in America at the rate of approximately 1,200,000 units a year.

Floor Polishers.—The tendency toward polished floors with scattered rugs instead of completely carpeted floors has developed a market for floor scrapers and polishers operated by an electric motor. These consist, usually, of heavy revolving or rotating brushes or a revolving drum equipped with sand-paper or other abrasive and attachments of suitable character for polishing and waxing. Because these floor polishers are more expensive than vacuum cleaners and because they need to be used less frequently, many people prefer to rent these devices for a brief period rather than buy them outright.

Laundry Equipment.—The hand-operated washing machine and the washing machine operated by the pressure from the water faucet had both come into wide use before the adoption of the electrically driven washing machine. The electric washing machine found its active market from 1918 on and since that time, large numbers have been sold and many types have been developed with much technical improvement. (*See* WASHING MACHINE.) Whatever the type of clothes washer—agitator, cylinder, vacuum cup, oscillator or dolly—its function is to drive soapy water through soiled clothes with enough force to remove dirt. For farm districts, where no electrical power is available, washers driven by a small light weight gas engine have come into use. The electric washer sold in 1928 in America at the



BY COURTESY OF (1) THE FRIGIDAIRE CORPORATION, (3) THE STANDARD GAS EQUIPMENT CORPORATION, (4) THE NEW YORK EDISON COMPANY, (6) THE KERNER INCINERATOR COMPANY, (7) THE HOOSIER MANUFACTURING COMPANY

MODERN ELECTRIC AND GAS HOUSEHOLD EQUIPMENT

1. Electric refrigerator: freezing chamber upper left, motor below
2. Electric range, with automatic temperature and time controls
3. Semi-enamel gas range with automatic heat control for oven
4. Electrical device for squeezing fruit, beating eggs or whipping cream
5. Electric toaster and coffee percolator
6. Incinerator for apartment-house
7. Kitchen cabinet, combined with refrigerator and broom closet, designed for use where economy of space is essential

rate of 750,000 to 800,000 units per year.

Accessory Heat and Ventilation.—Although the small electric fan has a certain popularity in the south of the United States and sells rapidly during a few weeks or months in the very warm weather, elsewhere electrical ventilation has never received the public response or use that is possible Manufacturers provide domestic ventilating fans in a variety of units. They are usually reversible so that used air from within the house may be exhausted or fresh air from without drawn in. These fans require no elaborate installation, being provided with adjustable frames which may fit into a partly opened sash window. (*See* HEATING AND VENTILATION.) For accessory room heating portable gas heaters are most popular Many types of portable gas heaters, including gas grates, are widely sold. Electric heaters of the radiant type are also in general use. These, however, produce but a small amount of actual heat, since they are limited to the amount of current which can be taken from a wall outlet. Portable kerosene heaters also find a considerable market, the common type being a large wick burner set in a steel cylinder for radiating heat.

Water Heaters.—One of the prime necessities in the modern home is a continuous and abundant supply of hot water. A common method of heating water is a coil or pipe in the fire box of the heating furnace or boiler connecting with a storage tank. This method, while perfectly satisfactory during the winter months, makes no provision for a hot water supply when the furnace is not in use. Hot water heating systems independent of the house heating systems are, therefore, very generally employed Where gas is available, it leads all other fuels in popularity for water heating There are a number of types of gas water heaters, the simplest of which is the side-arm heater. This consists of a gas burner below a coiled pipe or water container attached to a tank by two pipes which provide circulation through either the container or the coil In general this side-arm heater has to be lit whenever hot water is desired It can, however, be thermostatically controlled, maintaining water at a constant temperature in the storage tank. Time clock control is also possible.

The instantaneous gas water heater provides hot water at the turning on of any hot water tap on the pipe line attached to the heater, operating by means of a hydrostatic valve When all the taps on the hot water line are closed, the pressure on both sides of the hydrostatic valve is such that the latter remains closed When any tap is opened, the release of the pressure operates the valve, which, in turn, opens the gas valve supplying the burner. Kerosene water heaters are in use in many districts where gas is not available. These heaters are generally similar to the gas water heater. Electric water heaters, flexible and easy to operate, have been in use for many years Until recently they have been comparatively expensive, even where electricity rates were low. However, development of a type employing low-wattage consumption indicates a broad use of this equipment for water heating in the future. The storage electric water heater cannot furnish an immediate supply of hot water, requiring several hours for sufficient amount to be heated The efficiency of the electric water heater, however, is very high, owing to the fact that the heating element is mounted directly in water

(L E M)

GREAT BRITAIN

In 1920 in London the first post-war Ideal Home Exhibition began the movement in Great Britain. The time payment or hire purchase method of selling has been utilized by makers of household appliances with astonishing success. In Great Britain and other English-speaking countries increasing numbers of housewives are purchasing household appliances out of their housekeeping allowance, setting aside sums—equal to the amount formerly paid for a human assistant—to purchase mechanical aids.

Vacuum cleaners are becoming increasingly popular, and it was estimated in 1928 that more than 150,000 are sold annually of the electrically operated and non-electric types. Electric floor polishers are not as widely used in Great Britain as in the United States and in a lesser degree in European homes. The educational propaganda of companies interested in marketing mechanically operated refrigerators has caused similar activity by companies making artificial ice, and householders are realizing that a good refrigerator is a necessary appliance in the modern home.

Large capacity dish washers are available for hotels and restaurants and several reliable and efficient dish washers for household use are marketed but the cost in 1928 was high and a considerable amount of human attention necessary. A household ventilator has recently been marketed in England which may considerably change the method of house planning Whereas architects had to exercise great care in the location of the kitchen—especially in flats or boarding houses—by this ventilator, cooking smells, steam, etc., can be satisfactorily dispersed, no matter where the kitchen is placed. This device consists of an electrically driven fan, either set into the wall of the kitchen, bathroom, etc., or placed in the window. The motor is reversible, so that the fan will either exhaust cooking smells, fumes, steam, etc , or bring fresh air into the room. It is particularly useful to prevent discolouration of walls by fumes, or condensation of steam.

Washing Machines and Heaters.—While dish washing by mechanical means cannot be said to have had a great popular response, clothes washing by machine has proved to be both practical and labour saving (*See* WASHING MACHINES)

The increasing use of steam or hot water central heating has in many modern homes meant that the kitchen fire has been supplanted by gas, electricity or oil. In Great Britain, although central heating has not become universal in the ordinary home, hot water heaters, known as independent boilers, are being used not only to supply hot water but also to heat two or three radiators. These independent boilers burn coke, anthracite or soft coal and are also used as incinerators for kitchen refuse. Owing to the general use of gas-coke, which is a by-product obtainable at a reasonable price, for an ordinary three- to five-bedroom house these independent boilers can be operated at a cost of 6d or 12 cents per day, and give ample supplies of hot water from three or more outlets. When installing an independent boiler it is very necessary that the "flow and return" or "two pipe" system is employed. Gas is also widely used in Great Britain for water heating, either by a specially constructed gas-boiler or a "geyser" The latter consists of a coil, through which the water passes, heated by a number of gas burners; it is thus able to deliver quickly a large volume of water at high temperatures. A similar form of coil heater is also in general use in France, in which, when the water is turned on at any outlet, a pressure valve is released and the gas supply is turned on, a pilot jet lighting the burners. When the gas boiler, of which there are many economical and excellent types, is employed the water is passed through a storage tank, the burners being controlled by a thermostat By using heavily insulated storage tanks it is possible, where current is cheap, to heat water electrically at a cost competitive with other methods. Some electricity supply companies have special "off-peak" rates which enable morning bath water to be heated at an exceptionally low cost. As it is controlled by a thermostat, no attention is necessary

Methods of Cooking.—A single century has seen greater improvement in methods of cooking than in all the previous years during which man has had to eat to live. Coal has replaced wood as a fuel, gas has replaced coal, and electricity, wherever supplies are available at reasonable cost, is replacing coal and gas The spit and grill were replaced by the coal and wood stove, which have themselves been replaced by the gas or electric range, and these may be partially replaced by steam and pressure cookers. In the 20th century, greater developments have been made with various forms of new cookers and adaptations of existing methods of cooking, than in any other household appliances. Automatic oven controls for electric and gas ranges are now in general use. The burners of gas stoves have been improved and hot plates for electric stoves have been perfected.

Two new forms of cooking are now claiming attention. One is the inducer or transformer system of electric cooking and the other is a 20th century adaptation of Denis Papin's "Marmite," invented in 1685. This system of steam pressure cooking has been attracting attention for several years and although entirely successful is not in general use largely owing to lack of public information. In France, cooking by pressure is increasing in popularity

rapidly. At recent exhibitions of household appliances, pressure cookers have been freely exhibited. With the French cookers, cooking is done at temperatures of 260° to 275° F and at pressures of from 20 to 30 lb. to the square inch.

The transformer or inducer system of electric cooking can hardly be termed, as yet, commercially successful. Contingent factors which may mar its ultimate success are that it is restricted to use on alternating current, and, the utensil itself forming part of the heating unit which is made of the relatively costly stainless steel (*q v.*), the initial outlay is heavy The frying pan, kettle or saucepan is arranged to act as the opposite side of the transformer, taking current at low voltage On a 3·7 kw inducer a pint of water can be boiled in one minute Twenty minutes after switching on, a 4·5 kw. heater will supply 5 gal of boiling water at the rate of 4 pints per minute, or provide for a 20 gal bath at a cost of 2¼ units. The electric inducer provides a method of cooking whereby the entire quantity of heat generated by the amount of current consumed is actually transmitted to the food through the walls of the container, there being no escape to the atmosphere. The power factor of the inducer is usually well above ·9 It seldom falls as low as ·85 The maximum loading of a complete inducer equipment is less than that of a corresponding electric equipment; although the loading of one or more units may be much lighter than is customary in other equipments For instance, an oven and grill with one large (3,700 watts) and two small inducers (750 watts each), will have a maximum loading of 5,200 watts as against a maximum loading of 6,000 to 8,000 watts on other electrical cookers. The heat is induced in the vessel itself, the inducer remains cool, no surrounding metal parts are heated along with the vessels. The action being instantaneous, this method of cooking will, if successful, do much to eliminate one of the present disadvantages of electric cooking

Other Labour-saving Devices.—There are many appliances which will save labour in the home but in this short article detailed descriptions are impossible. The tradesmen's delivery hatchway is an appliance which is invaluable It consists of a series of compartments mounted on a frame which rests in hydraulic tubes The compartments are inside the house and communication with these compartments is obtained by the tradesman opening a door in the wall and depositing his parcel When the door is closed, the inside series automatically descends one notch, making another empty compartment available for the next tradesman. This hatchway and similar types have been adopted in many restaurants and hotels In hard water districts, a water softener is a particularly useful appliance It can be arranged for the particular supply required, *e g*, for the bathroom, or large models can be obtained through which the complete household supply can pass. Oil burners for furnaces are becoming increasingly popular Wherever they are used, being automatic in action and controlled by thermostats, they enable the whole house to be heated with little human attention (*See* OIL HEATING, DOMESTIC) In Great Britain, the general absence of cellars or basements and the more stringent insurance regulations regarding the storage of oil fuel, have restricted the sale even to those homes which have central heating. A cheaper device which, although not eliminating the necessity of stoking, enables an even temperature to be obtained automatically, consists of an electric blower which is arranged in the furnace A thermostat, which is set at the temperature required, controls the motor in the blower.

Aluminium ware has now become almost universal for saucepans, kettles, etc It has been found to be serviceable, easy to clean and light in weight. Enterprising manufacturers have devised many interesting and useful vessels in this metal Porcelain enamelled table tops, sink draining boards and tray tops are now widely used in the kitchens of both American and British houses. The perfection of a 99% pure iron has enabled vitreous porcelain to be satisfactorily applied to this metal, giving a white smooth surface easily cleaned and hygienic. Linings for refrigeration are also made of this material.

Trolleys or dinner waggons are found to be the best solution of clearing or setting the dinner table The best type of waggon has 4″ swivel acting, rubber tyred wheels, which enable the trolley to run over rugs, etc. without jarring. (G. E. W. C.)

HOUSEHOLD TROOPS: *see* GUARDS and HOUSEHOLD TROOPS.

HOUSEKEEPING. The control or management of household affairs, including (1) the provision of sufficient and suitable food for all members of the household, (2) the control of household expenditure, (3) the engaging and supervision of servants and (4) the responsibility for the cleaning, warming and lighting of the house, and the care, laundering and renewal of the linen.

Organization and Routine.—Housekeeping is one of the most comprehensive occupations that a woman can undertake, for there are few other careers which demand a knowledge of such widely different subjects as child welfare, dietetics, marketing, cooking, elementary finance, mending, home nursing and entertaining, and many people undertake this exacting work without any previous experience It is therefore not surprising that difficulties frequently arise

Just as the heads of commercial undertakings run them methodically and on strict business lines, the housekeeper must make full use of her organizing ability if she wants to make a success of her work She should regard herself as the managing director and should aim at reaching a high standard of efficiency by careful and methodical planning, and by keeping her ideas up to date

Whilst it is unwise to introduce unnecessary rules into the home, the first duty of the housekeeper should be to draw up a budget for her own guidance, so that expenditure may not exceed the allowance, and a daily and weekly plan of work for herself and maids By this means, mismanagement and confusion will be avoided.

Budgeting the Income.—The sum to be allotted for housekeeping expenses should be agreed after due consideration, bearing in mind not only the income but all fixed expenses For example, parents willingly forego some of the amenities of life in order that their children may have a liberal education Therefore, during the period that educational expenses are high it may be necessary to cut down the housekeeping expenditure considerably This can be achieved by the reduction of domestic staff, curtailment of entertainment, and in other ways, but it is false economy to reduce either the quantity or quality of the food

When the income is strictly limited, ill health and other contingencies demand the practice of strict economy, and frequently the cutting down of the housekeeping allowance is the only way by which this may be achieved

Although space will not permit a discussion of family finance at great length, sufficient has been said to show that it is difficult to make a hard and fast rule, or to state definitely with any degree of accuracy what proportion of the total income should be allocated to housekeeping in any particular ménage

After making careful study of a number of budgets, it would appear that incomes above £400 may be apportioned as follows:

40% Housekeeping Expenses including wages.
15% Rent, rates and taxes or mortgage
10% Education
10% Clothing
10% Holidays.
8% Insurance and Saving
2% Charity
5% Incidental.

N B Considerably more than 15% of incomes under £400 will be required for rent, etc.

Cost of Food.—It is possible to feed a family of three adults on 10/6d per head per week, at prices ruling in Britain in 1928 This sum provides a balanced diet and one which—at least physiologically—is sufficient in quantity, although the fare would not be particularly interesting. If an attractive diet and good quality food are desired, at least 17/- to 20/- per head per week must be allowed when catering for as small a number as three adults If the numbers are increased, the cost can be reduced to 15/- to 17/- per head, although it is impossible to provide luxuries for this sum

Housekeeping Expenses.—Not only is it necessary to decide the sum to be allocated to housekeeping expenses, but it is also

very important that the person responsible for spending the money should have definite knowledge as to her responsibilities.

In large establishments it is customary for a paid housekeeper to receive an allowance from which she pays all tradesmen's accounts for food, cleaning materials, laundry, renewals, servants' wages and small incidental expenses. Accounts for repairs to the fabric of the house, charges for gas, electricity and water and local rates are usually dealt with by the head of the house.

In small households the housewife often prefers—particularly if she has any business ability—to be responsible for every cost incurred in connection with the management of the home, including rates, monthly or quarterly tradesmen's accounts, wages, etc. When this arrangement is decided upon it is advisable to open an account at a local bank, and utilise it entirely for household expenses, the head of the house paying in the agreed sum of money either monthly, quarterly or half yearly and the housewife drawing the cheques herself.

When circumstances are such that it is not convenient or necessary to adopt this method, or when the housekeeper does not wish to shoulder the responsibility, she should receive an allowance in cash weekly out of which tradesmen's bills, laundry, small incidental expenses and weekly wages should be paid, the husband settling monthly and quarterly accounts, rates, taxes and rent as they become due.

The keeping of a simple system of household accounts is strongly advised, in which money expended on clothes and personal items should be kept entirely separate

Housekeeping in the Servantless Home.—Owing to the scarcity and relative inefficiency of domestic help combined with the increased cost of living and wages, a very large number of housewives who previously kept one or two maids now prefer to do their own work, and provided the members of the family appreciate the changed conditions, the running of a servantless house need not deprive the housewife of her outside interests, friends and pleasures.

Labour Saving Houses and Equipment.—Having decided to dispense with paid labour, those who are living in old-fashioned houses which appear to have been designed with the object of making work, will naturally endeavour to obtain a modern dwelling better suited to the new conditions Such houses are not difficult to find, for builders are now providing houses in which a serious attempt is made to reduce labour to a minimum. When selecting a house to be run with little or no paid labour, attention should be paid to the following points —

1 The wiring of the house for electric power as well as for lighting and, if power is not available, when it is likely to be in the near future Only those who regularly use such efficient and tireless servants as electric cleaning and washing machines, floor polishers, toasters, kettles and irons can appreciate the labour they save

2. The elimination of all unnecessary mouldings on windows, etc , dust collecting cornices, and tarnishable metal fittings

3 The proximity of the kitchen to dining-room and the provision of a serving-hatch The absence of steps, not only at the front entrance but between the kitchen and living room, so that full use can be made of a tray wagon, thus eliminating the carrying of trays.

4. The provision of built-in cupboards, the shelves of which can be reached without strain or inconvenience.

5. The position of the sink in relation to the cooking stove and larder, for step saving is worthy of much greater attention than it receives.

These few points are sufficient to indicate that the actual planning and design of a house affects very largely the possibilities of saving labour

Planning the Work of a Servantless House.—It is presumed that the house consists of two living rooms, hall, kitchen and scullery, four bedrooms, bathroom and staircase

Housewife's Daily Duties

7 00	Rise.
7 20	Unlock, light fire if necessary, prepare breakfast.
8.00	Breakfast.
8.30	Clear away and wash up. Open beds.
9 00	Sweep porch, clean steps and letterbox, and shake mats.
9.15	Daily work in dining- and sitting-rooms.
9.45	Make beds Sweep or vacuum and dust bedrooms, bathroom, landing, stairs and hall
10.40	Prepare for lunch and evening meal. Shopping when necessary.
11 30–12 45	Weekly work
12 45	Cooking.
1 15	Lunch
1 50	Washing up. Sweep and dust kitchen, etc.
3 00– 4.30	Free time
4 30	Tea and free time
6 00	Prepare evening meal.
7 00	Supper or dinner.
8 00	Clear away.

Weekly Work —Monday, Laundrywork, Tuesday, Ironing; Wednesday, turning out dining-room and lounge alternate weeks; Thursday, turning out two bedrooms; Friday, bathroom, landing and kitchen; Saturday, stairs and hall

The One-Maid House.—Where one maid is kept and there are no children, the arrangement of work given above could be adhered to The mothers of young children generally prefer to take complete charge of them, leaving the maid free to do the housework

The mistress of a one-maid house must organise the work of the house so that the maid has at least two hours a day free, one evening or half-day a week and every Sunday afternoon and evening

The conditions of domestic service will then more nearly resemble those of industrial work, and dissatisfaction is less likely to occur

Homes with More Than One Servant.—A mistake commonly made by inexperienced housewives is to attempt to run their house with too small a staff, and failing to give assistance when it is required Therefore, it is most important that a plan of work and time tables similar to that given for the servantless house, be drawn up, in which the duty of each maid is stated If, after it has been tried, it does not prove satisfactory the matter should be discussed with the senior maid and the time table modified. If dealt with sympathetically few maids prove unwilling to co-operate with a mistress who is interested in their welfare

Another duty of the housekeeper is to provide a comfortable sitting room in which maids can spend their leisure time

Duties of Servants —

The Cook is responsible for all cooking, and sometimes for the cleaning of dining room, kitchen and larder

The Parlourmaid waits at table, is responsible for the drawing room and lounge, answers the door and valets the master

The Housemaid is responsible for bedrooms, bathroom and dressing rooms

The House-Parlourmaid combines the duties of housemaid and parlourmaid. (D D.C T)

THE UNITED STATES

The general principles of household management, while the same in all countries, must be modified in the United States to meet the diversified conditions of American life

The Household Employee.—From colonial times the problem of paid help in the household has been greater than in older countries, since the opportunities for work other than domestic have been more numerous. Families on the same economic level as those employing three or four servants in Europe, employ one "general housework" girl in the United States, with perhaps some part-time assistance for cleaning and laundry. The social position of the household "help" was not affected in colonial times by domestic service, but with the increase of industrial and clerical work open to women the servant's status sank in the social scale. Also the hours of duty were longer and the personal freedom of the servant in her "time off" was often restricted by the demands of the employer. "Living in" meant no home in which to receive friends, and the bedroom of the servant was often unattractive In consequence, the number of American girls willing to do such work steadily lessened, and even immigrant

girls soon learned that they would have greater freedom and better social advantages in other employments. With the restriction of immigration the servant supply was left far below the demand.

Of recent years there has grown steadily, especially in large cities, a movement to put the work of the household employee on an industrial basis The aim of this movement is to arrange for the employee an eight-hour day, a six-day week, to live and eat out, and to be called "Miss" or "Mrs" as would be done in a shop or office By this arrangement the employer receives eight hours of steady work, almost invariably more work than was done in the longer hours of the old type of servant The day off is chosen by the employer Where there is only one employee, this leaves the housewife responsible for one meal each day, and three on one day If two are employed, or even one full-time and one part-time, the hours can all be covered by a proper schedule. The employer saves the cost of an extra bedroom, often high in large cities, and the cost of food, which to-day is no small matter. A higher weekly wage compensates for this. Part-time service on this basis is increasing, and bids fair to solve the household help problem for many housewives who cannot afford full-time service The social stigma is largely removed by this plan, and it is believed that an increasing number of girls and women now employed as industrial workers or clerks will prefer this less monotonous and equally well-paid occupation

Labour-saving Devices.—The scarcity of household employees, the cost of employing them and the desire of the homemaker for more time for other interests, have combined to stimulate the production and general use of labour-saving devices The rapid growth of available electric power has made possible the greater number of these, and widespread advertising has made them known to everyone. The electric iron, toaster, grill, vacuum cleaner and washing machine are widely used; the electric or gas refrigerator, the electric dishwasher, floor polisher and mangle are sold in astounding numbers. From 1924 to 1928 the sale of electric washing machines doubled, and the sale of small electric equipment (including vacuum cleaners) increased 2,000%. In a single year there were sold 790,000 washing machines and 1,028,000 vacuum cleaners. Many of these were sold on the instalment plan, showing that they went to homes of moderate or low income The use of electric ranges increases less rapidly, since in most urban communities gas is still the cheaper fuel.

Care of the House.—In industrial centres and in many other places the use of soft coal entails more cleaning and therefore more wear and tear. Paint for walls is much more easily cleaned than wall-paper, and is more widely used. The use of the vacuum cleaner and the general substitution of rugs for carpets simplify the problem somewhat. The number of cleansing agents for household use is enormous As yet no testing bureau supplies the housewife with adequate data regarding these, but the American Home Economics Association and the Bureau of Home Economics of the U S Department of Agriculture are stressing the necessity for this. Much attention has been given to planning and arranging the kitchen equipment to make the work as easy and efficient as possible.

Laundry.—Modern equipment simplifies the laundry work, but in cities, lack of space for the work and the cost of hiring a laundress usually make it economical to send at least the household linen to a commercial laundry. It may be returned as "wet wash," to be dried and ironed at home, rough dried, to be ironed at home, or finished. The prevalence of silk underwear and silk stockings or socks makes possible easy laundering of these at home Dry cleaning of clothing, wool blankets, etc., is generally done in commercial establishments, though much of it is still done in the home.

Aids in Housekeeping.—The Bureau of Home Economics of the U S. Department of Agriculture does much research work, publishes helpful bulletins for the homemaker and gives personal advice to enquirers. The agents of the extension service of the same department daily teach, advise and help thousands of women in the rural districts and the smaller communities. (*See* HOME ECONOMICS) The U.S. Bureau of Standards does testing of value to the housekeeper, though at present this information does not often reach her. The women's magazines and the farm journals, which are many and whose combined circulation runs into millions, give their readers much valuable matter, and some of them conduct testing bureaux. They also publish pamphlets on various housekeeping subjects. Some large newspapers provide daily or weekly well-ordered and authentic information for the homemaker, and many other papers give more or less desultory information for her The alert housewife can get authoritative information regarding any part of her task easily and at a low cost (*See* also FAMILY BUDGET)

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(I E L.)

HOUSEL, the English name, until the time of the Reformation, for the Eucharist The word in O Eng was *húsel*, with the meaning "sacrifice" From this came the verb *housel*, "to give communion to" and from this the noun developed

HOUSELEEK, *Sempervivum*, a genus of ornamental evergreen plants belonging to the family Crassulaceae About 50 species are known, some of which are hardy perennial herbs, and grow well in dry or rocky situations; the others are evergreen shrubs or undershrubs, fit only for cultivation in the greenhouse or conservatory The genus *Sempervivum* is distinguished from the nearly allied *Sedum* by having more than five (about 12) petals, and by the glands at the base of the ovary being laciniated if present The common houseleek, *S. tectorum*, is often met with in Great Britain on roofs (where it is sometimes planted to keep slates in position), and wall-tops, but is not a native Originally it was indigenous in the Alps, but it is now widely dispersed in Europe, and has been introduced into America The leaves are thick, fleshy and succulent, and are arranged in the form of a rosette, lying close to the soil. The plant propagates itself by offsets on all sides, so that it forms after a time a dense cushion or aggregation of rosettes. The flowering stem, which is of rather rare occurrence, is about 1 ft high, reddish, cylindrical and succulent, and ends in a level-topped cyme, reflexed at the circumference, of reddish flowers, which bloom from June to September *Sedum acre* (stonecrop) is styled the little houseleek. In Germany it is sometimes called *Donnerkraut*, from being supposed to protect the house on which it grows from thunder. *S. glutinosum* and *S balsamiferum*, natives respectively of Madeira and the Canary islands, contain a very viscous substance in large quantity, and are used for the preparation of bird-lime; fishermen in Madeira, after dipping their nets in an alkaline solution, rub them with this substance, rendering them as tough as leather. *S. arboreum* is employed in Cyprus, the East, and northern Africa as an external remedy for malignant ulcers, inflammations and burns, and internally for mucous discharges

HOUSE OF CORRECTION or **BRIDEWELL,** in England and the United States a prison for the confinement of petty offenders. Originating as a workhouse, a place of compulsory employment for vagrants and others out of work, the house of correction in England for a hundred years performed a useful service in the relief of destitution, but by the end of the 17th century it had degenerated into a dumping ground for the riff-raff of the local criminal population When in 1774–76 John Howard made his famous survey of prison conditions in England and Wales there was little but the name to distinguish the Bridewell from the common gaol. With the centralization of the penal system effected by the Prisons Act of 1877, the houses of correction passed under the control of the Home Office. In the United States they are still administered by local government—city, town or county (*See* GAOL; PRISON) (G. W. KI.)

HOUSE OF ISSUE, an investment banking house which underwrites, advertises, and undertakes the sale of an issue of stocks or bonds for a corporation. It is known as the house of issue to distinguish it from other banking houses which may be merely participants in the disposal of the securities.

HOUSE PLANNING. The first quarter of the 20th century has marked a period of great progress in house planning

The great mechanical advances of the 19th century have been consolidated. The building industry has for the most part recovered from the mistakes made in the first joy over the discovery of power machinery. There was a dreadful period when tradition was thrown to the winds All past developments of style, mass, detail and even arrangement were forgotten Men began to study to recover their lost traditions in building and design. With the return of taste and understanding in domestic architecture at the turn of the century, the wealthy man was naturally the first to benefit. Recent years have witnessed further development People of moderate means have found that they, too, can obtain a modern well planned house.

The layman is apt to think of a house in terms of its appearance and to distinguish houses by various labels, such as "Colonial," "English" or "Spanish." The architect's method is preferable: it is to think first of the use to which the house is to be put; on the one hand what is to go into the house in the way of rooms, space and equipment; and on the other how so to arrange these facilities as to make the best use of the natural advantages of the site, such as sunlight, prevailing breeze, view and trees. When thought of in these terms, with the things wanted balanced against the expected price, the house evolves naturally and the type of design may then be selected.

Land.—The price of land has had a direct effect on the size and variety of houses High-priced land has produced the apartments and row houses of the more densely populated cities, (*see* SOCIAL ARCHITECTURE) Low-priced land has made the detached suburban house and the country house with its rambling wings. House planning proper deals with the individual country or suburban home

The small suburban lot has been a bane on the full enjoyment of natural advantages It so cramps the plan and the arrangement of both house and grounds that the beauty of the out-of-doors is either spoiled or lost To combat this difficulty, where the means of the owner are small, there has been developed in England a method of grouping houses so as to concentrate open spaces and make them more useful and enjoyable (*see* GARDEN CITIES) Perhaps the nearest approach to this in the United States is at Bridgeport, Conn., where a sincere effort to escape from the limitations of the small plot has been made. Had this plan not been adopted, land cost would have compelled either a suburban apartment development, a city row type or the suburban small lot street with each house denied any advantage of outlook and most of the rooms looking directly into neighbours' windows.

One of the great problems remaining to be solved is the question of the efficient utilization of land There must be a proper balance between the areas utilized for streets and public use and the areas to be put into private lands In some cases actual discredit has been brought upon the garden city movement by unintelligent and impossible community plans Mistakes which require disproportionate expenses for streets, pavements, water and sewer and other service features handicap house planning, for these mistakes must be made up for by skimping in design and construction. It is popular to blame the diminishing size of the house upon the high cost of labour This, however, is only one of the contributing factors Excessive land costs and wasteful promotion and financing are responsible for innumerable cases which are uneconomic before a single brick is laid or a nail driven.

Modern Conveniences.—The introduction of modern conveniences into homes has played a large part in changing methods of house planning From one point of view the decreasing size of the house has made necessary more efficient planning and equipment From another, the demand for conveniences has increased the intricacy of the construction work and added materially to costs, thereby reducing the size of houses. Closets were once a rarity; then they were a space behind a door; to-day even closets are efficiently planned in detail; while they occupy less than one-tenth or one-twelfth of the area of the average room, closets cost from one-quarter to one-fifth as much.

Bath-room.—Bath-rooms occupy perhaps one-fifth of the area of the average room but their cost is nearly double. Not so long ago one bath-room in a house was a luxury Now those who can afford it demand a bath for every bedroom and two bath-rooms are common in even the smallest houses. Bath-room costs vary greatly, but an important part of the expense is in bringing the water-pipes to the room and in carrying off the drainage and the gases from the pipes in a sanitary manner Money is saved when the plan is so arranged that the structural difficulties involved in carrying pipes through walls and ceilings are reduced to a minimum The finish of walls, base and bath-room floors in tile or other special material, which brings another trade to the job, is the cause of a very considerable part of the expense of the bath-room, for obviously the tile-work must wait until all pipework behind the walls is complete The many kinds of special tile and other fittings in all grades and combinations of colour that may be had to-day are a temptation to the average owner Frequently there are long waits for special orders, and delays above all things are expensive in construction Further details in regard to plumbing and bath-room equipment are given in the section of this article dealing with *Mechanical Equipment*

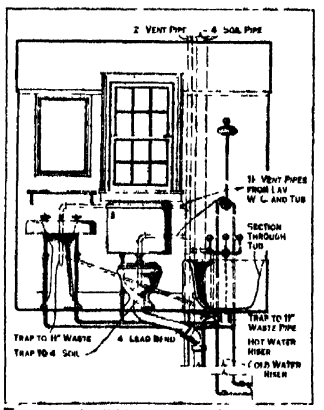


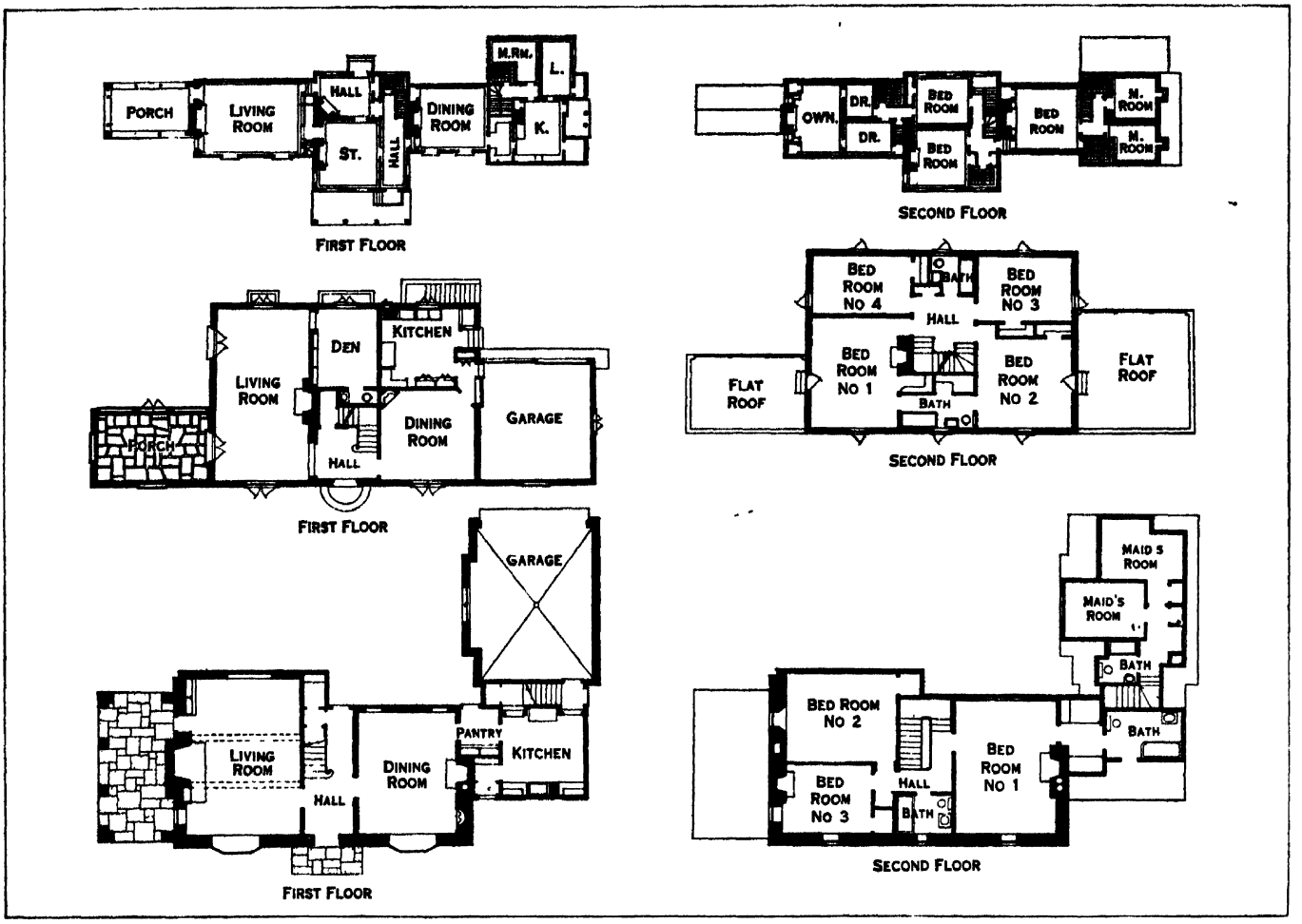
FIG 1.—LAYOUT OF A MODEL BATH-ROOM

Heating.—House heating has become an exact science with a system of ducts, pipes and valves just as complicated as those that serve the bath-room Economy in heating is gained like all economies by reducing waste A great step in advance has been made by more thoroughly insulating the shell of the house against exterior cold. Insulating material applied to the sheathing of a frame house or under the furring of a masonry house and in the attic, together with effective window stripping, will greatly increase the efficiency of any heating unit The principal methods of modern heating are described in the section of this article dealing with *Mechanical Equipment*

Garage.—The garage has developed from a shed in the back yard into a part of the house, in most cases commodious enough for two cars and with at least the simplest provisions against the spread of fire to the house proper. The floor should be of cement and the walls of masonry; hard cement plaster on a fire-proof backing may be used for both walls and ceilings The door, at least on the garage side, should be metal clad, though conformity with insurance companies' regulations requires even greater protection The tendency to make the garage a part of the house has helped to clean up unsightly back yards and, because of the greater privacy possible, to reverse the desirability of front and rear for living or service features. It is certain that in modest cost suburban developments the removal of the clutter and noise from the back yards has been a great step in the direction of better homes.

Kitchen.—The kitchen has developed from a large room containing a huge coal stove, a hot water drum and a tiny sink into a smaller room designed in detail and equipped with labour-saving devices The modern sink and the small efficient gas or electric stove should be properly related to each other The dressers, cupboards and counters should be arranged convenient to the sink and service dining table, dry groceries should be convenient to the preparation table There are various types of dressers. Open shelving is the cheapest Enamelled metal shelves with glass doors are perhaps more sanitary than those of wood

There are two types of kitchen efficiency, one for the house designed to be operated with one or no servants and the other for the house designed for several servants. There is the combination sink and the single laundry tray, and the combination sink and dishwasher. There is the electric washing machine and the electric mangle, which of course in the larger houses are placed in a separate laundry. The built-in dining alcove is typical of the modern tendency to save space and labour. Folding ironing boards are also space savers. The electric iron has displaced the old-



BY COURTESY OF THE ARCHITECTS (TOP) ARTHUR C HOLDEN AND ASSOCIATES; (CENTRE) ALFRED EASTON POOR; (BOTTOM) EDGAR & VERNA COOK SALOMONSKY

FIG. 2 —TOP PLAN· RAMBLING FARM-HOUSE TYPE, ONE ROOM DEEP, PRINCETON, N J CENTRE FRENCH PROVINCIAL CHARACTER WITH HIGH ROOF LINES AND STUCCO WALLS, WOODMERE, L I BOTTOM· "L" SHAPED HOUSE WITH LOCAL STONE WALL, SCARSDALE, N.Y.

fashioned flat-iron The electric outlet used for the iron should always have special fuse provision and a bull's-eye signal switch Electric or gas refrigeration is fast displacing the old-fashioned ice

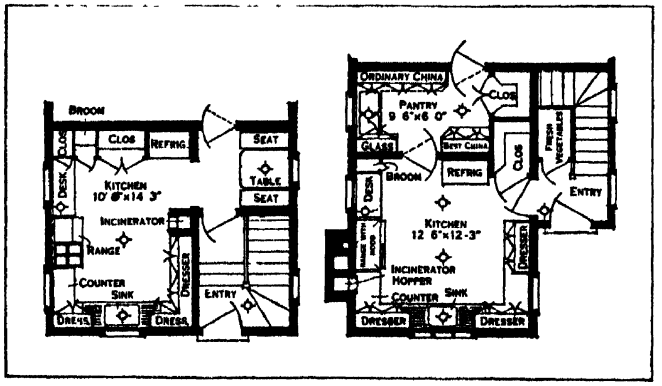


FIG. 3.—LAYOUTS OF TWO WELL-ARRANGED KITCHENS IN A MODERN HOUSE

man and the old annoyances of ice deliveries and overflowing ice drains. For those who can afford its installation, the incinerator is the cleanest and most convenient method of garbage and rubbish disposal These modern conveniences add to the complexity and expense of construction, but they facilitate housekeeping and increase the productivity of the housewife or her servants

Plan and Its Relation to Style.—Houses take their character largely from that of the plan they follow The influences that usually fix the type of plan are: (1) the economic factor, (2) climate, (3) habit, (4) site Some kind of house may be planned to fit almost any kind of site; the lot for which it is most difficult to plan a good house is the long narrow city type; some irregular sites offer very unusual opportunities

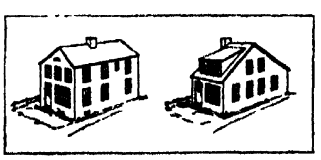


FIG. 4.—HIGH, NARROW HOUSE WITH A LONG RIDGE (LEFT) AND HOUSE WITH OVERSIZED GABLE AND SHORT RIDGE (RIGHT)

In the great majority of cases the economic limitations of the narrow town lot dictate a narrow house. If that house is to be made detached, and considered only as an individual house, the problem is one to which there is practically no solution aesthetically satisfactory If there are two storeys and the roof ridge runs the length of the house with a gable at each end the effect will be of an unpleasant high-waisted box If the gable is placed on the long side of the house it will bring the roof down lower at front and back as desired but it will make it necessary to put on two sets of dormer windows in order to get light at front and rear on the second storey Of course in the case of houses on narrow lots these will be the most important windows of all, hence will have to be made disproportionately large. As a result, the rafters of the main roof will be cut to pieces and the roof itself then degenerates into little more than a fringe around the house. A single detached house on a lot narrower than 50 ft. is almost certain to be an architectural and economic monstrosity. When the shape of the rectangular plan comes nearer to square, there are limitless possibilities of design. If the house is very small, it will be out of proportion unless the rafters start from below the ceiling height on the second floor.

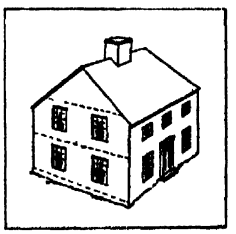
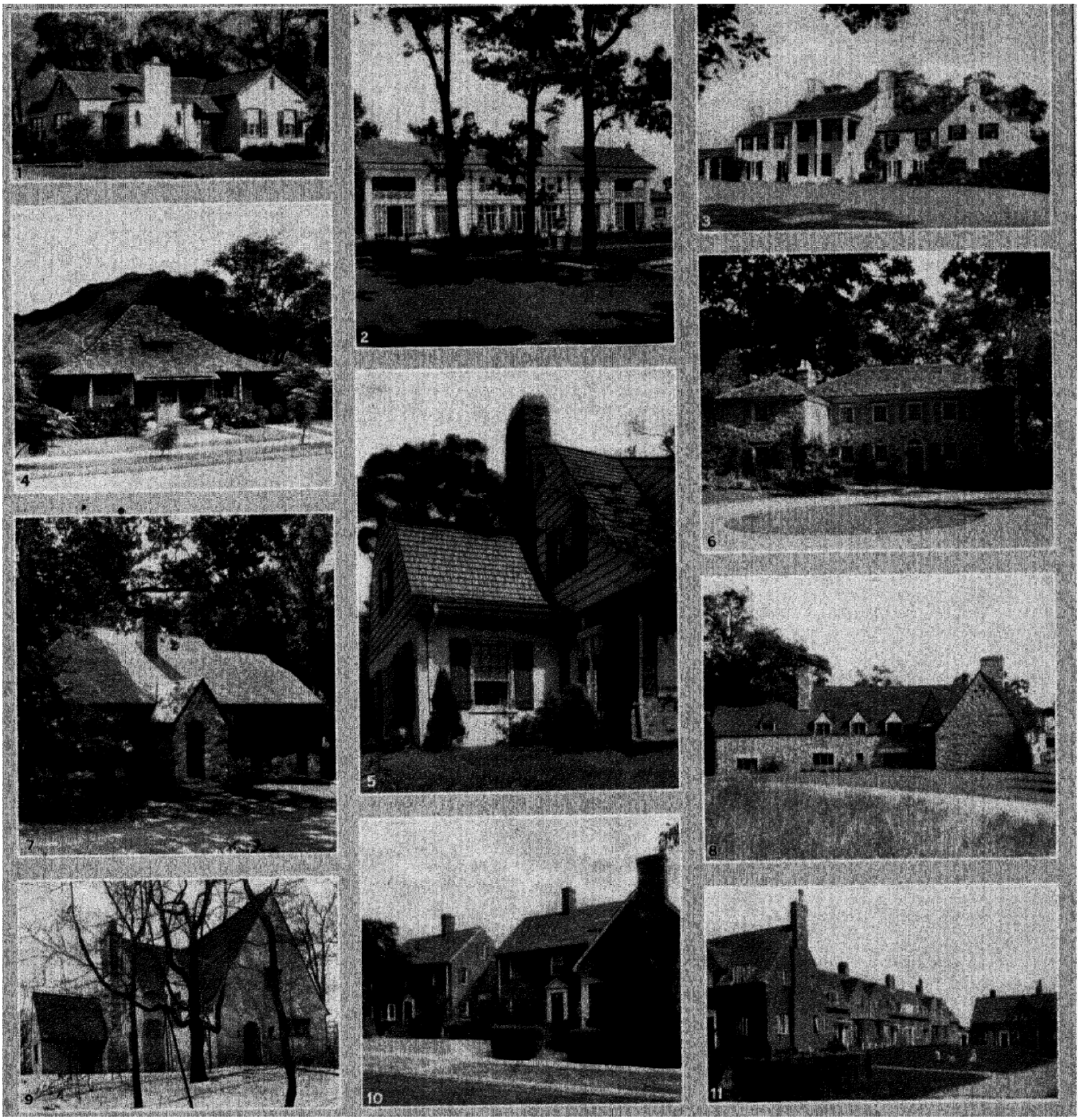


FIG. 5.—DIAGRAM SHOWING RIDGE ON CENTRE, RAFTERS STARTING BELOW SECOND STOREY CEILING



PHOTOGRAPHS, (1) COPR., ARCHITECT'S SMALL HOME SERVICE BUREAU, (7) DREX DURYEA, (11) F. A. STEELE

MODERN HOUSE DESIGN

1. An American bungalow with a Spanish tile roof, from design 5-B-6 Architects' Small Home Service Bureau
2. Classic lines and mass used for a gentleman's home, Mt. Kisco, N. Y. Chas. A. Platt, architect
3. Example of five unit rambling plan, the glorified farmhouse, Princeton, N. J. Arthur C. Holden & Associates, architects
4. Adaptation of native thatch, Honolulu, Hawaii. C. W. Dickey, architect
5. Mass kept low by use of Dutch roof, Riverdale, N. Y. Dwight James Baum, architect
6. Georgian mass and details executed in informal stone, Lloyd's Neck, N. Y. John Russell Pope, architect
7. Irregular roof ridge giving 3 story rear and 1½ story front, Pawling, N. Y. Arthur C. Holden & Associates, architects
8. English domestic roof lines, informal mass and details executed in native stone, South Norwalk, Conn. Frank J. Forster, architect
9. Exaggerated roof lines and informal mass executed in stucco, Riverdale, N. Y. Julius Gregory, architect
10. Informal combination of formal brick units, Seaside village, Bridgeport, Conn. R. Clipston Sturgis and A. H. Hepburn, architects
11. Continuous informal English grouping in brick, Welwyn, England. Hennell & James, architects

Very little variation is possible in storey height, for this dimension is set by the height of a man, whereas length and breadth are dependent only upon the number and size of rooms. As a two storey house is made smaller, it is impossible to reduce the height dimension in the same proportion as the dimensions of length and breadth. It is no wonder, therefore, that the appearance of most small houses is so unattractive Their design is a far more difficult problem than the design of a larger house.

It must be remembered that there are many different solutions to a problem. What we know as style is nothing more than a method employed for solving the problems of design In different localities of the Old World different races confronted with different climatic and natural conditions reached different solutions. The flat roof is characteristic where there is little snow or rainfall The sloping roof increases in steepness where snowfall is heavy. In a hot climate window openings are larger and ceilings are higher. In a damp climate houses are built farther off the ground. Where wood is abundant it is likely to be used as a building material. Where clay abounds it is pressed into brick; elsewhere stone may be the prevailing material.

Habits, manners of life and contacts with other peoples also influence design In all the great migrations peoples have carried their customs in building with them, though they have frequently developed new characteristics under the influence of their new environment. The Roman influence was carried far and wide over Europe and into eastern Asia and northern Africa. But the Roman influence would have meant little to domestic architecture had not the Italian gentlemen of a later day, wishing to give grandeur to their houses, borrowed the arches, the columns and the decorative elements which they found about them in the ruins of Roman civilization. In imitating Roman models the Italian stone cutter became skilled above all others He was sent for from France, distant England and even Spain, and he put his stamp upon the architecture of the world, for this was the period of the Spanish conquest of the New World and of the English colonizations. When the carpenters of New England sought to give distinction to their houses they used the classic motives that the Italian stone cutters had introduced into England These motives, which they had known at home as Georgian, they copied in wood, which, excepting brick, was the only material easily available in the colonies. The style that grew out of it is to-day known as Colonial, though it is often confused with the classic revival of the early American republic and its greater use of the column, a movement in which the research of Thomas Jefferson played an important part.

Through the colonial carpenter builders, the traditional domestic cottage of England took on in the United States some of the outward embellishments of the Italian nobleman But other influences, both racial and economic, have caused interesting developments in America. In New York and New Jersey the Dutch influence was very active; as a result witness the gambrel roof and the upward curve of the roof at the wide eaves. In Virginia, where large estates predominated and brick was the usual material, great formal houses were built with outlying wings Further south, in Florida, Mexico and South America, the Spanish influence was dominant; it has taken firm root and it is flourishing to-day in those regions that are exempt from snowfall and where protection is needed against bright summer suns (*See* MODERN ARCHITECTURE: *18th and 19th Centuries.*)

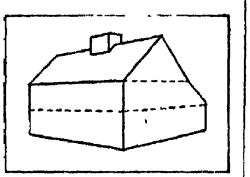


FIG. 6—TYPE IN WHICH THE RIDGE IS OFF CENTRE. THE REAR RAFTERS START AT SECOND FLOOR

Style Evolved from Efficient Use.—Style in architecture is equipment for efficient use and is a natural evolution It is a product of the factors of economics, climate, tradition and natural environment. To-day the lessons of the entire past experience of mankind can be drawn on. This heritage teaches methods for roofing the narrow house, the square house, the house of irregular or formal plan and the long rambling type of house. It need not be slavishly followed, but a person unfamiliar with it trying to design is like a child. He thinks that the ridge of the roof of a square rectangular house must always be in the centre. He is ignorant of the "salt box" type, built by the New England farmers, where the roof on the north side ran down almost to the ground; or of the extra space the Dutch type of gambrel roof affords where a small compact plan makes it difficult to keep the mass low.

When considering the irregular form of plan it is most important to consider roof treatments and stair locations. Indeed, there are many irregular treatments of roof plan possible with a first floor plan that is perfectly square or rectangular in outline but unsymmetrical within The lines of the English domestic wayside cottage have been an inspiring guide to modern architects seeking to obtain irregular roof lines. Plans must never be thought of as flat but always as having volume as well as length and breadth. The second floor cannot be planned out of all relation to the floor below; bearing partitions must run through; its windows must be in reasonable relation to the first floor openings. The special consideration for locating the stair is so to place its point of arrival on the second floor that it may easily serve the greatest possible number of rooms without waste of hall space; on the ground floor it must be convenient to the entrance

It is desirable to locate the dining room and kitchen with eastern exposure so that they will have the advantage of morning sun and yet be sheltered in the afternoon If possible the kitchen should have cross ventilation. The living-room and porch should be exposed to the prevailing breeze. In a northern climate the less important rooms should be located on the northern side of the house, unless the outlook happens to be to the north. In any case, great care should be taken never to shut off an important room from the benefit of sunlight and the prevailing breeze.

In making any plan it should always be remembered that rooms must be correctly related with regard not only to interior arrangement but also to their proper relation to the out-of-doors. In an irregular plan this is easier to do than in a rectangular or formal plan. Many unsymmetrical interiors were laid out in outwardly formal houses by the builders of colonial Maryland and Virginia. The best modern planners of domestic architecture have learned from the experience of their forerunners. Avowedly irregular plans were not laid out in the early days. They grew as wing was added to wing Often the arrangement within was most inconvenient Modern architects have built up irregular plans having all the charm of the outward aspects of the old rambling houses but carefully developed for internal convenience and the greatest benefit of contact with the out-of-doors.

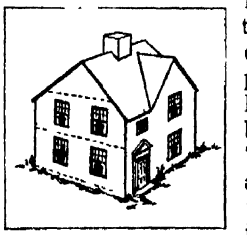


FIG 7—DESIGN IN WHICH RIDGE IS ON CENTRE, GABLE INTRODUCED FOR HEAD ROOM WHERE RAFTERS START BELOW SECOND STOREY CEILING

To secure the fullest benefit of the site is one of the most important considerations. Especially is this true of the hillside or irregular site, where very frequently, if cleverly taken advantage of, differences in level may result in real economies of construction because of the practical utilization of space which otherwise might go into an excessive cellar or attic.

Exterior.—Beauty of exterior comes from the correct combination of the factors of mass, material, window treatment, detail and the relation of mass to site. Mass as an element of plan has already been discussed. No beauty of exterior is possible without correctly proportioned masses. If mass is right the house may be beautiful even with inferior detail, but the best detail can hardly make a house beautiful if the mass is wrong The arrangement of windows, sometimes known as fenestration, when properly handled adds to the play of light and shadows over the wall surfaces The shapes of both the windows and the spaces between them are important In the small house where fenestration is successful, ornamentation and enrichment may be omitted altogether and only the simplest of details used. It must be remembered that one of the principal functions of ornament is to introduce the play of light and shade at the proper points (*see* ORNAMENT, ARCHITECTURAL). That detail which gives too little or too much shadow, or shadow at the wrong place, is bad. For example, most of the heavily shadowed gable-ends commonly seen are badly designed;

their only excuse is that they are a lazy carpenter's way of keeping rain-water from coming through at the top of the gable

Perhaps as important as any factor that has to do with exterior appearance is the choice of materials Materials are chosen not alone for their surface texture but for their endurance; their selection, of course, is controlled by the budget There are many types of wall from expensive cut stone down through rubble, masonry, brick and brick veneer, to stucco, shingles and clapboards

If the walls of the house are to be of frame construction, there is no wall finish superior to shingles Clapboards are cheaper but they are not so warm and it costs more to keep them properly painted. Shingles vary in quality and size. Though even red cedar shingles will eventually wear out when used on a roof, as a wall covering they are practically permanent For insulation, under either shingles or clapboards, it is well to use a good grade of building paper or insulating quilt. The real base for stucco is a masonry wall, but it sometimes gives good results if well applied on a frame house in a climate not subject to extremes A good form of outer covering for a frame house is brick veneer, though great care must be taken with the flashing Stucco when applied over hollow tile or other masonry is a far more enduring material than when used over wood There has been a tendency in recent years to overdo stucco Variety of texture is desirable but not to the point that it is sometimes carried. A wall of solid brick or other masonry should be furred out on the inside before applying plaster, otherwise there is likely to be trouble from dampness coming through A brick wall depends for its beauty upon its bond, its colour and the character of the joints Even though it is not possible to build a whole house of stone a great deal is added to appearance if some stone can be used In a house of irregular plan it is often especially happy to vary the materials of outside walls

An exterior feature that must not be neglected is the chimney Too many chimneys are wrongly located with respect to the roof ridge and are too small to have character If it can be done in no other way chimneys may be enlarged at the roof line by corbels inside the attic space Modern chimneys in well built houses are invariably lined with fire clay flues.

Interior Finish.—The interior is that part of the house with which people come most in contact, so not only its arrangement and convenience but also its finish is most important The usual materials of interior finish are wood floors, plaster walls and ceilings and wood trim for openings There is a vast difference in possible methods of treatment

The best plaster is put on in three coats: the scratch, the brown and the white. The final coat may be a fine eggshell finish, an irregular surface or a sand finish No finish better than plaster has been found for interior walls but it has many disadvantages: it is a very wet, messy job and it introduces moisture into the building at just the wrong time; it delays the work because it stops all other work and no wood trim or finish can be put in until the plaster is thoroughly dry. Therefore, many types of plaster substitutes have begun to come on the market. These range from plaster boards over which the final white coat is applied to other types of board to which paint or wall paper may be applied direct There are many excellent grades of wall board now on the market, but with all of them there are two defects that so far have been only partially overcome. if broken the walls are difficult to repair; the cracks between the boards are almost impossible to conceal even when thoroughly plastered over with a fine mesh covering strip

In the house of modest cost, wood panelling and fine carving are not likely to be used A single panelled wall, if well worked out, will add charm not easily gained otherwise. It is true that we are likely to stain our oak and pine too yellow, our walnut too brown and our mahogany too red, but we are again learning how to finish woods to make the most of their natural beauty (*See* WOOD FINISHES; PAINTS, CHEMISTRY OF; VARNISHES.) The fireplace and the stairs are the two points where beautiful woodwork may usually be used in ways that count A good cornice in one room counts more than meaningless strips arranged around the walls of all the rooms Mouldings when applied to walls have value principally for the variations of shade and shadow that they give, and they must be carefully designed or their effect will be lost. Walls are made beautiful by colour, texture and, where paper is used, by pattern in the proper scale combined with colour. Many people are afraid of colour. All colours are relative. Sometimes what seems to be a strong colour is selected for a background but when furniture and hangings are introduced, it pales into insignificance. (*See* INTERIOR DECORATION.)

Revolt in Style —With many new materials becoming available, there is little doubt but that new methods of expression will be developed (*see* ARCHITECTURE). To be different merely for the sake of being different is infantile To be wise enough to discover more effective methods of building than those that have been tried, and then to put those methods into practice at the risk of being different, is courageous and worthy of applause A part of the tendency to modernism is a revolt against the use of classic forms in decoration It is a movement to be commended in so far as it deals with the elimination of unmeaning and unintelligent forms. A movement confronted with the development of new forms, however, must be led by men who are familiar with the aesthetic subtleties of historic ornament, else the whole movement to revolt will be merely a fumbling in the dark, with accidental achievement its only hope of success New methods of construction and new forms are certain to evolve from the intelligent effort of an alert and virile race. But progress does not come from shutting the eyes to experience and disregarding tradition.

Mechanical Equipment. *Plumbing* —There are three parts to any plumbing installation: (1) the drainage system; (2) the supply system; (3) the fixtures

The *drainage system* is controlled by traps which should always be filled with water Their purpose is twofold. to prevent things from going down the drain that should not, and to prevent gases from backing up through the drains and creating unhealthful odours in the house. Drain pipes from water closets (known as soil lines) are larger than sink, tub and basin drains. They should be of extra heavy cast-iron pipe rather than wrought-iron or steel When a water closet is flushed it creates a suction in the pipe sufficient to syphon the water out of traps on the same line There are two ways of preventing this. by using anti-syphon traps, and by running fresh air vents from all traps to the outer air, which also permits the back gases from the drains to pass off The system of vent pipes is very expensive but is required by law in most cities The drainage is not complete until it is connected to a town sewer or an individual cesspool or septic tank and disposal field

The *supply system* is controlled by valves The size and material of the pipes is important. Practically all water contains impurities which, to varying degrees, produce corrosion in certain metals Hot water corrodes pipes more rapidly than cold Brass pipe does not corrode Iron and steel pipes even though galvanized tend to corrode Genuine wrought-iron pipe is the most superior grade of iron pipe and corrodes very slowly, depending, however, upon the character of the water Pipes in exposed walls should be protected against freezing. Provision should always be made so that the water-supply system may be drained when the house is unoccupied.

The selection of the fixtures is of the greatest importance There are many different models. Roughly, the materials are of two classes, vitreous china and porcelain enamelled iron The plumber generally purchases from what is known as a jobbing house, where popular models are kept in stock Usually there is a long delay if a less popular model is ordered, even though it is carried in the regular manufacturer's catalogue The plate number in the catalogue describes the fixture complete with nickel-plated, or chromium-plated, fittings and faucets.

There are many different means for heating water for washing: (1) a hot-water back in a coal range; (2) a gas coil; (3) a small auxiliary coal stove; (4) an automatic gas heater; (5) a coil for winter use inside the steam boiler; (6) a steam coil over which the water passes. In all cases a drum or tank is used. The best location is in the cellar. A ground floor bath-room is a better location for the tank than the kitchen

The treatment of bath-room walls and floors may vary greatly

from wood floor and plaster walls to the more expensive grades of tile for both walls and floor. Different colours, finishes and shapes of tiles are now obtainable There are also many varieties of tile substitutes.

Heating.—Modern houses are heated far more efficiently than was dreamed possible by our fathers. There are three typical methods: (1) warm air; (2) steam; (3) hot water.

Warm Air—The air is warmed by passing through the heating apparatus and then delivered through ducts into the rooms. Where conditions are favourable it will work easily, for it is based on the single principle that warm air rises. Cold air currents check or alter the circulation of warm air currents; thus in a long rambling house, the colder the weather the less heat will be delivered to remote rooms. A cheap variation is the pipeless furnace where all the air passing through the furnace comes through one single large register and circulates directly through the rooms instead of through ducts This works best in a small square compact house

Steam—There are various varieties of steam-heating Water is boiled in the boiler and steam rises through properly sized pipes passing through radiator coils which give off heat to the rooms. The number of square feet of surface of the coil determines the amount of heat given off in each room. Radiators should be so placed as to combat cold air currents where they enter the rooms but with consideration for economy of the piping runs necessary to reach them Variations in the system depend upon the way the steam is made to circulate. The simplest form is the one pipe up-feed system The pipes are large enough to carry the rising steam and at the same time the return water caused by condensation of the steam in the radiators The pipes must be carefully graded so that the water will flow back to the boiler. Also there must be air valves on the radiators to allow the entering steam to force out the air Care must be taken in grading pipes so that the returning water may not get trapped and thereby shut off the steam Where a steam system works easily and quickly it will, because of the vapour given off by the warm water, begin to heat up before steam is actually formed in the boiler This vapour may be made to do the work of the steam by using special quick-acting valves and a separate pipe to return the water to the boiler, and by inducing the vapour to rise quickly from the boiler by creating a partial vacuum in the radiators. This is known as a vapour system; it is really a refinement of a steam system.

Hot Water—A hot water system is based on the principle that warm water rises Circulation commences immediately By varying the fire the radiators may be kept at any desired temperature up to 180° F Because they never reach the temperature of steam, greater radiation surface is necessary In other words, in a water job the radiators must be about half again as large as in a steam job, usually larger pipes are required—installation cost is greater Where space is precious, hot water heat is objectionable If the circulation is poor a hot water system will not work Care should be given to the layout of pipes and to connections and branches.

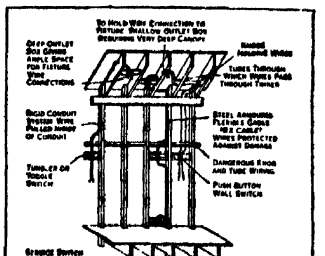


FIG. 8.—LAYOUT OF WIRING SYSTEM FOR ELECTRIC CURRENT

Oil.—Great progress has recently been made in oil burning devices for residences. Oil, as a substitute for coal, is now in practical use in steam, vapour and hot water systems Different types of oil burners are required, dependent upon whether electricity or gas is used for ignition.

Lighting.—Electricity is sold by the public service companies at different prices, at a lighting rate and at a power rate Where there is a low power rate, it is worth while considering having the house wired for modern electrical labour-saving equipment.

Electric current is controlled by a system of switches and fuses. The latter are especially important because they will not allow a greater than a safe current to pass through a given system of wiring. Fuses burn out when they are overloaded; therefore they should always be installed in metal panel boxes protected against fire

The cheapest form of wiring is known as knob and tube. Most city codes will not allow this method, because the insulation is unprotected. The use of flexible armoured cable is much safer and worth the difference in price Rigid iron conduit has further advantages, though it is used principally for large scale work. Connections between runs are made at junction boxes, between runs and fixtures at outlet boxes. All electric work should be securely held in position to prevent straining or breaking which might cause a dangerous fire. The connections between fixtures and wiring should be soldered and then wrapped with tape inside the outlet-box.

All sorts of money can be spent on *fixtures* Where economy is necessary the modern tendency is to provide a few essential wall fixtures and a large number of base outlets to which standard and table lamps may be attached. (*See* LIGHTING)

Calculation of Costs.—The builders think in terms of quantities, prices of materials and the time and cost of labour necessary to put them together The home owner thinks in terms of the finished product and he is likely to be frequently misled, because he is apt to confuse construction costs with finished product costs, which include also the cost of land and improvements to land, and the cost of financing, sales and promotion The architect is likely to think in terms of units of construction His method is likely to be most helpful to the prospective owner. Cost per cubic foot is often used A modest sized home may range anywhere from 45 to 85 cents per cubic foot. It is more reliable, however, to attempt to assign a cost to each room taking into consideration size, finish and complexities of construction Taking each unit of the house, such as cellar, halls and stairs, kitchen and pantry, living-room, bedroom, bath-room, etc., it is relatively simple to grade each of these between fairly reasonable limits and thus arrive at an approximately accurate figure for the house

Finance.—The increase in prices has made it both difficult and inadvisable for the average family to provide all the capital required for a home For the money borrowed a mortgage is given in exchange. This document records that the owner has transferred his property to the lender as security for the repayment of the debt. After the debt is paid what remains belongs to the owner. This is known as the owner's equity, thus, if property worth $10,000 is mortgaged for $5,000 the owner retains an equity worth $5,000. Very frequently in buying a home, the owner has not enough cash to purchase an equity worth as much as half the value of the property. He therefore desires a higher mortgage. From the point of view of the person who lends the money, however, the risk increases as the difference between the total value of the mortgage and the total value of the property diminishes. Therefore, the owner of the mortgage demands either a higher interest rate for increasing the value of the mortgage, or he requires the owner to go to someone else to borrow what additional money he may need. If this is done, a second mortgage is generally placed on the property, with the result that the owner transfers part of his equity as a security for that mortgage. The scarcity of homes after the World War combined with the increase in prices and the necessary revision of the family budget brought about a general decrease in the size of the equity in the home that the average family was able to afford. The story of housing finance has been the story of the various methods pursued to close the gap between that portion of the home, which could be paid for by this diminishing equity, and that portion covered by the first mortgage loan The steadily increasing cost of financing has been due primarily to the inability of the modern family to pay cash.

Attention must be given to the need for lessening risks and stabilizing house financing, especially secondary financing. Present methods have in many cases come to amount merely to exploitation, for the high return has attracted capital, which has been poured into the field indiscriminately, giving support to all sorts

of irresponsible and undesirable building projects. One of the most helpful steps that has been taken has been in Pennsylvania, where building and loan associations have been allowed to enter the second mortgage field and loan up to 80% of the value of the property. Under this system the man who can find cash to the amount of one-fifth of the value of his home is assured of obtaining the balance at reasonable rates The man who has a steady income and lives within it, and is well protected by life insurance is a good mortgage risk; in time such a man will receive the consideration that he deserves, especially if he agrees to reduce his mortgage if he sells the house The home that is well planned, well built, conservatively financed and saleable is a good mortgage risk, and in time such homes will receive the consideration that they deserve in more liberal loans and lower rates of interest than the badly planned and uneconomic home. At the present time the public is carrying through ignorance a great and needless burden It will be able to buy better homes for less money and subject to lower carrying costs when it is intelligently informed in regard to house planning and housing finance. *See* also BUILDING SOCIETIES.

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HOUSE SPARROW (*Passer domesticus*), a bird characterized by its attachment to human habitations; it destroys noxious insects, but in part counterbalances this by its ravages on crops. Its range extends to northern Scandinavia and Russia.

In the years 1860–66 more than 200 house sparrows (called, in America, English sparrows) were brought to New York, where they established themselves and began to spread. By 1928 the house sparrow had found its way to every State and much of Canada. The house sparrow was introduced by Sir W. Buller to New Zealand, to combat a plague of caterpillars. It was also introduced into Australia, and has multiplied immensely in both countries The house sparrow is rapidly spreading eastward through Siberia, as cities multiply. It was introduced into Greenland, but soon became extinct there. The closely allied tree sparrow (*P. montanus*), distinguished by a brown cap, takes the place of the house sparrow in the cities, in part of Europe and Asia

HOUSING. The word housing has a general meaning covering conditions and statistics applying to all the dwellings of the community. The word has also acquired more limited and special meanings It is used to refer to the problem created by deficiency in number, or defects in condition of the dwellings which are available for the poorer members of the community; and in a more technical sense it is employed to signify the housing of the working classes undertaken under the various acts of Parliament which have been passed to deal with the problem.

I. INTRODUCTORY

A housing problem, which differs in character from other problems due to poverty, has arisen so generally in modern civilized countries, that it is worth while to consider what are the various conditions in connection with dwellings which together account for the fact that the housing problem differs in kind as well as in extent from problems arising from lack of food, clothing or other necessaries of life

High Costs: Permanence: Rent.—The three most important of such conditions are:—

1. The high initial cost of even the smallest family dwelling which will satisfy modern standards.
2. The permanent and immovable character of houses when erected.
3. The custom by which the majority of consumers of this particular commodity borrow their house, instead of buying it, paying for it a periodic rent.

The cost of even a small modern dwelling is quite beyond the reach of the vast majority of those who set up a family home. Many will not accumulate during their lifetime a capital sum sufficient to secure the unencumbered ownership of a small dwelling Many others who might raise the cost have other more tempting uses for their capital, or prefer not to hamper their mobility by the ownership of their house Owing to the high cost, the majority of occupants must depend on living in dwellings built by those who have command of capital; many prefer to do so.

The permanence of the structure, and the impossibility of moving it from place to place, further differentiate the dwelling from other necessities, and in fairness to the earlier tenants, involve that the repayment of the capital cost be spread over a very long period The greater part of each rent payment consequently represents interest on the capital invested, or other current outgoings, and only a small portion represents an instalment paying off the capital cost. Periods of twenty to thirty years are commonly adopted for systems of purchase by instalment, while forty to sixty years are usual over which to spread the repayment of loans for housing purposes to public utility societies and local authorities. Even these longer periods do not represent the full life of a well built dwelling house; many last for centuries; and it is commonly accepted that the average useful life of small dwellings built during the last century may be taken at about eighty years. This long period of use or consumption gives opportunity for the play of many factors disturbing to the value, or rent-earning capacity of dwellings; these involve the owner in risks which hardly arise in connection with other classes of products bought and sold across the counter Considerable changes in the standard of living, of accommodation and of sanitary equipment may take place during the life of the building The general introduction of internal plumbing and sanitary conveniences, the more recent provision of bathrooms, together with the demand for more sleeping accommodation, and a greater degree of amenity and air space about dwellings, are examples of the changes which have been operative during the last half century The character of localities also changes; centres of employment may cease to operate, or move to other districts, leaving houses no longer wanted. On the other hand extensive new industrial development may take place in the immediate neighbourhood of good houses bringing dirt and confusion; and the dwellings may become less attractive to good tenants than when they were erected. This may be followed by a general depreciation of the character of the neighbourhood and the value of the houses. Apart from such cases, the influx of a few rowdy or dirty tenants has sometimes proved sufficient to create bad conditions which spread from dwelling to dwelling driving away better tenants and resulting in a general depreciation of the property. The makers of all products and those who deal in them take the risk of changes in value occurring during the course of production or sale; but the long life of a dwelling house involves risks of a quite different order. During the last half of the 19th century, when conditions in Great Britain were fairly stable, there were three tendencies noticeable which affected the rent of dwellings. The standard of accommodation tended to improve; such a tendency might depreciate the value of houses old enough to fall materially below the current standard. The rate of interest on capital tended to fall; thus reducing the rent required to give a remunerative return on a given outlay per house. On the other hand the cost of erecting new dwellings tended to increase, involving an increased rental per dwelling. The financial disturbances caused by the Boer War and other reasons arrested the fall in the rates of interest. Apart from such disturbances it is probable that similar

tendencies would operate during long periods of fairly stable conditions.

The supply of small dwellings has seldom for long exceeded the demand and has frequently been insufficient to meet it, and during the period referred to the value of the older cottages has on the whole risen in sympathy with the rentals of the newer ones to a greater extent than it has been decreased owing to inferior standard or reducing rates of interest; and it is generally true that rent of dwellings gradually rose during that period This fact among others caused cottage property to be regarded generally as a profitable investment. Various changes in legislation, in the character and equipment expected for dwellings, and in the consequent responsibilities of the owners, were having the effect before the war of diminishing the relative attractiveness of this class of investment. The concurrent increase in alternative openings for the small investor to place his money with reasonable security and return has been an important element in this change. Violent fluctuations in rates of interest, cost of production, and values of money, such as have followed the Napoleonic wars and the recent World War, introduce quite new factors. Periods arise in which the cost of building and the rate of interest which must be paid for capital are so high, and their maintenance at these rates so improbable, that even if adequate rentals could be secured at the moment, there must be considerable risk that such rentals could not be maintained. It must be anticipated that the return to stable conditions in the world will result in a rapid fall in costs and rates Consequently there will be no prospect of maintaining rents over a sufficient period to repay the capital cost with interest, in competition with dwellings erected at lower cost with cheaper capital.

The permanence of dwellings also brings into play the powerful influence of custom. The regular payment of rents over a long period sets up a customary standard of value A certain rental, say six shillings a week, becomes habitual; and any higher rent than the customary one is regarded as exorbitant This influence is one of considerable strength in many places, tending to obstruct the adjustment between rentals and the cost of production or rate of interest. The continuance of low customary rentals for estate or tied cottages in many rural areas has greatly increased the difficulty of securing or maintaining the needed houses for the working classes. The conditions arising from the permanence of the dwelling are intensified owing to the impossibility of moving it from place to place. Many circumstances constitute the ownership of his dwelling by the occupier a considerable tie. the majority of men frequently change their place of employment. Change of ownership is liable to involve capital loss on each occasion. it is difficult to realize on a forced sale of a single house as good a price as that which the purchaser had to pay when he desired to obtain possession of it. The expenses of sale and transfer are also considerable Ownership, moreover, involves responsibility for upkeep and liability from time to time for comparatively heavy outlays for repair or adjustment to changing conditions Many of these expenses fall with special weight on the owner of one dwelling, while they are more easily provided for by the property owner who can average the risks, and deal with larger blocks of houses, reducing considerably the incidental expenses per dwelling. These reasons tend to restrict the number of people willing to own their own dwellings. On the other hand, occupying ownership promotes care for the dwelling, tends to reduce maintenance costs, and confers a degree of stability and responsibility on the owner which constitutes an education in citizenship, and from many other points of view is eminently desirable.

Hiring of Houses.—Arising out of the conditions already described there has grown up the general custom of hiring dwelling houses. Peasants have usually hired from the landowner; in the case of agricultural labourers frequently through the farmer; while in urban areas property owners have supplied the need regarding the building and letting of dwellings as a sound investment. As regards those occupiers who rent houses for convenience rather than from necessity, the system presents little difficulty in normal times. If in any place or period conditions temporarily render the provision of dwellings to let not sufficiently attractive, such persons, if need be, can build for themselves. As regards the majority of people who must depend on renting dwellings the position is, however, different. Property owners will only provide dwellings in numbers and of a character for which they can see a reliable prospect of securing remunerative return. That means rentals adequate to pay the interest on the outlay, to provide a sinking fund to repay the capital cost, and leave something to cover insurance against the many risks involved. Where such prospect does not exist, house shortage is likely to arise.

The increasing standard of accommodation, sanitary equipment, or amenity, is one which is set by the community generally Unfortunately it does not always represent an effective demand on behalf of poorer tenants. Occupants become accustomed to inferior conditions in dwellings, and easily sink to a low standard of cleanliness and decency. There are, especially in large towns, numbers who will put up with inferior accommodation rather than pay a small additional rent for better dwellings. Considerable numbers of obsolescent houses tend to linger in use by such tenants after the period when they should be destroyed as being below the minimum standard of the day. Public opinion and the sanitary authorities seek to enforce improved standards; on the other hand, among a large section of the population an effective demand, at rents which would render the provision of dwellings up to the improved standard remunerative, does not exist The individual property owner cannot take the risk of providing up-to-date dwellings in excess of the effective demand. It is these conditions which give rise to the housing problem: how to secure the erection of sufficient dwellings of an up-to-date standard for the poorer sections of the community, so that the demolition of dwellings no longer considered fit for occupation may proceed, and the occupants be removed from the unhealthy and degrading conditions which the tenancy of such dwellings involves To solve this general housing problem many efforts have been made by legislators and philanthropists; but before referring to them it is desirable to touch on the special housing problem created by the World War which has overshadowed and in a sense absorbed the general problem.

General House Shortage.—In many countries the cessation of house building was almost complete for periods varying from four to six years Naturally there resulted a shortage of all kinds of houses. Exception should perhaps be made of those at the larger end of the scale; for the general reduction in personal means, owing to war losses, monetary depreciation or taxation, has reduced the effective demand for the larger houses below pre-war level, which has incidentally tended to increase that demand for the middle class of houses Not only was this shortage of exceptional character, but the difficulties of making it good were unusually great. The mobilization of much skilled building labour for war, or war work, the losses occurring among these craftsmen in the belligerent countries, and the transference of many to other occupations greatly reduced the amount of trained labour available for the work. Recruitment of apprentices to the various crafts also practically ceased, normal wastage was not made good, and at the end of the war the belligerent, and to a less extent some of the neutral countries, were faced with great shortage of dwellings, with large arrears of repair work to existing buildings, while only a much reduced staff of skilled workmen were available to undertake the greatly increased volume of work. Similar conditions existed in other industries It is not surprising therefore that the cost of building rose; and that the extent of the rise was increased by the general rise in the cost of living and the consequent addition to the rates of pay.

In view of the fact that such high prices were deemed to be temporary, it was impossible to finance the building of houses to let, even if remunerative rents had been for the moment obtainable, and for a large section of the community they were impracticable. The proportion which could be borrowed on mortgage was reduced in the face of such inflated prices; consequently, the fortunate section who had benefited by the war industries and who had ready money accumulated could alone afford to buy or build dwellings. The demand for houses for the middle and working classes was quite abnormal. The middle classes, the clerks

and the skilled well paid artisans, were as much affected by the shortage as the unskilled labourers or the very poor The returning soldiers found all the existing dwellings occupied and their demand for homes intensified the need These conditions constituted a quite special housing problem, different not only on account of its magnitude, but also because of the general character of the shortage, from the housing problem existing in pre-war days, which there is reason to fear may still remain to be dealt with after the special shortage due to the war has been made good

II. EXTENT OF NEED

After the war it was still hardly possible to gauge the extent of the actual shortage of houses in Great Britain, or of the effective demand for them which would arise on demobilization Many estimates of the need were made, varying from 300,000 up to 1,000,000, depending much on the standard that was adopted in regard to the condemning of old houses Accurate estimates for the decay and demolition of dwellings are difficult to make at any time. Moreover, it was not easy to estimate the number of post-war families which would need separate dwellings After the census of 1921, however, figures were available for the number of separate dwellings and families or units of occupancy, which could fairly be compared with those recorded in the 1911 census Such comparison affords, perhaps, the best foundation available for comparing the need of dwellings at the census periods and indeed at any intermediate date The relative figures from the two census returns are as follows —

	No of separate families	No of separate dwellings	Dwellings per 100 families	Empty dwellings
1911	8,065,290	7,753,000	97 6	434,048
1921	8,730,107	8,030,000	91·9	215,215

Dwellings and Families.—It will be noticed that the number of separate dwellings available for each hundred families fell from 97·6% to 91 9% On the same standard of accommodation as shown in the 1911 census there should have been 8,529,456 separate dwellings in 1921 showing a relative shortage of 499,456 In other words 8,529,456 separate dwellings would have been required in the 1921 census to show the same relation between the number of separate census family units and the number of separate dwellings as recorded in 1911 It will be realized that separate families for census purposes has a special meaning; and while its character may vary from census to census it does appear to have some relation to the units of population requiring separate dwellings. The number of empty dwellings recorded in 1921 on the night of the census is less by 215,215 than the number recorded in 1911. This seems to indicate that the intense pressure for housing accommodation known to exist in 1921 had the effect of reducing the number of empty dwellings from 434,048 to 218,833 From one point of view it may be regarded as surprising that the reduction in empties was not greater; on the other hand, it must be remembered that the empties for census purposes include dwellings temporarily closed while the occupants are absent on holiday or for other purposes The number of empties in the 1911 census was still greater (448,832), and in view of the smaller number of dwellings then in existence the proportion of empties would be somewhat higher than the difference in the figures show It is not possible to estimate with accuracy what figure for empty dwellings on the basis of the census return can be regarded as adequate in normal times to allow for dwellings from which the occupants are temporarily absent; to provide for empties during changes of tenancy; to allow for the reasonable mobility of the workers; for periods when houses are undergoing drastic repair, or are about to go out of use; as well as those which may be caused locally by definite changes in the distribution of population. Perhaps the figure will lie somewhere between the number shown in the census of 1911 and that shown in the census of 1921. When, moreover, it is realised that the 1911 census recorded 3,129,472 people as living in an overcrowded condition, that is, more than two people to the room, it would seem safer when comparing the conditions with those existing in 1911 to accept the proportion of empties at that period as forming part of those conditions; and an estimate of the need of dwellings in 1921 based on the number required to restore the condition of housing generally as in 1911 can hardly be regarded as other than a moderate standard to take as a measure of the post-war housing problem.

Taking into consideration the number of unoccupied dwellings that there must be at any time, the number of people who own week-end cottages or in other ways occupy more than one dwelling, and the extent of overcrowding still existing, bearing in mind also that the small size of some of the existing dwellings renders them inadequate to provide for families of average size; many housing reformers would be inclined to set off the number of empties against the limited number of cases where it is desirable for two families to occupy one dwelling, and would like to aim at a condition which would be shown if the census returns gave the number of separate dwellings equal to the number of separate families It should be realized that neither the standard of the 1911 census, nor the standard of one family one dwelling accurately represents the actual need of new dwellings in order that the people of Great Britain may be properly housed; nor, on the other hand, does it indicate the effective demand for dwellings, that is, the number which if built would be immediately occupied by people who could afford to pay the rents at which the houses could be provided with the present financial assistance, building prices and rate of interest

Reference has already been made to the number of people living in an overcrowded condition, based on the standard of two persons per room This number increased from 3,139,472 persons in 1911 to 3,580,274 persons in 1921 The increase of density of room occupation, which shows the pressure on house space in 1921, is not however spread over the whole range of dwellings, but is chiefly found in the one-roomed dwellings. It should be realized that between the census periods the average size of families recorded for census purposes has fallen, the figures being as follows:—

Persons per family in all families . . .	1911	4 36
" " " " " "	1921	4·14
" " " " those families occupying dwellings of one to nine rooms .	1911	4·52
Persons per family in those families occupying one to nine rooms	1921	4 35

Density of Occupation.—The following tables indicate the comparison of density of occupation at the time of the two census periods, both in terms of occupants per room and rooms per occupant, from which it will be seen that the reduction in the size of family is reflected in a reduced density except in the case of one roomed dwellings, where the greatest overcrowding is found

Further interesting comparison is that between the percentage of families at the two census periods occupying dwellings of various sizes The general move down in size of dwelling per family as the result of the war, and partly perhaps also as the result of the average reduction in the size of the family unit, is apparent. The total of 11·5% of families occupying dwellings of 1 and 2 rooms and of 25·3% occupying dwellings of 1 to 3 rooms suggests a considerable population living in very inadequate dwellings.

The above figures taken together, indicating to some extent the degree of overcrowding in existing dwellings, show that even if the number of dwellings were brought up to the 1911 standard, or to the standard of one dwelling one family, it might still be found that there were in existence too many dwellings defective in character or providing inadequate accommodation for the size of the families.

A fairly accurate record of all dwellings erected year by year in England and Wales since the census of 1921 is available, the total to the end of March 1928 being 1,020,123. No such accurate figures are, however, available for the wastage of houses due to demolition on account of old age, to removal to make way for the expansion of the business and industrial quarters in the grow-

England and Wales: Average Occupants per Room and Rooms per Occupant in Dwellings of the Following Number of Rooms

	Year Census	Rooms per dwelling									
		1	2	3	4	5	6	7	8	9	Average
Occupants per room	1911	1 90	1 59	1·33	1 08	0 95	0 78	0 68	0·61	0·56	1 0
" " "	1921	1 96	1·54	1·33	1 05	0 90	0 71		0·56		0·95
											0 93
Rooms per occupant	1911	0 52	0 63	0 75	0 93	1 05	1·23	1 47	1 64	1·79	1·05
" " "	1921	0 51	0 65	0 75	0 95	1·10	1·40		1·78		1 06

England and Wales Percentage of Families Living in Various Units of Occupation

	Number of rooms									
	1	2	3	4	5	6	7	8	9	10 or more
Census 1911	3 2	8·3	13 9	25 0	20 7	13 7	5·9	3·5	2 0	3 8
" 1921	3 6	10 5	15 5	24 4	20 8	12 0	5 1	3 0	1·5	2·7
Increase + Decrease −	+0 4	+2 2	+1 6	−0 6	+0 1	−0 8	−0 8	−0·5	−0 5	−1 1

ing towns, or for the making of new roads, railways or other public works As regards wastage from old age an estimate is sometimes made based on the assumption that the houses built during the 19th century may be given an average effective life of from eighty to one hundred years. Such an estimate must rest solely on general observation and judgment Taking it however for what it is worth, the number of additional families which would fall to be provided for eighty years ago would be in round figures 40,000 per annum, and assuming on the average that the number of houses built would bear a fairly close relation to the increase of population, if the average age is taken at from eighty to one hundred years, something like that number of houses should be reaching the limit of their useful life each year To this figure would need to be added those demolished for other reasons, here again only a conjectural estimate can be made. If that be taken at five thousand houses per annum demolished for all other purposes than old age, a figure would be reached of forty-five thousand houses per annum needed fully to maintain the desirable supply of housing, in addition to any needed to provide for a growing population.

Increase of Dwellings.—Records of the number of houses built year by year before the war are not available, but the returns as to inhabited houses duly show the net increase in the number of dwellings yearly from 1900 to 1914 as follows —

1900	122,578	1908	126,569
1901	117,146	1909	96,251
1902	108,034	1910	29,532
1903	118,681	1911	89,778
1904	115,409	1912	57,039
1905	129,842	1913	59,312
1906	101,674	1914	67,577
1907	59,193		

These figures, which do not include houses built to replace those destroyed but only the net increase in the total number of dwellings assessed, do not suggest that an allowance of rather over 100,000 new dwellings per annum for all purposes is likely to prove an unreasonable one.

Houses and Families.—On the basis of the above estimates, and with a full realization of the numerous factors about which there is considerable uncertainty, it may, nevertheless, be worth while to assess the position in England and Wales at the end of March 1928. An estimate of the probable number of separate families on the census basis for that date gives a figure of 9,208,500; adding to the number of separate dwellings, shown in the 1921 census, the number built and deducting for wastage of houses for six and three quarter years at the rate of 45,000 per annum given above; the following figures would be arrived at as an indication of the number of dwellings needed at the end of March 1928 (a) to restore the position as in the 1911 census, which may perhaps be regarded as the special war problem, or (b) to provide the number of dwellings on the standard of one family one dwelling —

Estimate of separate Families as at March 31, 1928		9,208,500
Standard of 1911 Census 97·6 dwellings per 100 families 97 6% of 9,208,500 families=separate dwellings		8,987,496
Separate dwellings recorded in 1921	8,030,000	
Built between 1921 and March 31, 1928	1,020,123	
Gross total dwellings	9,050,123	
Less wastage estimated, 6¾ years at 45,000	303,750	
No of dwellings estimated at March 31, 1928	8,746,373	8,746,373
Deficiency on 1911 census basis	dwellings	241,123
To give one family one dwelling —		
Family units at March 1928	9,208,500	
Dwellings " " "	8,746,373	
Required to give one family one dwelling standard	dwellings	463,127

If this estimate were correct it would indicate that at the end of March 1928 sufficient houses had been built to meet current needs year by year and to contribute 258,333 dwellings towards the war time arrears Moreover, if it could be assumed that the 215,215 less dwellings recorded as empties as compared with 1911 represented the condition also at March 31, 1928, and that this reduction in empties did not represent houses occupied which ought to have been empty on account of unfitness or other good reason, there would then be shown a deficiency of occupied dwellings as compared with 1911 of only 25,908 Such assumptions would be very unsafe, however, in face of the general evidence as to the extent of the need still remaining in the spring of 1928

While these figures may be useful as giving a rough estimate of the position, too much reliance must not be placed upon their accuracy owing to the uncertainty about the wastage of old houses and other factors. Nor should the assumption be made that if the deficiency, on the 1911 basis, whatever it may actually be, could be made good at once, there would be an effective demand for so large a number of dwellings The extent and duration of unemployment existing in Great Britain must be borne in mind, a large number of people have become accustomed to the inconvenience of two families living in one dwelling. The number of new dwellings which these families would be willing to take up at the rentals at which they can be provided, even with the present financial assistance, can only be approximately gauged by the definite demands for new dwellings of which the various local authorities have records

The need for housing accommodation and the pressure on existing dwellings are affected not only by the rate of increase in the population, but also by the average numbers in the separate families The tendency which has for some time prevailed for

the average number of persons per family to diminish, increases the number of dwellings needed to provide for every thousand of the population On the other hand, the same tendency to smaller families is likely to reduce the extent of overcrowding in existing dwellings or rooms.

Allowing for the diminishing increase in the population, and making due allowance for the increasing number of dwellings which will annually reach the estimated limiting age of 80 years in the future, it seems probable that the annual need for new dwellings will for long lie in the neighbourhood of 100,000 per annum, and may prove somewhat less To this figure something may need to be added for the clearance or improvement of slum areas if not adequately covered by the allowance made for wastage. During the last few years the building industry has been erecting houses at a rate considerably over 200 000 per annum A sudden drop from such a figure to an output of 100,000 would be serious for the industry While it is desirable that the deficiency in dwellings should be made good as rapidly as possible, time should be allowed for a gradual slowing down to the normal figure so that such sudden drop in production may be avoided

The next census return of 1931 will show how nearly the forecasts are confirmed by the facts and should enable a much closer estimate of the then remaining problems to be made.

III. MEASURES OF RELIEF

While no accurate estimate could be made of the shortage of houses with which Britain would be faced at the end of the World War, the fact that a serious problem would arise had been foreseen, and it was realized that the resources of the country would be severely taxed to make good the deficiency In the same way, though it was impossible to forecast the extent to which building prices and rates of interest would rise, it was evident that, under the conditions likely to prevail at the close of the war, it would not be possible to build small dwellings to let on an economic basis, and that on every such house erected until conditions again reached a level of pre-war stability, a loss must be faced. Unless that loss could be made good by public funds it was clear that no houses would be built to let

The working of the Rent and Interest Restriction Act, necessary to prevent a general increase in the rents of existing dwellings, undoubtedly tended in some cases to increase the difficulty of providing new houses Several committees appointed by the President of the Local Government Board and the Minister of Reconstruction made a study of the problem, and of the alternative methods for dealing with it Reference may be made to the following published reports dealing with various aspects of the matter —

Memorandum by the Advisory Housing Panel of the Ministry of Reconstruction Presented October 1917. C. 8 9087. Published 1918.

Interim and final reports of the Women's Housing Sub. Cd. 9166. Committee Ministry of Reconstruction, 1918–19

Report of the Housing (Building Construction) Committee C. 9166 (known as the Tudor Walters Committee), 1918

The method adopted and embodied in the Housing Act of 1919 imposed upon the local authorities the duty of preparing housing schemes for their areas providing for the building, as soon as possible, of the number of houses needed to house the working classes in their districts Each local authority was required to make a survey of its needs and report the result to the Local Government Board, soon to become the Ministry of Health To meet the annual loss, *i e*, the difference between the net revenue from the rents which could be charged for the houses, and the outgoings for interest, repairs, sinking fund, etc, the Government undertook to bear on behalf of each local authority during the period of the loan, the annual deficiency resulting from approved expenditure in so far as it should exceed the annual proceeds of a local penny rate, which was to represent the contribution of the local authority towards the loss

Included in the scheme could be improvement or slum clearance schemes made under Parts I and II of the Housing Acts, and the loss incurred in these was treated as part of the scheme for the purpose of assessing the Government's contribution.

Financial assistance was given on a comparable scale though in different form to public utility societies. In a later act, to encourage private enterprise, a subsidy in the form of a lump sum grant per house was offered to private persons building houses within prescribed limits of size and specification of character. As a result of this scheme about 170,000 houses were erected by some 1,274 municipal authorities, 4,500 by public utility societies, and 40,000 by private persons or builders The progress of the

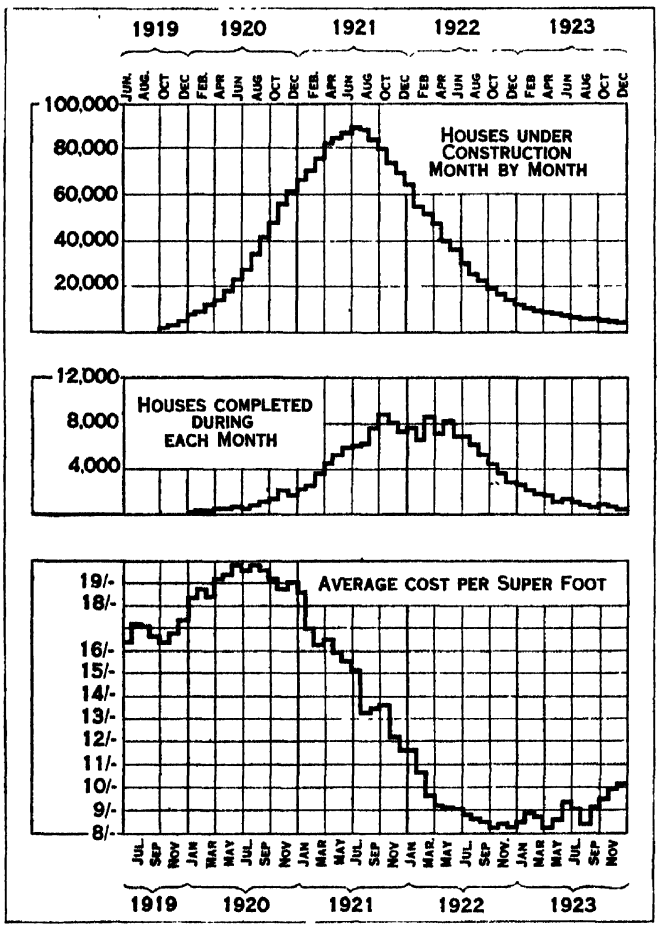
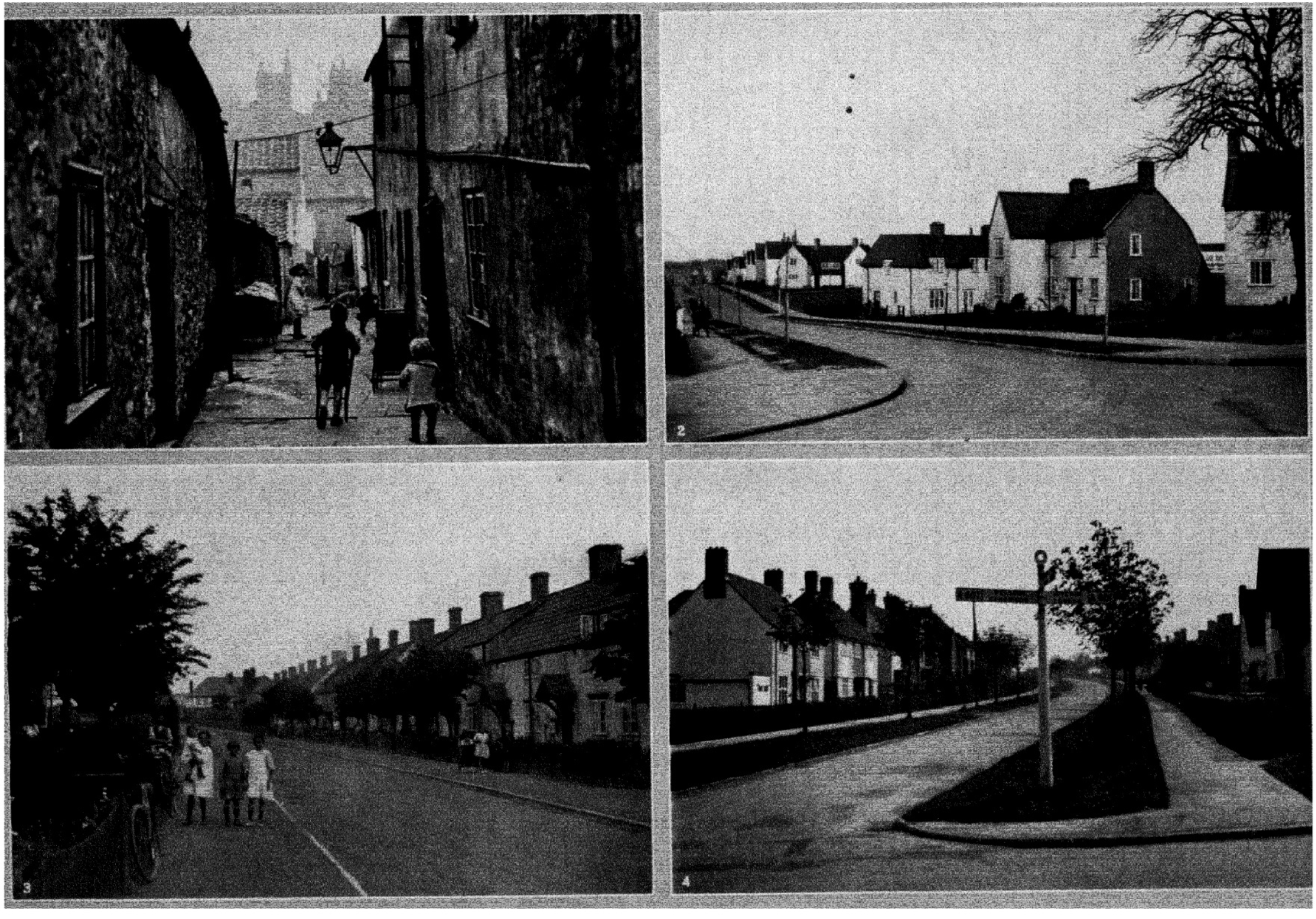


FIG. 1—DIAGRAMS OF PROGRESS AND COST IN THE 1919 HOUSING SCHEME, INDICATING THE VARYING LOAD THROWN UPON THE BUILDING INDUSTRY BY THE SCHEME AND THE FLUCTUATIONS IN THE AVERAGE PRICE OF TENDERS APPROVED MONTH BY MONTH

housing scheme is summarized in the following diagrams indicating the fluctuation in production and in cost (*See* fig 1) In regard to the contracts placed by municipal authorities, progress during 1919 was slow Prices tendered for houses gradually rose, concurrently with the increased demands upon the industry, and with the general rise in the cost of living, rates of wages and prices of building materials. The peak of prices was reached in the summer of 1920 from which time a general decline commenced This was mainly due to the check which high prices produced in all classes of building other than domestic Men and materials were liberated for housing work so rapidly that in spite of the increasing numbers put in hand during the autumn of 1920 and in 1921, prices continued to fall. The exercise of greater caution in loading the industry, and stricter control of the prices approved, helped materially to bring about the downward tendency during the autumn of 1920.

In the spring of 1921 conditions of financial stress brought about a change of policy; the expansion of the housing scheme was checked, and in the summer of 1921 the scheme was terminated by a decision to limit the number of houses to be erected under it to a maximum of about 175,000 This curtailment and ultimate stoppage of the scheme intensified the fall in prices which had previously set in, and which already affected many other national products The fall in building prices ultimately stimulated the production of houses for sale, and other branches of



PHOTOGRAPHS: (1, 2) THE TIMES, LONDON; (3, 4) A. CLUTTERBUCK

THE SLUM ALLEY OF THE OLD TYPE, AND MODERN HOUSING SCHEMES

1. A slum alley. Post-war housing schemes in England and Wales are designed to abolish such conditions, and many slums have been replaced by developments of the type shown in figs. 2–4

2. A new village showing the ample roadway and garden space, features of modern town planning
3 and 4. Views of Letchworth Estate, a housing scheme, Herts. England

the building industry; but as regards the smaller dwellings for the working classes, few new houses were put in hand to take the place of the subsidized contracts under the previous housing scheme, which were rapidly being completed during 1922. Towards the end of that year the housing position was again becoming acute; the number of houses to which the first scheme had been limited, did not suffice to keep pace with the annual growth of the housing need since the end of the war, and had done nothing to meet the accumulated arrears of the war period. Even at the comparatively low prices then available for the small number of houses being put in hand, it was evident that without some form of financial assistance dwellings for the working classes could not be erected to let. In the spring of 1923 a new act was promoted by the Minister of Health under which a subsidy was again offered, but on quite different conditions.

Under the 1919 housing scheme, while the local authorities were made responsible for building houses subject to the approval of the Local Government Board, the contribution towards the loss on the dwellings which they had to make was limited to the proceeds, year by year, of a penny rate; and the Government had undertaken to make good the remainder of the loss by an annual subsidy to the local authorities which was thus unlimited The amount of the penny rate representing in most cases a very small proportion of the loss, the position was soon reached that the whole of the further loss on the schemes being dealt with fell upon the Government, who had only limited means of controlling the expenditure under contracts made between the local authorities and the builders. Such a position was administratively one of great difficulty, on the one hand it gave little encouragement to economy on the part of the local authorities; on the other hand it sometimes promoted the cutting down of the standard of building as a means of reducing the price and so securing the approval of the Government to contracts very advantageous to the local authorities. In the Housing Act of 1923 the position was reversed The Government undertook to give a definite and limited contribution of £6 per annum per house for a period of twenty years towards the loss which the local authorities might incur in building houses, the latter taking all risk of further loss. Moreover, to encourage private enterprise, the local authorities were authorized, under schemes to be generally approved by the Minister of Health, to give assistance to builders or others wishing to erect houses suitable for the working classes This assistance could either take the form of passing on to the builder the £6 per year for twenty years, which they would receive from the Government, or the local authorities could, on the security of this payment, raise the equivalent sum, about £75, and give it as a capital grant to the builder. They were further empowered to increase the amount of the grant at the expense of the local rates. Many local authorities did in fact pay lump sum grants of £100 or even more per house.

Provision was also made in this act for subsidizing in a new form slum clearance schemes. In addition to approving loans, the minister was authorized to make grants towards the expenses incurred by local authorities in carrying out improvement schemes, and the consequent re-housing work, under Parts I and II. of the Housing Acts The amount of the grant which was to take the form of a fixed annual contribution was to be settled in each case by consultation with the local authority but was not to exceed 50 per cent of the estimated average annual loss likely to be incurred in carrying out the scheme. While contributions have varied, the full 50 per cent has usually been paid in respect of approved schemes.

Additional powers were also given to local authorities to assist private enterprise by way of loans to builders of houses not exceeding £1,500 in value The Small Dwellings Acquisition Act was amended so as to facilitate loans to owner occupiers for houses not exceeding £1,200 in value. Guarantees to building societies were also authorized so that local authorities could facilitate their operations if they so desired

The scheme began to produce considerable effect in the autumn of 1923 by which time about 10,000 houses, qualified to receive assistance under the new scheme, were being constructed; this number rose to about 50,000 in the summer of 1924. The new Labour Government which was then in power considering that the act had not adequately stimulated the building of dwellings to be let to the poorer classes, introduced a further housing act known as the Housing (Financial Provisions) Act 1924. This act left the provisions of the 1923 scheme untouched except as regards one or two minor details of the conditions. Its operation was indeed continued for a period of 15 years, subject to periodic revision as to the amount of the subsidy. In addition to the terms of the former act however it created a new form of financial assistance in the shape of an increased subsidy given for houses built under covenants that they were not to be sold, but to be let under special conditions. The most important was that so long as the annual charge on the rates did not exceed £4 10s. per house, houses should be let at rents not exceeding the rent of similar pre-war houses for the time being prevailing in the district. Since 1924 both these schemes have been running concurrently. The 1923 scheme, with its provision for a lump sum grant and its freedom to sell, has naturally proved the more attractive to private enterprise, while the 1924 scheme which authorized a subsidy of £9 per year for forty years in urban areas

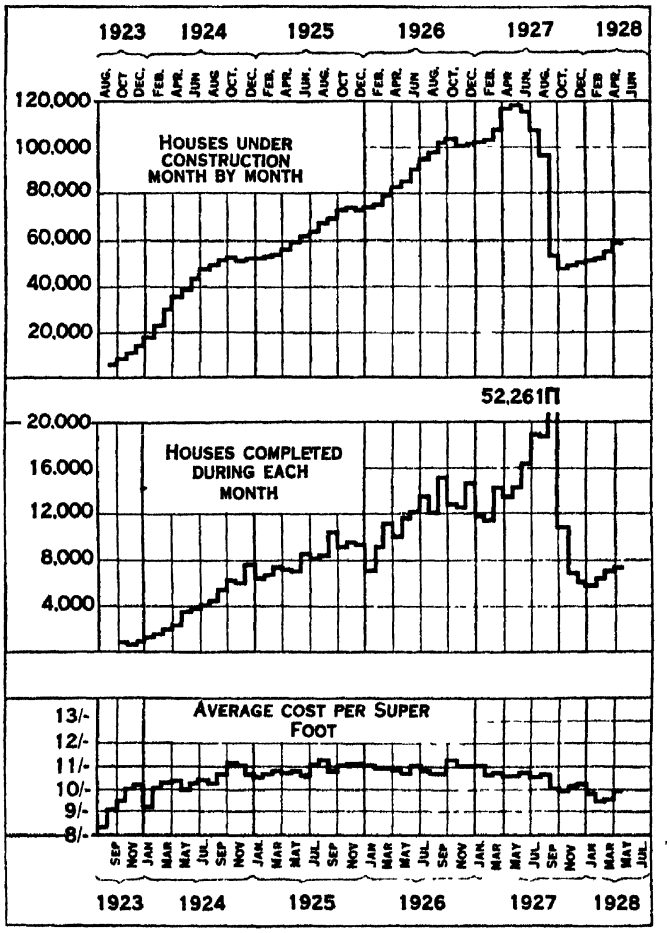


FIG. 2.—PROGRESS AND COST DIAGRAMS IN THE 1923 AND 1924 HOUSING SCHEMES, SHOWING THE TOTAL NUMBERS OF HOUSES UNDER CONSTRUCTION AND COMPLETED MONTHLY AND THE FLUCTUATION OF THE AVERAGE TENDER PRICES FOR MUNICIPAL HOUSES REPORTED

and £12.10s for agricultural areas for the same period, has proved more attractive to local authorities. They were in a position to comply with the conditions as to letting; and could limit the rents to the required amount by meeting any additional loss out of the local rates. Under the terms of the act they are required to do this up to, but not exceeding, an amount of £4 10s per annum. After this, if a further loss would be entailed, owing to the relation of local costs to prevalent rents, these rents may be increased sufficiently to keep down the contribution from the local rates to the figure of £4 10s per annum The numbers of

houses built under these two schemes grew rapidly until the end of Sept 1927, when the first revision of the subsidy took effect. All houses completed after that date were eligible only for a reduced subsidy of £4 per house for twenty years under the 1923 Act, and, under the 1924 Act, £7.10s. per house for forty years in urban areas and £11 2s 6d in agricultural areas The general progress of the 1923–24 housing schemes is shown by diagrams which may be compared with those for the 1919 scheme. (*See* fig 2.)

Previous to the outbreak of war in 1914 the actual contribution to the number of houses erected year by year made by local authorities was very small. The vast majority of houses were erected by private enterprise without any public assistance Voluntary agencies, such as building societies, co-operative and co-partnership societies of various types, were contributing an increasing number of dwellings and were particularly influencing the type of houses and the standard of lay out and amenity But apart from the building societies mainly financed by private enterprise, the volume of building by all these agencies was relatively small The war conditions had the effect of bringing private enterprise building practically to a standstill, and not until some years had elapsed were conditions such that private enterprise gradually resumed its activities. The following table indicates the relative number of houses built since the war with or without financial assistance from the Government or local authorities houses built with assistance, and are divided into those built by municipalities and those by private enterprise —

the Minister to deal with special cases.

In regard to the subsidy for private persons under the 1923 and 1924 Acts, local authorities have been given considerable freedom to adapt schemes to local circumstances; but they have been encouraged to include conditions calculated to check the misuse of the subsidy, such as, the control of the further sale of dwellings within a period of years, or the limiting of the right to alter or extend the building within a like period, and the fixing of maximum selling prices. This latter was subsequently made an absolute condition for earning the grant.

Slum Clearance.—Apart from the provision of additional new dwellings, a commencement has been made with the clearing of unhealthy areas In spite of the priority given to the erection of new dwellings to increase the total supply, up to the end of January 1928 the following progress had been made.

No of houses (including shops or other buildings) in schemes confirmed	14,135
No. actually acquired	9,280
No demolished	5,164
Total number of persons required to be rehoused in connection with schemes confirmed	68,427
No. of dwellings for which loans have been sanctioned	8,377
No. completed	5,887

Some idea of the volume of work undertaken by local authorities in connection with the inspection of dwellings, the repair of those found defective, and their closing or demolition, may be gathered from the following particulars given in the *Annual Report* of the Ministry of Health for the year 1926–27.—

England and Wales

	State-assisted schemes under the following Housing Acts				Total assisted schemes	Houses included in preceding columns completed by		Non-assisted building
	Housing Act 1919	Private building subsidized 1919	Housing Act 1923	Housing Act 1924		Local authorities	Private enterprise	Houses having a rateable value not exceeding £78 or £105 in London Metropolitan Police District
	2	3	4	5	6	7	8	9
								Years (or period) ending Sept. 30
Jan 1, 1919 to Dec 31, 1922	152,295	39,186			191,481	147,888	43,593	30,000 estimated
Calendar Year								
1923	15,679	..	3,506		19,185	17,545	1,640	52,740
1924	4,127	.	48,066	537	52,730	17,269	35,461	73,032
1925	1,324	.	79,010	19,163	99,497	37,360	62,137	66,735
1926	920	.	80,184	54,515	144,619	68,504	76,115	65,680
1927	342		100,050	95,288	196,589	110,486	86,103	60,313
1928 to March 31	6		7,791	11,971	19,768	12,749	7,019	*30,000
TOTAL	174,593	39,186	328,516	181,574	723,869	411,801	312,068	378,518

*(Six months to March 31 approximate.)

Maximum and Minimum Sizes.—It should be added that in order to secure the erection of suitable types of dwelling, maximum and minimum limits of size were fixed in the Housing Act of 1923 and were maintained in the 1924 Act. The limits fixed were, for two storey houses, a minimum floor area of 620 square feet with a maximum of 950 square feet; and for one storey houses or flats a minimum of 550 square feet and a maximum of 880 square feet. The areas are measured over all within the main containing walls of the dwelling, and where there is more than one floor the combined areas are taken Some discretion is allowed to the Minister in special circumstances to permit houses 50 feet smaller than the minimum figures given In the 1923 Act, houses were required to be provided with a bath, and in the 1924 Act the words were added "in a bathroom." Here again some discretion is allowed to the Minister to dispense with this requirement in special cases, as for example in rural areas where adequate water supply and drainage facilities may not exist. Under all the schemes a requirement that houses shall be built at a density not exceeding twelve to the acre in urban areas and eight to the acre in rural has been generally operative, discretion being left to

During the year under review reports by Medical Officers of Health were received for the year 1925

In 1,677 districts for which returns were tabulated, 428,625 houses were inspected under the Housing (Inspection of District) Regulations, and the total number of houses inspected, including inspections under the Public Health Acts, was 1,114,504 Defects in 279,407 houses were remedied without the service of formal notices. Notices under section 28 of the Housing, Town Planning, etc. Act, 1919, or section 3 of the Housing Act, 1925, were served in respect of 24,369 houses, and of these houses 18,961 were rendered fit by their owners, and 785 by the Local Authorities, while in 463 cases the owners gave notice of their intention to close the houses. Notices were served under the Public Health Acts in respect of 278,894 houses, in 225,058 of the houses the defects were remedied by the owners, and in 4,285 by the Local Authorities

The figures as to Closing and Demolition Orders were as follow.—

Representations made with a view to Closing Orders	3,141
Dwelling houses in respect of which Closing Orders were made	2,287
Closing Orders determined after houses were made fit	443
Dwelling houses in respect of which Demolition Orders were made	549
Dwelling houses demolished in pursuance of Demolition Orders	678

IV. STANDARDS OF DEVELOPMENT AND ACCOMMODATION

The general limitation of the density of building to 12 houses to the acre in urban and 8 in rural areas has proved perhaps the most valuable as it has been the most characteristic feature of

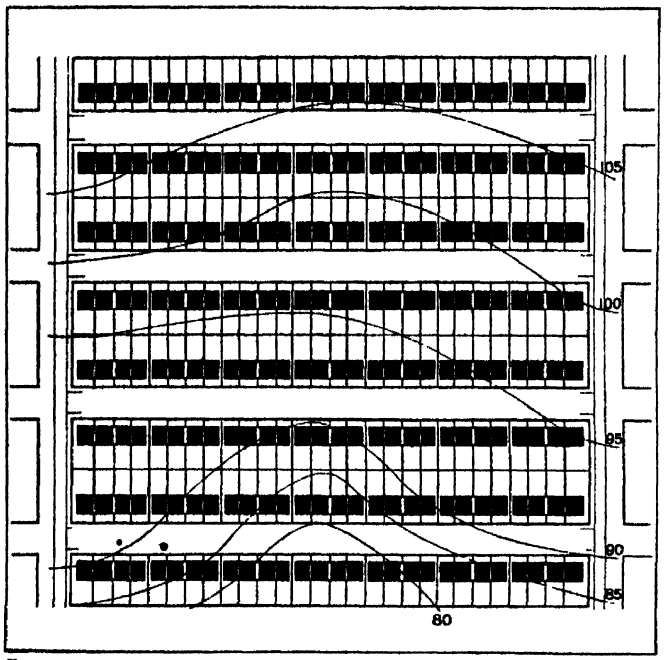


FIG 3.—THE DIAGRAM SHOWS THE OLD TYPE OF DEVELOPMENT OF 224 HOUSES ON 10 ACRES OF LAND WITH ROADS OF BYE-LAW WIDTH AND CONSTRUCTION

post-war housing. It has greatly added to the economic ability of the tenants to pay rent by providing each with a valuable plot of garden ground It has secured ample air space and sunlight for all the dwellings and increased the opportunities for healthy

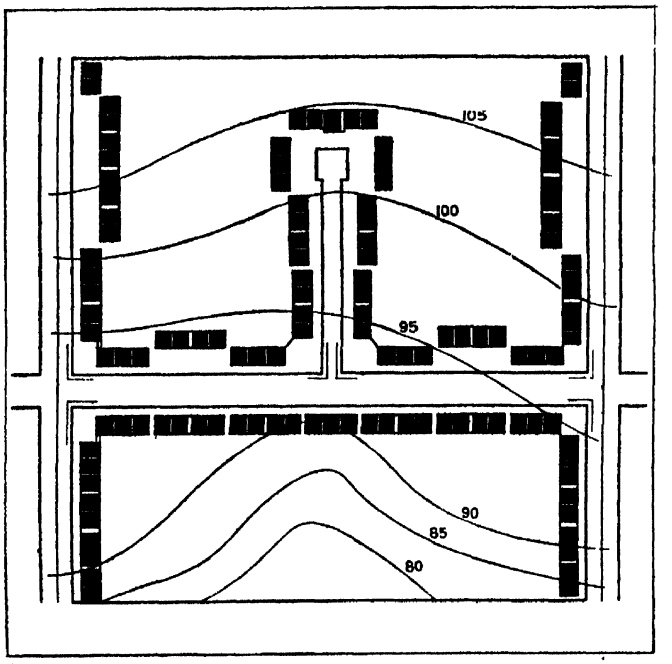


FIG 4 —DIAGRAM SHOWING NEW TYPE OF DEVELOPMENT OF 120 HOUSES ON 10 ACRES WITH SOME ROADS OF LESS COSTLY CHARACTER AND BETTER ADAPTATION TO THE CONTOURS OF THE LAND THAN ARE POSSIBLE WITH THE DENSER DEVELOPMENT IN FIGURE 3

living. It has introduced into housing a new standard of amenity, the garden space and open layout of the sites having enhanced the attractiveness of well designed schemes of houses, and given opportunities for screening in the future with foliage those with less pleasing buildings. (*See* fig 4.)

This great improvement has moreover been secured at little, if any, extra cost, the open type of development having allowed economies to be effected in the amount and character of the road works which must have balanced the small extra cost of the additional land.

The gain that can be made by crowding dwellings on land is in any case small; and must be regarded as a very inadequate offset to the great reduction in open space and amenity which results Where, as in the assisted housing schemes, the average cost of land has been little in excess of £200 per acre, and full opportunity has been afforded to take advantage of less costly types of road appropriate for open development, the possible money gain from over-crowding dwellings practically vanishes, and the advantages of low density become overwhelming

Economy of Spacious Planning.—The diagrams illustrating the two methods of development and the relative cost per dwelling show how the small saving in original land cost which can be made by adopting high density, is soon expended in the extra

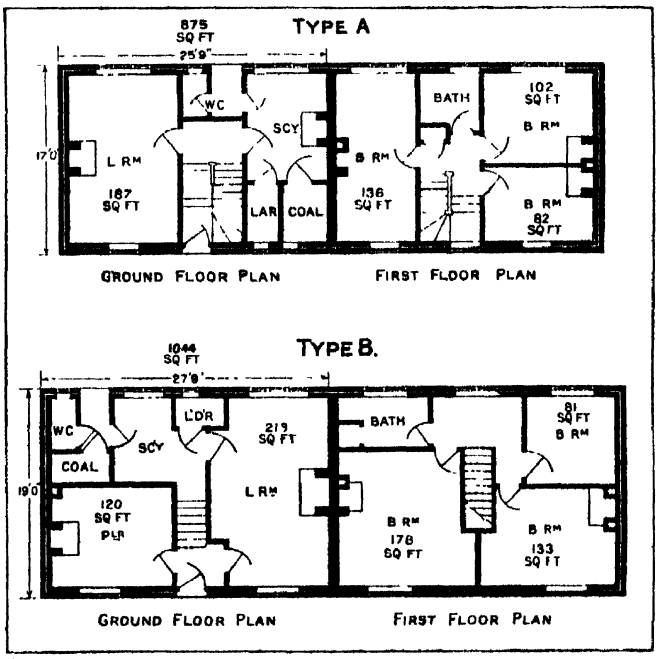


FIG. 5 —HOUSE PLANS OF EARLY TYPES OF COTTAGE USED IN HOUSING SCHEMES

A, non-parlour, and B, parlour, indicate the sizes and accommodation widely used in the 1919 housing schemes

road cost which that increased density of dwellings involves. Much road work cost is expended at every street junction which affords no building frontage, and the greater the density the greater the proportion of such wasted works. Lighter roads may also be used with the type of planning which can be adopted with low density, moreover, with open development the placing of the roads and their exact directions can be chosen to suit the ground, and to reduce excavation and filling, or the deep digging of drains, all of which leads to economy in cost. (*See* fig. 4.)

The average standard of accommodation and size of dwelling adopted in the 1919 housing scheme was influenced by the fact that during the war the building of houses for the well paid artisans had ceased as completely as the building of smaller houses for the less well paid labourers. Consequently both the Government and the municipalities felt a responsibility to provide houses to meet all sections of the working classes and to interpret that classification in a liberal manner Owing in the first instance to the rapid rise in building costs, and later to the belief that private enterprise could again take up the supply of the larger types of dwelling, the average accommodation and size was gradually reduced. In the first years the majority of houses built were parlour houses (known as B type) but as time passed the proportions changed and during 1927 the great majority were non-parlour houses (A type) Compare figs 5 and 6.

An indication of the extent of reduction in actual size of the two types may be gained from the following representing the

average sizes in square feet of municipal houses being approved in the last month of each of the following years:

For	A Type	B Type
Dec. 1919	882 square feet	1,007 square feet
„ 1923	802 „ „	948 „ „
„ 1927	786 „ „	904 „ „

In the A type house part of the reduction in the average size in 1927 is due probably to an increased number of two bedroom

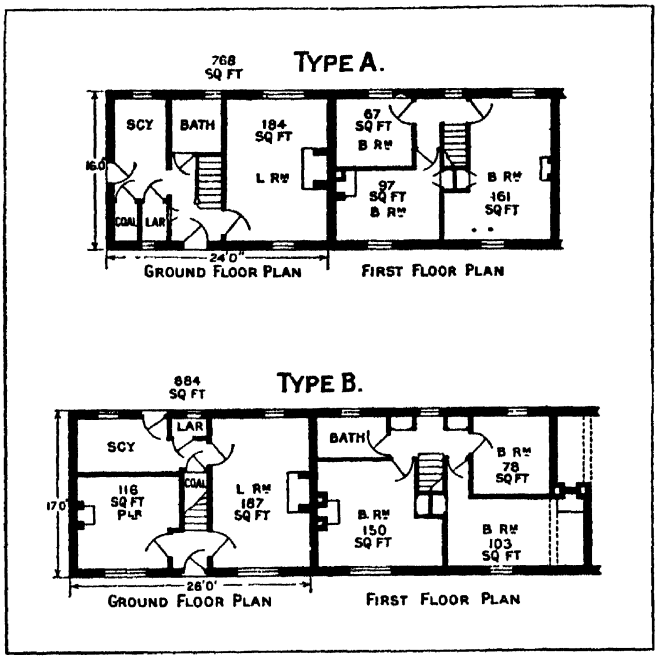


FIG 6.—PLANS INDICATING THE REDUCED SIZES GENERALLY ADOPTED FOR MUNICIPAL HOUSES IN 1927–1928

houses being included as compared with the earlier periods In both types moreover the reduction in average area has been in no small degree due to experience and skill in planning to give the required accommodation with the least waste of space, and it does not represent an equal reduction in the size of the rooms.

It is sometimes overlooked that the standard of room area and accommodation adopted in the 1919 housing scheme was not a post war standard due to the enthusiasm for building homes for returning soldiers. It was in fact a pre-war standard, laid down by two committees appointed by the Board of Agriculture and Fisheries, that on Buildings for Small Holdings which reported in 1913 (Cd. 6708) and the Advisory Committee on Rural Cottages which reported in 1914 The standard published in those reports was adopted in the Report of the Tudor Walters Committee, and is as shown below.

V. COST AND RENT

The cost of building houses varies much from place to place as well as from time to time, and it is affected by the design and size of the individual cottages Comparisons of cost can therefore usefully be given only in the form of averages, and based on a common type of agreed size. Throughout the various assisted housing schemes since the World War, records of the size and cost of houses, taken from monthly returns sent by the local authorities to the Ministry of Health have been kept, and have been reduced to a common standard of a price per square foot. The general trend of prices for municipal building is therefore accurately represented by the diagrams based on such monthly figures and showing the average of the tender prices approved month by month, or in the limited number of cases where houses were built by cost contracts, or by direct labour, the approved estimates of cost (*See* figs. 1 and 2)

When seeking to compare prices with those prevalent before the war, the difficulty arises that no similar average prices were then available. It is possible for those experienced in building in different parts of the country to fix a range of prices commonly found in pre-war days for cottage building; but no data exist which would enable the average to be accurately placed within that range. Consequently in comparing the cost of providing a dwelling in the years immediately preceding the war with the cost at the commencement of 1928, it may be safer to take two figures in both cases, giving the range of usual high and low limits of cost for each of the important items.

The normal three bedroom non parlour cottage, if compactly planned and providing rooms of the standard of accommodation generally recognized as a desirable minimum, would contain on the two floors measured over all within the containing walls about 800 square feet In pre-war times usually cubic feet would have been taken; the cubic measure for a certain area varies considerably according to the design of the cottage, but 9,200 cubic feet would be a reasonable figure to take for comparison in this case For cottages of approximately equivalent character to those erected in post-war housing schemes, though frequently containing no separate bathroom, the range of cost per cubic foot pre-war would be from 4d to 8d. A figure as low as 4d was becoming rare, and a figure as high as 8d was also unusual in carefully managed schemes It is impossible to say where the average of all working class dwellings erected would be; perhaps 5½d per cubic foot may be taken as a probable average. 9,200 cubic feet at this figure would equal £210 16s 8d or 5s 3½d per square foot; and, allowing something for the difference in amenity and equipment, 5s 6d per square foot is probably not an unfair average figure to take for pre-war houses for the purpose of comparison with the post-war average figures given above.

As regards land, no average figure can be given, but on the basis of 12 houses to the acre adopted generally for post-war housing schemes and for much of the more progressive work pre-war, the following represents the cost of land at different prices per acre, commonly paid

£100 per acre equals per house	£ 8 6 8d.
200 „ „ „ „ „	16 13 4d.
300 „ „ „ „ „	25
400 „ „ „ „ „	35 6 8d.

How Costs Have Risen.—The cost of road making is another item which varies considerably and for which average figures do not exist. A range of from £20 to £35 pre-war, and £35 to £50

1	I. Dimensions to be regarded as the irreducible minimum (from section 157 of Report of Departmental Committee)		II. Dimensions recommended as a desirable minimum (from section 17 of Report of Departmental Committee)		III. No. II. with the addition of a parlour	
	Floor areas in sq feet 2	Cubic contents in cubic feet* 3	Floor areas in sq. feet 4	Cubic contents in cubic feet* 5	Floor areas in sq. feet 6	Cubic contents in cubic feet* 7
Parlour	.	.	..	..	120	960
Living room or kitchen	165	1,320	180	1,440	180	1,440
Scullery	65	520	80	640	80	640
Larder or pantry	18	.	24	..	24	..
Bedroom No. 1	144	1,152	150	1,200	160	1,280
Bedroom No. 2	(100)	(800)	100	800	120	960
Bedroom No. 3	65	520	65	520	110	880

*The cubic contents are computed by multiplying the floor areas by 8 feet, the assumed average height of the rooms.

in 1928 would probably cover the majority of cases. On this basis it is possible to set out the probable range of costs for the two periods somewhat as follows:—

	1913–1914		1927–1928	
	From	To	From	To
	£	£	£	£
House of 800 sq.ft. including drains, fences	180	260	360	440
Land	10	30	10	30
Roads & Sewers	20	35	35	50
Total all in cost	210	325	405	520

No doubt figures higher and lower could be found in both periods but the above probably represent the ranges of cost within which the majority of dwellings would fall which were built in the year before the war or were being built in the period 1927–28

The economic rent of dwellings depends however not only on the total capital cost of providing the buildings, land, roads, drains, etc.; but also on the rate of interest and sinking fund ruling at the period; and on the cost of repairs. To give a general idea of how these different factors affect the weekly rental, it is simpler to take the all-in cost of the cottage and to give examples in round figures of cottages costing £200, £300, £400 and £500, which will cover pre-war and present costs. As the cost of repairs will vary much more nearly with the cost of building than with any factor affecting the rate of interest, it is best to take the repairs as a percentage of the cost Allowing 1¼% as a reasonable amount to cover repairs, insurance and other similar items, the following table gives the necessary rentals per annum and per week for cottages of the different costs named, which would be required to meet the outgoings with inclusive rates for interest and repayment of loan of 3½%, 4½% and 5½% respectively

Cost	£ 200	£ 300	£ 400	£ 500
Interest 5½%	11.	16 10	22.	27 10
Repairs etc. 1¼%	3	4 10	6	7 10
Rent per year	14.	21	28.	35
Equivalent per week to nearest penny	5s 5d	8s 1d.	10s 9d	13s.
Interest 4½%	9.	13 10.	18.	22 10.
Repairs 1¼%	3.	4 10	6.	7. 10
Rent per year	12.	18	24.	30
„ „ week	4s 8d	6s 11d	9s 3d	11s 6d
Interest 3½%	7.	10. 10	14	17 10
Repairs 1¼%	3.	4 10	6.	7 10
Rent per year	10.	15.	20	25.
„ „ week	3s 10d	5s 9d	7s 8d	9s.7d

Price of Money.—It will be noticed that a drop of 1% in interest charged is equivalent in its effect upon rent to a considerable reduction in cost. The range in rates of interest represents approximately that applicable to municipal houses for pre-war and present periods. For dwellings financed by private enterprise, and where it is intended that the rentals shall yield something more than bare interest on costs a higher percentage would have to be allowed, to make the venture profitable. On the other hand, it may be said that private enterprise can build more cheaply than the municipality. Recent evidence based on selling prices does not suggest, however, that they are in fact able to provide similar dwellings at an all-in figure less than the total cost of those built by the municipalities, or to let them at lower rents.

VI. HOUSING IN LONDON

Housing in London presents a problem of special difficulty owing to the magnitude of the urbanized area and the extent of the movements of population which take place from one part to another. It has long been customary to think of London as a city the population of which has been increasing, not only by the natural increase due to excess of births over deaths, but by attracting population from the country or other parts of the world. This has long ceased to be the case The census of 1911 first revealed the fact that the population in the area administered by the London County Council was actually decreasing, and the census of 1921 showed a still further decrease for that area. The census of 1911 further showed that the excess of emigration over increase and immigration even from Greater London to places more than 30 miles from the centre, could not have been less than 187,000 persons in the period of ten years previous to that census The census of 1921 has shown that this tendency has increased, and that both the County of London and Greater London have each in the period 1911 to 1921 failed to hold their natural increase of population and have sent out emigrants. It is interesting to note, however, that the inter-census period 1901 and 1911 revealed a very great movement of population into the outer ring, a tendency the checking of which by the want of housing accommodation is revealed by the census of 1921 The annexed table giving these figures in detail, is an interesting record of very great movements of population, numbers equivalent to the total population of large towns having moved from the County of London to the outer ring, or from Greater London to other places, during the inter-census decades:

Balance of Migration

Area	Increase or decrease of population + or −			Excess of births over deaths			Balance of migration + or −		
	1891–1901	1901–11	1911–21	1891–1901	1901–11	1911–21	1891–1901	1901–11	1911–21
Administrative County of London	+308,313	− 13,306	− 37,162	484,699	538,927	359,861	−176,386	−553,509	−397,023
Outer Ring	+639,283	+684,867	+266,005	247,026	363,026	296,053	+392,257	+321,512	− 30,048
Greater London (*i.e.*, County plus Outer Ring)	+947,596	+671,561	+228,843	731,725	901,953	655,914	+215,871	−231,997	−427,071

But for this outward movement of population the need for dwellings in London would have been much greater than has been the case When the supply of dwellings in London is sufficient to leave freedom for normal movements the tendency to move out from the centre to the suburbs, which was so marked in the period 1901–1911 may again become more active

The increasing pressure on dwelling accommodation in London even before the war is indicated by the proportion of empty dwellings recorded by the L C.C. on their many housing estates, as shown by the percentage of rental loss due to empties in each year During the war there was further increase of pressure and the loss diminished. The following table shows the changes which have taken place The figures seem to indicate a certain relaxation of pressure, but it is stated that the increase of empties is partly due to the holding of a number of new houses on the various estates for short periods to meet the special needs of certain groups of tenants.

Date	Percentage of rental losses	Date	Percentage of rental losses
1909–10	7·45	1918–19	0·18
1910–11	7·53	1919–20	0·05
1911–12	6 33	1920–21	0·02
1912–13	3·63	1921–22	0·05
1913–14	1·84	1922–23	0·04
1915–16	0·64	1923–24	0 03
1916–17	0·38	1924–25	0·03
1917–18	0·66	1925–26	0 06
		1926–27	0·22

Progress in Greater London.—To meet the needs of Greater London there had been erected since the war up to Sept. 30, 1927:

By the various local authorities	52,190
„ trusts or public utility societies	2,245
„ private enterprise, including houses of all classes	97,691
	152,135

Up to Dec 31, 1927 the London County Council had built altogether since the Armistice 24 085 dwellings Of these 1,632 were tenements to meet rehousing obligations under the slum clearance schemes leaving a net addition of 22,453 dwellings The council had taken steps to deal with 23 unhealthy areas covering 98 acres This would involve displacing 28,500 persons, of whom rehousing must be provided for 27,000 persons, 20,000 in the cleared sites and 7,000 elsewhere.

VII. HOUSING IN SCOTLAND

While the greater part of what has been written in regard to housing in England and Wales would apply to Scotland also, there are certain distinctions which should be known, and certain aspects of the problem which are special to that country.

The standard of housing north of the Tweed, measured in the number of rooms per dwelling, has been lower than in England; one or two roomed dwellings prevail to a far greater extent; and less complete separation of sleeping rooms from living rooms has taken place. On the other hand, the difference in area occupied per family is not as great as the difference in the number of rooms would suggest, for the rooms are generally larger in pre-war Scottish dwellings than in the English cottages of like period. The prevalence in the larger towns, particularly in Edinburgh and Glasgow, of the tenement block as the method of housing the working classes has also distinguished Scottish practice from English

The whole problem of housing in Scotland was exhaustively investigated by a Royal Commission which was appointed in Oct. 1912 and published its report in 1918. The commission then estimated that before the housing conditions in Scotland could be regarded as satisfactory 235,990 dwellings would need to be provided, of which number they considered 121,430 were immediately needed to relieve overcrowding and take the place of dwellings clearly unfit for habitation Their estimates were based on the census of 1911 which showed the population as 4,760,904, the number of occupied houses 1,013,369 and unoccupied 89,060 The commission recommended that no tenements should be built more than three stories high, or exceeding, when three stories high, 32 dwellings to the acre For double flatted houses 24 to the acre, and for single cottages 16, were recommended as the maximum numbers to be permitted; and these limits they advised should be embodied in an appropriate act of parliament

The various housing acts giving financial assistance to stimulate the building of houses already described have applied to Scotland, with slight variations chiefly in regard to administration. Building progress there has not been equally rapid, however; probably the much larger volume of work in the neighbouring country had the effect of creating a stronger draw on the inadequate supplies both of labour and materials. The following shows the progress made up to the end of April 1928:

	Completed	Under construction
1919 Act	25,550	
„ „ private builders	2,324	
1923 „ local authorities	3,966	119
„ „ private builders	12,298	2,641
1924 „ local authorities	21,396	12,429
„ „ private enterprise	431	419
Slum clearance schemes	7,095	2,854
Demonstration houses	17	
Steel houses erected on behalf of the Government	2,542	10
Total	75,619	18,472

Persons Per Room.—Bearing in mind the difference in size of rooms and character of dwellings already referred to, the following particulars, taken from the 1911 and 1921 census returns, show the changes during the inter census period; if compared with similar figures given for England and Wales, they also indicate the difference in the standard of housing between the two countries.

	Percentage of persons living	
	More than 3 persons per room	More than 2 persons per room
1911 Census	21·9	45·1
1921 „	21·1	43·3

Population and Houses

	Total population	No of occupied houses	Percentage of population	No of unoccupied houses	Percentage of houses	No of houses in course of erection
1911 census	4,760,904	1,013,369	21 3	89,060	8 79	4,718
1921 „	4,882,497	1,057,609	21 7	51,835	4·90	10,628

Percentage of population living in houses containing the following number of rooms

Rooms	1	2	3	4	5	6	7 and over
Percentage of population 1911 census	8·7	40·9	21 9	9·9	5'6	3 8	9·2
1921 census*	8·6	41·7	22·6	10 7	5 9	4·0	7·2
Percentage increase + or decrease −	−0·8	+2 0	+3·0	+8 3	+4 8	+5 2	−22 8

*Calculated from percentage increase or decrease

It will be noted that the figures indicating a movement towards houses having more rooms, and the reduction of the proportion of those living in the one roomed dwelling, are more favourable than in England and Wales; while the reduction in numbers occupying houses having more than six rooms is relatively greater

VIII. THE HOUSING ACT, 1925

The various acts passed since 1890 giving powers for dealing with housing problems were consolidated in the Housing Act of 1925 This act is divided into five parts dealing with the various divisions of the subject

The act is a long one containing 137 sections, and it is only possible here to give a brief summary.

Part I. (Sections 1–34).—In contracts for the letting of houses at rents not exceeding £40 per annum in the county of London, and £26 per annum elsewhere, there is an implied condition that such houses are at the commencement of the tenancy, and shall be maintained in all respects reasonably fit for human habitation.

The local authorities are authorized to require owners to make and keep dwellings in all respects reasonably fit for human habitation, except where the house is in such condition that without reconstruction it is incapable of being made fit. In such cases the owner has an option to close the house, in which case a closing order by the local authority is deemed to have been made If a notice for repair is not complied with, the local authorities have an option to do the work and recover expenses from the owner. Where a closing order is deemed to be operative the Ministry of Health may authorize a local authority to acquire the house on terms similar to those on which slum property is acquired under Part II. schemes, that is, practically at cleared site value.

In regard to houses occupied by more than one family, that is houses let in tenements, local authorities are authorized to make byelaws to regulate the number of occupants and other matters A duty is put upon local authorities to inspect their district, and to ascertain whether any dwelling houses are unfit for human habitation, and to keep such records as the Ministry of Health may require. On a representation by the medical officer of health or other officer that a house is unfit for human habitation, the local authority are empowered to make a closing order prohibiting the use of the dwelling for human habitation until rendered fit. If the house is made fit for habitation the closing order is deter-

mined. When a closing order remains operative for three months, it is the duty of the local authority to consider the question of demolition. If there appears to be no prospect of the house being made fit, the local authority may order its demolition. If the order is confirmed the owner must take down and remove the house within three months; failing this, the local authority must do so; and may recoup itself by the sale of materials or recover from the owner the excess cost. Where the owner has executed the required works, the local authority are empowered by an order to charge upon the house an annuity to repay the amount expended in repairs

This part of the act also forbids back to back houses, and the use of cellars for sleeping rooms, except under certain conditions; and empowers local authorities to make regulations prescribing these conditions Power is given to secure the removal of obstructive buildings, even if not themselves unfit for habitation, if they render adjacent dwellings unfit or incapable of being made fit. When an order for this purpose is confirmed the local authorities are authorized to purchase the land from the owner. Compensation in this case is paid for the land and building, and is settled if necessary by arbitration.

Should a local authority fail to exercise their powers, and complaint of default is made by the county council, parish council or four electors, the Minister may hold a public local inquiry, and if the default is established the Minister may direct the local authority to act; if they again fail to do so, he may with their consent instruct the county council to carry out the works, and in certain cases the Minister may enforce his order on the local authorities by mandamus Provision is also made enabling county councils to take action in the areas of the lesser authorities on proper representation Part I concludes with various provisions protecting ground landlords and others interested in the property and defining the local authorities upon whom the various duties fall.

Part II. (Sections 35–56) Improvement Schemes.—Where an official representation is made to a local authority, other than a rural district council, respecting any area in the district, either "(a) that any houses, courts or alleys within the area are unfit for human habitation, or (b) that the narrowness, closeness and bad arrangement or the bad condition of the streets and houses or groups of houses within the area, or the want of light, air ventilation or proper conveniences or any other sanitary defects, or one or more of such causes are dangerous or injurious to the health of the inhabitants either of the buildings in the area or neighbouring buildings," and that the most satisfactory method of dealing with the faults is by means of an improvement scheme, if the local authority are satisfied that this is the case, and of the sufficiency of their resources, it is their duty to pass a resolution to the effect that the area is an unhealthy area, and that an improvement scheme ought to be made for it, and they shall forthwith proceed to make a scheme for the purpose. (Several areas may be included in one scheme.) The official representation is made to the local authority by their medical officer of health.

Reconstruction Schemes.—The reconstruction scheme differs from the improvement scheme mainly in being concerned with smaller areas and with the rearrangement of buildings and their sites only, and not with more extensive rearrangements involving streets and alleys. They are to be made in the following cases.

(a) Where a demolition order has been made and the local authority consider it would be beneficial to the health of the inhabitants of the neighbouring houses if the area, of which such buildings forms part, were

1. adopted as a highway or open space, or
2. appropriated, sold, or let for the erection of houses for the working classes, or
3. exchanged with other neighbouring land for such purposes.

(b) Where it appears to the local authority that the closeness, narrowness and bad arrangement or bad condition of any building, or the want of light or ventilation is prejudicial to the health of the inhabitants either of the said building or of the neighbouring buildings.

and that the most satisfactory method of dealing with the faults is by a reconstruction scheme; in either of the above cases, it is the duty of the local authority to pass a resolution to this effect, and direct such reconstruction scheme to be prepared

The Act itself should be consulted for the provisions as to appeals, the making, if necessary amending, and confirming of improvement schemes; also as regards compensation; broadly speaking, the principle is that for the unhealthy area proper, the compensation to be paid is the value of the land as a site cleared of buildings and available for development according to the local byelaws. Where, however, the scheme provides for the rehousing of the working classes on the land, or part of it, or requires that the land, or part of it, shall be laid out as an open space, the compensation is reduced to the extent that these limitations on the user of the land diminish its value As regards the land included only for the purpose of making the scheme efficient, and not on account of its sanitary condition, ordinary compensation for land and buildings under the provisions of the Acquisition of Land Act of 1919 is to be paid.

Part III. (Sections 57–80).—This is concerned with the provision of additional new dwelling houses, and authorizes the various local authorities to provide housing accommodation for the working classes by the erection or acquisition of dwelling houses, or by the conversion of buildings into dwellings, and for this purpose dwellings include lodging houses, tenement houses or cottages; and the latter may have gardens not exceeding in size one acre. The act also includes power to provide and maintain with the consent of the Minister of Health buildings adapted for use as shops, any recreation grounds or other buildings or land, which in the opinion of the Minister will serve a beneficial purpose in connection with the requirements of the persons for whom the housing accommodation is provided (Section 107)

Urban local authorities may go outside the boundaries of their areas for the purpose of building dwellings or exercising the like powers The duty is put upon the local authority to consider the needs of their area, and as often as the occasion arises, or within three months of notice given by the Minister of Health, to prepare a scheme showing the number and the nature of houses to be provided When approved with or without modification the scheme becomes binding on the local authority It is interesting to note that under Section 60 (3) the local authority in preparing a scheme and the Minister in approving it, are directed to take into account and so far as possible, to preserve, existing erections of architectural, historic or artistic interest, and to have regard to the natural amenities of the locality; and under certain circumstances the Minister is empowered to direct that an architect nominated by the Royal Institute of British Architects shall be appointed to secure these ends

Power is given under which the local authority may acquire land by agreement, and may be authorized by the Minister of Health to purchase compulsorily, for the purpose of carrying out the objects of the Housing Act Provision is made for empowering the local authority to make byelaws for the management, use and regulating of their houses

In addition to building themselves, local authorities are authorized to promote or assist public utility societies to provide housing accommodation.

Part IV. (Sections 81–97).—This part contains the financial provisions, defining how the expenses incurred by the local authorities are to be defrayed, expanding their borrowing powers, providing for loans by the public works loans commissioners, and dealing with loans made by local authorities for the purpose of promoting housing development in their area

Part V. (Sections 98–137).—Part V contains miscellaneous provisions, *e.g.*, for the varying of restrictive building byelaws, and other matters necessary for the smooth administrative working of the act.

IX. EUROPEAN HOUSING

The shortage of dwellings and their inadequate character have constituted a serious problem in most European countries The difficulties of solving it have been increased owing to the World War both in the belligerent and the neutral countries; and have been specially aggravated by inflation and consequent instability of currencies Loans and subsidies to stimulate the erection of dwellings, or remission of taxation upon them when erected, have in one form or another been generally adopted. In many coun-

nental countries a controversy has raged which plays small part in English housing; that between the one-family dwelling, which so overwhelmingly prevails in England, and the multi-family dwellings in the form of blocks of flats, or tenements, which prevail in so many continental cities. In some cases the position as between these two types of dwelling has been influenced by special economic or political considerations. In Vienna, for example, the great scarcity of food for some years after the war caused the garden attached to the one-family dwelling built outside the city to be of quite unusual economic or rent paying value, and for some time attention was mainly directed to building one-family dwellings with good gardens Later, economic and political considerations produced a reaction from this policy, and a reversion to the general custom in the city of Vienna to building dwellings in large blocks In England, where flats play so small a part in the general housing, the importance of the controversy abroad is not generally realized Exact statistics are not available, but an estimate made after enquiry in ten of the larger cities gave a proportion, outside London, of over 97% cottages, and less than 3% flats, of which over one-third would be in buildings of only two storeys. The figures would be different in London; but of the dwellings built by the London county council probably over 80% have been single family cottages As regards the relative cost of the two types of dwelling, evidence from different countries is conflicting This is partly accounted for by the fact that building custom, land values and road charges tend to become adapted to the most general form of development in each country Also climatic conditions or building regulations may require for the single family cottage a thickness of wall construction not required in England In England, per square foot of accommodation provided, it is seldom that flats cost for the building as little as single family cottages In some other countries where flats predominate it is reported that the building cost apart from land and roads is somewhat less per square foot than the cost of single family cottages It is interesting to compare the methods of assistance and results attained in some of the European countries Particulars can only be given in very general terms however because the methods adopted vary not only in the different countries, but in the different states composing the countries, and from city to city within the same state. In many countries on the continent the cities possess a degree of autonomy in such matters much in excess of that possessed by towns in England

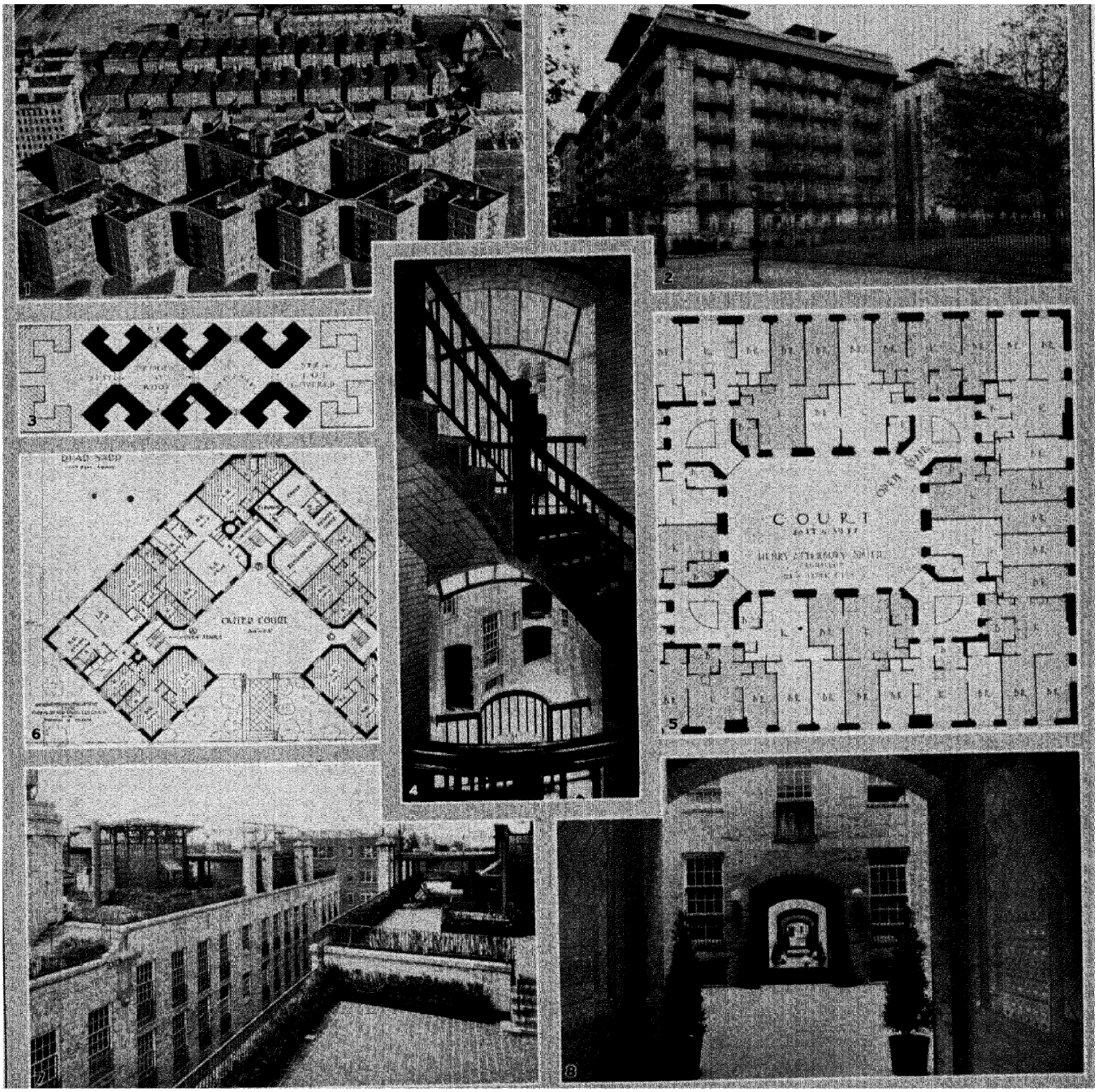
Austria.—In Austria co-operative societies have had a legal status since the Law of 1873. Subsequent to the World War the position was exceptionally difficult, the single city of Vienna representing about a third of the population of the reduced Austria. Famine conditions for some time existed, and there was a great exodus of population, officers from other parts of the old Austrian empire returning to their various cities and people moving out to the country, where living conditions were easier The sudden collapse of the value of money coupled with rent restriction which was not at first varied to meet the money situation, resulted for a time in house room being the only cheap commodity A great expansion of accommodation took place, the one roomed dwelling having been very prevalent in the city before the war; families gladly took advantage of the low rents and the available space to secure a more adequate number of rooms. The urgent necessity of growing food as a means of sustenance produced a strong reaction from the general pre-war tendency to live in small flats within Vienna, and an interesting movement sprang up for the creation of housing settlements with small one-family dwellings having from four to five hundred metres of garden land attached to each. This movement was assisted by the Society of Friends and others interested in the city, and a number of settlements (*Siedlungs*) were built on land largely provided by the city of Vienna from the extensive green belt in their possession The co-operative building societies grew to an enormous scale, tens of thousands of applicants for houses being enrolled In spite of the rapidly depreciating currency and other difficulties, great efforts were made to continue the building of dwellings in the settlements. An interesting feature was the condition that each intending householder must contribute from 1,000 to 2,000 hours of free labour to assist in the erection of the dwellings This labour, being unskilled, was largely used in digging foundations, making roads, and in the preparation of simple concrete blocks, and in other ways assisting the limited number of skilled workers available In the summer evenings and at the week-ends when the intending occupants of the dwellings could get free from their ordinary employments, people of all classes could be seen busily engaged in carrying out such operations as they could in connection with the erection of their dwellings At a latter date after the stabilization of the Austrian currency, owing to the need to press forward more rapidly with the erection of large numbers of dwellings, owing also to certain political considerations, there was a return to the building of the small flat dwellings within the town area. Quite a number of these have been erected in handsome blocks of buildings by the city of Vienna. There is in the city considerable conflict between the advocates of the two policies, those who desire to see the continued erection of *Siedlungs* containing one-family dwellings with ample garden space somewhat on the lines of the English housing schemes, and those who favour the housing of the people in large blocks of small tenements within the central area of the city

During the nine years up to Dec 1927 31,542 dwellings were erected in Vienna, and the building programme of the city contemplated erecting a further 30,000 in the following five years

Belgium.—The construction of dwellings was completely arrested during the World War and after, until it was stimulated by the application of the housing law passed in Oct. 1919. Under this act was founded the *Société Nationale des Logements à Bon Marché* This central society is the medium through which assistance is given to the regional building societies which are public utility societies and number about 261. Loans have been given to the full value of the lands and buildings under the complete supervision and approval of the *Société Nationale,* in this way differing from most countries where loans have been given only for a proportion of the value The shareholders of the societies are the State, the provinces, the municipalities and other public institutions or private persons. The first 570,000,000 francs were lent at 2% plus 0·75% sinking fund, plus 0 25% general costs, the period being 65 years The State bears the difference between the rate at which the money can be raised and this low interest charged for the loans, thus giving in effect a substantial subsidy After allowing for their own expenses, repairs, etc , it will be seen that the societies would be in a position to let dwellings at a rental of from 4 2% to 4·3% of the cost. For the following 100,000,000 fr. allotted in 1927 interest is raised to 3% and a further 300,000,000 fr. has been proposed with interest at 3½%. With the first 570,000,000 fr there were built 33,000 dwellings, including apartment dwellings and one-family houses It is expected that with the next 400,000,000 fr. there will be built about 13,000 dwellings

In addition to the above arrangements, subsidies have been given to provide for people building for themselves varying from 2,500 fr to 3,500 fr. per dwelling and 18,000 houses were built under this arrangement up to 1926, when owing to the financial stress and the depreciation of the currency, this form of subsidy was stopped. An addition to this subsidy has been made by some provinces and a very small number of municipalities It is contemplated that this subsidy may be again renewed A further subsidy on similar lines is given to the purchasers of houses built by the societies already referred to. In this case the subsidy is not paid in cash, but is given in the form of a reduced price, and some 6,800 of the houses built by the societies have been sold by this method With the money received for such sales the societies build other houses. It is proposed to give additional assistance by exempting from the land tax for a period of ten years every dwelling erected under a certain value.

As indicating the disturbance in conditions, prices, etc., which has caused and is still causing difficulty in dealing with the housing problem in Belgium, the following figures may



BY COURTESY OF HENRY ATTERBURY SMITH

TWO PLANS OF MODERN APARTMENT HOUSE ARRANGEMENT

1. Apartment house buildings at Jackson Heights. Diagonal, 45°, "Sawtooth," or ¾ Open Units. Observe the "Open Stair" heads with incinerator chimneys adjacent. Two elevators furnish express service to the roof, distributing tenants to all stair heads by means of connecting bridges. Note absence of dark yards or courts
2. Vanderbilt East River Homes, fireproof throughout, with balcony floors on level with apartment floors. The window sash is open from floor to ceiling, permitting open air sleeping. These buildings house 376 families, having 900 rooms and 376 baths. 632 rooms are less than 7'0" wide, and some are 6'0" wide, but all are light and airy
3. Drawing showing layout of the buildings at Jackson Heights. Diagonal placement permits of maximum light and air for occupants. In such buildings, running north and south in single rows, each room would actually receive sunlight during some portion of every day
4. Open Stairs of the Vanderbilt Apartments. These eliminate all halls and inter-communication between suites. Entrances to all apartments open into fresh air. Contagion, infection, odours and neighbour annoyances are reduced to a minimum. Entrance to apartments is under control and observation at all times
5. Plan submitted to W. K. Vanderbilt in 1908. Observe all primary rooms in zone of primary value. Vestibules, baths and staircases are in zone of secondary value. Apartments only two rooms deep are assured of complete cross-ventilation
6. Plan of one building at Jackson Heights. All of the six buildings vary in arrangements. Observe the absence of halls and interior rooms. Complete cross-ventilation is secured
7. View across courts of a roof of the Vanderbilt Apartments. Observe two "Open Stair" heads. Tiled roofs of all "Open Stair" multiple dwellings are used for many open air purposes, e. g., for sun rooms and drying decks as illustrated
8. Entrance to "Open patios" of the Vanderbilt apartments. There are no doors or gates between street and individual apartment entrances. Dead air pockets are thus eliminated and complete circulation of fresh air is permitted

be of interest comparing conditions in 1914 with those in 1926.

	1914	1926
Wages per Hour	50 to 60 centimes	4 to 4 25 francs
Average Working Class Rent	30 to 50 francs	100 to 160 francs
Average Cost of constructing working class dwelling	5,000 to 7,000 francs	18,000 to 26,000 francs

The following measures are recommended for dealing with the slums and the housing problem by *La Ligue Nationale Belge contre les Taudis,* which has been created with the approval of the government and the patronage of the king.

(1) Inspection of dwellings.
(2) Construction of cheap dwellings, 20,000 to 25,000 francs
(3) Subventions to families needing it to build or buy their houses, up to 6,000 fr.
(4) Exemption from property tax for 10 years
(5) Reconditioning old houses and closing slums, with recourse to the Crown if the municipality fails to act
(6) Sanitary inspection of dwellings to be independent of local authorities.
(7) Education in housekeeping

France.—The State, the department and the commune each take part in promoting the building of houses for the working classes The communes can themselves undertake to contract for the building of houses for large families, and owing to the anxiety as to the diminishing population, special facilities are given for houses for larger families, but most of the work is done through co-operative societies known as *Sociétés d'Habitations à bon marché* (d'H B M). The State assists these societies by granting loans at less than the market rate of interest; frequently at 3½%, up to 60% of the cost of the building or the selling price, whichever is the least, but where repayment is guaranteed to the State by a department or commune the proportion may be increased to 75%. The State has also given subsidies up to ⅓ of the cost of the building to communes, organizations (d'H B M.), and certain other public or semi-public bodies willing to construct houses that are to be let at ⅔ the ordinary market rent and are to be available for the use of large families having more than three children under sixteen years of age The communes are empowered to make donations to societies (d'H.B M) of land area for purposes of construction and may also make loans to them. They may subscribe to the shares of such societies or may guarantee the interest on those shares up to 3% for 20 years They may also guarantee interest and sinking fund of loans which are approved by the public offices. All such new buildings have been given exemption from certain taxes for a period of fifteen years. There are about 340 co-operative housing societies that were actively working before the World War. In addition to the co-operative societies there are public offices for cheap houses of which the boards consist of 18 members, six appointed by the prefect, six by the department and municipalities jointly, and six by various institutions such as trade unions, savings banks, mutual benefit societies, housing associations, etc. Societies (d'H.B.M), public offices, etc., in 1928 received subventions equal to 33% of the building cost and loans up to 52% of the cost at 3% interest, repayment spread over 40 years. The advantages are granted where two-thirds of the houses are let to families with at least four children under 16 years of age. The estimates of the number of new dwellings required in France have varied very much. In 1921 an estimate of 500,000 for the whole of the country was made by Bonnevez and Loucher, while the bureau of municipal statistics estimated the urgent need for Paris at 47,794, and that in the remainder of the department of the Seine as 13,924. There were those, however, who consider that these figures underestimate the needs.

Germany.—In Germany the maximum difficulties have been experienced. The housing problem was a serious one before the World War; rents had risen until they represented about 20% of the incomes of the mass of the people. The greatest fluctuations in currency and instability of conditions generally, have had to be faced. Excessive speculation in land owing partly to comparative simplicity of transfer had seriously hampered developments in many places Co-operative housing societies for building dwellings had been fostered by the Government and by municipalities to counteract the evils of speculation and speculative building. Of these societies something like a thousand were formed between 1870 and the commencement of the war A public audit of their accounts was required, and their capital was obtained partly by shares taken up by investors, partly from Governmental and other public bodies. The war brought about an acute shortage. The emergency was met by varying methods in different States and cities, but general control of rents was introduced, and in many States a rationing of house room in existing dwellings was put in force, each family being allowed so many rooms. In some cases a maximum was fixed of three rooms for the ordinary family, and the householder was required to take in tenants or lodgers to fill the remaining rooms in the dwelling Subsidies of various kinds were given to stimulate building, and owing to the instability of financial conditions, it may perhaps be said generally that up to 1924 the subsidies were given in forms which represented the amount of capital which would be lost permanently as a result of building operations. The inflation which so seriously increased the difficulties of building new houses had the effect on all existing buildings of practically cancelling the mortgages, which could be, and were, extensively paid off in the debased and almost valueless currency. Subsequently the position was stabilized, so that all mortgages paid off before June 15, 1922, were regarded as completely cancelled, but those paid after that date, or left standing, were to be commuted in the revised currency at 25% of their original value In view of the great relief thus conferred on the owners of pre-war buildings, a tax, known as the house interest tax, was imposed on all such buildings. This amounts approximately to 50% of the pre-war rents; and about half of this tax has been earmarked to provide cheap mortgages for new dwellings. Taking the conditions prevailing in year 1927–8 and comparing them with pre-war conditions, the problem still to be faced in Germany may be set down as follows:

	Cost	Yearly charges per cent	Yearly charges marks	Per week
Pre-war	5,000 mks	7%	350 mks	6s 8d.
1927–28	10,000 mks	15%	1,500 mks	28s 10d.

Since 1924 there has no longer been a cash subsidy, but cheap second or third mortgages have been arranged by the States or municipalities coming behind the first ordinary and very expensive mortgage, the latter costing from six to twelve per cent. Interest on the cheap mortgages has generally been fixed at about 3%, plus 1% for repayment of the capital, but during the first three years in many cases a nominal charge of one per cent without any repayment has been fixed. The money to provide for this reduced interest comes largely from the house tax referred to above.

In spite of all the difficulties 1,337,714 new dwellings had been built in Germany since the war up to the end of 1927. They include flats and houses, flats probably predominating largely. Of these dwellings 288,635 were built during the year 1927, of which number 282,968 were subsidized In the case of houses costing 15,000 marks the financing would be somewhat as follows:—

6,000 marks, on first mortgage borrowed at market rate
5,700 marks, on second mortgage.
3,300 marks, the building owner's money, or third mortgage, the second and third mortgages being provided by the State or local authority through the agency of the central building society.

Holland.—Holland, a non-belligerent country in some ways able to profit by the World War, nevertheless was faced with a serious housing problem, and has undoubtedly handled it with great ability and zeal. Both in regard to the development of new areas for cottage dwellings, and of those for blocks of flats, a degree of skill, architectural taste and originality has been devoted to the laying out of the sites and the designing of the buildings, which has won the admiration, and in some respects the

wonder, of all housing experts. For occasionally it must be admitted that the originality has been such that those not initiated find some difficulty in appreciating the results. This, however, applies to a small proportion of the work only, most of it being quite successful and much very beautiful.

In spite of its good fortune in keeping out of the war and being able to preserve a sound currency, Holland in common with other countries was faced with the difficulty of high prices rendering the erection of dwellings to be let at possible rentals over long periods unremunerative. Moreover in many of her most important towns no buildings could be erected except on an expensive foundation set on deeply driven piles and with a raising of the surface ground from ten to fifteen feet Under the Housing Act of 1901 facilities were in operation for the granting of loans for housing purposes both from the State and municipality, very largely operated through building societies, such as are known as public utility societies in England, and from 1916 to 1927 subsidies were granted in addition to loans The State and the municipality undertook to bear jointly the loss due to the difference between actual rents obtained for the dwellings and what would have been an economic rent, the State paying 75% of the deficit and the municipality 25% In 1920 a scale of minimum rents was fixed according to the space provided, the percentage of the expenses to be covered by the rent rising with the increase of cubic space, and varying from 50 to 70 per cent of the economic rent, and by 1924 it was required that new dwellings should bring in at least 90 per cent of the economic rent For each of the years 1927 and 1928 the State provided for loans 12,000,000 guilders, and gave 80,000 guilders to cover 50% of the deficit on new houses which were let at rents less than required to give a return on the cost. One peculiarity of the loans in Holland has been that when made to approved public utility societies loans have been given up to 100% of the costs of the building. Such loans, however, were not granted direct, but through the local authority who had to take responsibility to the State The following table indicates that in spite of great variation in the activities of the different agencies building houses, the provision of loans and subsidies has been so managed as to maintain a wonderful uniformity of annual building, and to avoid the violent fluctuations in the demand made on the building industry, which have occurred in England and some other countries

property or for hire. These represent usually a rather better quality of dwelling and the limit in this case is fixed at ten rooms. Under this act facilities are given for financing the building of the *"case popolari"* and "economic" houses by means of loans and by way of subsidy, the State may contribute to the extent of 2½% towards the amortization and payment of interest on such loans Also power is given to grant special fiscal facilities in respect of dwelling houses, and the communes are empowered to co-operate for the direct construction of houses themselves, or through special institutes and for the taking over of the necessary land, and for the provision of public services. In this act no assistance was given to private enterprise working for speculative profit

For this reason, among others, from 1923 a change of policy took place. The contributions for amortization purposes were discontinued, but the fiscal facilities were extended by a decree of March 8, 1923, which provided exemption for 25 years from the building tax for all new buildings and extensions to existing buildings for use as dwellings, hotels, offices and shops, whether carried out by private enterprise or otherwise provided the extensions were completed by Dec 31, 1926 The exemption is extended to thirty years in respect of *"case popolari"* and "economic" houses constructed by the communes direct, or by institutes under their direct control The provisions proved effective in reviving private building enterprise, and from the second half of 1923 onwards, building was actively resumed The commune increased the assistance by reducing the duties payable on the necessary building materials; by placing municipal land at the disposal of the builders on favourable terms, and by directly subsidizing in the form of capital and contributions or amortization. The approach of the date, Dec. 31, 1926, at which these provisions were to expire, gave rise to frantic building activities resulting in scarcity of labour and an upward trend in prices. To check this movement, on Aug. 30, 1925, the period for the completion of the dwellings was extended to Dec 31, 1928, provided, however, that they were commenced within two months from the date of the official publication of the decree This had the effect of limiting the concession on the one hand, but, on the other hand, extended the period for carrying out the work, and thus greatly eased the strain on the building industry. In regard to dwellings commenced subsequent to Oct 31, 1925, the remission of the building tax will be graduated in regard to houses completed before Dec 31, 1940.

Holland Statistics for Period 1921–27

	Number of new houses built by				Converted or renovated	Total	Number of houses which have been built with premium or with subsidy under the Housing Act	Decrease of the total supply of houses by demolition, change of use, etc.	Net increase of the housing supply	Increase per 1,000 inhabitants
	State, provinces and other public corporations	Municipalities	Housing societies	Private persons						
1921	636	5,087	19,298	14,743	Not stated separately	40,364	32,500	1,895	38,469	5·6
1922	130	6,808	13,622	24,936	.	45,496	41,000	2,035	43,461	6·2
1923	94	5,449	9,590	27,009		43,132	34,500	2,629	40,503	5 7
1924	107	3,574	8,736	34,705	.	46,712	24,500	3,616	43,096	5·9
1925	41	4,059	8,538	34,552		47,100	20,000	4,415	42,775	5·8
1926	100	2,016	4,749	41,068	1,865	50,698	3,000	6,335	44,363	5·9
1927	69	2,759	4,801	42,603	1,376	51,608	2,000 (Note, 18,000 also in 1920)	6,931	44,677	5·9

Italy.—Italy before the World War had given legal status to public utility societies under the Housing Act of 1908. After the war by the Act of Nov 30, 1919, special provision was made for encouraging building This act made a distinction between "economic" houses, and houses for the people (*case popolari*), which are defined as those constructed by corporate bodies, such as communes, communal institutes, co-operative societies or industrial or agricultural concerns for letting, but not for sale. They remain permanently the property of the society. Such dwellings may not consist of more than six rooms. In addition to these there are houses built by loans ("economic") constructed by co-operative societies for their members, either to become their individual

After the first two years $\frac{1}{15}$ of the total tax in force will be paid, and this proportion will be gradually increased by degrees so that the entire tax becomes payable in the 17th year In addition, exemption from the building tax is still granted to the *"case popolari"* for 25 years from the date when they first become habitable, but only on condition that the dwelling does not consist of more than three rooms plus domestic offices, and that they are built by controlled institutes and remain their unalienable property. An exception is made to this point in regard to dwellings constructed for individual ownership by farm labourers, artisans, etc., in communes outside the large cities; these being treated as *"case popolari"* This is done in order to encourage building in rural or semi-

rural areas The State assists the corporate authorities by paying up to twenty per cent of the cost of construction, by granting facilities and exemptions from taxes and reductions up to 50% on the railway rates for carriage of building materials. In Italy, also, by a decree of June 30, 1927, luxury type of building was forbidden for twelve months in order to relieve the strain on the building industry. These and other experiences of Italy in connection with the assistance of housing, are of special interest owing to the parallel they afford with aims and conditions in England.

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HOUSING IN THE UNITED STATES

The term "housing" in a general sense may mean any form of building enterprise providing dwellings for the people, but in the United States it generally signifies some special way of providing dwellings for unskilled labourers and the very poor. This means primarily the "tenement house," defined as a house where three or more families live independently of one another and do their own cooking on the premises Although it is commonly felt that tenement laws were passed for the poor, living in low rental houses, the early tenement house laws made no such economic or social distinction But such distinction has been frequently made. The proposed laws in New York (1928), covering all kinds of houses, seem to avoid class distinction with the term "dwellings law." The housing problem has been created, in part, because a large portion of an American city's population is forced into unused, dilapidated dwellings which go to make up the slums Thus, housing, in the strictest sense, deals with slum-relief, *i.e.*, elimination of poor housing and prevention of its recurrence. In New York a survey of the problems indicates that one-third of the people live in old type tenements on expensive land with miserable accommodation; one-third live in modern tenements, far safer, more sanitary and improved as to light and air, and the remaining third live in one- and two-family houses and illegally converted tenements.

The Slums are a natural product of modern industrial conditions. Their beginning dates from the industrial revolution of 150 years ago, when workers left humble cottages, fields, shops and manual labour to assemble in factories operated on principles of mechanized, socialized labour. Their quarters were miserable; built to save space, they deprived the worker of light and air A city slum, the direct result of changed modes of living and labour, is no longer a necessary adjunct to the production of wealth. The application of the principle of efficiency to the housing problem shows itself in the community's concern about death rates and the prevalence of disease. (*See* SLUMS)

The term slums refers to any section of a community quarter, where unskilled workers and the poor dwell in houses made over for many families or in unhealthful tenements Such houses and tenements are often found in what were once good neighbourhoods Several families usually occupy a home meant for one, which makes a prosperous enterprise for the owner The owner of the multiple dwelling often erects a six-storey tenement on the 25 ft lot of the former two or three-storey house This is soon followed by others in the vicinity, and the whole block, once filled with desirable private homes, becomes a mass of crowded tenements with light and air at a premium

Social and Moral Effects.—Degeneration of areas into unsuitable tenements and dwellings cause general property deterioration, as well as seeming to create acute social problems. Darkness, dirt and disease breed discontent, disorder, crime and resentment against society. Disease and crime may be found in the more refined regions, but the source of the social evil is the slum, where poor dwelling conditions foster incurable ills. Attempting to cope with evil conditions incident to the slums, many American communities have worked on effects rather than on causes. Slums bred disease, communities built hospitals; crime came from congested areas, society met it with prisons. It is now realized that it were better for the community, which has long cared for disease and crime, to look to the causes of these social ills The simplicity of providing adequate facilities for a community are sometimes forgotten in dealing with complex legal provisions and structural plans Both legislation and subsequent construction refer to but four natural benefits expected by man on earth, namely, light, air, health and safety. It is only in crowded cities that such natural advantages become complicated problems.

The History of Housing.—The housing problems in the United States are epitomized in New York because its size and social character, as an immigrant port, ever tend toward insanitary conditions. Better housing activities have generally developed through popular agitation, political legislation, private philanthropy, the creating of special dwelling centres by employers or by a combination of these factors Housing reform goes back to 1647 when New York, or New Amsterdam, passed an ordinance aimed essentially at chimney fires, which authorized "surveyors of buildings" to regulate building in and near the city. For 200 of the 300 years during which New York has had some sort of housing ordinances, public interest has concentrated on fire hazards.

After the War of 1812, when New York's population grew rapidly, health authorities became interested in its housing problem In 1834, Gerrit Forbes, health official, traced high death rates to bad housing General concern for public health, deepened by yellow fever epidemics, cholera and the prevalence of smallpox and typhus, was shown in a report by Dr John H Griscom in 1842 which pointed out over-crowding and insanitary tenement conditions.

Added to these official recognitions of slum problems, humanitarian agitation was strongly voiced in 1847 and in 1853 by the Association for Improving the Conditions of the Poor. In 1857 the New York State legislature appointed the first special committee to investigate New York and Brooklyn tenement conditions Because of overcrowding, dilapidation, dirt, dark rooms, high rents and other attendant evils the committee recommended certain acts as to cellar apartments; halls and stairways as safe exits; prevention of prostitution, incest and drunkenness, providing separate apartments or enough rooms for decency The Council of Hygiene and Public Health investigated and reported on sanitary conditions, 1865; the department of health was formed, 1866; the first tenement house law passed, 1867, a tenement house commission founded with Joseph W. Drexel as chairman, 1884. In 1894 Richard Watson Gilder headed the tenement house committee The 1900 tenement house commission brought about the 1901 tenement house law and the tenement house department

Tenement House Legislation.—The 1867 tenement house act required city water in each house or yard, no cellar dwellings unless ceilings were at least 1 ft above ground, general repairs and cleanliness. The 1879 act dealt chiefly with ventilation, demanding windows to the outer air, and standardized each adult's air-space at 600 cubic feet. The governor appointed commissions, in 1884 and 1894 which were responsible for the 1887 and 1895 acts. The 1901 law is the standard, but is hardly the ideal. After operating over 25 years it is to have fairly radical changes It has been a model for most of the 11 States with tenement laws, although California, Indiana and Iowa have changed while Kentucky has repealed it Its provisions govern consideration of sanitation and safety Other States with tenement laws for cities, are Pennsylvania, which had a housing law in 1895, New Jersey, Connecticut, Wisconsin, Indiana, California, Kentucky, Massachusetts, Michigan and Minnesota. The 1901 law in 1928 had 102 sections and 150 amendments and over 40,000 tenements were built under its regulations. In 1927 New York State law created a temporary commission to revise the 1901 law It drew up a bill for the legislature's action.

Constructive Legislation.—There are two types of housing

laws: "restrictive," to prevent, correct or abolish bad housing in tenement design and building; and "constructive," to promote good housing The latter is still tentative and promissory. National legislation has not covered good housing; such constructive work is left to philanthropy, semi-philanthropy and private business initiative But there have been experiments at public expense like Mulberry bend, N Y.; Willow Tree alley, Wash ; and Morton street, Boston Even these were the elimination of bad, rather than the creation of good houses Such cases indicate that the tax-paying public will assume almost no responsibility for housing poorer classes The city of Cohoes, N Y., built and sold 20 houses at prices within the means of wage-earners receiving $30 a week Under the State police power Cohoes passed a law in 1924 directing the city to buy land and build houses to control congestion and epidemics. The authorities met no impediment from the State Constitution or city charter. So overwhelming is the amount and force of purely restrictive legislation that constructive attempts are overlooked or minimized, although the World War taught the United States that Federal, State and municipal Governments may find it expedient or necessary to engage in some degree and form of housing enterprise The Government undertook housing in the emergency of war, and while it did not bring permanent results it stimulated public sentiment With such a background, a municipal housing system may sometime become a settled policy of the United States

The Housing Situation in War Time.—The housing shortage in the United States prior to, during and after the war was due to general and economic conditions and specifically war activities Before the war, building declined because private initiative withheld capital from an enterprise growing less profitable Later dwelling construction through private capital was directly checked by war preparations. Federal Government influence was both negative and positive. Restrictively, through the U S Housing Corporation, it asked the public to stop unnecessary building, impeded credit and by prohibitive building permits brought construction to a standstill Constructively, it tried to secure housing for war-workers, provide transport, prevent congestion, encourage capital to build and itself tried to supply dwellings During 109 days of its own housing activity, July 25 to Nov 11, 1918, the U S Housing Corporation investigated over 100 cities, planned 128 sites, granted 60 contracts, was ready or preparing for 30 more, started on over 40 projects and provided 20,000 workers' homes. In 1919 the corporation began to liquidate its business

The Housing Shortage.—Housing conditions became worse after the war In New York, 1921, with 982,000 tenements, only 1,510 were vacant Housing facilities were so inadequate that dwellings abandoned nearly 100 years and almost uninhabitable, were used with almost no repair So great was the housing demand that obviously serious violations of law often occurred Then came a period of intensive building, through the 1920 Tax Exemption Act, which was partly maintained to satisfy the city's housing needs. This started a number of legislative bills tending to relax restrictions on the plea that restrictions increased necessary construction costs

Governmental Responsibility.—Since 1920 a temporary commission has been formed to examine and revise the tenement house law, and this has made New York housing legislation again restrictive Outside of the City of New York, there have been various enterprises assuming the form of government responsibility for citizens' dwellings. Typical of this is the National Homestead Act, 1862, whereby the Government gave 87,000,000 ac. of public land to settlers at $1 25 per acre

James H Mellon of the Massachusetts State legislature fostered in 1909 the Massachusetts Homestead Commission The State was to acquire and distribute abandoned farms, on a homestead basis to such city dwellers as might possess agricultural knowledge, thus decreasing city congestion and increasing food production. Later an act providing homesteads in suburbs of cities and towns was passed, with the commonwealth assisting. It was held contrary to the State Constitution and amended (1915) so that the general court could authorize the commonwealth to take and hold land to relieve congestion and provide homes; but not to sell land or buildings at less than cost. Upon the basis of this amendment, Massachusetts passed the first American law for direct housing enterprise. Lowell, Mass., has applied the law to a small building project.

The California Immigration and Housing Commission in 1913 investigated San Francisco, Sacramento and smaller cities, and recommended legislation. It also studied English town planning and public loans to individuals but was strongly influenced by the Massachusetts Homestead Commission's work An act resulted creating city-planning commissions and a State-wide housing act. To promote home ownership, Oklahoma, in 1915, passed a law authorizing and instructing the land office to invest in loans to home builders by selling State educational institution lands.

Federal efforts at helpful legislation through the Borland-Pomerene Bill which authorized loans to building associations formed to erect workers' homes in the District of Columbia, has had little practical effect. The Buchanan Bill, subsequently enacted, allowed postal savings to be used for housing loans to working men. The Federal attitude toward community housing is seen in a U S Supreme Court decision regarding North Dakota's purely economic enterprises It held that laws engaging the State in manufacturing, marketing farm products, homes, appropriating money, creating a State banking system and authorizing bonds and taxation to carry out the schemes were not unconstitutional as far as tax payers were concerned

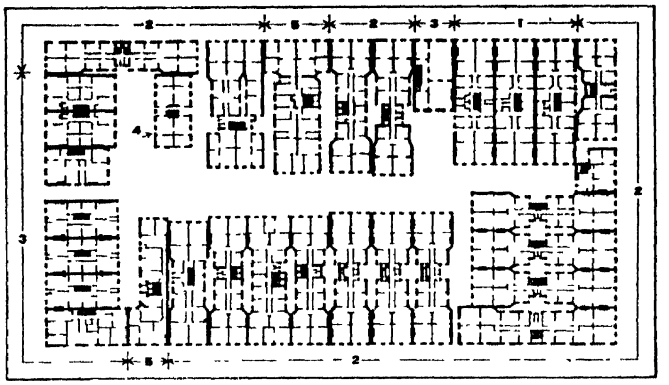
Model Tenements.—The New York Association for Improving the Condition of the Poor started the Workmen's Home Association, 1854 The Boston Co-operative Building Company, 1871, opened its first model tenement in 1872, and developed "estates" The Alfred T White Brooklyn tenements of three groups, 1877–78, were examples of good housing in that they were only two rooms deep, covering but 50% of the land. The City and Suburban Homes Company, with standards like those of the White tenements, formed through the Association for Improving the Condition of the Poor, followed the example of the Workmen's Home Association In New York city there are 26 model tenement properties Washington, D C , has its Sanitary Improvement Company, 1897, and Sanitary Housing Company, 1904; Cincinnati, its Schmidlapp houses, 1911 The Octavia Hill Association of Philadelphia, through some management features, *i e*, substituting women social workers for male rent collectors, has had wide influence More recent model housing examples in New York city are the apartments built by the Metropolitan Life Insurance Co , John D Rockefeller, Jr , and the City Housing Corporation

National Housing Agencies.—The National Housing Association (1910) headed by Robert W DeForest, partly financed by the Russell Sage Foundation, Better Homes in America (1923) controlled by James Ford, supported by the Laura Spellman Rockefeller Estate; and the National Housing Committee for Congested Areas (1927), August Heckscher, chairman and supporter, represent the development in organization during the present century The National Housing Association is limited to discussions and publications, Better Homes in America seeks practical demonstration from general discussion, while the National Housing Committee for Congested Areas aims at general constructive laws, particularly the excess condemnation law.

State and City Organizations.—There were State Housing Associations established in Indiana, 1911, New Jersey, 1913 and Pennsylvania, 1913, carrying on propaganda, securing and preserving restrictive laws There are many city associations throughout the country. In New York the tenement house committee of the Charity Organization Society, founded in 1898 under Robert W DeForest and Lawrence Veiller, aided the passage of the Tenement House Act, 1901, the institution of the tenement housing department and has supervised the tenement house law. The Philadelphia Housing Association (1909) aims at investigation of housing conditions, the enforcement of the housing law, the enactment of additional legislation and the education of the public in housing matters. The San Francisco Housing Association (1910) played an important part in securing State-wide tenement housing

legislation but since the establishment of the State Commission of Housing and Immigration (1913) has ceased to exist. Cincinnati has a Better Housing League, which is functioning effectively, Chicago has had a housing council and there were housing committees in Minneapolis and Cleveland, which latter drew up in 1914 the local tenement house law known as the Sunlight Code There were similar committees in Baltimore, St Louis, Detroit, Columbus, O, and Louisville

Private Housing Enterprises.—In addition to general housing agencies, endeavouring to stimulate building and actually



NEW YORK CITY TENEMENT BLOCK SHOWING 1 RAILROAD FLATS WITHOUT WINDOWS. 2 DOUBLE FLATS BUILT AFTER 1879; 3 CONVERTED DWELLINGS WITH INTERIOR ALCOVE ROOMS. 4. REAR TENEMENTS. 5 NEW LAW TENEMENTS BUILT AFTER 1901

construct model tenements, many employers in the United States have constructed dwellings for their employees More than 200 industrial companies have themselves provided dwellings for over 160,000 workers This activity is believed by many persons to be somewhat feudal in character and is at variance with modern social and economic tendencies so that such industrial housing is not expected to increase

The New York State Board of Housing.—The State board of housing was appointed in 1926 The essentials of the State housing plan are control of dividends on capital invested in housing projects to avoid speculative profit; exemption of the housing corporation, its stocks, bonds and interest thereon from State taxation to reduce annual charges on the project, exemption of buildings and improvements from local taxation further to reduce annual charges, exercise of the power of condemnation to insure acquisition, at fair prices, of suitable sites for large scale production, statutory limitation of rents so that economies thus gained shall be conserved for tenants, creation of a State board of housing to administer the law The State housing plan required special legislation, to provide for tax exemptions This law as enacted is not ideal but it recognizes that the housing of the poor in the slums, or the eradication of the slums, requires public action, since private enterprise or commercial building cannot supply the demand for low-priced dwellings

Housing on a broad scale involves considerable condemnation The New York act authorizes a "Public Limited Dividend Housing Company," and grants it the power of condemnation, but prohibits selling or otherwise disposing of land so acquired except to another limited company after the State housing board has approved the transfer A private limited dividend housing company has not the right of eminent domain in acquiring property

Condemnation by the Public Limited Dividend Housing Company occurs under the State condemnation law If the property is in New York city, the housing company may ask the city to start proceedings for acquisition of title The city then acquires the property as for a public use and conveys it to the company Rents of apartments built under the State housing law are limited in New York city to $12 50 a room monthly in Manhattan, $11 in Brooklyn and the Bronx, $10 in Queens and Richmond, and $9 elsewhere Rents may increase only if the State housing board deems it an economic necessity. A bill was before the Massachusetts senate in 1928 to form Limited Dividend Companies and a State board in order to build and supervise houses and apartments to rent reasonably.

New York City's Plan.—The National Housing Committee has centred its efforts upon the slums in New York city's most congested area. In 1928 a scheme known as the Walker-Heckscher plan, suggested by August Heckscher, indicated the possibility of New York city leasing lands to those who would erect thereon fireproof, elevator apartments to rent for not more than $8 a room monthly The principle of operating such housing is incorporated in the law of excess condemnation, which has existed for 300 years in various European countries The United States applied the law practically and extensively for the first time when, in 1812, the State of New York passed a law enabling New York city to condemn remnants left over after street and park openings The law was employed until 1834, when it was declared unconstitutional but it was revived in 1913 with an amendment

Excess Condemnation bears directly upon slum clearance and municipal housing Slum clearance concerns New York city more than any other municipality, and in this respect it is interesting to note that the State Constitution says. "The legislature may authorize cities to take more land and property than is needed for actual construction in the laying out, widening, extending or relocating parks, public places, highways or streets, provided, however, that the additional land and property so authorized to be taken shall be no more than sufficient to form suitable building sites abutting on such park, public place, highway or street. After so much land has been appropriated for such park, public place, highway or street as is needed therefor, the remainder may be sold or leased" (Amendment adopted 1914, Art 1, Sec 7)

The New York city charter embodied the spirit of the State amendment and the housing plan, referred to above, was adopted by the city of New York in 1927 by the board of aldermen It was submitted to the voters, who empowered the city, through the sinking fund commission, to extend the lease period of land thus taken from a 20-year maximum to a longer term to be decided by the commission in granting the lease. Thus a feasible plan, or at least a promising experiment, was formed for eradicating slum centres Subsidized housing does not appeal to the United States in the manner it does in Europe The government provides public schools, highways, bridges, courts, fire and police departments, etc, and although it is believed by some that the Government should create a housing subsidy, no action has been taken Thus far, indirect subsidy amounts to tax exemption and the remote aid of publicly owned transit facilities, which make profitable real estate developments in interest of cities

The housing situation in the United States is now included in the more general problem of city planning, including zoning, transit and traffic. Nearly 400 cities with about one-fourth of the country's total population have city planning commissions, and nearly one-half of these have adopted practical plans which are helping those cities develop

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HOUSMAN, ALFRED EDWARD (1859–), scholar and poet, was born on March 26 1859 He was educated at Bromsgrove school (1870–77) and held a scholarship at St John's college, Oxford (1877–81), of which college he has since been made an honorary fellow After leaving Oxford he held a post in H M patent office till he was appointed professor of Latin at University college, London, in 1892 In 1911 he was made a fellow of Trinity college, Cambridge, and professor of Latin in that university His chief publications, besides many papers in classical journals (for which see *A List of Adversaria* printed at Cambridge in 1926) are editions of Juvenal (1905), Manilius (I, 1903, II, 1912, III, 1916, IV, 1920), and Lucan (1926), and two volumes of lyrics, *A Shropshire Lad* (1896) and *Last Poems* (1922)

As a scholar Housman invites comparison with Bentley for learning, ingenuity and controversial vigour He has led the attack on superstitious fidelity to the "best ms." and "palaeographical probability," and brought to the defence of common-sense in scholarship an armoury of sarcastic wit which has helped to make him the most widely feared of contemporary scholars. It is not these powers, however, nor the range, depth, and unfailing accuracy of his learning, but the strength and keenness of his intellect, which give to his work its quality of greatness and to him his claim to pre-eminence in the world of scholarship

As a poet Housman appeals to a larger public. The popularity of *A Shropshire Lad* grew slowly, but so surely that *Last Poems* had an immediate success greater than that of any other book of poetry published in England during the century. The poems are enjoyed by those readers whose interests are not literary because the language is simple and the verse melodious, the subjects are attractive, and the thought is easily understood, they are admired by the best judges because they are flawless in taste and execution and possess a quality both in their form and in their feeling which it is equally vain to imitate and to seek elsewhere in literature: they are as romantic as ballads, as classical as the Greek Anthology The poems number little more than a hundred, about a third are written in the character of a country boy who is exiled in London; they deal with the vicissitudes of friendship, the passing of youth, the beauty and the cruelty of nature, and the vanity of human wishes, as experienced by one whom nothing can cheat either of his courage or of his despair.

Probably no well-known writer has been so averse from publicity as Professor Housman, and of those who know him few know him well. In the preface, as in the title, to *Last Poems* he indicated without any appearance of regret that no more poetry from him was to be expected (J. Sp.)

HOUSMAN, LAURENCE (1867–), English writer and artist, was born on June 18, 1867 Having studied at South Kensington, he first made a reputation as a book illustrator Some of his best pictorial work may be seen in the editions of Meredith's *Jump to Glory Jane* (1892), the *Weird Tales* of Jonas Lie (1892), Jane Barlow's *Land of Elfintoun* (1894), Christina Rossetti's *Goblin Market* (1893), *Werewolf* (1896), by his sister, Miss Clemence Housman, Shelley's *Sensitive Plant* (1898), and his own *Farm in Fairyland* (1894). His designs were engraved on wood by Miss Housman His volumes of verse include *Green Arras* (1896), *Rue* (1899), *Spikenard* (1898) and *Mendicant Rhymes* (1906); and the mysticism which characterizes the devotional poems in *Spikenard* recurs in his half-allegorical tales, *All Fellows* (1896), *The Blue Moon* (1904) and *The Cloak of Friendship* (1906). His nativity play, *Bethlehem*, was presented in the Great Hall of London University at South Kensington for a week in Dec. 1902 In 1900 he published anonymously *An Englishwoman's Love Letters*, and followed this essay in popular fiction by the novels *A Modern Antaeus* (1901) and *Sabrina Warham* (1904). On Dec 23, 1904, his fantastic and moving play *Prunella*, written in collaboration with Mr Granville Barker, was produced at the Court Theatre His later works include *Angels and Ministers* (1921) and *Little Plays of St Francis* (1922).

HOUSSAYE (HOUSSET), ARSÈNE (1815–1896), French novelist, poet and man of letters, was born at Bruyères (Aisne). He wrote *Histoire du quarante et unième fauteuil de l'académie française* (1855) In 1849, through the influence of Rachel, he became administrator of the Comédie Française, a position he filled with unfailing tact and success until 1859, when he was made inspector-general of works of art. He died on Feb. 26, 1896.

His *Confessions, souvenirs d'un démi-siècle* appeared in 1885–91. *See* also J. Lemaître, *Arsène Houssaye* (1897, bibl.).

HOUSSAYE, HENRY (1848–1911), French historian, son of the preceding, was born in Paris. His early writings were devoted to classical antiquity, and to Greek history. He is best known, however, for his works on the Napoleonic period. These include: *1814* (1888), which went through no fewer than 46 editions; *1815*, the first part of which comprises the first Restoration, the return from Elba and the Hundred Days (1893); the second part, Waterloo (1899); and the third part, the second abdication and the White Terror (1905); and *Iéna et la campagne de 1806* (1912). He was elected a member of the French Academy in 1895, and died in Paris on Sept. 23, 1911

See L. Sonolet, *Henri Houssaye* (1905).

HOUSTON, SAM or SAMUEL (1793–1863), American general and statesman, of Scotch-Irish descent, was born near Lexington, Va., on March 2, 1793. His father, who had fought in the Revolutionary War, died in 1806, and soon afterward Samuel removed with his mother to the frontier in Blount county, Tenn. When he was about 15 his elder brothers obtained for him a place as clerk in a trader's store, but he ran away and lived with the Cherokee Indians of East Tennessee for nearly three years On his return he opened a country school, and later attended a session or two of the Academy at Maryville During the War of 1812 he served under Andrew Jackson against the Creek Indians In 1817 he was appointed sub-agent in managing the removal of the Cherokees from East Tennessee to a reservation in what is now Arkansas, but he was offended at a rebuke from John C. Calhoun, then secretary of war, for appearing before him in Indian garments, as well as at an inquiry into charges affecting his official integrity, and he resigned in 1818 He entered a law office in Nashville, and was admitted to the bar From 1823 to 1827 Houston represented the ninth district of Tennessee in Congress, and in 1827 was elected governor of the State by the Jackson Democrats. He married Eliza Allen in Jan. 1829, his wife left him three months later, and he resigned his office of governor, again took up his residence among the Cherokees, who were at this time about to remove to Indian Territory, and was formally adopted a member of their nation.

In 1830 and again in 1832 he visited Washington to expose the frauds practised upon the Cherokees by Government agents Commissioned by President Jackson, Houston went to Texas in Dec. 1832 to negotiate treaties with the Indian tribes there for the protection of American traders on the border He decided to remain in Texas, and was elected a delegate to the constitutional convention which met at San Felipe on April 1, 1833 to draw up a memorial to the Mexican Congress asking for the separation of Texas from Coahuila, in which the anti-American Party was in control, as well as to frame a constitution for the commonwealth as a new member of the Mexican Republic. In Nov., 1835, soon after the outbreak of the War for Texan Independence, he was chosen commander-in-chief of the Texan army. On April 21, 1836, while in command of 743 raw troops, he met on the bank of the San Jacinto about 1,600 Mexican veterans led by Santa Anna and completely routed them; on the next day Santa Anna was taken prisoner

Texan independence was won by this victory and Houston was elected president of Texas, Sept. 1, 1836. His term expired in Dec. 1838; he was elected again in 1841 and served until 1844. During his first term a newly founded city was named in his honour and this was the seat of Government in 1837–39 and in 1842–45 Texas having been admitted as a State of the American Union in 1845, Houston was elected one of its first two U.S. senators He served as a stalwart Union Democrat from 1846 until 1859, he opposed the Kansas-Nebraska bill in an able speech and spoke frequently in defence of the rights of the Indians. In 1859 he was elected governor of Texas and tried to prevent the secession of his State: upon his refusal, in March 1861, to swear allegiance to the Confederacy he was declared deposed. He died at Huntsville, Tex., on July 26, 1863. Houston was an able soldier, wary, intrepid and resolute, and was a legislator of rare foresight, cool discrimination and fearless candour.

See A. M Williams, *Sam Houston and the War of Independence in Texas* (Boston, 1893), Henry Bruce, *Life of General Houston* (New York, 1891), and W C Crane, *Life and Select Literary Remains of Sam Houston* (Philadelphia, 1884), S. B. Elliot, *Sam Houston* (Boston, 1900); "Sam Houston" by S Acheson in the *American Mercury*, vol. ii., p. 487 (1927); G. Creel, *Sam Houston, Colossus in Buckskin* (1928).

HOUSTON, a city of south-eastern Texas, U S A., on the Houston ship channel (formerly Buffalo bayou), 50m from the Gulf of Mexico, surrounded by producing oil-fields; a port of

entry in the Galveston customs district, the county seat of Harris county, the principal industrial centre of southern Texas and one of the leading Gulf ports. It is on Federal highways 75 and 90, has two commercial airports, and is served by the Galveston, Houston and Henderson, the Houston, Belt and Terminal, the Missouri-Kansas-Texas, the Missouri Pacific, the Santa Fe and the Southern Pacific railways, and by 35 steamship lines, operating to the principal ports of the world The population in 1920 was 138,278, of whom 33,960 were negroes and 12,012 were foreign-born white; and was estimated locally (with allowance for new territory annexed since 1920) at 265,000 in 1928 The estimate for the entire metropolitan area in 1928 was 300,000

The city has a fine site, covering 40 sq m , on both sides of the channel, and a climate which permits home-grown strawberries in February and roses all the year round Its rapid commercial and industrial development since the World War has been accompanied by tremendous improvements in paving and widening streets, constructing sewers and bridges, building driveways along the bayous, adding parks and beautiful buildings (including a new library, an art museum, an auditorium and an outdoor theatre), and transforming the business section with modern office buildings and hotels The parks have an area of 2,500 acres The 19 first-class hotels can accommodate over 5,000 guests The assessed valuation of property in 1927 was $279,504,510. The Rice institute, founded by William Marsh Rice in 1891, and endowed by him with $10,000,000 (which did not become available until 1908), bids fair to be one of the most beautiful universities of America Its campus of 300ac is 3m from the centre of the city The general architectural plan contemplates eventually 30 main buildings, in a prevailing Mediterranean style The initial group was ready for the opening of the first session in Sept 1912 By 1928 the endowment had grown to $14,000,000 and the enrolment was about 2,000 Tuition is free

The city has a commission form of government, adopted in 1905, the second of its kind to be organized in the United States Since 1924 the public schools have been in the hands of an elected board, distinct from the city government The port (4m E of the city) is administered by the Harris county navigation and canal commission The municipality owns the port facilities, the Harbor Belt railway, the waterworks (artesian wells), the public market and an auditorium seating 4,500

The navigable waterway to the gulf has been the basis of Houston's economic life ever since sailing boats and flat-bottom barges made their way up and down the shallow, meandering tide-water stream in the early days of the village By 1928 about $24,000,000 had been spent by the Federal Government and the citizens of the Harris county navigation district in improving the channel and providing harbour facilities A 25ft channel from the turning basin at Houston to Galveston bay was completed in 1914, and in 1919–25 it was widened and deepened to 30 feet The port is a terminal of the intra-coastal canal, which will give it direct access to 7,000m of inland waterways. By 1925 Houston had become a world port, with 359 steamers clearing for foreign ports and 729 for American ports, and a total commerce valued at $522,429,205, 4·5 times as much as the previous high record (1918) and 43 times as much as it was 20 years earlier. The first shipment of cotton to Liverpool was made in 1919, and in 1927 2,167,420 bales were exported. Petroleum products rank next to cotton (in value) among the exports and first in tonnage Others of importance are rice, refined sugar and cotton-seed meal from local plants

On the banks of the ship channel are 13 oil refineries, with their own wharves, tank farms and tanker lines; cotton compresses and storage warehouses; fertilizer, cement and chemical works; flour mills and grain elevators, and other industries, representing a capital investment of over $140,000,000 Additional plants, valued at $12,000,000, are on the light-draft channel which connects the port with the city Houston was an important manufacturing centre even before the development of the coastal oil-fields and the recent commercial expansion, and in 1925 the output of the factories within the city limits was valued at $87,445,460. Among the most important industries (after the oil refineries) are railroad repair and construction shops, foundries and machine shops, rice mills and printing and publishing plants

Houston is office headquarters for the Southern Pacific and several other railways, for the intra-coastal canal commission, and for many of the oil companies operating in the gulf coast fields all of which are within a short journey, two of them (the Sinclair and the Galena Signal) lying just outside the city's bounds It is an important financial centre Bank debits to individual accounts in 1927 amounted to $: 103,652,612 In recent years it has been the meeting-place for many large gatherings, including the National Democratic convention of 1928

The permanent settlement of Houston began soon after the decisive battle of San Jacinto (April 21, 1836), and it was named after Gen Sam Houston It was the first capital of the Republic of Texas (1837–39) and was again the seat of government from 1842 to 1845 The city was incorporated in 1840 The population of 2,396 in 1850 grew to 16,513 in 1880, 44,633 in 1900, and 78,800 in 1910 Between 1910 and 1920 the area was more than doubled and the population increased 75·5% Further annexations of territory have been made since 1920 The battle-field of San Jacinto, 22m below Houston on the banks of the ship channel, has been a State park since 1906

HOUWALD, CHRISTOPH ERNST, FREIHERR VON (1778–1845), German dramatist and author, was born at Straupitz, Lower Lusatia, on Nov 28, 1778 In 1821 Houwald was unanimously elected syndic for Lower Lusatia He died at Neuhaus, near Lubben, on Jan 28, 1845 Houwald wrote several "Fate tragedies," of which the best known as *Das Bild, Der Leuchtturm, Die Heimkehr, Fluch und Segen* (all published in 1821) and some excellent books for young people

See his *Samtliche Werke* (Leipzig, 5 vols, 1851, 2nd ed, 1858–59); and O Schmidtborn, *C E von Houwald als Dramatiker* (1909).

HÒVA, the name originally applied to the middle-class Malayo-Indonesian natives of Madagascar (*q v*), as distinct from the noble class *Andriana* and the slave class *Andèvo* Hòva now means the most numerous and powerful of the tribes of the native population of Madagascar. The Hòva occupy the province of Imérina, the central plateau of the island, are of Malayo-Indonesian origin. They seem to have arrived four centuries ago but there may have been earlier migrations from Indonesia The Hòva are short and slim, with a complexion of a yellowish olive, many being fairer than the average of southern Europeans Their hair is long, black and smooth but coarse Their heads are round, with flat straight foreheads, flat faces, prominent cheekbones, small straight noses, fairly wide nostrils, and small black and slightly oblique eyes Among the lower classes, there is a tendency to thick lips, kinky hair and dark skin In many of their customs, such as taboo, infanticide, marriage and funeral rites, they show their Indonesian origin Most of them now profess Christianity

See Van Genep, *Tabou et Totemisme en Malgache.*

HOVE, a municipal borough of Sussex, England, adjoining Brighton on the west, on the Southern Railway Pop (1921) 46,505. Here is the Sussex county cricket ground The municipal borough, incorporated in 1898, includes the parishes of Hove and Aldrington, and is within the parliamentary borough of Brighton

HOVENDEN, THOMAS (1840–1895), American artist, was born in Dunmanway, Co Cork, Ireland, on Dec 28, 1840 He was a pupil of the South Kensington Art Schools and those of the National Academy of Design, New York, whither he had removed in 1863 Subsequently he studied under Cabanel in Paris and spent much time in Brittany, where he painted many pictures of the peasantry Returning to America in 1880, he became an academician in 1882, and attracted attention by an important canvas of "The Last Moments of John Brown" (now in the Metropolitan Museum of Art) His "Breaking Home Ties," a picture of American farm life, was engraved with considerable popular success Hovenden was mortally injured in a heroic effort to save a child from a railroad train in the station at Germantown near Philadelphia, and died at Norristown, Pa , on Aug. 14, 1895. Among his principal works are:—"News from the Conscript" (1877), "Loyalist Peasant Soldier of La Vendée" (1879) "A Breton Interior," "Image Seller" and "Jerusalem

the Golden" (in the Metropolitan Museum of Art).

HOWARD (ENGLISH FAMILY). The head of this family, the duke of Norfolk, is the premier duke and the hereditary earl marshal of England, while the earls of Suffolk, Carlisle and Effingham and the Lord Howard of Glossop represent in the peerage its younger lines.

Its founder was a Norfolk lawyer, William Howard or Haward, who was summoned to parliament as a justice in 1295, being appointed a justice of the common pleas in 1297. The genealogists trace back the Howard pedigree to a Howard or Hereward in the tenth century, grandfather of a Hereward who was banished by William the Conqueror.

William Howard's eldest son, Sir John Howard, served in Edward II.'s wars in Scotland and Gascony, was sheriff of Norfolk and Suffolk and governor of Norwich Castle. When he died in 1331 he was seised of many Norfolk manors. His son and heir, another Sir John, admiral of the king's navy in the north, was a banneret who displayed his banner in the army that laid siege to Calais. By the admiral's wife Alice, sister and heir of Sir Robert de Boys, the Howards had the Boys manor of Fersfield, near Diss, which is still among the possessions of the dukes of Norfolk. His son Sir Robert Howard, who had married a daughter of Sir Robert Scales (Lord Scales), died in 1388. From Sir John Howard, the only son of Sir Robert, two branches of the house of Howard spring. The elder line was soon extinct. By his first wife, Margaret, daughter and heir of Sir John Plays, Sir John Howard had a son who died before him, leaving a daughter through whom descended to her issue, the Veres, earls of Oxford, the ancient Norfolk estates of the Howards at East Winch and elsewhere with the lands of the houses of Scales, Plays and Walton, brought in by the brides of her forefathers. By his second wife, the heir of the Tendrings of Tendring, he had a second son, Sir Robert Howard, a knight who fought under Henry V. in France, and died, like his half-brother, before the old knight's career ended in 1436.

Robert Howard married Margaret Mowbray, daughter of the banished duke of Norfolk. Their only son, Sir John Howard, took service with his cousin the third duke of Norfolk, who had him returned as knight of the shire for Norfolk. The last of the Mowbray dukes of Norfolk had left a child heir, Anne Mowbray, married to the infant duke of York, the younger of the princes doomed by Richard in the Tower. By the death of this little girl, John Howard became one of the coheirs of her house, which was now represented by the issue of Margaret Mowbray, his mother, and of her sister Isabel, who had married James, Lord Berkeley. A lion's share of the Mowbray estates, swollen by the great alliances of the house, heir of Breouse and Segrave, and, through Segrave, of Thomas of Brotherton, son of Edward I., fell to Howard, who, by a patent of June 28, 1483, was created duke of Norfolk and earl marshal of England with a remainder to the heirs male of his body. On the same day the Lord Berkeley, the other coheir, was made earl of Nottingham. "Jack of Norfolk" led the archer vanguard at Bosworth and died in the fight, from which his son Thomas, earl of Surrey, was carried away a wounded prisoner. An attainder by the first parliament of Henry VII. extinguished the honours of the father with those of the son, who had been created an earl when the Lord Howard was raised to the dukedom. Their estates were forfeit.

Thomas Howard was released from the Tower of London in 1489, his earldom of Surrey and his Garter restored. In his 70th year, as lieutenant-general of the North, he led the English army at Flodden, earning a patent of the dukedom of Norfolk, dated Feb. 1, 1513–14. The victor of Flodden is the common ancestor of all living Howards that can show a descent from the main stock. For the history of the Howard dukes of Norfolk *see* NORFOLK, EARLS AND DUKES OF.

The eldest of the cadet branches of the ducal house has its origin in William (*c.* 1510–1573), eldest son of the victor of Flodden by his second marriage. He survived the reign of Henry VIII., that perilous age for the Howards, with no worse misadventure than the conviction of himself and his wife of misprision of treason in concealing the offences of his niece, Queen Catherine. But both were pardoned. In 1553 he had the office of lord admiral of England, and in the next year the Garter. For his services against Sir Thomas Wyat he was created (March 11, 1553) Lord Howard of Effingham, the title being taken from a Surrey manor granted him by Edward VI. Queen Elizabeth continued his employment in diplomacy, and had he been richer he might have had an earldom. His eldest son Charles, earl of Nottingham (*q.v.*) (1536–1624), was lord admiral of England in 1585 and commander in chief against the Spanish Armada. Two of his sons succeeded in turn to the earldom of Nottingham, extinct on the death of Charles, the third earl in 1681. Sir William Howard of Lingfield, younger brother of the great admiral, carried on the Effingham line, his great-grandson succeeding to the barony on the extinction of the earldom. Francis, seventh Lord Howard of Effingham, was created earl of Effingham in 1731, a title extinct in 1816 with the fourth earl, but revived again in 1837 for the eleventh baron, who had served as a general officer in the Peninsular campaign, the great-grandfather of the present peer.

A patent of 1604 created Henry Howard (1540–1614), younger son of Surrey the poet, earl of Northampton, a peerage which ended with his death.

Thomas, son of the fourth duke of Norfolk's marriage with the daughter and heir of Thomas, Lord Audley of Walden, founded the line of the present earls of Suffolk and Berkshire and of the extinct Lords Howard of Escrick. His barony of Howard of Walden has descended to his heirs general. Another son, Lord William Howard (*q.v.*) married in 1577 one of the three coheirs of the Lord Dacre of Gilsland. His great-grandson Charles Howard, was created, in 1661, earl of Carlisle (*q.v.*), Viscount Morpeth and Lord Dacre of Gilsland, titles which are still held by his descendants. From Sir Francis Howard, a cavalier colonel and a younger son of "bauld Willie," come the Howards of Corby Castle in Cumberland, a branch without a hereditary title.

William Howard, Viscount Stafford, was the fifth son of Thomas, earl of Arundel, and grandson of Philip the prisoner. Marrying the sister and heir of the fifth Lord Stafford, who died in 1637, he and his wife were created Baron and Baroness Stafford by a patent of 1640, with remainder, in default of heirs male, to heirs female. A grant of the precedence enjoyed by the bride's father being held illegal, her husband was in the same year created Viscount Stafford. Roger Stafford, the impoverished heir male of the ancient Staffords, had been forced to surrender his barony to the king by a deed dated in the preceding year. The Viscount Stafford was executed in 1680. In 1688 his widow was created countess of Stafford for life, and his eldest son, Henry, had the earldom of Stafford, with special remainder to his brothers. This earldom ended in 1762, but the attainder was reversed by an act of 1824 and in the following year Sir George Jerningham, the heir general, established his claim to the Stafford barony of 1640.

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HOWARD, CATHERINE (d. 1542), the fifth queen of Henry VIII., was a daughter of Lord Edmund Howard and a granddaughter of Thomas Howard, 2nd duke of Norfolk (d. 1524). Her father was very poor, and Catherine lived mainly with Agnes, widow of the 2nd duke of Norfolk, meeting the king at the house of Stephen Gardiner, bishop of Winchester. After the divorce of Anne of Cleves Henry was privately married to Catherine at Oatlands in July 1540. Soon afterwards she was publicly acknowledged as queen. Before her marriage Catherine had had several lovers, among them being a musician, Henry Mannock, or Manox; her cousin, Thomas Culpepper; and Francis Dereham, to whom she had certainly been betrothed. After becoming queen she occasionally met Dereham and Culpepper, and in November 1541 Archbishop Cranmer informed Henry that his queen's past life had not been stainless. Cranmer had obtained his knowledge indirectly from an old servant of the duchess of Norfolk. Dereham confessed to his relations with Catherine, and after some

denials the queen herself admitted that this was true; but denied betrothal to Dereham, or misconduct since her marriage. Dereham and Culpepper were executed in December 1541 and their accomplices were punished, but Catherine was released from prison On fresh evidence of alleged infidelity after marriage a bill of attainder was passed through parliament, and on Feb. 13, 1542, the queen was beheaded

See A Strickland, *Lives of the Queens of England* (vol. iii. 1877).

HOWARD, JOHN (1726–1790), English philanthropist and prison reformer, was born at Hackney, probably on Sept. 2, 1726. His father was a retired merchant who lived at Cardington, near Bedford. After serving as an apprentice to a firm of grocers, John Howard inherited considerable property on his father's death and decided to travel He was on his way to Portugal in 1754 when the ship was taken by a French privateer, the crew and passengers being carried to Brest, where they were treated with great severity. Howard was permitted to return to England on parole to negotiate an exchange He settled at Cardington, interesting himself in meteorological observations, and was admitted a member of the Royal Society in 1756 In 1766, after the death of his second wife, Howard went for a prolonged foreign tour, from which he returned in 1770

In 1773 he became high sheriff of Bedford and paid visits to the gaol. Howard found it, like all the prisons of the time, wretchedly defective in its arrangements; neither the gaoler nor his subordinates were salaried officers, but were dependent on fees from prisoners He found that some whom the juries had declared not guilty, others in whom the grand jury had not found even such appearance of guilt as would warrant a trial, others whose prosecutors had failed to appear, were detained in prison for months, until they paid the fees of gaol delivery His prompt application to the justices for a salary to the gaoler in lieu of his fees was met by a demand for a precedent in charging the county with an expense He went accordingly from county to county, and though he could find no precedent he discovered many abuses in prison management and determined to devote himself to prison reform

In 1774 he gave evidence before a committee of the House of Commons, and received the thanks of the house Almost immediately an act was passed which provided for the liberation, free of all charges, of every prisoner against whom the grand jury failed to find a true bill, giving the gaoler a sum from the county rate in lieu of the abolished fees This was followed by another requiring justices of the peace to see that the walls and ceilings of prisons were scraped and whitewashed once a year at least; that the rooms were regularly cleaned and ventilated, that infirmaries were provided for the sick, and proper care taken to get them medical advice; that the naked should be clothed, that underground dungeons should be used as little as could be; and generally that such courses should be taken as would tend to restore and preserve the health of the prisoners Howard had the provisions of the new legislation printed at his own cost, and sent to every gaoler and warder in the kingdom In 1774 he stood as an anti-ministerial candidate for Bedford, was returned, but was unseated after a scrutiny.

After a tour in Scotland and Ireland, he travelled in 1775 through France, the Low Countries and Germany. At Paris he was at first denied access to the prisons; but, on the pretext of giving alms he succeeded in inspecting the Bicêtre, the Force l'Évêque and other prisons, the only important exception being the Bastille. At Ghent he examined the great Maison de Force. At Amsterdam, as in Holland generally, he was much struck with the comparative absence of crime, a phenomenon which he attributed to the industrial and reformatory treatment there adopted. In Germany he found little that was useful and much that was repulsive; in Hanover and Osnabrück, under the rule of a British sovereign, he even found traces of torture. After a short tour in England (1775–76), he again went abroad, extending his tour to several of the Swiss cantons.

In 1777 appeared *The State of the Prisons in England and Wales, with Preliminary Observations, and an Account of some Foreign Prisons*. One result was the drafting a bill for the establishment of penitentiary houses, where by means of solitary imprisonment, accompanied by well-regulated labour and religious instruction, the object of reforming the criminal and inuring him to habits of industry might be pursued. New buildings were manifestly necessary; and Howard volunteered to go abroad again and collect plans. He first went to Amsterdam (1778), and carefully examined the "spin-houses" and "rasp-houses" where prisoners were set to useful work; next he traversed Prussia, Saxony, Bohemia, Austria and Italy, everywhere inspecting prisons, hospitals and workhouses, and carefully recording the merits and defects of each The information he thus obtained was presented to parliament, and a bill was passed for building two penitentiary houses; Howard was appointed first supervisor, but he resigned the post before anything practical had been achieved In 1780 he had published his *State of Prisons*. Howard made other and more extended continental tours to Denmark, Sweden and Russia in 1781, and to Spain and Portugal in 1783. The results of these journeys were embodied in 1784, in a second appendix to his great work.

The five remaining years of his life were chiefly devoted to researches on the means for prevention of the plague, and for guarding against the propagation of contagious distempers in general. After an extended tour of the continent, he was preparing to return when it occurred to him that he still lacked personal experience of quarantine discipline. He returned to Smyrna, and, deliberately choosing a foul ship, took a passage to Venice. A protracted voyage of 60 days, during which the ship was attacked by pirates, was followed by a weary term of quarantine in the Venetian lazzaretto He reached England in 1787 He then inspected prisons of the United Kingdom, and prepared his *Account of the Principal Lazarettos in Europe* (1789)

In 1789 he made his last journey Travelling overland to St. Petersburg and Moscow, and visiting the principal military hospitals that lay on his route, he reached Kherson where he inspected the hospitals In attending a case of camp fever he contracted the disease, which terminated fatally on Jan 20, 1790 He was buried near the village of Dauphigny on the road to St. Nicholas There is a statue to his memory in St Paul's, London, and one at Bedford.

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HOWARD, LELAND OSSIAN (1857–), American entomologist, was born at Rockford (Ill) on June 11, 1857 He graduated from Cornell university, becoming B S in 1877 and M S. in 1883 After serving as assistant entomologist at the United States Department of Agriculture, Washington (D C.), in 1878, he was made chief of the Bureau of Entomology in 1894. He retired from the chiefship of the Bureau in Oct 1927, to devote his time wholly to research. From 1904 he was consulting entomologist in the United States Public Health Service, and from 1895 honorary curator of the United States National Museum. He was in 1917 a member of the committee on agriculture and chairman of the sub-committee on medical entomology of the National Council of Defence He was chairman of the Pan-Pacific Food Conservation Congress at Honolulu (1924).

Howard wrote *Mosquitoes—How they Live* (1901), *The Insect Book* (1902); *The House Fly—Disease Carrier* (1911), a monograph on mosquitoes for the Carnegie Institution (1912), and many government bulletins

HOWARD, OLIVER OTIS (1830–1909), American soldier, was born in Leeds, Me , on Nov 8, 1830 He graduated at Bowdoin college in 1850, and at the U.S. Military Academy in 1854. At the beginning of the Civil War he resigned to become colonel of a Maine volunteer regiment, and at the first battle of Bull Run was in command of a brigade. He served in the Peninsular Campaign, and at the battle of Seven Pines (Fair Oaks) he was twice wounded, losing his right arm. On his return to

active service in Aug. 1862, he took part in the Virginian campaigns of 1862–63; at Antietam he succeeded Sedgwick in command of a division, and he became major-general of volunteers in March 1863. In the campaign of Chancellorsville (*see* WILDERNESS) he commanded a corps which was routed by "Stonewall" Jackson, and in the first day's battle at Gettysburg he was for some hours in command of the Union troops Howard's corps was transferred to Tennessee after Rosecrans's defeat at Chickamauga, and formed part of Hooker's command in the victory of Chattanooga When Sherman prepared to invade Georgia in the spring of 1864 Howard was placed in command of a new corps, and took part in the actions of the Atlanta campaign, receiving another wound at Pickett's mills On the death in action of Gen M'Pherson, Howard, in July 1864, was selected to command the army of the Tennessee In this position he took part in the "March to the Sea" and the Carolinas campaign

Howard served as commissioner of the Bureau of Refugees, Freedmen and Abandoned Lands from 1865 until 1874; in 1872 he was special commissioner to the hostile Apaches of New Mexico and Arizona; in 1874–81 was in command of the department of the Columbia and conducted the campaign against Chief Joseph in 1877 and that against the Bannocks and Piutes in 1878 In 1886 he was promoted major-general and in 1894 he retired Howard was deeply interested in the welfare of the negroes; and the establishment by the U S Government in 1867 of Howard university, at Washington, especially for their education, was largely due to him, it was named in his honour, and from 1869 to 1873 he presided over it In 1895 he founded for the education of the "mountain whites" the Lincoln Memorial university at Cumberland Gap, Tenn He died at Burlington, Vt., on Oct. 26, 1909 He wrote, amongst other works, *Donald's Schooldays* (1877), *Chief Joseph* (1881), a life of General Zachary Taylor (1892) in the "Great Commanders" series; *Isabella of Castile* (1894); *Fighting for Humanity* (1898), *Henry in the War* (1898); papers in the "Battles and Leaders" collection on the Atlanta campaign; *My Life and Experience among our Hostile Indians* (1907); and *Autobiography of O O Howard* (1907)

HOWARD, SIR ROBERT (1626–1698), English dramatist, sixth son of Thomas Howard, 1st earl of Berkshire, was born in 1626. He was knighted at the second battle of Newbury (1644) for his signal courage on the Royalist side. Imprisoned in Windsor Castle under the Commonwealth, his loyalty was rewarded at the Restoration, and he eventually became auditor of the exchequer His best play is a comedy, *The Committee, or the Faithful Irishman* (1663; printed 1665), which kept the stage, long after its interest as a political satire was exhausted, for the character of Teague, said to have been drawn from one of his own servants He was an early patron of Dryden, who married his sister, Lady Elizabeth Howard, and in the *Indian Queen*, a tragedy in heroic verse (1664; pr. 1665) Howard had assistance from Dryden, although the fact was not made public until the production of Dryden's *Indian Emperor* The magnificence of the spectacle made a great sensation In 1665 Howard published *Foure New Plays*, in the preface to which he opposed the view maintained by Dryden in the dedicatory epistle to *The Rival Ladies*, that rhyme was better suited to the heroic tragedy than blank verse Howard made an exception in favour of the rhyme of Lord Orrery, but by his silence concerning Dryden implicated him in the general censure. Dryden answered by placing Howard's sentiments in the mouth of Crites in his own *Essay on Dramatic Poesy* (1668) The controversy continued, but Dryden completely worsted his adversary in the 1668 edition of *The Indian Emperor* Howard died on Sept 3, 1698

His brother, James Howard, wrote two comedies, *All Mistaken, or the Mad Couple* (1667; pr. 1672) and *The English Mounsieur* (1666; pr. 1674), the success of which seems to have been partly due to the acting of Nell Gwynn

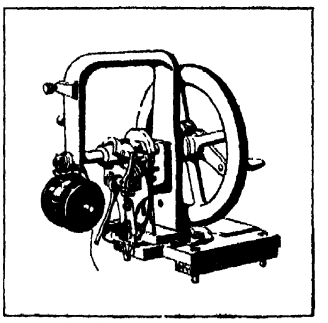
HOWARD, SIDNEY COE (1891–), American playwright and author, was born in Oakland, Calif., on June 26, 1891. He graduated at the University of California in 1915 and during the next year worked under George Pierce Baker in Harvard university During the World War he served with the American ambulance corps and was later a captain in the U.S. aviation service. He served on the editorial staff of *Life* 1919–22, and in 1923 was a feature story writer for Hearst's *International Magazine* In 1922 he was married to Clare Eames, the actress. He is the author of the following plays: *Swords* (1921), *Casanova* (1923), *They Knew What They Wanted* (1925), which won the Pulitzer prize for the best American drama of that year; *Lucky Sam McCarver* (1925) and *The Silver Cord* (1926), included in Burns Mantle's *The Best Plays of 1926–27* (1927), and of many translations and adaptations of European drama He has also published one volume of short stories, *Three Flights Up* (1924)

HOWARD, LORD WILLIAM (1563–1640), known as "Belted or Bauld (bold) Will," 3rd son of Thomas Howard, 4th duke of Norfolk (executed in 1572), and of his second wife Margaret Audley, was born at Audley End in Essex on Dec. 19, 1563. In 1577 he married Elizabeth, daughter of Thomas, Lord Dacre Being suspected of treasonable intentions together with his elder brother, Philip, earl of Arundel, he was imprisoned in 1583, 1585 and 1589 He joined the church of Rome in 1584, both brothers being dispossessed by the queen of a portion of their Dacre estates, which were, however, restored in 1601 for a payment of £10,000 Lord William was a learned and accomplished scholar He died in Oct. 1640 at Greystock *See* also HOWARD (FAMILY)

HOWARD OF EFFINGHAM, LORD: *see* NOTTINGHAM, CHARLES HOWARD, 1ST EARL OF

HOWARD OF EFFINGHAM, WILLIAM HOWARD, 1ST BARON (*c* 1510–1573), English lord high admiral, was the son of the 2nd duke of Norfolk (d 1524) At Anne Boleyn's coronation he was deputy earl marshal In 1541 he was charged with abetting his relative Queen Catherine Howard, and was convicted of misprision of treason, but pardoned In 1552 he was made governor of Calais, and in 1553 lord high admiral, being created Baron Howard of Effingham in 1554 for his defence of London in Sir Thomas Wyat's rebellion against Queen Mary He befriended the princess Elizabeth, but his popularity with the navy saved him from Mary's resentment; and when Elizabeth became queen he filled various important posts His son, the second baron, the victor over the Armada, was created earl of Nottingham (*q v*); and from a younger son the later earls of Effingham were descended

HOWE, ELIAS (1819–1867), American sewing-machine inventor, was born in Spencer, Mass., on July 9, 1819 In 1835 he entered the factory of a manufacturer of cotton machinery at Lowell, Mass., where he learned the machinist's trade. While employed in a machine shop at Cambridge, Mass., he conceived the idea of a sewing-machine, and for five years spent all his spare time in its development. In Sept. 1846 a patent for a practical sewing-machine was granted to him; and Howe spent the following two years (1847–49) in London, employed by William Thomas, a corset manufacturer, to whom he had sold the English rights for £250. Years of disappointment and discouragement followed before he was successful in introducing his invention, and several imitations which infringed his patent, particularly that of Isaac Merritt Singer (1811–75), had already been introduced and were widely used. His rights were established after much litigation in 1854 He died in Brooklyn, N Y, on Oct. 3, 1867



BY COURTESY OF THE U S NATIONAL MUSEUM
THE FIRST PRACTICAL SEWING MACHINE INVENTED BY ELIAS HOWE, SEPTEMBER 1846

See *History of the Sewing Machine and of Elias Howe, Jr, the Inventor* (Detroit, 1867); P. G. Hubert, Jr, *Inventors*, in "Men of Achievement" series (1893).

HOWE, JOHN (1630–1706), English Puritan divine, was born on May 17, 1630 at Loughborough, Leicestershire, where his father was vicar He studied at Christ's college, Cambridge, became fellow and chaplain of Magdalen college, Oxford, and held a Devonshire curacy. In 1657 Howe became domestic chap-

lain to Cromwell. In this position his conduct was such as to win the praise of even the bitterest enemies of his party. Without overlooking his fellow-Puritans, he was always ready to help pious and learned men of other schools. Seth War (afterwards bishop of Exeter) and Thomas Fuller were among those who profited by Howe's kindness, and were not ashamed subsequently to express their gratitude for it. On the resignation of Richard Cromwell, Howe returned to Great Torrington, to leave it again in 1662 on the passing of the act of Uniformity. For several years he led a wandering and uncertain life, until he found a home with Lord Massereene, of Antrim castle, Ireland, with whom he lived for five or six years as domestic chaplain. Here he produced the most eloquent of his shorter treatises, *The Vanity of Man as Mortal*, and *On Delighting in God*, and planned his best work, *The Living Temple*. In 1676 he became joint-pastor of a non-conformist congregation at Haberdashers' hall, London, and in the same year he published the first part of *The Living Temple*, entitled *Concerning God's Existence and his Conversableness with Man: Against Atheism or the Epicurean Deism.*

For five years after his settlement in London Howe enjoyed comparative freedom, and was on not unfriendly terms with many eminent Anglicans, such as Stillingfleet, Tillotson, John Sharp and Richard Kidder; but in 1685 he left England with Philip, Lord Wharton. In 1686 he determined to settle for a time at Utrecht, where he officiated in the English chapel Among his friends there was Gilbert Burnet, who introduced him to William of Orange In 1687 Howe returned to England He died in London on April 2, 1706 Richard Cromwell visited him in his last illness

The works published in his lifetime, including a number of sermons, were collected into 2 vols fol in 1724, and again reprinted in 3 vols 8vo in 1848 A complete edition of the *Whole Works*, including much posthumous and additional matter, appeared with a memoir in 8 vols. in 1822; this was reprinted in 1 vol in 1838 and in 6 vols in 1862–63. E. Calamy's *Life* (1724) forms the basis of *The Life and Character of Howe, with an Analysis of his Writings*, by Henry Rogers (1836, new ed. 1863). *See* also a sketch by R. F Horton (1896).

HOWE, JOSEPH (1804–1873), Canadian statesman, was born at Halifax, Nova Scotia, on Dec. 13, 1804, the son of John Howe (1752–1835), a United Empire Loyalist who was for many years king's printer and postmaster-general for the Maritime Provinces and the Bermudas In 1827 he started the *Acadian*, a weekly non-political journal, but soon sold it, and in 1828 purchased the *Nova Scotian*, which later became amalgamated with the *Morning Chronicle* In 1836 he was elected member for Halifax in the provincial assembly, and during the next twelve years agitated for responsible government for Nova Scotia This brought him into conflict with the lieutenant-governor, Lord Falkland (1803–1884), whom he forced to resign. Responsible government was finally conceded in 1848 by the imperial authorities. In 1850 he was sent to England on behalf of the Intercolonial railway, for which he obtained an imperial guarantee. In 1854 he resigned from the cabinet, and was appointed chief commissioner of railways.

From 1860 to 1863 he was premier of Nova Scotia Though his eloquence had done more than anything else to make practicable a union of the British North American provinces, he opposed confederation, but finally entered (on Jan. 30, 1869) the cabinet of Sir John Macdonald as president of the council. In May 1873 he was appointed lieutenant-governor of Nova Scotia, but died suddenly on June 1 of the same year.

His *Letters and Speeches* were published in 1858 in Boston, Mass., in 2 vols, edited nominally by William Annand, really by himself. *See* also *Public Letters and Speeches of Joseph Howe* (Halifax, 1909). The *Life and Times* by G E Fenety (1896) is poor. The *Life* by the Hon. James W. Longley (Toronto, 1904) is dispassionate, but otherwise mediocre. *Joseph Howe*, by George Monro Grant (reprinted Halifax, 1904), is a brilliant sketch

HOWE, JULIA WARD (1819–1910), American author and reformer, was born in New York City May 27, 1819, and died at her summer home, Oak Glen, in Rhode Island, Oct 17, 1910. The only woman to be honoured by election to the American Academy of Arts and Letters, Mrs Howe probably owed this distinction to her stirring Civil War poem, *The Battle Hymn of the Republic* (published first in the *Atlantic Monthly*, Feb 1862). Although this is the piece with which her name will ever be associated, Mrs. Howe was one of the most active and versatile personalities of her day. She wrote poetry from her childhood, the most complete collection of it being *From Sunset Ridge: Poems Old and New* (1898) She studied, wrote, lectured on German philosophy, did some editorial work, advocated abolition, preached occasionally from Unitarian pulpits, was one of the organizers of the American Woman-Suffrage Association, and was a zealous worker for the advancement of women, for prison reform, for world peace and for other humanitarian movements. Her father, Samuel Ward, was a banker, her mother, Julia Rush Cutler Ward, a poet of some ability; her husband, Dr. Samuel Gridley Howe, a distinguished philanthropist and pioneer in the education of the blind and the feeble-minded Her five children in turn made names for themselves in the educational and literary world

Mrs. Howe's dramatic experiments were failures, and the most of her books of travel and essays have been forgotten. Her biographical works, like her poetry, remain of interest. *A Memoir of Dr Samuel G Howe* (1876), *Margaret Fuller* (1883), *Sketches of Representative Women of New England* (1905), and her own *Reminiscences* (1899)

A selection from her speeches and essays has been made by her daughter, Florence Howe Hall, under the title *Julia Ward Howe and the Woman Suffrage Movement* (1913), and a selection from Mrs. Howe's journals has been made by her daughter, Laura E. Richards, under the title *The Walk with God* (1919) Laura E. Richards and Maud Howe Elliott published *Julia Ward Howe, 1819–1910* (2 vols, 1915, and one vol, 1925).

HOWE, RICHARD HOWE, EARL (1726–1799), British admiral, was born in London on March 8, 1726 He was the second son of the 2nd Viscount Howe. He entered the navy in 1740, saw much active service, and was rapidly promoted In 1755 he went with Boscawen to North America as captain of the "Dunkirk" (60), and his seizure of the French "Alcide" (64) was the first shot fired in the war. From this date till the peace of 1763 he served in the Channel in various more or less futile expeditions against the coast of France, with a steady increase of reputation as a firm and skilful officer. On Nov 20, 1759, he led Hawke's fleet as captain of the "Magnanime" (64) in the victory of Quiberon

By the death of his elder brother, killed near Ticonderoga on July 6, 1758, he became Viscount Howe—an Irish peerage In 1762 he was elected M P for Dartmouth During 1763 and 1765 he was a member of the Admiralty board, and from 1765 to 1770 was treasurer of the navy. In that year he was promoted rear-admiral, and in 1775 vice-admiral In 1776 he was appointed to the command of the North American station The rebellion of the colonies was making rapid progress, and Howe was known to be in sympathy with the colonists. He had sought the acquaintance of Benjamin Franklin, and it was perhaps because of his known sentiments that he was joined in commission with his brother, General Sir William Howe, to make a conciliatory arrangement A committee appointed by the Continental Congress conferred with the Howes in September 1776 but nothing was accomplished The appointment of a new peace commission in 1778 offended the admiral deeply, and he sent in his resignation Before it could take effect France declared war, and a powerful French squadron was sent to America under the Count d'Estaing. Being greatly outnumbered, Howe had to stand on the defensive, but he baffled the French admiral at Sandy Hook, and defeated his attempt to take Newport in Rhode Island by a fine combination of caution and calculated daring On the arrival of Admiral John Byron from England with reinforcements, Howe left the station in September Until the fall of Lord North's ministry in 1782 he refused to serve, assigning as his reason that he could not trust Lord Sandwich He considered that he had not been properly supported in America, and was embittered both by the supersession of himself and his brother as peace commissioners, and by attacks made on him by ministerial writers in the press

On the change of ministry in March 1782 he was selected to command in the Channel, and in the autumn of that year he carried out the difficult operation of the final relief of Gibraltar The French and Spaniards had in all 46 line-of-battle ships to his 33, and his ships were ill-equipped and manned He was, moreover, hampered by a great convoy carrying stores But Howe handled his ships well, the enemy was awkward and unenterprising,

and the operation was brilliantly successful. From Jan. 28 to April 16, 1783, he was First Lord of the Admiralty, and again from Dec. 1783 till Aug 1788, in Pitt's first ministry. On the outbreak of the Revolutionary war in 1793 he was again named to the command of the Channel fleet In 1794 he won the epoch-making victory of the First of June (*see* FIRST OF JUNE, BATTLE OF). Though Howe was now nearly seventy, and had been trained in the old school, he displayed an originality not usual with veterans, and not excelled by any of his successors in the war, not even by Nelson, since they had his example to follow and were served by more highly trained squadrons than his. In 1797 he was called on to pacify the mutineers at Spithead, and his great influence with the seamen, who trusted him, was conspicuously shown He died on Aug. 5, 1799, and was buried in his family vault at Langar His monument by Flaxman is in St Paul's Cathedral In 1782 he was created Viscount Howe of Langar, and in 1788 Baron and Earl Howe. In June 1797 he was made a knight of the Garter. His nickname of "Black Dick" was given on account of his swarthy complexion, and the well-known portrait by Gainsborough shows that it was apt

The standard *Life* is by Sir John Barrow (1838). Interesting reminiscences will be found in the *Life of Codrington*, by Lady Bourchier. Accounts of his professional services are in Charnock's *Biographia Navalis*, v. 457, and in Ralf's *Naval Biographies*, i 83 *See* also Beatson's *Naval and Military Annals*, James's *Naval History*, and Chevalier's *Histoire de la Marine française*, vols i and ii

HOWE, SAMUEL GRIDLEY (1801–1876), American philanthropist, was born at Boston, Mass., on Nov 10, 1801. He attended Brown university, Providence, R.I., and the Harvard Medical school He was admitted to practice, but abandoned the medical field to take part in the Greek revolution. After six years with the Greek army he returned to America to raise funds for the cause He collected $60,000 and established a relief depot near Aegina, where he started works for the refugees. The existing quay, or American Mole, was built through his efforts. He formed another colony of exiles in the Isthmus of Corinth He wrote a *Historical Sketch of the Greek Revolution*, which was published in 1828, and in 1831 he returned to America. Through the influence of his friend, Dr. John D Fisher, Howe received a proposal to direct the establishment of a New England asylum for the blind at Boston Howe set out at once for Europe to investigate the problem There he was temporarily diverted from his task by becoming involved in the Polish revolt He was arrested and imprisoned at Berlin, but was at last released through the intervention of the American minister in Paris. Returning to Boston in July 1832, he began receiving a few blind children at his father's house in Pleasant street. In Jan 1833, the project received help from the legislature, which voted $6,000 a year (later increased to $30,000) to the institution on condition that it educate gratuitously 20 poor blind from the State. In addition, Col Thomas H. Perkins, a prominent Bostonian, presented his mansion and grounds in Pearl street for the school to be held there in perpetuity. This building being later found unsuitable, Col Perkins consented to its sale, and in 1839 the institution was moved to a large building in South Boston, which had previously been a fashionable hotel It was henceforth known as the Perkins institution and Massachusetts asylum (or, since 1877, school) for the blind. Howe was the director and the life and soul of the school He opened a printing-office and organized a fund for printing for the blind

In 1843 he married Julia Ward, and with her made a prolonged European trip Upon their return to America he became interested in the condition and treatment of idiots. He became chairman of a State commission of enquiry into the number and condition of idiots in Massachusetts The report of this commission published in 1848 caused a profound sensation An appropriation of $2,500 per annum was made for training ten idiot children, and by degrees the value of the school for idiotic and feeble-minded youths, which, starting in South Boston, and in 1890 removed to Waltham, was generally appreciated. Dr. Howe was an ardent abolitionist and a member of the Free Soil Party. He played a leading part in Boston in the movements which culminated in the Civil War. In 1871 he was sent to Santo Domingo as a member of the commission appointed by President Grant to examine the condition of the island. The Santo Dominican Government desired annexation but the scheme fell through. Within two years Dr. Howe's health broke and on Jan. 19, 1876, he died at Boston.

A *Memoir* of Dr. Howe by his wife appeared in 1876. *See* also the *Letters and Journals of S. G. Howe*, edited by Laura E. Richards (1910); John Thomson Faris, *Men Who Conquered* (Chicago, 1922); and "Samuel Gridley Howe, 1801–76," *Social Service Review*, vol. i., p 291–309 (Chicago, 1927).

HOWE, WILLIAM HOWE, 5TH VISCOUNT (1729–1814), British general, was the younger brother of George Augustus, 3rd viscount, killed in the Ticonderoga expedition of 1758, and of Richard, 4th viscount and afterwards Earl Howe, the admiral. He entered the army in 1746 In Wolfe's expedition to Quebec he distinguished himself greatly at the head of a composite light battalion. He led the advanced party in the landing at Wolfe's Cove and took part in the battle of the Plains of Abraham which followed. He commanded his own regiment in the defence of Quebec in 1759–1760, led a brigade in the advance on Montreal and took part on his return to Europe in the siege of Belleisle (1761). He was adjutant-general of the force which besieged and took Havana in 1762, and at the close of the war had acquired the reputation of being one of the most brilliant of the junior officers of the army. He was made colonel of the 46th Foot in 1764 and lieutenant-governor of the Isle of Wight four years later. From 1758 to 1780 he was M P for Nottingham In 1772 he became major-general, and in 1774 he was entrusted with the training of light infantry companies on a new system, the training-ground being Salisbury Plain

Shortly after this he was sent out to North America. He did not agree with the policy of the government towards the colonists, and regretted in particular that he was sent to Boston, where the memory of his eldest brother was still cherished, and General Gage, in whom he had no confidence, commanded in chief He was the senior officer after Gage, and led the troops actively engaged in the storming of Bunker Hill, he himself being in the thickest of the fighting. In the same year Howe was made a K B. and a lieutenant-general, and appointed, with the local rank of general, to the chief command in the seat of war. For the events during his command *see* AMERICAN REVOLUTION. He retained it until May 1778—on the whole with success. He resigned because he thought the home government had not afforded the proper support, and after his return to England, he and his brother engaged in a heated but fruitless controversy with the ministers Howe's own defence is embodied in *Narrative of Sir William Howe before a Committee of the House of Commons* (London, 1780). In 1782 Howe was made lieutenant-general of the ordnance; in 1790 he was placed in command of the forces organized for action against Spain, and in 1793 he was made a full general. He held various home commands in the early part of the French revolutionary war, in particular that of the eastern district at the critical moment when the French established their forces on the Dutch coast. When Earl Howe died in 1799, Sir William succeeded to the Irish viscounty He had been made governor of Berwick-on-Tweed in 1795, and in 1805 he became governor of Plymouth, where he died on July 12, 1814. With his death the Irish peerage became extinct.

HOWEL DDA ("the Good") (d. 950), prince of Deheubarth (south central Wales) before 915, and king of Wales from 943 to 950, was the grandson of Rhodri Mawr (the Great), who had united practically the whole of Wales under his supremacy. As Idwal Voel succeeded his father Anarawd, the elder son of Rhodri, as lord of Gwynedd in 915, so Howel at some time before that date succeeded Rhodri's younger son Cadell as prince of Deheubarth. Howel married Elen, daughter of the last king of Dyfed, and also added Kidweli and Gwyr to his dominions, while on the death of Idwal, who was slain by the English in 943, he took possession of Gwynedd. Both these princes had done homage to the English kings, Edward the Elder and Aethelstan, in 922 and 926, and we find that Howel attended the witans of the English kingdom and witnessed about ten charters between the years 931 and 949 He was secure, therefore, from attack on the eastern side of his kingdom, and it is not certain whether he

was engaged in any of the battles recorded during these years in Wales, either in Môn 914, at Dinas Newydd 919 or at Brun 935. To the peaceful character of his reign is probably due the high place which he holds among the Welsh princes. From 943 to 950 Howel Dda was probably ruler of all Wales except Powys (apparently dependent on Mercia), Brecheiniog, Buallt, Gwent and Morgannwg. With Morgan Hen, king of Morgannwg, Howel had a dispute which was eventually settled in favour of the former at the court of the English king. Howel died in 950, and such unity as he had preserved at once disappeared in a war between his sons and those of Idwal Voel. The code of laws attributed to this prince is perhaps his chief claim to fame. He is said to have summoned four men from each cantref in his dominions to the Ty Gwyn (perhaps Whitland in Carmarthenshire) to codify existing custom. Three codes, accordingly called Venedotian, Demetian and Gwentian, are said to have been written down by Bleggwryd, archdeacon of Llandaff (*see* WELSH LAWS).

See Sir John Rhys and Brynmor-Jones, *The Welsh People* (1900); and Aneurin Owen, *Ancient Laws and Institutions of Wales* (1841).

HOWELL, JAMES (*c.* 1594–1666), author of the *Epistolae Ho-elianae,* who came of an old Welsh family, was born probably at Abernant, in Carmarthenshire, where his father was rector. From the free grammar school at Hereford he went to Jesus college, Oxford, and took his degree of B.A. in 1613. He occupied numerous posts, served for a time in parliament and at various periods maintained himself almost entirely by writing pamphlets, dictionaries and translations. In 1660 the post of historiographer royal was created for him. Howell was buried in the Temple Church on Nov. 3, 1666.

All Howell's writings are imbued with a certain simplicity and quaintness. But he lives by his entertaining *Letters,* the *Epistolae Ho-elianae* (4 vols, 1645–55). Their dates are often fictitious, and they are, in nearly every case, evidently written for publication. Thackeray said that the *Letters* was one of his bedside books. He classes it with Montaigne and says he scarcely ever tired of "the artless prattle" of the "priggish little clerk of King Charles's council."

The *Epistolae* have been frequently edited, notably by J. Jacobs in 1890, with a commentary (1891), and Agnes Repplier (1907).

HOWELLS, WILLIAM DEAN (1837–1920), American novelist, was born at Martin's Ferry (O.), March 1, 1837. His father, William Cooper Howells, a printer-journalist, moved in 1840 to Hamilton (O.), and here the boy's early life was spent as type-setter, reporter, and editor in the offices of various newspapers. In the midst of routine work he contrived to familiarize himself with a wide range of authors in several modern tongues, and to drill himself thoroughly in the use of good English. In 1860, as assistant editor of the leading Republican newspaper in Ohio, he wrote—in connection with the Presidential contest—*The Campaign Life of Lincoln.* In the same year he was appointed consul at Venice, where he remained till 1865. On his return to America he joined the staff of the *Atlantic Monthly,* and from 1872 to 1881 was its editor-in-chief. From 1885 until his death on May 11, 1920, he lived in New York. For a time he conducted for *Harper's Magazine* the department called "The Editor's Study," and in Dec. 1900 he revived for the same periodical the department of "The Easy Chair," which had lapsed with the death of George William Curtis. In 1915 he received the gold medal of the National Institute of Arts and Letters for his work in fiction. Of Mr. Howells's many novels, the following may be mentioned as especially noteworthy: *Their Wedding Journey* (1872); *The Lady of the Aroostook* (1879); *A Modern Instance* (1882); *The Rise of Silas Lapham* (1885); *The Minister's Charge* (1886); *A Hazard of New Fortunes* (1889); *The Quality of Mercy* (1892); *The Landlord at Lion's Head* (1897). He also published *Poems* (1873 and 1886); *Stops of Various Quills* (1895), a book of verse; books of travel; several amusing farces, and volumes of essays and literary criticism, among others, *Literary Friends and Acquaintance* (1901), which contains much autobiographical matter; *Literature and Life* (1902); and *English Films* (1905). His later works included *My Mark Twain* (1910); *Imaginary Interviews* (1910); *Parting Friends; a Farce* (1911); *Familiar Spanish Travels* (1913); *New Leaf Mills; a Chronicle* (1913); *The Seen and Unseen of Stratford-on-Avon; a Fantasy* (1914); *The Daughter of the Storage and Other Things in Prose and Verse* (1916); *The Leatherwood God* (1916) and *Years of My Youth* (1916). In 1920 he edited with an introduction *The Great Modern American Stories.* He left unfinished *Years of My Middle Life.*

Howells was long considered the foremost representative of the realistic school of indigenous American fiction. Though in his earliest novels his method was not consistently realistic—he was at times almost as personal and whimsical as Thackeray—yet his vivid impressionism and his choice of subjects, as well as an occasional explicit protest that "dulness is dear to him," already revealed unmistakably his realistic bias. In *A Modern Instance* (1882) he gained complete command of his method, and began a series of studies of American life remarkable for their loyalty to fact, and their power to reveal both the springs of American character and the sociological forces shaping American civilization He refused to over-sophisticate or to over-intellectualize his characters, and he was very sparing in his use of psychological analysis. He insisted on seeing and portraying American life under its own skies and with its own atmosphere; he did not scrutinize it with foreign comparisons in mind, and thus try to find and to throw into relief unsuspected configurations of surface. He kept his dialogue toned down almost to the pitch of everyday conversation, although he has shown in his comedy sketches how easy a master he was of adroit and witty talk

See also J. M. Robertson, *Essays towards a Critical Method* (1889); H. C. Vedder, *American Writers* (Boston, 1894), D. G. Cooke, *William Dean Howells* (1922); Oscar W. Firkins, *William Dean Howells* (1924); H. T. and W. Follet, *Some Modern Novelists* (1919); and *William Dean Howells; Life in Letters,* edited by his daughter Mildred Howells (1928).

HOWITT, WILLIAM (1792–1879), English author, born at Heanor, Derbyshire. He married, in 1821, Mary Botham (1799–1888), like himself a Quaker and a poet. The Howitts collaborated throughout a long literary career, the first of their joint productions being *The Forest Minstrels and other Poems* (1821). In 1831 William Howitt produced *The Book of the Seasons, or the Calendar of Nature.* Mary Howitt devoted herself to Scandinavian literature, and between 1842 and 1863 she translated the novels of Frederika Bremer and many of the stories of Hans Andersen. With her husband she wrote in 1852 *The Literature and Romance of Northern Europe.* In June of that year William Howitt, with two of his sons, set sail for Australia, where he spent two years in the goldfields and collected the material for *A Boy's Adventures in the Wilds of Australia* (1854). He died in Rome on March 3, 1879, and his wife, Mary Howitt, also died there on Jan. 30, 1888. Their son, Alfred William Howitt, made himself a name by his explorations in Australia.

Mary Howitt's autobiography was edited by her daughter, Margaret Howitt, in 1889. William Howitt wrote some 50 books, and his wife's publications, inclusive of translations, number over 100.

HOWLER, a name applied to the members of the genus *Alouatta* of tropical American monkeys. These monkeys, which are of large size, with thick fur, red or black in colour, are characterized by the inflation of the hyoid bone (which supports the tongue) into a large shell-like organ communicating with the windpipe, and giving peculiar resonance to the voice. The muzzle is projecting, and the profile of the face slopes regularly backwards. The long tail is prehensile, thickly furred, with the under surface of the extremity naked, to secure a better grip. Howlers dwell in companies, and in the early morning and evening make the woods resound with their cries, which are often continued throughout the night. They feed on leaves, and are in the habit of sitting on the topmost branches of trees. When on the move they progress in order, led by an old male.

"Howler" is also a slang term for conspicuously absurd blunders made by schoolboys or students in examinations, etc.

HOWRAH, a city and district of British India, in the Burdwan division of Bengal. The city is situated opposite Calcutta, with which it is connected by a floating bridge. The municipal area is about 11 sq m.; pop. (1921), 195,301 Since 1881 the

population has been more than doubled, owing to the great industrial development that has taken place. Howrah is the terminus of the East Indian and Bengal-Nagpur railways; also of two light railways which run to Amta and Sheakhala Further, it is the centre of the jute-manufacturing industry, with many jute mills and presses

The Royal Botanic Garden, first established in 1787, and the Bengal engineering college, which occupies the buildings of the bishop's college, originally a theological college founded in 1824, are in the suburb of Sibpur.

The DISTRICT OF HOWRAH extends southwards down the right bank of the Hooghly to the confluence of the river Damodar Its area is 530 sq m , pop (1921), 997,403 In addition to the two steam tramways and the East Indian railway, the district is crossed by the high-level canal to Midnapore, which communicates with the Hooghly at Ulabaria The district is densely populated (1,882 persons per square mile), though the manufacturing industries of Howrah extend beyond the city, a large portion is rural in character and there are marshy areas for which drainage schemes affecting 320 sq m. have been constructed

HOWTH, a seaside town of Co Dublin, Ireland, on the northern horn of Dublin bay, 9 m. E N E of Dublin by rail Pop. (1926), 1,357 The collegiate church was founded about 1235, and has a monastic building attached to it. The town is frequented as a watering-place by residents of the capital The artificial harbour, formed (1807–32) between the mainland and Ireland's Eye, preceded Kingstown as the mail-packet station for Great Britain, but was found to be liable to silt, and is now chiefly used by fishing boats and yachts

HÖXTER, a town in the Prussian province of Westphalia, situated on the Weser, 32 m N. of Cassel Pop. (1925) 7,217. It has a mediaeval town hall, and 15th and 16th century houses Höxter in the time of Charlemagne was a *villa regia* and the scene of a battle between him and the Saxons It was in the protection of the adjacent monastery of Corvey and later joined the Hanseatic League. It suffered severely during the Thirty Years' War After the peace of Westphalia in 1648 it was united to Brunswick; and in 1807 it was transferred to the kingdom of Westphalia, after the dismemberment of which, in 1814, it came into the possession of Prussia The church of St. Kilian has a pulpit dating from 1595 and a font dating from 1631 The principal manufactures are paper, bricks, cement and rubber, and it has a number of sawmills.

HOY (Norse *Haey*, "high island"), the second largest island of the Orkneys, county of Orkney, Scotland. Pop. (1921) 964, area 53 sq m It is situated 2 m. S W of Pomona, from which it is separated by Hoy Sound It is a lofty island and its shore line is much broken, Long Hope forming a good natural harbour with many landing places Off the eastern coast lie the islands of Graemsay, Cava, Risa, Fara, Flotta and Switha, while the peninsula of South Walls, forming the southern side of the harbour of Long Hope, is almost cut off by the sea Red sandstone cliffs, sometimes over 1,000 ft in height, stretch for 10 to 12 m. on the Atlantic front The detached pillar or stack called the Old Man of Hoy (450 ft.) is a well-known landmark to sailors and a remarkable example of sea denudation. The only break in this remarkable run of rocky coast is at Rackwick in the bight below the head of Rora. In the interior, Ward Hill (1,564 ft.) is the loftiest summit in either the Orkneys or Shetlands while the Cuilags reach 1,420 ft. and the Knap of Trewieglen 1,308 ft. In the valley between Ward Hill and the ridge of the Hamars to the south-east is the famous Dwarfie Stone, an enormous block of sandstone, with associations with Scandinavian folklore. Rooms have been carved out of it and there are signs of habitation.

HOYLAKE, watering place, urban district of Hoylake and West Kirby, Wirral parliamentary division, Cheshire, England Pop. (1921) 17,068. It is situated at the mouth of the estuary of the Dee, 6 m. W. of Birkenhead on the L.M.S. railway. It possesses a famous golf course and racecourse.

HOYLAND NETHER, an urban district of the West Riding of Yorkshire, England, 5½ m S S.E of Barnsley, on the L.M.S railway Pop (1921), 14,904 There are collieries and brickworks

HOYLE, EDMUND, or EDMOND (1672–1769), the first systematizer of the laws of whist, and author of a book on games, was born in 1672. For the use of his pupils in whist he drew up a *Short Treatise* (1742). The laws of Hoyle continued to be regarded as authoritative until 1864, after which they were gradually superseded by the new rules adopted by the Arlington and Portland clubs in that year (*see* WHIST) The weight of his authority is indicated by the phrase "according to Hoyle," which, doubtless first applied with reference to whist, has gained currency as a proverb Hoyle died in London on Aug. 29, 1769.

HOZ Y MOTA, JUAN CLAUDIO DE LA (1630?–1714), Spanish dramatist, was born in Madrid, and in his later years acted as official censor of the Madrid theatres *El Montañés Juan Pascal*—the source of Rivas's *Una antigualla de Sevilla* and of Zorrilla's *El Zapatero y el Rey*—and *El castigo de la muserta* give a just idea of his adaptable talent

HRABANUS (rah-bah'nus), or **RABANUS MAGNENTIUS MAURUS** (*c.* 776–856), archbishop of Mainz, born of noble parents at Mainz, and educated at Fulda and Tours under Alcuin, who in recognition of his ability surnamed him Maurus, after St Maur the favourite disciple of Benedict. In 803 he became director of the school at Fulda, which under him acquired great fame He was ordained priest in 814 but shortly afterwards, apparently on account of disagreement with Ratgar, he withdrew from Fulda, and made a pilgrimage to Palestine. He returned to Fulda on the election of a new abbot (Eigil) in 817, upon whose death in 822 he himself became abbot After an efficient and successful tenure of office, he retired in 842, but five years later, succeeded Otgar in the archbishopric of Mainz, where he remained for eight years. He died at Winkel on the Rhine, on Feb. 4, 856.

In politics, Hrabanus gave his support to Louis the Pious against his rebellious sons, and after the death of the emperor sided with Lothair, the eldest son In theology and philosophy, a sphere in which he came into conflict with Gottschalk, he was one of the most learned men of his time Besides his extensive commentaries on the Bible, his chief works were the encyclopaedic dictionary *De Universo*, the *Glossaria Latino-Theodisca*, and the pedagogical treatise *De Institutione clericorum.*

The 1627 Cologne edition of his works was reprinted in Migne's *Patrol. Lat.* vols. 107–112. *See* Schwarz, *De Rhabano Mauro primo Germaniae praeceptore* (1811), Kunstmann, *Hrabanus Magnentius Maurus* (1841), Spengler, *Leben des heil Rhabanus Maurus* (1856); Kohler, *Rhabanus Maurus u die Schule zu Fulda* (1870); Richter, *Hrabanus Maurus* (1882) and Hablitzel, *Hrabanus Maurus* (1906). *See* also Pertz, *Monum. Germ Hist* (I. and II); and bibliography in Überweg, *Gesch. der Philosophie*, vol. II. (1928)

HRADEC KRÁLOVÉ, town of Bohemia, Czechoslovakia, situated at the confluence of the Orlice with the Elbe. It is the natural market centre of a fertile region known as the "Golden Road," in which settlement has existed from prehistoric time. It was one of the dower towns of Elizabeth of Poland, the wife of King Wenceslas II of Bohemia, and was the first town to declare for the national cause in the Hussite Wars It is famous for the decisive battle of Sadowa in the Austro-Prussian War of 1866 The growth of the modern town is across the Elbe towards the railway and the industrial centre of Kukleny. Here are engineering works, tanneries and sawmills Other industries include the manufacture of soap, candles, confectionery and pianos. Pop. (1923), 13,115. (*See* SEVEN YEARS' WAR.)

HRDLICKA (hurd-lits'ka), **ALES** (1869–), American anthropologist, was born at Humpolec, Bohemia, on March 29, 1869. His early education was received in Bohemia. He studied at the New York Eclectic, Homoeopathic and Allopathic colleges, graduating in medicine in 1892 and 1894. In 1894 he joined the New York State service, investigating the insane and other defective classes, and became in 1896 associate in anthropology in the State pathological institute.

In 1898, Dr. Hrdlicka was given charge of physical anthropology in the Hyde expedition to Mexico and the south-western United States, in connection with the American Museum of Natural History of New York. In 1903 he was called as assistant

curator to organize the division of physical anthropology at the U.S. National Museum, Washington (D C.), becoming curator in 1910. As a member of many anthropological expeditions he made researches in many countries of the globe. He became a leading exponent of the theories that the North American Indian is of Asiatic origin, that the cradle of man's development was not in Asia but in Europe; and that the Neanderthal man was not a separate species of man, but only a phase of his evolution. He is the founder (1918) and editor of the *American Journal of Physical Anthropology*. He is the author of. *Ancient Man in North America* (1907); *Ancient Man in South America* (1912); *Anthropological Work in Peru* (1914); *Physical Anthropology (American)* (1919); *Anthropometry* (1920); *Anthropology of Florida* (1922); *Old Americans* (1925); and numerous other books and papers on anthropology and related subjects.

HRÓLFR KRAKI, perhaps the most famous of the Danish kings of the heroic age In *Beowulf*, where he is called Hrothwulf, he is represented as reigning over Denmark in conjunction with his uncle Hrothgar, one of the three sons of an earlier king called Healfdene In the Old Norse sagas Hrólfr is the son of Helgi (Halga), the son of Halfdan (Healfdene) He is represented as a wealthy and peace-loving monarch similar to Hrothgar in *Beowulf*, but the latter (Hróarr, or Roe) is quite overshadowed by his nephew in the Northern authorities The chief incidents in Hrólfr's career are the visit which he paid to the Swedish king Aðils (Beowulf's Eadgils), of which several different explanations are given, and the war, in which he eventually lost his life, against his brother-in-law Hiorvarðr The name Kraki (pole-ladder) is said to have been given to him on account of his great height by a young knight named Vöggr, whom he handsomely rewarded and who eventually avenged his death on Hiorvarðr There is no reason to doubt that Hrólfr was an historical person and that he reigned in Denmark during the early years of the 6th century

See Saxo Grammaticus, *Gesta Danorum*, pp 52–68, ed A Holder (Strasbourg, 1886); and A Olrik, *Danmarks Helteđigtning* (1903).

HROSVITHA (rōs-vēth'ą) (ROSWITHA, properly HROTSUIT) (*c* 935–*c* 1002), German dramatist and chronicler Some time before 959 she entered the Benedictine nunnery of Gandersheim, a foundation highly favoured by the Saxon dynasty, and lived there until her death about the turn of the century She wrote eight narrative religious poems, in leonine hexameters or distichs, dealing with the Nativity of the Virgin (from the apocryphal gospel of St James, the brother of our Lord), the Ascension and a series of legends of saints (Gandolph, Pelagius, Theophilus, Basil, Denis, Agnes) Her comedies are six in number, being doubtless in this respect intended to recall their nominal model, the comedies of Terence They are written in prose, with an element of something like rhythm, and an occasional admixture of rhyme Founded upon legends of the saints, and exhibiting a knowledge of the Fathers and of Christian philosophers, they nevertheless contain many elements of comedy and even of farce, though they were written to glorify virginity How far Hrosvitha's comedies were an isolated phenomenon of their age in Germany is uncertain, but in the history of the drama they form the bridge between the few earlier attempts at utilizing the forms of the classical drama for Christian purposes and the miracle plays

The third group of the writings of Hrosvitha contains her versified historical chronicles. At the request of the abbess Gerberga, she composed her *Carmen de gestis Oddonis*, an epic attempting to follow the great Roman model It was completed by 968, and presented by the authoress both to the old emperor and to his son (then already crowned as) Otto II Unfortunately only half of it remains; the part treating of the period from 953 to 962 is lost with the exception of a few fragments, and the period from 962 to 967 is summarized only Subsequently, in a poem (of 837 hexameters) *De primordiis et fundatoribus coenobii Gandersheimensis*, Hrosvitha narrated the beginnings of her own convent, and its history up to 919.

The Munich ms, which contains all the above works except the *Chronicle of Gandersheim*, was edited by Conrad Celtes, in 1501 and printed at Nuremberg, with eight wood-cuts presumably by Dürer. It was re-edited by H L Schurzfleisch and published at Wittenberg in 1707. The comedies have been edited and translated into German by J. Bendixen (Lubeck, 1857), and into French by C. Magnin (1845) with a good introduction. *See* also Hrosvitha's *Poésies latines*, with French translation by V. Rétif de la Bretonne (1854). Her two chronicles in verse were edited by Z H Pertz in the *Monumenta Germaniae*, iv. (Hanover, 1841) *See* also J. P. Migne, *Patrol Lat* vol. 137 The *Carmen* was included by Leibnitz in his *Scriptores rer. Brunsvic.* (Hanover, 1707–11). For other early editions *see* A Potthast, *Bibliotheca historica medii aevi* (supplement, 1862–68), and for an appreciation of them *see* Wattenbach, *Geschichtsquellen*, pp. 214–216 There are modern editions of Hrosvitha's works by P von Winterfeld (1902) and by K Strecker (1906); and German translations of the chronicle by Pfund (1860, new ed 1891) and of the comedies by Piltz in Reclam's *Universal Bibliothek*. *See* Eng translations of the plays by Christopher St. John (1923 with good introduction) and by H J W Tillyard (1923). *See* also J Schneiderhan, *Roswitha von Gandersheim, die erste deutsche Dichterin* (Paderborn 1912).

HROZNÝ, FREDERIC (1879–), Czech orientalist and archaeologist, studied in Prague, Vienna, Berlin and London. In 1904 he took part in the Sellin excavations in Ta'anuk (north Palestine), on the basis of which he wrote *Die Keilschrifttexte von Ta'annek* (1904) and *Die neugefundenen Keilschrifttexte von Ta'annek* (1906) In 1905 he was appointed professor at Vienna, and in 1919 professor of cuneiform research and ancient Oriental history at the Charles university of Prague Hrozný left the solution of the Hittite hieroglyphics to chance, proceeded to work on the basis of Hittite documents from the Boghazkeui archives written in cuneiform script, and in 1915 thus succeeded in deciphering the Hittite language, which he proved to be an Indo-European tongue, closely akin to the Iranian, Celtic, Italic and Slavonic families of speech His solution was attacked from many quarters, but he substantiated his claim by the success with which he read and translated a number of documents, among others a Hittite legal code (published in Paris, 1922, under the title: *Code Hittite provenant de l'Asie Mineure, I Partie: Transcription, traduction française*) In 1925 excavations for the purpose of further research were made under his direction by a Czech scientific expedition to Asia Minor *See* HITTITES, contributed by Prof Hrozný, and bibliography there for his later writings

HSÜAN TSANG (HIOUEN THSANG, HIWEN T'SANG, YÜAN TSANG, YUAN-CHWANG), Chinese collector of the narratives of Chinese Buddhists who travelled to India, whilst their religion flourished there, with the view of visiting the sites consecrated by the history of Sakya Muni, of studying at the great convents which then existed in India, and of collecting books, relics and other sacred objects In relation to his travels there are two Chinese works, translated by Stanislas Julien, viz., (*a*) the *Ta-T'ang-Si-Yu-Ki, or Memoirs on Western Countries issued by the T'ang Dynasty*, which was compiled under the traveller's own supervision, by order of the great emperor Tai-Tsung, and (*b*) a *Biography of Hsuan Tsang* by two of his contemporaries

Hsüan Tsang was born in the district of Keu-Shi, near Honan-Fu, about 605, a period at which Buddhism appears to have had a powerful influence upon a large body of educated Chinese From childhood grave and studious, he adopted the monastic life For some years he travelled over China, teaching and learning, and eventually settled for a time at the capital Chang-gan (now Si-gan-fu in Shensi), where his fame for learning became great In August 629 he started alone for India, eluding with difficulty the strict prohibition which was in force against crossing the frontier

The "master of the law," as his biographers call him, plunged alone into the desert of the Gobi, then known as the Sha-mo or "Sand River," between Kwa-chow and Igu (now Hami or Kamil). At long intervals he found help from the small garrisons of the towers that dotted the desert track After great suffering Hsuan Tsang reached Igu, the seat of a Turkish principality, and pursued his way along the southern foot of the T'ian-shan, which he crossed by a glacier pass (vividly described) in the longitude of Lake Issyk-kul Passing by the present Tashkend, and by Samarkand, then inhabited by fire worshippers, he reached the basin of the Upper Oxus, which had recently been the seat of the powerful dominion of the Haiathelah, Ephthalites or White Huns, known in earlier days to the Greeks as *Tochari*, and to Hsüan Tsang (by the same name) as *Tuholo* or Tukhāra. His account of the many small states into which the Tukhāra empire

had broken up is of great interest, as many of them are identical in name and topography with the high valley states and districts on the Upper Oxus.

Passing by Bamian, where he speaks of the great idols, he crossed Hindu-Kush, and descended the valley of the Kabul river to Nagarahara (Nagara, adjoining Jalalabad) Travelling thence to Peshawar (*Purushapura*), the capital of Gandhara, he made a detour, through the valley of Swat and the Dard states, to the Upper Indus, returning to Peshawar, and then crossing the Indus (*Sintu*) into the decayed kingdom of *Taxila* (Ta-cha-si-lo, Takshasila), then subject to Kashmir In the latter valley he spent two whole years (631–633) studying in the convents, and visiting the many monuments of his faith In his further travels he visited Mathura (*Mot'ulo*, Muttra), whence he turned north to Thanesar and the upper Jumna and Ganges, returning south down the valley of the latter to Kanyakubja or Kanauj, then one of the great capitals of India The pilgrim next entered on a circuit of the most famous sites of Buddhist and of ancient Indian history, such as Ajodhya, Prayaga (Allahabad), Kausambhi, Sravasti, Kapilavastu, the birth-place of Sakya, Kusinagara, his death-place, Pataliputra (Patna, the *Palibothra* of the Greeks), Gaya, Rajagriha and Nalanda, the most famous and learned monastery and college in India, adorned by the gifts of successive kings, of the splendour of which he gives a vivid description There he spent nearly two years in mastering Sanskrit and the Buddhist philosophy Again, proceeding down the banks of the Ganges, he diverged eastward to Kamarupa (Assam), and then passed by the great ports of Tamralipti (Tamluk, the misplaced *Tamalitis* of Ptolemy), and through Orissa to Kanchipara (Conjeeveram), about 640 Thence he went northward across the Carnatic and Maharashtra to Barakacheva (Broach of our day, *Barygaza* of the Greeks). After this he visited Malwa, Cutch, Surashtra (peninsular Gujarat, *Syrastrene* of the Greeks), Sind, Multan and Ghazni, whence he rejoined his former course in the basin of the Kabul river

This time, however, he crossed Pamir, of which he gives a remarkable account, and passed by Kashgar, Khotan (*Kustana*), and the vicinity of Lop-nor across the desert to Kwa-chow, whence he had made his venturous and lonely plunge into the waste fifteen years before. He carried with him great collections of books, precious images and reliques, and was received (April 645) with public and imperial enthusiasm The emperor T'ai-Tsung desired him to commit his journey to writing, and also that he should abandon the eremitic rule and serve the state. This last he declined, and devoted himself to the compilation of his narrative and the translation of the books he had brought with him from India The former was completed AD 648. In 664 Hsüan Tsang died in a convent at Chang-gan. On the approach of death the saint caused one of his disciples to frame a catalogue of his good works, of the books that he had translated or caused to be transcribed, of the sacred pictures executed at his cost, of the alms that he had given, of the living creatures that he had ransomed from death

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(H. Y.; R. K D.)

HSUAN T'UNG (1906–), emperor of China, or, more correctly, the Ch'ing emperor. At a meeting of the Grand Council held on Nov. 13, 1908, under the presidency of the Empress Dowager Tzu-Hsi, in anticipation of the death of the Emperor Kuang Hsu, Pu Yi, the infant son of Prince Ch'un, was selected to succeed his uncle, under the style of Hsuan T'ung The emperor died on Nov 14, and the empress dowager on Nov 15, whereupon Prince Ch'un became regent for his son. The reign lasted for three disturbed years during which the demand for reforms grew in intensity to a point when on Feb. 12, 1912, a decree of abdication was issued The boy was permitted to retain his title of emperor and to reside in the imperial palace, a subsidy being voted for the maintenance of the imperial family. In July 1917, during the presidency of Li Yuan-hung, an attempt by General Chang Hsun, to restore the emperor was frustrated by Tuan Chi-jui after a few days' nominal "reign" The emperor's education has been upon modern lines and included the services of an English tutor In 1922 he married a daughter of Jung Yuan, a Manchu noble. The ceremony took place with every symbol of imperial magnificence, costly wedding gifts being sent by the highest republican officials including the president, who conveyed the congratulations of the republican government. He then took the significant step of cutting off his queue, and adopting the personal name, Henry Pu-yi. In Nov 1924, during the occupation of the capital by the Kuominchun, or National Army, he left the palace under duress and has since resided in the Japanese Concession at Tientsin.

HUAMBO: *see* ANGOLA

HUANCAVELICA, a department of central Peru, bounded by the departments of Junín, north, Ayacucho, east and south, Ica and Lima, west. Area, 8,300 sq.m , pop. (estimated 1920), 223,796. It is a region of lofty peaks, dark lakes, high valleys and the headwaters of great streams, chief of which is the Mantaro. The only finished roads are a section of the *sierra* trunkline in the valley of the Mantaro and part of the Huancavelica-Lircai highway. Communication is still largely by mule The chief resources are silver, copper, lead, coal, tungsten and mercury; chief products, wheat and other cereals (Acobamba), potatoes and livestock, especially alpacas The capital, Huancavelica, about 80 m south of Huancayo, with which it has been connected by rail since Dec 1926 (altitude 12,464 ft ; pop , about 6,000), is in a cold and remote valley, surrounded by mountains There are no modern improvements, but substantial stone houses and several fine churches of the colonial period It is 160 m from the port of Pisco. The history of Huancavelica is interwoven with that of the Santa Barbara mercury mine, 2,000 feet above the town—in a seam of cinnabar of varying breadth, 40 m in length—from its acquisition by the Spanish crown in 1570 to its purchase by the Fernandini interests in 1915. Other towns are Castrovirreina, noted for its silver mines, Pampas and Lircai.

HUÁNUCO, a mountainous department of central Peru, bounded on the north by Libertad and San Martín, east by Loreto, south by Junín, west by Lima and Ancachs. Area, 15.430 sq m ; pop. (estimated, 1920), 145,309, largely Indian. It includes *sierra* and wooded eastern slopes of the Cordillera and is traversed from south to north by the valley of the Huallaga river and the upper Marañon. Cotton, sugar-cane, coffee, rice, cacao, coca and other tropical crops are grown in the valleys Posuso, a German colony, is on a tributary of the Pachitea The enormous mineral resources are little exploited. The only finished road connects Cerro de Pasco with the city of Huánuco, a distance of 62 m. The road to Puerto Leguía on the Pachitea, is finished (1928) only as far as the Puente de Rancho across the upper Huallaga, 18 m. below the capital. Huánuco, capital of the department, in a beautiful valley on the left bank of the Huallaga river, is about 8,000 ft. above sea-level. Pop. (estimated) 6,000 The town was founded in 1539 by Gomez Alvarado and was an important colonial centre. Huánuco is celebrated for its fruits, the *chirimoya* (*Anona cherimolia*) of this region being the largest and most delicious of its kind.

HUARÁS, capital of the department of Ancachs, Peru, on the left bank of Huarás river, about 190 m. N.N.W. of Lima and 84 m. by mule from the port of Casma. Pop. (estimate, 1920) 14,000; altitude 9,800 ft. It is a picturesque Indian town in a fertile valley with magnificent views of snow-capped peaks. The climate is cool and bracing. The chief agricultural products are

wheat, barley, maize, potatoes and fruit. Cattle are superior in quality. Silver, lead and copper mines in the vicinity are worked on a small scale; mineral springs are locally famous. A railway up the Santa valley from the port of Chimbote is finished only as far as Huallanca (86 m.) but will eventually connect Huarás with the coast, a distance of 149 m. (*see* ANCACHS).

HUARTE DE SAN JUAN or HUARTE Y NAVARRO, JUAN (*c.* 1530–1592), Spanish physician and psychologist, was born at Saint-Jean-Pied-de-Port (Lower Navarre) and studied medicine at the university of Huesca, during the plague which devastated Baeza in 1566. His *Examen de ingenios para las ciencias* (1575), one of the first attempts to show the connection between psychology and physiology, won him a European reputation, and was translated by Lessing.

HUASTEC. A native people of the Atlantic coast of Mexico, south of Tampico and the lower Panuco river. They form an isolated offshoot of the great Maya family of Yucatan and Guatemala, but decisive evidence is lacking as to whether Huastec speech represents an archaic form of the Mayan language and the people a remnant left behind in an ancient southward migration of the stock, or the reverse. Culturally the Huastec belong rather in the Toltec-Aztec than in the Maya province, although their lowland habitat brought with it many differentiations. They formed the north-eastern frontier of the higher civilization of ancient Mexico. About 20,000 Huastec-speaking Indians survive.

See B. Sahagun, book X., ch. 29; Seler, *Gesamm. Abh.*, II. (1904); W. Staub, *El Mexico Antiguo*, I. (1919); R. Schuller, *ibid.*, II. (1924).

HUBAY, EUGENE DE (1858–), Hungarian composer and violinist, sometimes known as Eugen Huber, was born at Budapest Sept. 15, 1858. His first teacher was his father, who was a professor of the violin, and conductor of the Hungarian national opera. From 1871–5 he studied in Berlin under Joachim, and later, on the recommendation of Liszt, gave successful violin recitals in different countries including England. While in Paris he was associated with Vieuxtemps and Massenet. In 1882 he succeeded Wieniawski as professor of the violin at the Brussels Conservatoire, and in 1886 was appointed to a similar post at the Budapest Academy, of which he has been the director since 1919. His pupils include many eminent violinists, among them Vecsey, Jelly d'Aranyi and Szigeti. Hubay has written a number of operas (*The Violin Maker of Cremona; Anna Karenina; Alienor; Die Maske; Moosröschen; Lavottas Liebe*, etc.) as well as symphonies, violin concertos, smaller instrumental works and songs.

HUBBARD, ELBERT (1856–1915), American author and founder of the Roycrofter Corporation, was born in Bloomington, Ill., in 1856, and perished in the sinking of the "Lusitania," on May 9, 1915. In 1891, after having sold his interest in a manufacturing company in Buffalo, N.Y., he started tramping through Europe. Meeting William Morris and visiting his Kelmscott Press in England, he was inspired to found a similar press, the Roycroft Press, at East Aurora, N.Y. Here he wrote in 1894 *A Little Journey to the Home of George Eliot*, the first of the famous *Little Journey* booklets, one of which was issued each month from his press for 15 years thereafter. These were pleasant biographical essays, in which the facts and information were interwoven with shrewd comment, wisdom and satire. In the same year Hubbard began printing *The Philistine*, an original magazine of pocket size, which was continued until his death, Hubbard's facile pen supplying most of the contents. In an 1899 number was printed "A Message to Garcia" the most famous single piece that Hubbard wrote. In 1908 he began to edit and publish *The Fra*, his second monthly magazine, which was continued to 1917. By this time his printing establishment had grown to large proportions. Besides his writings it was publishing many artistic books, hand-illuminated and hand-bound. To the printing shop Hubbard added furniture and leather shops and a smithy, in all of which the aim was to produce articles with something of the excellence of workmanship possessed by the old time craftsman. Painting, clay-moulding and terra-cotta work were included and an art school was established. Much of the work was done by neighbouring boys and girls although many persons were attracted to the community by its leader and the spirit of his enterprise. The Roycrofters were formed into a legal corporation in which only the workers held shares. The community and the Roycroft enterprises were continued by Hubbard's son, Elbert.

Hubbard preached a gospel that was both individualistic and communal, and his writings contain a strong mixture of radicalism and conservatism. He apotheosized work, and his constant theme was efficiency. In style his writings were clear, vigorous and epigrammatic. Besides those mentioned his more important books were. *Time and Chance* (1899), *Life of Ali Baba* (1899); *The Man of Sorrows* (1906); *So Here Cometh White Hyacinths* (1907), and *The Roycroft Dictionary* (1914). *Elbert Hubbard's Scrap Book* (1923) and *The Note Book of Elbert Hubbard* (1927) were published posthumously. *See* also A. Lane, *Elbert Hubbard and His Work* (1901); and F. Shay, *Elbert Hubbard of East Aurora* (1926).

HUBER, JOHANN NEPOMUK (1830–1879), German philosophical and theological writer, a leader of the Old Catholics, was born on Aug. 18, 1830, at Munich, where he was professor of theology from 1864 until his death on March 20, 1879. He joined Dollinger and others in the challenge to the supporters of the Vatican council in the treatise *Der Papst und das Koncil*, which appeared under the pseudonym of "Janus," and also in 1870 by a series of letters (*Romische Briefe*, a redaction of secret reports sent from Rome during the sitting of the council), which were published over the pseudonym Quirinus in the *Allgemeine Zeitung* (*see* DÖLLINGER).

His *Über die Willensfreiheit* (1858) was followed in 1859 by *Die Philosophie der Kirchenvater*, which was promptly placed upon the *Index*. He also published adverse criticisms of Darwin, Strauss, Hartmann and Haeckel.

See E. Zirngiebl, *Johannes Huber* (1881).

HUBER, LUDWIG FERDINAND (1764–1804), German publicist, was born in Paris on Sept. 14, 1764, and was brought up in Leipzig, where he became closely associated with Körner, to whose sister-in-law, Dora Stock, he became betrothed. From 1787 to 1792 he was secretary to the Saxon legation at Mainz, but abandoned the post on account of his passion for Thérèse Forster, whose husband had deserted her. On Georg Forster's death in Paris Huber married Thérèse in Switzerland. In 1798 he became editor of the *Allgemeine Zeitung* in Stuttgart, and, when the paper was prohibited in Wurttemberg, removed with it to Ulm, where he died on Dec. 24, 1804.

Huber wrote many plays, the best of which was *Das heimliche Gericht*. His *Samtliche Werke* (4 vols., 1807–19) contain a biography by Thérèse Huber.

HUBER, MAX (1874–), Swiss lawyer, was born on Dec. 28, 1874, at Zürich. From 1902 to 1921 he held a law professorship—first extraordinary and subsequently ordinary—at the University of Zurich. In 1921 he resigned his chair and became honorary professor. The Swiss Federal Council on many occasions consulted him as an expert in international questions and he was a Swiss representative at The Hague Conference in 1907. During the World War he was legal adviser to the Swiss Political Department; he was entrusted with several missions to the Peace Conference, to the League of Nations and to various Governments. He was a member of the Jurists' Committee of the Council of the League of Nations dealing with the Aaland islands question and of the International Blockade Commission. He became both a judge of the Permanent Court of International Justice in 1922 and a member of the Permanent Court of Arbitration.

His publications include. *Die Staatensuccession* (1898) and *Volkerbundsprobleme in der Botschaft des schweizerischen Bundesrats vom 4 Aug. 1919* (1919).

HUBERT, ST. (d. 727) bishop of Liége, of whose life nothing is known except that in 708 he succeeded Lambert in the see of Maestricht (Tongres), and that he erected a basilica to his memory. In 825 Hubert's remains were removed to a Benedictine cloister in the Ardennes, which thenceforth bore his name. A late legend represents his conversion as having been brought about while he was hunting on Good Friday by a miraculous appearance of a stag bearing between his horns a cross or crucifix

surrounded with rays of light. He is the patron of hunters, and is also invoked in cases of hydrophobia. His feast is celebrated on Nov. 3

See *Acta Sanctorum*, Nov. i. G. Kurth, *Chartes de l'abbaye de St. Hubert en Ardenne* (Brussels, 1903)

HUBLI, a town of British India, in the Dharwar district of Bombay, 15 m S E of Dharwar town. Pop. (1921) 69,206. It is a railway junction on the Madras and Southern Mahratta system, where the lines to Bangalore and Bezwada branch off south and west It is an important centre of trade in cotton, grain and salt, and has spinning and weaving mills, factories for ginning and pressing cotton, railway workshops, soap and manure works. Hubli was an early English factory; it is a military station

HÜBNER, EMIL (1834–1901), German classical scholar, son of the historical painter Julius Hübner (1806–82), was born at Düsseldorf on July 7, 1834 After studying at Berlin and Bonn, he travelled widely on antiquarian and epigraphical researches. The results of these travels were embodied in several important works: *Inscriptiones Hispaniae Latinae* (1869, supplement 1892), *I. H Christianae* (1871, supplement 1900), *Inscriptiones Britanniae Latinae* (1873), *I B. Christianae* (1876); *La Arqueologia de España* (1888), *Monumenta linguae Hibericae* (1893) Hubner wrote several other classical books of great ability in their day He died on Feb. 21, 1901.

HÜBNER, JOSEPH ALEXANDER, COUNT (1811–1892), Austrian diplomatist, was born in Vienna on Nov 26, 1811, of middle-class origin, his real name, afterwards changed to Hübner, being Hafenbredl He began his public career in 1833 under Metternich, who employed him successively in Paris (1837), Lisbon (1841), Leipzig (1844) and Milan (1848) After being held some months as hostage by the Italians in 1848, he returned to the Austrian Court; his journal of this period (*Ein Jahr aus meinem Leben*) is a very valuable record of contemporary events In March 1849 he became Austrian ambassador in Paris, leaving his post only on the outbreak of the war of 1859, which took him unprepared After a short period as Minister of Police he lived in retirement till 1865, when he became ambassador at Rome till 1867. In 1879 he was made a life-member of the Austrian *Herrenhaus;* in 1854 baron; in 1888 count He died in Vienna on July 30, 1892 Besides his journal Hübner wrote two racy travel books and a *Life of Sixtus the Fifth* (English trans. 1872) A strong conservative and admirer of Metternich, of whose era he was the last survivor, he was yet an able and broad-minded man.

See Sir Ernest Satow, *An Austrian Diplomatist in the Fifties* (1908).

HUC, ÉVARISTE RÉGIS (1813–1860), French missionary-traveller, was born at Toulouse, on Aug 1, 1813 He entered the congregation of the Lazarists at Paris, and shortly after receiving holy orders in 1839 went out to China At Macao he spent some 18 months in the Lazarist seminary, preparing himself for the regular work of a missionary. He at first superintended a Christian mission in the southern provinces, and then perfected his knowledge of the language at Peking, eventually settling in the Valley of Black Waters or He Shuy, just within the borders of Mongolia There, beyond the Great Wall, a large, scattered population of native Christians had found refuge from the persecutions of Kia-King, to be united half a century later in an apostolic vicariate. Huc studied the dialects and customs of the Tatars, translated various religious works, and in 1844, at the instigation of the vicar apostolic of Mongolia, undertook an expedition to Tibet

Accompanied by his fellow-Lazarist, Joseph Gabet, and a young Tibetan priest who had embraced Christianity, he set out from Dolon Nor. To escape attention the little party assumed the dress of lamas or priests. Crossing the Hwang-ho, they advanced into the sandy tract known as the Ordos desert. After terrible sufferings they entered Kansu, having recrossed the flooded Hwang-ho, and in Jan 1845 reached Tang-Kiul on the boundary. There they waited for eight months, and studied the Tibetan language and Buddhist literature, residing for part of the time in the Kunbum Lamasery, which was reported to accommodate 4,000 persons Towards the end of September they joined a returning Tibetan embassy from Peking, which comprised 2,000 men and 3,700 animals. Crossing the deserts of Koko Nor, they passed the lake of that name, with its island of contemplative lamas, and, following a difficult and tortuous track across snow-covered mountains, they at last entered Lhasa on Jan. 29, 1846 Favourably received by the regent, they opened a little chapel, but the Chinese ambassador interfered and had the two missionaries conveyed back to Canton, where they arrived in October of the same year. For nearly three years Huc remained at Canton, but Gabet, returning to Europe, proceeded thence to Rio de Janeiro, and died there shortly afterwards Huc returned to Europe in shattered health in 1852. He died in Paris on March 31, 1860

His writings comprise, besides numerous letters and memoirs in the *Annales de la propagation de la foi,* the famous *Souvenirs d'un voyage dans la Tartarie, le Thibet, et la Chine pendant les années 1844–1846* (2 vols., 1850; Eng. trans. by W. Hazlitt, 1851, abbreviated by M. Jones, 1867); its supplement, crowned by the Academy, entitled *L'Empire chinois* (2 vols, 1854; Eng. trans, 1859); and an elaborate historical work, *Le Christianisme en Chine, etc.* (4 vols, 1857–58; Eng trans., 1857–58).

See, for information specially relating to the whole subject, the Abbé Desgodin, *Mission du Thibet de 1855 à 1870* (Verdun, 1872); and "Account of the Pundit's Journey in Great Tibet," in the *Royal Geographical Society's Journal* for 1877. *See* also Prince Henry of Orleans, *Le père Huc et ses critiques* (1893)

HUCBALD (HUGBALDUS, HUBALDUS) (*c.* 840–930), Benedictine monk, and writer on music, was born at the monastery of Saint Amand near Tournai He studied at the monastery, where his uncle Milo was head of the school Hucbald's success in music is said to have excited his uncle's jealousy and to have made it necessary for him to leave St Amand In 860 he was at St. Germain d'Auxerre, bent upon completing his studies, and in 872 he was back again at St Amand as successor to his uncle, to whom he had been reconciled in the meantime. Between 883 and 900 Hucbald went on several missions of reforming various schools of music, including that of Reims, but in 900 he returned to St. Amand, where he died on June 25, 930, or, according to other chroniclers, on June 20, 932 The only work which can positively be ascribed to him is his *Harmonica Institutio* The *Musica Enchiriadis,* published with other writings of minor importance in Gerbert's *Scriptores de Musica,* and containing a complete system of musical science as well as instructions regarding notation, dates from the close of the 10th century. This work is celebrated chiefly for an essay on a new form of notation described in the present day as *Dasia Notation.* The author of the *Harmonica Institutio* wrote numerous lives of the saints and a curious poem on bald men, dedicated to Charles the Bald

AUTHORITIES—Sir John Hawkins, *General History of the Science and Practice of Music* (i. 153), *Histoire littéraire de la France* (vi 216 *et seq*), Coussemaker, *Mémoire sur Hucbald* (Paris, 1841); Hans Muller, *Hucbald's echte und unechte Schriften uber Musik* (Leipzig, 1884), Spitta, *Die Musica Enchiriadis und seine Zeitalter* (*Vierteljahresschrift fur Musikwissenschaft,* 1889, 5th year); H. Riemann, *Geschichte der Musik theorie* (2nd ed., 1920).

HUCH, RICARDA (1864–), German poet and historical novelist, was born at Brunswick on July 18, 1864, and educated in Brunswick and Zürich She was appointed secretary of the library in Zürich and married first Dr. Ceconi, and later Dr. Richard Huch, a lawyer After leaving Zürich she lived in Bremen, Vienna, Trieste and Florence, then settling in Munich. She wrote a number of romantic and imaginative novels, among which may be mentioned *Aus der Triumphgasse* (1902); *Vita Somnium Breve, Erinnerungen, von Ludolf Ursleu dem Jüngeren* (1893); *Der grosse Krieg in Deutschland* (1912–14); and *Der wiederkehrende Christus* (1925) Her most important historical works are *Blüthezeit der Romantik* (1899); *Ausbreitung und Verfall der Romantik* (1902), *Das Risorgimento* (1908); *Michael Bakunin* (1923). In 1919 appeared a volume of reflections, *Der Sinn der heiligen Schrift,* which reveal a profound knowledge of psychology. One of the leaders of the revolt against naturalism, Ricarda Huch attained at her best a high degree of musical rhythm and romantic beauty.

HUCHOW, a Chinese town of 100,000 inhabitants in north-east Chekiang, lying to the south of the Tai-Nu Lake about 50 m.

N. of Hangchow and 120 m. W.S.W. of Shanghai. Huchow is the centre of the great silk area of the Yang-tze delta which is shaped like an inverted funnel with its stem along the Grand Canal, splaying out beyond Wusih to include all northern Chekiang where the mulberry has little competition from cotton Huchow is famous for silk products but in recent years its output has decreased owing to the competition of Shanghai, Wusih and Hangchow with their more modern methods It retains its importance, however, for the cultivation of the Huchow mulberry. It has a large export trade in saplings and its raw cocoons and hand-reeled silk are in great demand at Shanghai, Wusih and Hangchow Trade is carried on by junks

HUCHOWN, "of the Awle Ryale" (*fl.* 14th century), Scottish poet, is referred to by Wyntoun in his *Chronicle* in these words.—

Hucheon,
Þat cunnande was in littratur,
He made a gret Gest of Arthure,
And Þe Awntyr of Gawane,
Þe Pistil als of Suet Susane
He was curyousse in his stille,
Favr of facunde and subtile,
And ay to pleyssance hade delyte,
Mad in metyr meit his dyte
Litil or noucht neuir Þe lesse
Wauerande fra Þe suythfastnes.
(Cott. ms. bk. v. 11, 4308–18)

Much critical ingenuity has been spent in endeavouring to identify (*a*) the poet and (*b*) the works named in the foregoing passage It has been assumed that "Huchown," or "Hucheon," represents the "gude Sir Hew of Eglyntoun" named by Dunbar (*q v*) in his *Lament for the Makaris* (i 53) The only known Sir Hugh of Eglintoun of the century is frequently mentioned in the public records from the middle of the century onwards, as an auditor of accounts and witness to several charters By 1360 he had married Dame Egidia, widow of Sir James Lindsay and half-sister of Robert the Steward. His public office and association with the Steward sorts well with the designation "of the Awle Ryale," if that be interpreted as "Aula Regalis" or "Royal Palace" He appears to have died late in 1376 or early in 1377

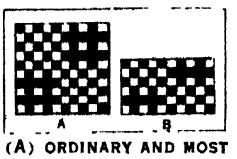
The first of the poems named above, the *Gest of Arthure* or *Gest Historyalle* (*ib.* i. 4288), has been identified by Dr. Trautmann, "Anglia," *Der Dichter Huchown* (1877), with the alliterative *Morte Arthure* in the Thornton ms at Lincoln, printed by the E E T S (1865). The problem of the second (*The Awntyr of Gawane*) is still in dispute. There are difficulties in the way of accepting the conjecture that the poem is the "Awntyres of Arthure at the Tern Wathelyne" (*see* S T S, Scottish *Alliterative Poems*, 1897, and Introduction, pp 11 *et seq*), and little direct evidence in favour of the view that the reference is to the greatest of middle English romances, *Sir Gawain and the Grene Knight* The third may be safely accepted as the well-known *Pistil* [Epistle] *of Swete Susan*, printed by Laing (*Select Remains*, 1822) and by the S T S. (*Scottish Alliterative Poems, u.s*).

See, in addition to the above works, G Neilson, *Sir Hew of Eglintoun and Huchown of the Awle Ryale* (Glasgow, 1901) and *Huchown of the Awle Ryale, the Alliterative Poet* (Glasgow, 1902); J. T. T. Brown, *Huchown of the Awle Ryale and his Poems* (Glasgow, 1902), in answer to the foregoing. *See* also the correspondence in the *Athenaeum*, 1900–01, and the review of Neilson's pamphlets, *ib* (Nov. 22, 1902), and J H Millar, *Literary History of Scotland* (1903).

HUCHTENBURG, JOHN VAN (1647–1733), Dutch painter, a native of Haarlem, was first taught by Thomas Wyk, and afterward visited Italy, where he lived in Rome with his brother Jacob, who spent all his life in Italy and painted landscapes, very few of which are extant After Jacob's death, John wandered homewards, taking Paris on his way, and served under Van der Meulen, then employed in illustrating for Louis XIV the campaign of 1667–68 in the Low Countries. In 1670 he settled at Haarlem, where he married, and kept a dealer's shop. He produced pictures of hunts and robber camps, and, later, ventured on cavalry skirmishes and engagements or regular troops These were admired by Prince Eugène, who made him court painter and employed him to paint the chief incidents of his battles A series of ten of these pictures is in the Turin gallery. He died in Amsterdam in 1733.

The earliest date on his pictures is 1674, when he painted the "Stag-Hunt" (museum of Berlin), and the "Fight with Robbers," (Lichtenstein collection at Vienna) A "Skirmish at Fleurus" (1690), in the Brussels gallery, was the precursor of more powerful works, such as the "Siege of Namur" (1695), in the Vienna museum The National Gallery, London and the Louvre have each a picture by him. Munich has the well-known "Tallart taken Prisoner at Blenheim in 1704," and Amsterdam the "Battle of the Boyne."

HUCKABACK, the name given to a type of cloth used for towels For this purpose it has perhaps been more extensively used in the linen trade than any other weave One of the chief merits of a towel is its capacity for absorbing moisture; plain and other flat-surfaced cloths do not perform this function satisfactorily, but cloths made with huckaback, as well as those made with the honeycomb (*q v*), and similar weaves, are particularly well adapted for this purpose The body or foundation of the cloth is plain and therefore sound in structure (*see* designs A and B in figure), but at fixed intervals some of the warp threads float on the surface of the cloth, while at the same time a number of weft threads float on the back. Thus the cloth has a somewhat similar appearance on both sides Weave A is the ordinary and most used huck or huckaback, while weave B, which is usually woven with double weft, is termed the Devon or medical huck The cloths made by the use of these weaves were originally all linen; for cheapness and ease of weaving, cotton threads were gradually introduced, wholly or in part, for the warp Such cloths have also been made solely from cotton yarns and occasionally by mixed yarns made from inferior fibres



(A) ORDINARY AND MOST USED HUCK OR HUCKABACK (B) DEVON OR MEDICAL HUCK

See T Woodhouse and T. Milne, *Textile Design Pure and Applied*, pp. 56–67 (1912). (T. W.)

HUCKLEBERRY, the popular name in the north-eastern United States of the genus *Gaylussacia* (family Ericaceae), small branching shrubs resembling in habit the English bilberry (*Vaccinium*), to which it is closely allied, and bearing a similar fruit The common huckleberry of the northern states is *G resinosa;* while *G. brachycera* and *G. dumosa* are known respectively as box and dwarf huckleberry The name *Gaylussacia* commemorates the famous French chemist Gay-Lussac.

HUCKNALL TORKARD, a town in Nottinghamshire, England; 132 m N N W. from London by rail Pop (1921) 16,834 The church of St Mary Magdalene contains the tomb of Lord Byron. There are collieries in the vicinity, and the town has tobacco and hosiery works Small traces are found of Beauvale abbey, a Carthusian foundation of the 14th century, to the west; and 3 m N is Newstead abbey, founded by Henry II, and associated with Byron There remain the Early English west front of the church, a Perpendicular cloister and the chapter-house To the south of Hucknall are traces of Gresley castle, of the 14th century.

HUDAIDA, chief sea-port of Yaman, on the Arabian coast of the Red sea, 14° 48′ N. and 42° 57′ E, on sandy beach exposed to S and W. winds Steamers anchor more than 1 m from shore, and all goods are lightered by *Sanbūks* (Arab sailing boats) Its population of 30,000 in Turkish times, when there were a garrison and many officials, contained Indian, African and Greek traders, but since the World War prosperity has declined, though more recently Italian commercial and political activity bids fair to improve matters Regular steamer communication is maintained with Massawa in Eritrea, while Hudaida is also served from Suez and Aden After the war Hudaida, which was occupied by British troops, was handed over by the British Government to the Idrīsī ruler of 'Asīr, but in 1921 Imām Yahya of Yaman had no difficulty in wresting the town and district from him And by the Italian treaty with the Imām, Hudaida is formally recognized as forming part of Yaman, though the Wahhabi king of Hijāz and Najd still regards it as *de jure* part of 'Asīr within his dominions. Hudaida has long since displaced Mocha as the chief emporium

of the Yaman coffee trade, and also handles by far the greater part of the import trade of the country.

HUDDERSFIELD, a municipal, county and parliamentary borough in the West Riding of Yorkshire, England, 16½ m. S.W. of Leeds and 190 m N N.W of London Pop. (1921), 110,102. The town is situated on fairly steep slopes on the left bank of the river Colne, a tributary of the Calder. It is served by the L.M S. railway and has connection by rail with all the important towns of industrial northern England. The Sir John Ramsden's canal links it, by water, with the Calder Navigation, giving water communication with the extensive canal system of Lancashire and Yorkshire.

Huddersfield (*Odersfelte*) rose to importance only after the introduction of the woollen trade in the 17th century. After the Conquest, William I granted the manor to Ilbert de Lacy, of whom the Saxon tenant Godwin was holding as underlord at the time of the Domesday Survey. From the Lacys it passed to Thomas Plantagenet, duke of Lancaster, through his marriage with Alice de Lacy, and so to the crown, on the accession of Henry IV. In 1599 Queen Elizabeth sold it to William Ramsden, whose descendants still own it To John Ramsden, in 1670, Charles II. granted a market in Huddersfield to be held every Wednesday. By the beginning of the 18th century Huddersfield had become a "considerable town," chiefly owing to the manufacture of woollen kersies, and towards the end of the same century, trade was increased by two events—the opening of navigation on the Calder in 1780 and the completion of the cloth-hall or piece-hall, built and given to the town by Sir John Ramsden in 1784

The town is almost entirely modern, the chief buildings being great warehouses and business premises, built principally of grey stone. The parish church of St Peter was rebuilt in 1837 and is believed to occupy a site which has carried a church since the 11th century The cloth-hall dates from 1784, when it was erected as a clothiers' emporium, but it now serves as an exchange newsroom Huddersfield college was opened in 1838, the Longwood school was founded in 1731. There is a sulphurous spa in the district of Lockwood. Huddersfield is the chief seat of the fancy woollen trade in England, but plain and fancy woollen goods of every description, including worsteds, are manufactured there. Fancy goods in silk and cotton are produced in great variety. Coal is abundant in the vicinity and there are iron foundries, engineering works and silk and cotton spinning mills in the town. Since 1832 Huddersfield has had representation in parliament and returns one member. The town possesses no charter before 1868, when it was created a municipal borough. The county borough was created in 1888.

HUDSON, GEORGE (1800–1871), English railway financier, known as the "railway king," was born in York in March 1800 He helped to secure the passing of the York and North Midland bill, and was elected chairman of the new company—the line being opened in 1839. From this time he turned his undivided attention to the projection of railways In 1841 he initiated the Newcastle and Darlington line. With George Stephenson he planned and carried out the extension of the Midland to Newcastle, and by 1844 had over a thousand miles of railway under his control. In this year the mania for railway speculation was at its height, and no man was more courted than the "railway king." Deputy-lieutenant for Durham, and thrice lord mayor of York, he was returned in the Conservative interest for Sunderland in 1845. He was suddenly ruined by the disclosure of the Eastern Railway frauds. Sunderland clung to her generous representative till 1859, but on the bursting of the bubble he had lost influence and fortune at a single stroke. He died in London, on Dec. 14, 1871.

HUDSON, HENRY, English navigator and explorer. The first of his voyages in quest of new trade and a short route to China by way of the North Pole, in accordance with the suggestion of Robert Thorne (d. 1527), was made for the Muscovy company with ten men and a boy in 1607. Hudson first coasted the east side of Greenland, and sailed along the great ice barrier until he reached "Newland," as Spitsbergen was then called, and followed its northern coast to beyond 80° N. lat. On the homeward voyage he accidentally discovered an island in lat. 71° which he named Hudson's Touches, and which has since been identified with Jan Mayen island. Molineux's chart, published by Hakluyt about 1600, was Hudson's blind guide in this voyage, and the polar map of 1611 by Pontanus illustrates well what he attempted. He investigated the trade prospects at Bear island, and recommended his patrons to seek higher game in Newland; hence he may be called the father of the English whale-fisheries at Spitsbergen.

Next year Hudson was again sent by the Muscovy company to open a passage to China, this time by the north-east route between Spitsbergen and Novaya Zemlya. In this voyage (April 22–Aug 26) he raked the Barents sea in vain between 75° 30′ N.W. and 71° 15′ S.E. for an opening through the ice, and on July 6, "voide of hope of a north-east passage (except by the Waygats, for which I was not fitted to trie or prove)," he resolved to sail to the north-west, and if time and means permitted to run 100 leagues up Lumley's Inlet (Frobisher strait) or Davis's "overfall" (Hudson strait). But he was compelled to return without accomplishing his wish The Muscovy company thenceforward directed all its energies to the profitable Spitsbergen trade.

Towards the end of 1608 Hudson "had a call" to Amsterdam, where he saw the cosmographer Plancius and the cartographer Hondius, and, after some delay, undertook for the Dutch East India company his third voyage to find a passage to China either by the north-east or north-west route With a mixed crew of 18 or 20 men he left the Texel in the "Half-Moon" on April 6, and by May 5 was in the Barents sea, and soon afterwards among the ice near Novaya Zemlya. Some of his men becoming disheartened and mutinous, he submitted to them, as alternative proposals, either to go to Lumley's Inlet and follow up Waymouth's light, or to make for North Virginia and seek the passage in about 40° lat., according to the letter and map sent him by his friend Captain John Smith. The latter plan was adopted, and on May 14 Hudson set his face towards the Chesapeake and China He touched at Stromo in the Faroe islands for water; an accident (June 5) off Newfoundland compelled him to put into the Kennebec river. Sailing again on July 26, he began on Aug 28 the survey where Smith left off, at 37° 36′ according to his map, and coasted northwards On Sept 3, in 40° 30′, he entered the bay of New York, and after having gone 150 m up the river which now bears his name to near the position of the present Albany, treating with the Indians, surveying the country, and trying the stream above tide-water, he became satisfied that this course did not lead to the South seas or China. On Oct 4 the "Half-Moon" left for the Texel, and on Nov. 7 arrived at Dartmouth, where she was seized and detained by the English Government, Hudson and the other Englishmen of the ship being commanded not to leave England, but rather to serve their own country. The voyage exploded Hakluyt's myth, which from the publication of Lok's map in 1582 to the 2nd charter of Virginia in May 1609 he had lost no opportunity of promulgating, that near 40° lat. there was a narrow isthmus, formed by the sea of Verrazano, like that of Tehuantepec or Panama.

A new company was formed to support Hudson in a fourth attempt on the North-West passage, the principal promoters being Sir Thomas Smith (or Smythe), Sir Dudley Digges and John Wolstenholme. He determined this time to carry out his old plan of searching for a passage up Davis's strait. Hudson sailed from London in the little ship "Discovery" of 55 tons, on April 17, 1610, and entered the strait which now bears his name about the middle of June. Sailing steadily westward he entered Hudson bay on Aug. 3, and spent three months examining the eastern shore of the bay. On Nov. 1 the "Discovery" went into winter quarters in the S W. corner of James bay, being frozen in a few days later. On the ship breaking out of the ice in the spring Hudson had a violent quarrel with a young fellow named Henry Greene, who now retaliated by inciting the discontented part of the crew to put Hudson and eight others (including the sick men) out of the ship (June 22, 1611). Robert Bylot was elected master and brought the ship back to England. During the voyage home Greene and several others were killed in a fight with the Eskimo,

while others again died of starvation, and the remnant which reached England in September were thrown into prison. Nothing was ever heard of the deserted men

The four great geographical landmarks which to-day serve to keep Hudson's memory alive, namely the Hudson bay, strait, territory and river, had repeatedly been visited and even drawn on maps and charts before he set out on his voyages; but he carried his discoveries beyond the limits of his predecessors. The fisheries of Spitsbergen and the fur industry of the Hudson Bay Territory were the immediate fruit of his labours

See *Henry Hudson, the Navigator* (Hakluyt Society, 1860); T. A. Janvier, *Henry Hudson* (1909), L. Powys, *Henry Hudson* (1928).

HUDSON, SIR JEFFERY or **GEOFFREY** (1619–1682), English dwarf, was born at Oakham, Rutlandshire, in 1619 For the first 30 years of his life he measured only 18–20 in, though perfectly proportioned, but he then grew to 3 ft. 9 in. After the marriage of Charles I. and Henrietta Maria, Hudson was taken to court where he became a favourite of the queen. He led an adventurous life and is reputed to have held a commission as captain of horse during the Civil War He accompanied the queen to Paris, left after killing Crofts in a duel, was captured at sea and sold as a slave in Barbary. He escaped, and after the Restoration lived in retirement on a pension, to which the duke of Buckingham contributed He was arrested in 1679 on suspicion of complicity in the Popish Plot, and confined in the Gatehouse prison. He died in 1682, after his release Several portraits of him exist, of which that by Sir Ralph Mytens is at Hampton Court.

HUDSON, JOHN (1662–1719), English classical scholar, was born at Wythop in Cumberland He was educated at Oxford, where the remainder of his life was spent. In 1701 he was appointed Bodley's librarian, and in 1711 principal of St. Mary's hall. He died on Nov. 26, 1719. His works were chiefly editions of classical authors.

See Wood, *Athenae Oxonienses*, iv; introduction to the edition of Josephus, W. Hutchinson, *History of Cumberland* (1794).

HUDSON, WILLIAM HENRY (1841–1922), British naturalist and writer, was born at Quilmes, near Buenos Aires, on Aug 4, 1841, and remained on the pampas until 1874, when he came to England. From then the greater part of his life was spent in poverty, and marked by frequent ill-health. His wife, Emily, long kept a boarding-house in London, where Hudson too lived, known to only a small circle of appreciative friends. A civil list pension granted in 1901 aided him somewhat, but he relinquished this when belated success reached him He died in London on Aug. 18, 1922, and was buried at Broadwater, Sussex. Hudson called himself a field naturalist, and though the charms of wild life made a pre-eminent appeal to his sincere observing mind, he was not without an understanding of simple human joys and sorrows This versatility of his sensitive nature is well instanced in his last work, *A Hind in Richmond Park*, published posthumously in 1922. His other writings include the memorable pictures of the South America of his youth, such as *The Purple Land* (1885); *A Crystal Age* (1887); *El Ombú* (1902); *Green Mansions* (1904); *Far Away and Long Ago* (1918); of the English countryside, such as *A foot in England* (1909); *A Shepherd's Life* (1910); *Dead Man's Plack* (1920); ornithological works, as his collaboration with P. L. Sclater in *Argentine Ornithology* (1888); and his own *British Birds* (1895); and *Birds of La Plata* (1920); and many pamphlets for the Society for Protection of Birds. A bird sanctuary with a decoration by Jacob Epstein was erected to his memory in Hyde Park, London, in 1925.

BIBLIOGRAPHY.—Hudson's collected works were published in London (24 vols, 1922–23). *See* G. F. Wilson, *A Bibliography of the Writings of W. H. Hudson* (1922); H. J. Massingham, *Untrodden Ways: Adventures among the Works of Hudson*, etc. (1923); Morley Roberts, *W. H. Hudson* (1924); and *Letters from W. H. Hudson to Edward Garnett* (1925).

HUDSON, a town of Middlesex county, Massachusetts, 28m. W. of Boston; on the Assabet river and served by the Boston and Maine railroad. The population in 1925 was 8,130. It has important manufactures of boots and shoes, rubber footwear, lasts, shoemaking machinery and accessories, worsted, webbing and knitted goods. The settlement here, dating from about 1699, was at first called Howe's Mills, and after 1800 Feltonville The shoe industry was established in 1816, and by 1860 the place was known throughout the east as a shoemaking centre

HUDSON, a city of New York, on the E. bank of the Hudson river, 114m above New York city, at the head of natural deep-water navigation; the county seat of Columbia county. It is served by the Boston and Albany and the New York Central railways, and by river steamers. The population was 11,755 in 1925 (81% native white). The city lies on sloping ground, commanding fine views of the Hudson and the Catskills beyond, with the Berkshires a few miles to the east It is the seat of the State Training school for girls Its diversified manufactures, including cement, ice tools and conveying machinery, ginger ale, power presses, marine equipment and knitted goods, in 1925 were valued at $4,924,802. Hudson was named after Hendrik Hudson, who (tradition says) landed here from the "Half Moon," proceeding on up the river by a smaller boat. For many years it was merely a landing, with two crude wharves and storehouses, called Claverack Landing Some Dutch settlers came in the middle of the 18th century, and in 1783 the place was colonized by an association of merchants and fishermen from Rhode Island, Nantucket, and Martha's Vineyard The present name was adopted in 1784 and the city was chartered in 1785. It was made a port of entry in 1790, and until the War of 1812 had a considerable foreign commerce and was the base of a large whaling fleet.

HUDSON BAY, an inland sea in the N E of Canada, extending from 78° to 95° W. and from 51° to 70° N. On the east it is connected with the Atlantic Ocean by Hudson Strait, and on the north with the Arctic Ocean by Fox Channel and Fury and Hecla Strait. Its southern extremity between 55° and 51° N. is known as James Bay. It is 590 m. in width, and 1,300 from south to north, including James Bay (350 m) and Fox Channel (350 m). The customary use of the term includes James Bay, but not Fox Channel. The average depth of water is about 70 fathoms, deepening at the entrance of Hudson Strait to 100 fathoms. James Bay is much shallower, and unfit for shipping save for a central channel leading to the mouth of the Moose river. The centre and west of the main bay are absolutely free from shoals, rocks or islands, but down its east coast extend two lines of small islands, one close to shore, the other at 70 to 100 m. distance, and comprising a number of scattered groups (the Ottawa Islands, the Sleepers, the Belchers, etc.).

Into Hudson and James Bays flow numerous important rivers, so much so that the water of the latter is rather brackish than salt Beginning at the north-west, the chief of these are Churchill, Nelson (draining Lake Winnipeg, and the numerous inland rivers of which it is the basin), Hayes (the old boat route of the *voyageurs* to Winnipeg), Severn, Albany, Moose, Nottaway, Rupert river (draining Lake Mistassini), East Main, Great Whale and Little Whale.

Save for some high bluffs on the east and north-east, the shores of the bay are low Around much of James Bay extend marshes and swampy ground Geologically the greater part of the Hudson Bay district belongs to the Laurentian system, though there are numerous outcrops of later formation; from Ordovician to Devonian on the south and west, and on the east coast a narrow belt of Animikie rocks, of which the islands are composed. Iron ores occur in the latter rocks. Spruce, balsam and poplar grow to a fair size as far as the northern limit of James Bay. Caribou, musk ox and other animals are still found in large numbers, and there is an abundance of feathered game—ducks, geese, loons and ptarmigan; hunting and fishing form the chief occupations of the Indians and Eskimo who live in scattered bands near the shore. The bay abounds with fish, of which the chief are cod and salmon. There are also porpoise and whales The last have long been pursued by American whalers, whose destructive methods have so greatly depleted the supply that the government of Canada is anxious to declare the bay a *mare clausum*.

Hudson Strait is about 450 m. long with an average breadth of 100 m., narrowing at one point to 45. Its shores are high and bold, rarely less in height than 1,000 ft., save on the coast

of Ungava Bay, a deep indentation on the south-east No islands or rocks impede navigation. Its depth is from 100 to 200 fathoms. Owing to the violence of the tides, which rise to a height of 35 ft, it never absolutely freezes over.

After three centuries of exploration, the navigability of Hudson Bay and Strait remains a vexed question To Canada it is one of great commercial interest, and numerous expeditions have been made and reports issued by the Geological Survey. From Winnipeg to Liverpool via Churchill is over 500 m less than via Montreal, and from Edmonton to Liverpool almost 1,000 m. less. Were navigation open for a sufficient time, such a route for the grain of the Canadian and American west would be of enormous advantage But heavy ice often drifts about in the strait Past the mouth flows a stream often over 100 m. wide, of berg and floe ice, carried by the Arctic current Owing to the proximity of the Magnetic Pole (in Boothia) the compass often refuses to work. For sailing ships, such as the Hudson's Bay Company has long employed, the season for safe navigation is from July 15 to Oct. 1 In over 200 years very few serious accidents have occurred to the company's ships within these limits It is claimed that specially built and protected steamers would be safe from June 15 till Nov. 1, and the problem may be solved by ice-breaking vessels of great power. The only good harbour available is Fort Churchill, at the mouth of the Churchill river, which is large and easy of access. Moose Factory (at the foot of James Bay) and York Factory (at the mouth of the Nelson) are mere roadsteads Marble Island, south of Chesterfield Inlet, where the whalers winter, is too far north for regular shipping

The Cabots entered the strait in 1498, and during the next century a series of Elizabethan mariners, but the bay was not explored until 1610, when Henry Hudson pushed through the ice and explored to the southern limit of James Bay

See Lieutenant Gordon, R N, *Reports on the Hudson's Bay Expeditions* (1884, 5, 6); William Ogilvie, *Exploratory Survey to Hudson's Bay in 1890* (Ottawa, 1891); R F. Stupart, *The Navigation of Hudson's Bay and Straits* (Toronto, 1904).

HUDSON FALLS, a village of Washington county, New York, on the Hudson river, 58m above Albany, adjoining Ft Edward on the south and Glens Falls on the north It is on federal highways 4 and 9, and is served by the Delaware and Hudson railway The population in 1925 was 6,266 It has ample water-power and important manufactures, producing annually some 20,000,000 rolls of wall-paper, thousands of tons of paper bags and pulp and other commodities The village was incorporated as Sandy Hill in 1810 The present name was adopted in 1910

HUDSON RIVER, situated entirely within the State of New York, U S A, has its source in the Adirondack mountains near Newcomb, Essex county, in 14 small lakes, 2,000 ft above tidewater, and having an area of about 6,000 acres The river flows generally south and empties into New York bay, distant about 250 m in a straight line and about 315 m measured along the course of the river. The principal tributary is the Mohawk river, which rises in Lewis county, N Y, flows southward to Rome, and thence east to the Hudson at Cohoes Above Troy, N.Y, the drainage basin is about 9,900 sq m, of which the drainage basin of the Mohawk constitutes about 40%. The fall in the upper portion of the river is very rapid The discharge at Troy varies within wide limits; the low water discharge is generally assumed at about 2,000 cu ft per second, but discharges as low as 1,500 cu ft per second have been observed The maximum observed flow was 240,000 cu ft per second The Hudson is tidal from its mouth to the U S dam at Troy The mean range of tide is 4 4 ft at the Battery (New York city), 3·3 ft at Albany, and slightly less at Troy. In its natural state the 21 m section of the river below Troy was exceedingly tortuous and unstable with a minimum depth of 4 ft at mean low water above Albany and 7½ ft below. Improvement for navigation was commenced by the State of New York in 1797 Between 1834 and 1890 the Federal Government and the State of New York simultaneously improved the river, but since 1890 the Federal Government alone has continued the improvement The controlling depth between Troy and Hudson is about 11½ feet. Below Hudson, a natural depth of 27 ft. or more exists except for a few shoals near New Germantown, on which there is a depth of 25 feet. The lower portion of the Hudson, called the North river, forms a part of New York harbour and has been improved to a depth of 40 ft. Fast river steamers with a maximum draught of 11 ft. carry passengers and package freight between New York and Albany, stopping at intermediate ports Bulk freight is largely carried in barges and canal boats, the greatest number of which draw 10 ft. or less The New York State barge canal, entering the Hudson river via the Mohawk, provides a waterway for barge traffic between New York city and the Great Lakes with terminals at Oswego on Lake Ontario, and Tonawanda and Buffalo on Lake Erie This canal carries a large and important commerce There is also a waterway for small boats and barges from the Hudson to the lower St Lawrence by way of the Champlain canal, Lake Champlain, and the Richelieu river and Chamblay canal This waterway is now little used. Poughkeepsie, N Y, which is the farthest port upstream on the Hudson river to which ocean-going vessels now go, is a very important distributing centre for Pacific coast lumber brought through the Panama canal The commerce at Poughkeepsie was about 165,000 tons in 1926 The U S Congress has authorized the improvement of the river to provide a depth of 27 ft from the upper limits of New York harbour to Albany, N Y, and work on this project was being prosecuted vigorously in 1928 Albany, already a very important railroad centre, is expected to become one of the great inland ports and trans-shipment points in the country The principal ports and cities on the river above New York city are Yonkers, Tarrytown, Nyack, Ossining, Haverstraw, Peekskill, West Point, Newburgh, Poughkeepsie, Kingston, Catskill, Hudson, Albany, Troy, Cohoes and Glens Falls Above Troy there are numerous falls and rapids which are used as a source of the power which serves many busy manufacturing centres The New York Central and Hudson River railroad parallels the river on the east bank between New York and Albany, and the West Shore railroad on the west bank Excursion boats and passenger steamers make regular trips between New York and Albany or Troy, stopping at intermediate points

History.—Verrazano proceeded a short distance up the Hudson by boat in 1524, but the first European to demonstrate its extent and importance was Henry Hudson (*q v*), from whom the river derives its name The Dutch later settled the valley During the early days of colonization and settlement by the Dutch and later by the English, the valley of the Hudson provided a natural highway to Canada via the Lake George, Lake Champlain route, and to western New York via the Mohawk valley During all of the early wars on the North American continent, the valley was a region of great strategic importance It has been used in exploration, in war and in commerce Water transportation on the river itself and later on via the Erie canal to the Great Lakes played a most important part in determining the location and building up of the great commercial, industrial and trans-shipment centres at the mouth in the New York city area.

The valley of the Hudson has been the scene of many important historical events During the Revolutionary War, an enormous chain was stretched across the river between Gee's Point and Constitution island to prevent the passage of British ships Benedict Arnold, while military commander of the forts in this locality, planned to surrender them to the British. He made his escape from his quarters on the east bank near the site of the village of Garrison to a British ship anchored in the river below. Fulton made his first successful experiments with steam navigation on the Hudson river. Washington Irving, who is buried in Sleepy Hollow cemetery, has memorialized the valley in his stories A highway bridge crosses the river at Bear Mountain park located on the river just below the naval station at Iona island. This park is the summer playground of the people of New York city

Above Cornwall the valley slopes gently away from the river and the scenery, though not tame, cannot compare with the grandeur of the lower river The Catskill mountains are visible to the west. At Cornwall the river enters the northern portals of the highlands between a series of hills, whose precipitous sides often rise abruptly from the water's edge. For about 16 m. the river

scenery is magnificent. Below Peekskill the view from the river continues beautiful, but the banks are less precipitous. Beginning at Piermont on the west bank are the famous Palisades which extend some 13 m. along the river to the south. These rock cliffs rise precipitously to a height of over 500 ft. above the water. New York city, with its teeming millions and its enormous sky-scrapers is situated at the mouth of the river. A suspension bridge connecting New York city and Fort Lee on the New Jersey side was begun in 1928. Tunnels or tubes for the trains of the Pennsylvania railroad, inter-urban electric lines, and vehicles have been constructed under the North river connecting New York city with the New Jersey side. (E. JA.)

HUDSON'S BAY COMPANY, or "the Governor and Company of Adventurers of England trading into Hudson's Bay," a corporation formed for the purpose of importing into Great Britain the furs and skins which it obtains, chiefly by barter, from the Indians of British North America.

In 1670 Charles II. granted a charter to Prince Rupert and 17 other noblemen and gentlemen, incorporating them as the "Governor and Company of Adventurers of England trading into Hudson's Bay," and securing to them a monopoly of the trade of all lands watered by streams flowing into Hudson bay. Besides the complete lordship and entire legislative, judicial, and executive power, the corporation received also the right to "the whole and entire trade and traffic to and from all havens, bays, creeks, rivers, lakes, and seas into which they shall find entrance or passage by water or land out of the territories, limits, or places aforesaid." The first settlements in the country thus granted, which was to be known as Rupert's Land, were made on James bay and at Churchill and Hayes rivers; but it was long before there was any advance into the interior, for in 1749, when an unsuccessful attempt was made in parliament to deprive the company of its charter on the plea of "non-user," it had only some four or five forts on the coast, with about 120 regular employees. Although the commercial success of the enterprise was from the first immense, great losses were inflicted on the company by the French. After the cession of Canada to Great Britain in 1763, numbers of fur-traders spread over that country and began even to encroach on the Hudson's Bay Company's territories. These individual speculators finally combined into the North-West Fur Company of Montreal.

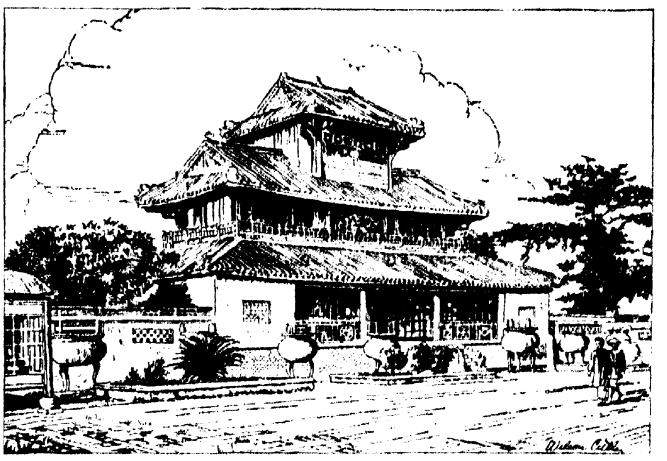
In the competition which arose between the companies the Indians were demoralized, body and soul, by the abundance of ardent spirits with which the rival traders sought to attract them to themselves; the supply of furs threatened soon to be exhausted by the indiscriminate slaughter, even during the breeding season, of both male and female animals; and the worst passions of both whites and Indians were inflamed to their fiercest (*see* RED RIVER SETTLEMENT). At last, in 1821, the companies amalgamated, obtaining a licence to hold for 21 years the monopoly of trade in the vast regions lying to the west and north-west of the older company's grant. In 1838 the Hudson's Bay Company acquired the sole rights for itself, and obtained a new licence, also for 21 years. On the expiry of this it was not renewed, and since 1859 the district has been open to all.

The licences to trade did not of course affect the original possessions of the company. Under the terms of the deed of surrender, dated Nov. 19, 1869, the Hudson's Bay Company surrendered all its rights of government, subject to certain terms and conditions, including the payment to the company by the Canadian Government of a sum of £300,000 sterling on the transfer of Rupert's Land to the Dominion of Canada, the retention by the company of its posts and stations, with a right of selection of a block of land adjoining each post in conformity with a schedule annexed to the deed of surrender; and the right to claim in any township or district within the fertile belt in which land is set out for settlement, grants of land not exceeding one-twentieth part of the land so set out. The boundaries of the fertile belt were fixed as follows: "On the south by the United States' boundary; on the west by the Rocky Mountains; on the north by the northern branch of the Saskatchewan; on the east by Lake Winnipeg, the Lake of the Woods, and the waters connecting them." In 1872 it was agreed that the one-twentieth of the lands in the fertile belt reserved to the company under the terms of the deed of surrender should be taken by "allotting in every fifth township two whole sections of 640 acres each, and in all other townships one section and three-quarters of a section each."

From this time little was done to develop the Company until just before the outbreak of the World War. During the period 1914–18 one part of the company with 300 steamers was engaged in food and munition transport for the French and Belgian Governments. From the end of the war the company began to develop rapidly; the annual reports show a steady increase in business done, and the company is opening new offices in territories hitherto untouched. Large stores are now complete in Winnipeg, Saskatoon, Calgary, Edmonton, Vancouver, and Victoria, and agreements have been made with the United States for the importation of furs to special centres. An experiment in reindeer farming in Baffin's Land failed; but efforts are being made elsewhere, with promises of success. For the past few years (to 1927) the company has ceased trading in Kamchatka and Siberia owing to the rapidly changing authority there.

See G. Bryce, *Remarkable History of the Hudson's Bay Company* (1900); and A. C. Laut, *Conquest of the great Northwest; being the story of the adventurers of England known as Hudson's Bay Co.* (1909); *Canadian Progress* (an annual publication), and the annual reports of the Hudson's Bay Company. (X.; A. N. J. W.)

HUÉ, a town of French Indo-China, capital of Annam, on the Hué river (Song-Huong-Giang) inaccessible to large ships, about 8 m. from its mouth in the China Sea. Pop. about 60,000, of whom only some hundreds are Europeans. The country immediately surrounding it is flat, alluvial land, traversed by streams and canals and largely occupied by rice fields. Beyond the plain rises a circle of hills formed by spurs of the mountains of Annam. Hué consists of a native market town and a European quarter in which the palace of the French resident general is situated, separated by the official Annamite part of the town. The latter contains the royal palace, the houses of the native ministers and officials, the arsenals, etc. The palace stands inside a separate enclosure. Glass- and ivory-working are carried on, but otherwise industry is of only local importance. Rice is imported by way of the river. A frequent service of steam launches connects the town with the ports of Thuan-an, at the mouth of the river, and Tourane, on the bay of that name. Tourane is also united to Hué by a railway opened in 1906. In the vicinity the chief objects of interest are the tombs of the dead kings of Annam.



ROYAL PALACE AT HUÉ, CAPITAL OF ANNAM, INDO-CHINA, SHOWING, IN FRONT OF THE BUILDING, THE URNS OF THE ANNAMITE DYNASTIES

HUE AND CRY, a phrase employed in English law to signify the old common law process of pursuing a criminal with horn and voice. It was the duty of any person aggrieved, or discovering a felony, to raise the hue and cry, and his neighbours were bound to turn out with him and assist in the discovery of the offender. In the case of a hue and cry, all those joining in the pursuit were justified in arresting the person pursued, even though it turned

out that he was innocent. A swift fate awaited any one overtaken by hue and cry, if he still had about him the signs of his guilt. If he resisted he could be cut down, while, if he submitted to capture, his fate was decided Although brought before a court, he was not allowed to say anything in self-defence, nor was there any need for accusation, indictment or appeal Although regulated from time to time by writs and statutes, the process of hue and cry continued to retain its summary method of procedure, and proof was not required of a culprit's guilt, but merely that he had been taken red-handed by hue and cry The various statutes relating to hue and cry were repealed in 1827 (7 and 8 Geo IV. c. 27). The Sheriffs Act, 1887, re-enacting 3 Edw. I c. 9, provides that every person in a county must be ready and apparelled at the command of the sheriff and at the cry of the county to arrest a felon, and in default shall on conviction be liable to a fine (*See* also HARO)

For the early history, *see* Pollock and Maitland, *History of English Law*, vol ii.; W. Stubbs, *Select Charters*

HUEHUETENANGO, a town in north-western Guatemala, capital of the province of the same name, 106 m. W N.W. of Guatemala city It is overwhelmingly Indian in population and is an important centre of the Guatemalan area known as "los altos" (the highlands) Pop (1920) 9,513. Huehuetenango is on the river Salega, and lies at an altitude of 7,050 feet. It enjoys a semi-tropical climate and is surrounded by a fertile agricultural country raising wheat, maize, potatoes, beans, melons, fruits, etc Sheep graze on the hills, and there is a considerable production of hand-woven woollens in ancient patterns used by the local villagers for their typical costumes and also in conventional tweed patterns which are sold in Guatemala city Coffee, cacao, sugar cane and tropical fruits are grown in neighbouring valleys Huehuetenango is reached by automobile from San Felipe, the nearest railway station, and from Quezaltenango (*q.v.*) and, via the latter city, from Guatemala city

The name, Huehuetenango means "Place of the Ancients" and the town is located close to the ruins of an ancient Indian centre called Zaculeu In Spanish times, the Dominican missionaries penetrated to Huehuetenango, and near by, at Chiantla, had a monastery richly equipped from the returns of a silver mine owned by the Dominicans and worked by the Indians, it was at one time one of the wealthiest religious communities in Central America. It was taken over by the government in 1873, and the mines were abandoned

HUELVA, a maritime province of south-western Spain, formed in 1833 of districts taken from Andalusia, and bounded on the north by Badajoz, east by Seville, south by the Gulf of Cadiz and west by Portugal. Pop. estimated (1925) 360,101; area 3,913 sq m The northern district is highland traversed in a south-westerly direction by the Sierra Morena, here known, in its main ridge, as the Sierra de Aracena. The south is a low-land maritime strip with flat waste lands (Las Marismas) in the south-east around the mouth of the Guadalquivir The lower reaches of the Guadalquivir and Guadiana are navigable and form respectively for some distance the south-eastern and south-western boundaries The Odiel and the Tinto both fall into the Atlantic by navigable *rias* or estuaries Huelva has a mild and equable climate, with abundant moisture and a fertile soil. In the northern highlands there are many oaks, pines, beeches, cork-trees and chestnut, while the lowlands afford excellent pasturage But agriculture and stock-breeding are here less important than in most Spanish provinces, although the exports comprise large quantities of fruit, oil and wine, besides cork and esparto grass. The headquarters of the fishing trades, which include the drying and salting of fish, are at Huelva, the capital, and Ayamonte on the Guadiana. There are numerous brandy distilleries, but the great local industry is the mining of copper manganese and iron. The well known Rio Tinto copper mines, near the sources of the Tinto, like those of Tharsis, 30 m. N.N.W of Huelva, were exploited from very early times and later by the Carthaginians, and Romans Saline and other mineral springs are common throughout the province. Huelva is the principal seaport, with railway connections with Seville and Mérida, while a network of narrow-gauge railways gives access to the chief mining centres. *See* also ANDALUSIA.

HUELVA (the ancient Onuba, Onoba or Onuba Aestuaria), the capital of the Spanish province of Huelva, about 10 m. from the Atlantic ocean, on the left bank of the river Odiel, and on the Seville-Huelva, Mérida-Huelva and Rio Tinto-Huelva railways, the last-named being a narrow-gauge line. Pop (1920) 34,437. Huelva is built on the western shore of a triangular peninsula formed by the estuaries of the Odiel and Tinto, which meet below the town Huelva was originally a Carthaginian trading-station, and afterwards a Roman colony. The colossal statue of Columbus was erected in 1892 to commemorate the fourth centenary of his voyage which began and ended in the village of Palos de la Frontera on the Tinto. Columbus resided in the neighbouring Franciscan monastery of Santa María la Rábida after his original plans for the voyage had been rejected by King John II. of Portugal in 1484 The present town is modern in appearance, and owes its prosperity to a transit trade in copper and other ores, for which it is the port of shipment After 1872, when the famous Rio Tinto copper mines were for the first time properly exploited, it progressed rapidly in size and wealth. Besides exporting copper, manganese and other minerals, Huelva is the headquarters of the sardine, tunny and bonito fisheries, and of a trade in grain, grapes, olives and cork The copper and cork industries are mainly in British hands, and the bulk of the imports, which consist chiefly of coal, iron and steel and machinery, comes from Great Britain Foodstuffs and Australian hardwood are also imported

HUÉRCAL OVERA, a town of south-eastern Spain, in the province of Almería, on the Lorca-Baza railway, and between two branches of the River Almanzora Pop (1920), 15,982. Huércal Overa is the chief town of a thriving agricultural district, largely dependent on the lead mining carried on among the surrounding highlands

HUESCA, a frontier province of northern Spain, formed in 1833 of districts previously belonging to Aragon; and bounded on the north by France, east and south-east by Lérida, south-west and west by Saragossa, and north-west by Navarre Pop. estimated (1925) 252,237; area 5,848 sq m The entire northern half of Huesca belongs to the mountain system of the Pyrenees, which here attain their greatest altitudes in Aneto, the highest point of the Maladetta ridge (11,168 ft.), and in Monte Perdido (10,998 ft.). The southern half forms part of the rugged and high-lying plateau of Aragon, with the Sierra de Alcubierre on the south-western border The whole province is included in the basin of the Ebro, and is drained by four of its principal tributaries—the Aragon in the north-west, the Gallego in the west, the Cinca in the centre, and the Noguera Ribagorzana along part of the eastern border These rivers rise among the Pyrenees, and take a southerly course; the two last-named unite with the Segre before joining the Ebro The Cinca receives the combined waters of the Alcanadre and Isuela on the right and the Esera on the left

The climate is influenced locally by the cold winds of the snow-capped Pyrenees and the continental conditions of the interior plateau.

Agriculture is facilitated by a fairly complete system of irrigation, by means of which much waste land has been reclaimed, although large tracts remain useless There is good summer pasturage on the mountains, where cattle, sheep and swine are reared The mountains are richly clothed with forests of pine, beech, oak and fir; and the southern regions, wherever cultivation is possible, produce abundant crops of wheat and other cereals, vines, mulberries and numerous other fruits and vegetables. The mineral resources include small quantities of argentiferous lead, copper, iron and cobalt, with salt, lignite, limestone, millstone, gypsum, granite and slate. The minerals are of little commercial value and there are many transport difficulties. Mineral springs are numerous. Timber, millstones, cattle, leather, and some brandy and wine are exported to France. The manufactures of Huesca are of little importance.

The Saragossa-Lérida-Barcelona railway traverses the province, and gives access, by two branch lines, to Jaca, by way of

Huesca, the provincial capital, and to Barbastro. Jaca is connected with Pau (France) by rail. Huesca and Jaca are episcopal cities. Fraga was an ancient residence of the kings of Aragon; there is a fine 12th century parish church and a ruined Moorish citadel. Monzon, the meeting-place of the Aragonese and Catalonian parliaments, is a town on the lower Cinca, with the ruins of a Roman fortification, and of a 12th century castle, which was owned by the Knights Templar. (*See* also ARAGON.)

HUESCA (anc. *Osca*), the capital of the Spanish province of Huesca, 35 m. N.N.E. of Saragossa, on the Tardienta-Huesca-Jaca railway. Pop. (1920), 13,921. Huesca occupies a height near the right bank of the river Isuela, overlooking a broad and fertile plain Strabo (iii. 161, where some editors read Ileosca) describes Osca as a town of the Ilergetes, and the scene of Sertorius's death in 72 B.C ; while Pliny places the Oscenses in *regio Vescitana*. Plutarch (*loc cit.*) calls it a large city. Julius Caesar names it Vencedora; and the name by which Augustus knew it, Urbs victrix Osca, was stamped on its coins, and is still preserved on its arms. In 1096 Pedro I. of Aragon regained it from the Moors, after winning the decisive battle of Alcoraz Huesca is an episcopal see and has an imposing Gothic cathedral, begun in 1400, finished in 1515, and enriched with fine carving. In the same plaza is the old palace of the kings of Aragon, formerly given up for the use of the now closed Sertoria (the university), so named in memory of a school for the sons of native chiefs, founded at Huesca by Sertorius in 77 B.C (Plut *Sert* 15) Huesca manufactures cloth, pottery, bricks and leather, but its chief trade is in the cereals, wine, fruit and vegetables produced in the Hoja.

HUET, PAUL (1804–1869), French landscape painter, was born in Paris on Oct 3, 1804 He forms a link between Georges Michel and Théodore Rousseau as one of the initiators of the "paysage intime" movement in France. His fiery, romantic temperament led him to endow trees and natural objects with the emotions which he himself experienced, and his paintings of Nature in her stormy aspects though admirably composed are apt to be over-dramatic in treatment. He died on Jan. 29, 1869

See Muther, *Hist of Modern Painting*, II. xxiv , Ernest Chesneau, *Peintres et statuaires romantiques* (1880), Léon Mancino, *Un précurseur* (*L'Art*, 1883, i 49), *Paul Huet d'après ses écrits, sa correspondance, ses contemporains*, documents recueillis par son fils, M. René Paul Huet (1911).

HUET (HUETIUS), PIERRE DANIEL (1630–1721), bishop of Avranches, French scholar, was born at Caen. He was educated at the Jesuit school of Caen, and also received lessons from the Protestant pastor, Samuel Bochart In 1652 Samuel Bochart took Huet with him to Stockholm This journey, in which he saw Leyden, Amsterdam and Copenhagen, as well as Stockholm, resulted in the discovery, in the Swedish royal library, of some fragments of Origen's *Commentary on St. Matthew*, which gave Huet the idea of editing Origen, a task he completed in 1668. He eventually quarrelled with Bochart, who accused him of having suppressed a line in Origen in the Eucharistic controversy. In Paris he entered into close relations with Chapelain. During the famous dispute of Ancients and Moderns Huet took the side of the Ancients against Charles Perrault and Desmarets Among his friends at this period were Conrart and Pellisson His taste for mathematics led him to the study of astronomy. He next turned his attention to anatomy, and, being himself short-sighted, devoted his inquiries mainly to the question of vision and the formation of the eye. In this pursuit he made more than 800 dissections. He then learned all that was then to be learned in chemistry, and wrote a Latin poem on salt All this time he was no mere book-worm or recluse, but was haunting the salons of Mlle. de Scudéry and the studios of painters; nor did his scientific researches interfere with his classical studies, for during this time he was discussing with Bochart the origin of certain medals, and was learning Syriac and Arabic under the Jesuit Parvilliers. He also translated the pastorals of Longus, wrote a tale called *Diane de Castro*, and defended, in a treatise on the origin of romance, the reading of fiction.

On being appointed assistant tutor to the Dauphin in 1670, he edited with the assistance of Anne Lefèvre, afterwards Madame Dacier, the well-known edition of the Delphin Classics This series was an edition of the Latin classics in about 60 volumes, and each work was accompanied by a Latin commentary and verbal index. Huet was admitted to the Academy in 1674. He issued one of his greatest works, the *Demonstratio evangelica*, in 1679. He took holy orders in 1676, and two years later the king gave him the abbey of Aulnay, where he wrote his *Questiones Alctuanae* (Caen, 1690), his *Censura philosophiae Cartesianae* (1689), his *Nouveau mémoire pour servir à l'histoire du Cartésianisme* (1692), and his discussion with Boileau on the Sublime In 1685 he was made bishop of Soissons, but after waiting for installation for four years he took the bishopric of Avranches instead. He exchanged the cares of his bishopric for what he thought would be the easier chair of the Abbey of Fontenay, but there he was vexed with continual law-suits At length he retired to the Jesuits' House in the Rue Saint Antoine at Paris, where he died in 1721 His great library and manuscripts, after being bequeathed to the Jesuits, were bought for the royal library

In the *Huetiana* (1722) of the abbé d'Olivet will be found material for arriving at an idea of his prodigious labours, exact memory and wide scholarship Another posthumous work was his *Traité philosophique de la faiblesse de l'esprit humain* (Amsterdam, 1723) His autobiography, found in his *Commentarius de rebus ad eum pertinentibus* (1718), has been translated into French and into English.

See de Gournay, *Huet, évêque d'Avranches* (1854).

HUFELAND, GOTTLIEB (1760–1817), German economist and jurist, was born at Danzig on Oct 19, 1760 He studied at Leipzig, Gottingen and Jena, and in 1788 was appointed to an extraordinary professorship at Jena Five years later he was made ordinary professor. He lectured on natural law, developing with great acuteness and skill the formal principles of the Kantian theory of legislation In 1803 Hufeland removed to Würzburg, and then to Landshut From 1808 to 1812 he acted as burgomaster in his native town of Danzig He died at Halle on Feb 25, 1817

Hufeland's works on the theory of legislation are marked by precision of statement and clearness of deduction. They form on the whole the best commentary upon Kant's *Rechtslehre*, the principles of which they carry out in detail, and apply to the discussion of positive laws. In political economy Hufeland's chief work is the *Neue Grundlegung der Staatswirthschaftskunst* (2 vols., 1807–13), the second volume of which has the special title, *Lehre vom Gelde und Geldumlaufe*. Hufeland was the first among German economists to point out the profit of the *entrepreneur* as a distinct species of revenue with laws peculiar to itself.

See Roscher, *Geschichte der National Ökonomik in Deutschland*

HUGEL, FRIEDRICH VON, BARON (1852–1925), Catholic theologian, son of Karl Von Hugel (1775–1870), baron of the Holy Roman Empire, was born on May 5, 1852 at Florence. In 1867 the family moved to England, and settled at Torquay. Von Hugel later became one of the most sympathetic, resourceful and persuasive religious teachers of his age. But while he possessed a generous sympathy for all seekers after truth, he held the Catholic Church to possess the fullest, richest and deepest realization of religion He accepted the papacy, but thought that Church government was overcentralized, believing that this tendency could be counteracted by the healthy interaction of energy between the head and the members of the whole body of believers. His relations with the Higher Criticism resulting from his Biblical scholarship led him to be classed with the Modernists, but when the crisis of Modernism was over he made it clear that he could not follow the Modernists who revolted from Rome, and that he rejected their theory of belief

In 1873 Von Hugel married Lady Mary Herbert, a daughter of Sydney Herbert (Lord Herbert of Lea). He died in London on Jan. 27, 1925, leaving his library to St Andrews university.

His works include· *The Mystical Element of Religion as studied in St. Catherine of Genoa and her Friends* (1908, new and rev. ed 1923); *Eternal Life, a Study of its Implications and Applications* (1912, 2nd ed. repr. 1913); *The German Soul in its Attitude towards Ethics and Christianity; The State and War* (1916); *Essays and Addresses on the Philosophy of Religion* (1921).

HUGGENBERGER, ALFRED (1867–), Swiss poet and novelist, was born at Bewangen (Canton Zurich) on Dec 26, 1867. Himself of peasant stock, he is one of the most masterly delineators of Swiss village life of to-day, both in prose and verse. Among his novels mention may be made of *Die Bauern von Steig* (1913), *Die Geschichte des Heinrich Lenz* (1915), *Der Kampf mit dem Leben* (1926), and *Die Frauen von Siebenacker* (1925) *Dorfgenossen* (1914) and *Von den Klemen Leuten* (1910) are characteristic specimens of his shorter tales His poetical power (at its best in the lyric) is well seen in *Lieder und Balladen* (1895), *Hinterm Pflug* (1908), *Die Stille der Felder* (1913), and *Lebenstreue* (1923) He has also written in dialect (Thurgovian), stories for children, and *Der Brunnen der Heimat* (1927), a volume of reminiscences.

See R. Hagni, *Alfred Huggenberger: Personlichkeit und Werk* (1927). (J. F M)

HUGGINS, SIR WILLIAM (1824–1910), English astronomer, was born in London on Feb 7, 1824, and was educated at the City of London school and then under private tuition Having determined to apply himself to the study of astronomy, he built in 1856 a private observatory at Tulse Hill, in the south of London. At first he occupied himself with ordinary routine work, but soon seized eagerly upon the opportunity for novel research offered by Kirchhoff's discoveries in spectrum analysis. The chemical constitution of the stars was the problem to which he turned his attention, and his first results, obtained in conjunction with Prof W A Miller, were presented to the Royal Society in 1863, in a preliminary note on the "Lines of some of the fixed stars" His experiments, in the same year, on the photographic registration of stellar spectra, marked an innovation of a momentous character But the wet collodion process was then the only one available, and its inconveniences were such as to preclude its extensive employment; the real triumphs of photographic astronomy began in 1875 with Huggins's adoption and adaptation of the gelatine dry plate which enabled the observer to make exposures of any desired length

In the last quarter of the 19th century spectroscopy and photography together worked a revolution in observational astronomy, and in both branches Huggins acted as pioneer Many results of great importance are associated with his name Thus in 1864 the spectroscope yielded him evidence that planetary and irregular nebulae consist of luminous gas On May 18, 1866, he made the first spectroscopic examination of a temporary star (Nova Coronae), and found it to be enveloped in blazing hydrogen In 1868 he proved incandescent carbon-vapours to be the main source of cometary light, and in the same year applied Doppler's principle to the detection and measurement of stellar velocities in the line of sight In solar physics Huggins showed that the form of the prominences could be observed spectroscopically. With Lady Huggins (*née* Margaret Lindsay Murray, who, after their marriage in 1875, actively assisted her husband) he produced calcium in the laboratory under such conditions that it gave a pair of lines identical with a pair in the solar spectrum whose origin before this had been uncertain Huggins was made K C B in 1897 and was an original member of the Order of Merit (1902). He was president of the British Association in 1891, and during the years 1900–05, president of the Royal Society, from which he at different times received a Royal, a Copley and a Rumford medal. Four of his presidential addresses were republished in 1906, in an illustrated volume entitled *The Royal Society* A list of his scientific papers is contained in chapter ii of the magnificent *Atlas of Representative Stellar Spectra*, published in 1899, by Sir William and Lady Huggins conjointly, for which they were adjudged the Actonian prize of the Royal Institution. His memoirs in the *Philosophical Transactions* and other journals were collected in his *Scientific Papers*, published in 1909. Sir William Huggins died on May 12, 1910 Lady Huggins died on March 24, 1915.

HUGH, called THE GREAT (d 956), duke of the Franks and count of Paris, son of King Robert I of France (d. 923) and nephew of King Odo or Eudes (d 898), was one of the founders of the power of the Capetian house in France Hugh's first wife was Eadhild, a sister of the English king, Aethelstan. At the death of Raoul, duke of Burgundy, in 936, Hugh was in possession of nearly all the region between the Loire and the Seine, corresponding to the ancient Neustria, with the exception of the territory ceded to the Normans in 911 He took a very active part in bringing Louis IV. (d'Outremer) from England in 936, but in the same year Hugh married Hadwig, sister of the emperor Otto the Great, and soon quarrelled with Louis. Hugh even paid homage to Otto, and supported him in his struggle against Louis When Louis fell into the hands of the Normans in 945, he was handed over to Hugh, who released him in 946 only on condition that he should surrender the fortress of Laon. At the council of Ingelheim (948) Hugh was condemned, under pain of excommunication, to make reparation to Louis who had made an alliance with Otto It was not, however, until 950 that the powerful vassal became reconciled with his suzerain and restored Laon. But new difficulties arose, and peace was not finally concluded until 953 On the death of Louis IV. Hugh was one of the first to recognize Lothair as his successor, and, at the intervention of Queen Gerberga, was instrumental in having him crowned (Nov. 12, 956). In recognition of this service Hugh was invested by the new king with the duchies of Burgundy (his suzerainty over which had already been nominally recognized by Louis IV) and Aquitaine But his expedition in 955 to take possession of Aquitaine was unsuccessful In the same year, however, Giselbert, duke of Burgundy, acknowledged himself his vassal and betrothed his daughter to Hugh's son Otto At Giselbert's death (April 8, 956) Hugh became effective master of the duchy, but died soon afterwards, on June 17, 956

HUGH CAPET (*c* 938–996), king of France and founder of the Capetian dynasty, was the eldest son of Hugh the Great by his wife Hadwig When his father died in 956 he succeeded to his numerous fiefs around Paris and Orleans, and his cousin, the Frankish king Lothair, recognized him somewhat reluctantly as duke of the Franks Many of the counts of northern France did homage to him as their overlord, and Richard I , duke of Normandy, was both his vassal and his brother-in-law His authority extended over certain districts, south of the Loire, and, owing to his interference, Lothair was obliged to recognize his brother Henry as duke of Burgundy Hugh supported his royal suzerain when Lothair and the emperor Otto II fought for the possession of Lorraine; but chagrined at the king's conduct in making peace in 980, he went to Rome to conclude an alliance with Otto Laying more stress upon independence than upon loyalty, Hugh appears to have acted in a haughty manner toward Lothair, and also towards his son and successor Louis V ; but neither king was strong enough to punish this powerful vassal When Louis V died without children in May 987, Hugh and the late king's uncle Charles, duke of Lower Lorraine, were candidates for the vacant throne, and in this contest the energy of Hugh's champions, Adalberon, archbishop of Reims, and Gerbert, afterwards Pope Sylvester II., prevailed. Declaring that the Frankish crown was an elective and not an hereditary dignity, Adalberon secured the election of his friend, and crowned him, probably at Noyon, in July, 987.

The authority of the new king was quickly recognized in his kingdom, which covered the greater part of France north of the Loire with the exception of Brittany, and in a shadowy fashion he was acknowledged in Aquitaine; but he was compelled to purchase the allegiance of the great nobles by large grants of royal lands, and he was hardly more powerful as king than he had been as duke Moreover, Charles of Lorraine was not prepared to bow before his successful rival, and before Hugh had secured the coronation of his son Robert as his colleague and successor in December 987, he had found allies and attacked the king. Hugh was worsted during the earlier part of this struggle, and was in serious straits, until he was saved by the wiles of his partisan Adalberon (*q.v*) bishop of Laon, known as Asselin, who in 991 treacherously seized Charles and handed him over to the king. This capture virtually ended the war, but one of its side issues was a quarrel between Hugh and Pope John XV , who was supported by the empire, then under the rule of the empresses Adelaide and Theophano as regents for the young emperor Otto III.

In 987 the king had appointed to the vacant archbishopric of Reims a certain Arnulf, who at once proved himself a traitor to Hugh and a friend to Charles of Lorraine. In June 991, at the instance of the king, the French bishops deposed Arnulf and elected Gerbert in his stead, a proceeding which was displeasing to the pope, who excommunicated the new archbishop and his partisans Hugh and his bishops remained firm, and the dispute was still in progress when the king died at Paris on Oct 24, 996

Hugh was a devoted son of the church, to which, it is not too much to say, he owed his throne. As lay abbot of the abbeys of St. Martin at Tours and of St. Denis he was interested in clerical reform, was fond of participating in religious ceremonies, and had many friends among the clergy. His wife was Adelaide, daughter of William III., duke of Aquitaine, by whom he left a son, Robert, who succeeded him as king of France The origin of Hugh's surname of *Capet*, which was also applied to his father, has been the subject of some discussion. It is derived undoubtedly from the Lat. *capa, cappa*, a cape, but whether Hugh received it from the cape which he wore as abbot of St. Martin's, or from his youthful and playful habit of seizing caps, or from some other cause, is uncertain.

See Richerus, *Historiarum libri IV.*, edited by G Waitz (Leipzig, 1877); F. Lot, *Les Derniers Carolingiens* (1891), and *Études sur le règne de Hugues Capet* (1903); G Monod, "Les Sources du règne de Hugues Capet," in the *Revue historique*, tome xxvii (Paris, 1891); P Viollet, *La Question de la légitimité à l'avènement à Hugues Capet* (1892); and E. Lavisse, *Histoire de France*, tome ii. (1903–05).

HUGH DE PUISET (*c* 1125–1195), bishop of Durham, was the nephew of Stephen and Henry of Blois; the latter brought him to England and made him an archdeacon of the see of Winchester Hugh afterwards became archdeacon and treasurer of York In 1153 he was chosen bishop of Durham, in spite of the opposition of the archbishop of York; but he only obtained consecration by making a personal visit to Rome. Hugh remained neutral, as far as he could, in the quarrel between Henry and Becket, but he at least connived at the rebellion of 1173 and William the Lion's invasion of England in that year After the failure of the rebellion the bishop was compelled to surrender Durham, Norham and Northallerton to the king In 1179 he attended the Lateran Council at Rome, and in 1181 by the pope's order he laid Scotland under an interdict In 1184 he took the cross At the general sale of offices with which Richard began his reign (1189) Hugh bought the earldom of Northumberland The archbishopric of York had been vacant since 1181 This vacancy increased Hugh's power vastly, and when the vacancy was filled by the appointment of Geoffrey he naturally raised objections. This quarrel with Geoffrey lasted till the end of his life Hugh was nominated justiciar jointly with William Longchamp when Richard left the kingdom But Longchamp soon deprived the bishop of his place (1191), imprisoned him, and forced the surrender of his castle, his earldom and hostages Hugh was compelled to acknowledge Geoffrey of York as his ecclesiastical superior in 1195 Combining in his own hands the palatinate of Durham and the earldom of Northumberland, Hugh held a position not much dissimilar to that of the great German princes, a local sovereign in all but name.

See Kate Norgate's *England under the Angevin Kings* (1887); Stubbs's preface to Hoveden, iii.

HUGHES, ARTHUR (1832–1915), English painter, was born in London on Jan. 27, 1832 In 1846 he studied at the art school at Somerset House, under Alfred Stevens, and later entered the Royal Academy schools. He met Millais and Holman Hunt, and became one of the pre-Raphaelite group of painters He also became widely known as an illustrator. He died at Kew Green on Dec. 22, 1915.

HUGHES, CHARLES EVANS (1862–), American lawyer and statesman, was born at Glens Falls, New York, on April 11, 1862. He attended Madison (now Colgate) university (1876–78), whence he proceeded to Brown university where he was awarded the Dunn Premiums for excellence in English literature and general excellence (B.A., 1881; M.A. 1884). He then taught at Delhi, N.Y., studying law in his leisure. In 1882 he entered the Columbia Law school, taking his LL.B. degree in 1884 and obtaining a prize fellowship of three years' duration In the same year he was admitted to the New York bar and engaged in practice until his appointment in 1891 as professor of law at Cornell university, a position which he resigned in 1893 in order to resume practice He continued, however, to maintain his connection with Cornell in the capacity of special lecturer, and was a special lecturer at the New York Law school from 1893 to 1900 In 1905 he was counsel for the Stevens Gas and Electric Lighting Commission appointed by the State legislature to investigate the cost of gas In the same and following year he acted as counsel for the Armstrong Life Insurance Commission which investigated the affairs of the life insurance companies operating under State charters In 1906 he was retained by the Federal Government to investigate alleged violation of the Sherman law by the coal-carrying roads In the same year, as nominee of the Republican Party for governor of the State of New York, he was elected by 57,897 votes over William Randolph Hearst, being the only successful candidate on the Republican ticket, and was re-elected in 1908 His régime as governor was distinguished by the initiation of far-reaching reforms both legal and administrative, including the formation of a Public Service commission, legislation protecting women and children in factories and stricter election laws By his efforts also pool-selling and book-making on race tracks were placed in the same category as other forms of gambling He resigned on Oct 6, 1910, being appointed associate justice of the U S Supreme Court by President Taft

He remained on the Supreme Court bench for six years His contributions on constitutional questions were always masterly particularly those which he rendered in the "State Rate Cases," which involved the line of division of State and Federal sovereignty in the field of railway regulation (See *Minnesota Rate Cases*, 230 U S R 352)

In 1912 he had refused to be a candidate for the presidency, but on his nomination, June 10, 1916, by the Republican national convention in Chicago, he accepted and resigned from the Supreme Court President Woodrow Wilson was renominated by the Democrats. The electoral vote was 277 for Wilson against 254 for Hughes The popular vote was 9,129,606 for Wilson against 8,538,221 for Hughes The following year he again entered upon the practice of law in New York city In 1917 he was appointed chairman of the Draft Appeals board of New York city, and in 1918 he acted as special assistant to the U.S. attorney general in charge of the investigation of alleged waste and delay in the construction of aircraft

On the inauguration of President Harding, on March 4, 1921, he became the secretary of State The Soviet Government approached him in his first month of office asking that the United States should resume trade relations with Russia, but he promptly rejected the Soviet proposals Later on M Chicherin communicated with him with a view to recognition by the United States of the Soviet republic, but this also was refused on Dec 19, 1923 In 1921 Hughes, under authorization by President Harding, sent out invitations suggesting a conference on the limitation of armaments The conference was held—Hughes being chief U S delegate and chairman—with the result that seven treaties were negotiated relating to limitation of naval armaments, the fortification of islands in the Pacific and relations between China and other Powers. (*See* WASHINGTON CONFERENCE)

In a speech at New Haven in Dec 1922 Hughes dealt with the matter of German reparations, and unofficially suggested a committee of experts to investigate. This was the genesis of the committee which ultimately prepared what is known as the Dawes Plan. (*See* REPARATIONS) The Tacna-Arica dispute afforded another instance of his intervention on behalf of peace. (*See* TACNA-ARICA QUESTION.)

Hughes's attitude in respect of foreign affairs was well set forth in an address entitled "The Pathway of Peace," delivered by him before the Canadian Bar Association on Sept. 4, 1923. "The League of Nations," he said, "by its constitution presupposed that peace could be maintained by economic pressure and military force." He dissented from this, since he believed that there was no path to peace except as the will of peoples might open it. The

way to peace was through agreement, not force. He was in favour of the adherence of the United States to the World Court of International Arbitration. The judicial impartiality of Hughes's character fitted him admirably to succeed in handling the international problems confronting him as secretary of State, but his personality was not magnetic, and he was incapable of arousing enthusiasm even in the ranks of his own party.

He resigned office on March 4, 1924, retired from active politics, and resumed practice at the bar. In 1925 he acted as chairman of the New York State Reorganization Commission, appointed to investigate the structure of the State Government. The commission reported on March 1, 1926, urging that the 180 State bureaux and departments be merged into 18 and that an executive budget system be introduced, and these recommendations were subsequently carried into effect by the State legislature. He was appointed by President Coolidge on Oct 1, 1926, U.S. member of The Hague Court of Arbitration. Early in that year steps were taken to bring his name forward again for the Presidency, which he discouraged, saying that he was too old. Later on he announced definitely that he would not be a candidate. Having been appointed special master of the U S Supreme Court to enquire into the diversion of the water from Lake Michigan by the Chicago sanitary district he brought in a report on Nov 24, 1927, upholding the rights of Chicago and advising the interested States to withdraw from their litigation He was appointed chief of the U S delegation to the sixth Pan-American conference, which was held at Havana on Jan 16 to Feb 20, 1928 Declining the chairmanship, he was elected vice-president, and became a powerful factor in assuaging the jealousies and compromising the conflicting claims of the various countries represented, at the same time impressing upon the conference that the policy of the U S in Latin-American affairs was in no sense aggressive In Sept 1928 he was appointed a judge of the Permanent Court of International Justice

C. E. Hughes has delivered numerous addresses on political, patriotic and historical subjects, a number of which were subsequently reproduced in pamphlet form In addition, he has published *Addresses and Papers* (1908); *Conditions of Progress in Democratic Government* (Yale Lectures, 1910); *Addresses 1906–16* (1916); *Foreign Relations* (1924); *The Pathway of Peace* (1925); and *The Supreme Court of the United States· Its Foundation, Methods and Achievements* (1928); *Our Relations to the Nations of the Western Hemisphere* (1928). *See* also *Public Papers of C. E. Hughes, Governor, 1907–1910* (1907–10). (H W. H. K)

HUGHES, DAVID EDWARD (1831–1900), Anglo-American electrician, was born on May 16, 1831, in London, but the earlier part of his life was spent in America, whither his parents emigrated when he was about seven years old In 1850 he became professor of music at the college of Bardstown, Kentucky, and soon afterwards teacher of natural philosophy at the same place, but resigned in 1854 In 1855 he took out a patent in the United States for his type-printing telegraph instrument Its success was immediate and in 1867 Hughes brought it over to Europe In the succeeding ten years it came into extensive use all over Europe, gaining for its inventor numerous honours and prizes. Hughes played an important part in the development of telephony; his microphone was the forerunner of the various forms of carbon transmitter in general use Continuing his experiments with his microphonic joints, Hughes discovered the phenomena on which depends the action of the so-called "coherers" used in wireless telegraphy. Hughes, who is also known for his invention of the induction balance and for his contributions to the theory of magnetism, died in London on Jan. 22, 1900

HUGHES, SIR EDWARD (*c.* 1720–1794), British admiral, entered the Royal Navy in 1735, and four years later was present at Porto Bello. In 1740 he became lieutenant, and in that rank served in the Cartagena expedition of 1741, and at the indecisive battle of Toulon (1744). From that time he was almost continuously employed on active service. He was with Boscawen at Louisburg and with Saunders at Quebec. As Commodore he commanded in the East Indies from 1773 to 1777 It was not long before he returned to the East as a rear-admiral, with an overwhelming naval force. On his outward voyage he retook Goree from the French. In 1782 he stormed Trincomalee a few days before the squadron of Suffren arrived in the neighbourhood. In 1783 Suffren (*q.v.*) was perhaps the ablest sea-commander that France ever produced, but his subordinates were factious and unskilful; Hughes, on the other hand, whose ability was that born of long experience rather than genius, was well supported. Five fiercely contested general actions were fought by the two fleets, neither of them gaining a decisive advantage In the end Hughes held his ground. After the peace he returned to England. He died at Luxborough, Essex, in 1794.

HUGHES, HUGH PRICE (1847–1902), British Nonconformist divine, was born at Carmarthen on Feb. 8, 1847, the son of a surgeon. He established in 1887 the West London mission, holding popular services on Sunday in St. James's hall, Piccadilly, when he preached from time to time on the housing of the poor, sweating, gambling and other subjects of social interest. In connection with this mission he founded a sisterhood to forward the social side of the work, which was presided over by Mrs Hughes. He had started in 1885 the *Methodist Times,* and rapidly made it a leading organ of Nonconformist opinion He was a born fighter, and carried the fire and eloquence he showed on the platform and in the pulpit into journalism. He supported W. T. Stead in 1885, as he had earlier supported Mrs. Josephine Butler in a similar cause; he attacked the trade in alcohol, was an anti-vivisectionist; he advocated arbitration; and his vehement attacks on Sir Charles Dilke and Charles Stewart Parnell originated the phrase the "Nonconformist conscience" He differed strongly from a large section of Nonconformist opinion in his defence of the South African War. In 1898 he was president of the Wesleyan Conference His energies were largely devoted to co-operation among the various Nonconformist bodies, and he was one of the founders and most energetic members of the National Council of the Evangelical Free Churches He died in London on Nov 17, 1902

See his *Life* (1904) by his daughter, Dorothea Price Hughes.

HUGHES, JOHN (1677–1720), English poet and miscellaneous writer, was born at Marlborough, Wiltshire He died on the night of the production of his most celebrated work, *The Siege of Damascus,* Feb. 17, 1720 Hughes wrote some of the libretti of the cantatas (2 vols, 1712) set to music by Dr John Christopher Pepusch Others of his pieces were set to music by Ernest Galliard and by Handel. In the masque of *Apollo and Daphne* (1716) he was associated with Pepusch, and in his opera of *Calypso and Telemachus* (1712) with John E Galliard Hughes's version of the *Letters of Abelard and Heloise* . . (1714) is notable as the basis of Pope's "Eloisa to Abelard" (1717).

His *Poems on Several Occasions, with some Select Essays in Prose* . . were edited with a memoir in 1735, by William Duncombe, who had married his sister Elizabeth. *See* also *Letters by several eminent persons* (2 vols, 1772) and *The Correspondence of John Hughes, Esq. . . . and Several of his Friends* . . . (2 vols, 1773), with some additional poems.

HUGHES, JOHN (1797–1864), American Roman Catholic divine, was born in Annaloghan, county Tyrone, Ireland, on June 24, 1797. He followed his father to Chambersburg, Pa, and was ordained deacon in 1825 and priest in 1826 He opposed the lay trustee system in Philadelphia where he served in several churches. In the New York diocese he was consecrated coadjutor to Bishop Dubois in 1838, bishop in 1842, and first archbishop in 1850, and worked against the lay trustee system and for State support for parochial schools. At all times he constituted himself a defender of his faith against miscellaneous attacks of Protestant clergy and the "Native American" and "Know-Nothing" agitations of 1844 and 1854. He was equally ready, however, to denounce sources of weakness within the Church as is shown by his attack in 1856 on three classes of Roman Catholic papers which he considered injurious. During the Civil War his ardent attachment to the Union resulted in his going to France to counteract the influence of the Slidell mission and was productive of good feeling towards the North both in Rome and Ireland. The establishment of St. John's college (now Fordham university) in 1841 largely with funds collected by him in Europe is one of his most constructive achievements He died in New York city on Jan. 3, 1864. His reputation as a member of the Church militant he himself explained on the

ground that "the circumstances by which I have been surrounded, and the character of the country and people with whom I had to deal, did not allow me to use, at all times, that meek and apostolic spirit which is so appropriate and beautiful."

His works were edited by Laurence Kehoe (1864–65). Good biographies were prepared by J. G. Hassard (1865) and H. A. Brann (1892).

HUGHES, SIR SAM (1853–1921), Canadian soldier and politician, was born at Darlington, Ont on Jan 8, 1853 In the Fenian raids of 1870 he served with the Canadian volunteer militia, and in 1873 was gazetted to the 45th Regiment. Educated at Toronto University, he lectured at a Toronto collegiate institute until 1885, when he took up journalism, being editor and proprietor of the Lindsay *Warder,* 1885–97 In 1892 Hughes was elected to the Dominion parliament, but service in the South African War interrupted his political career. Returning to Canada after the coronation of King George V in 1911, he became minister of militia and defence, and was chiefly responsible for the creation of the overseas force which sailed for Europe in 1914 In 1915 Hughes was created K C.B and promoted major-general, but in the following year disagreements with Sir Robert Borden resulted in his resignation Hughes criticized severely the strategy and leadership of Sir Arthur Currie In July 1921 he announced his intention of retiring from parliament, and he died at Lindsay, Ont , on Aug 24, 1921

HUGHES, THOMAS, English dramatist, a native of Cheshire, entered Queens' college, Cambridge, in 1571, and became a member of Gray's Inn. He wrote *The Misfortunes of Arthur, Uther Pendragon's son reduced into tragical notes by Thomas Hughes,* performed at Greenwich in the queen's presence on Feb 28, 1588. Nicholas Trotte provided the introduction, Francis Flower the choruses of Acts I and II , William Fulbeck two speeches, while three other gentlemen of Gray's Inn, one of whom was Francis Bacon, undertook the care of the dumb show. The argument of the play, based on a story of incest and crime, was borrowed, in accordance with Senecan tradition, from mythical history, in this case Geoffrey of Monmouth's *Historia Britonum.* Dr. W J. Cunliffe has proved that Hughes's memory was saturated with Seneca, and that the play may be resolved into a patchwork of translations, with occasional original lines

The Misfortunes of Arthur was reprinted in J. P. Collier's supplement to Dodsley's *Old Plays;* and by Harvey Carson Grumline (Berlin, 1900) who points out that Hughes's source was Geoffrey of Monmouth's *Historia Britonum,* not the *Morte D'Arthur*

HUGHES, THOMAS (1822–1896), English lawyer and author, second son of John Hughes of Donnington Priory, editor of *The Boscobel Tracts* (1830), was born at Uffington, Berks He was educated at Rugby school under Dr Arnold, and at Oriel college, Oxford. He was called to the bar in 1848, became Q C. in 1869, a bencher in 1870, and was appointed to a county court judgeship in the Chester district in July 1882. While at Lincoln's Inn he came under the dominating influence of his life, that of Frederick Denison Maurice. In 1848 he joined the Christian Socialists, under Maurice's banner, among his closest allies being Charles Kingsley. In Jan. 1854 he was one of the original promoters of the Working Men's College in Great Ormond Street, of which he became principal after Maurice's death. Hughes sat in parliament from 1865 to 1874, and introduced a trades union bill which, however, only reached its second reading On one of his visits to America in 1879 he planned a co-operative settlement, "Rugby," in Tennessee, which involved him in money losses In 1848 Hughes had married Frances, niece of Richard Ford, of Spanish *Handbook* fame They settled in 1853 at Wimbledon, and there was written his famous story, *Tom Brown's School Days* (1857) "by an Old Boy." *Tom Brown* did a great deal to fix the English concept of what a public school should be. Hughes also wrote *The Scouring of the White Horse* (1859), *Tom Brown at Oxford* (1861), *Religio Laici* (1868) and *Life of Alfred the Great* (1869). He died at Brighton on March 22, 1896.

HUGHES, WILLIAM MORRIS (1864–), Australian statesman, was born on Sept. 25, 1864, at Llansantffraid, Montgomeryshire, Wales. At the age of 20 he went to Australia Here he drove sheep and cattle across New South Wales and Queensland, worked on farms and cooked for harvesting gangs, became a sailor on coasting steamers, prospected for gold, tramped from station to station doing odd jobs, taught children in remote settlements, walked hundreds of miles organizing for the Australian Workers' Union, and in the end drifted back to Sydney and gravitated to politics He formed the Sydney waterside workers into a militant organization, and entered the New South Wales parliament in 1894 as member for the Lang division of Sydney

As a member of the Opposition Hughes was an effective debater, and devised the Labour party's caucus system of settling all internal dissensions outside the House and presenting a united front in parliament. Then in 1901 came federation, and as member for West Sydney in the first House of Representatives Hughes found wider scope for his political genius. In 1904 J C. Watson formed the first Labour ministry, and Hughes, who in the midst of his industrial and political work had found time to qualify as a barrister, became minister for external affairs. The ministry was short-lived, but thenceforth it was clear to friends and foes alike that a new force had entered Australian politics. During the years that followed Hughes became a powerful orator, and his courage, energy, intellectual gifts and dominating personality made his succession to Mr Fisher almost inevitable.

Hughes was attorney-general in the Fisher ministry of 1908, and revealed a breadth of view and a warm Imperialism hardly to be looked for in a party which, not so many years before, had toyed with the idea of "cutting the painter" He promoted the scheme of compulsory military service, and he was heart and soul with his leader when Fisher, who had returned to office after the Liberal defeat of 1913, made his historic offer in 1914 of Australia's last man and last shilling In 1915 Fisher went to London as high commissioner, and Hughes succeeded him as prime minister. Hughes, by his driving force and faculty of kindling enthusiasm, gave an immense stimulus to the raising and maintenance of the Australian Expeditionary Forces, and with equal energy he set to work to eradicate German commercial influence from Australia He secured legislation annulling German contracts, transferred control of output to the newly established Australian Metal Exchange, prevented trading with the enemy, and disinherited enemy shareholders in commercial enterprises of every kind

In 1916 he visited England and preached a renaissance of the British race based upon a greater development of the empire's resources and a closer-knit economic system. Returning to Australia he attempted to introduce conscription. On this issue the Labour party split, and Hughes formed a Coalition Government composed of the Liberals and that section of the Labour party which followed him on the conscription issue The conscription referendum, on which the Government was defeated, was marked by great bitterness, and there followed a period of industrial and political strife without parallel in Australia's history. Hughes was hotly attacked for his autocratic methods, for his excursions into State shipowning and shipbuilding, and for his policy of concentrating power in his own hands by means of the War Precautions Act, the establishment of boards to control industry, and the appointment of special tribunals to settle industrial disputes over the head of the Arbitration Courts. But so long as the War lasted there was no acceptable alternative leader, and the prime minister left to attend the Peace Conference with his prestige higher than ever. His assertion of Australia's right to proclaim something rather like a Monroe Doctrine for the Pacific awakened Americans and the world to the importance of Australasia, and at Versailles his dogged advocacy of the Commonwealth's right to a mandate over the former German colony of Papua, helped to make history. His quarrel with President Wilson, embittered by mutual dislike, gave rise to some of the most piquant passages in the annals of the conference.

In Australia, on his return, Hughes found grave industrial troubles disturbing a country already weighed down by an immense load of debt and the problem of reabsorbing 400,000 men into civil life But he could not prevent discontent revealing itself in the secession of certain Liberal-Nationalists and the formation of a new Country party. As the conditions which had brought it

into existence disappeared, the war party which he led began to crumble, and in Feb. 1923, after holding office as prime minister for eight years, he was forced by a Liberal-Country party coalition to resign in favour of the treasurer, S M. Bruce.

(G C Di ; X.)

HUGH OF LINCOLN, ST. (*c* 1140–1200), bishop of Lincoln, was born of a noble family at Avalon, in Burgundy He entered the canons regular at Villard-Benoît and about 1160 was appointed prior of a dependent cell. Later, however, he joined the monks of the Grande Chartreuse, and rising to the important office of procurator, he acquired a reputation for energy and tact which led Henry II. of England to request his assistance in establishing at Witham in Somersetshire the first English Carthusian monastery Hugh became the first prior, and under him the Charterhouse, a copy of the Grande Chartreuse, was completed In 1186 Henry procured his election to the see of Lincoln. There he let neither royal nor ecclesiastical influence interfere with his conduct, but fearlessly resisted any infringement of the rights of his church or diocese. Though himself an ascetic, he was noted for his kindness to the poor, to lepers and to Jews. In 1200 Hugh revisited his native country and on the return journey was seized with an illness, of which he died at London on Nov 16, 1200 He was canonized by Honorius III and his feast is celebrated on Nov. 17

The *Magna vita S Hugonis* was edited (1864) by J. F. Dimock, who also edited a *Metrical Life of St Hugh of Avalon* (1860) and *a Vita* by Giraldus Cambrensis (1877). *See* the *Vie de St. Hugues, évêque de Lincoln* (1140–1200) *par un religieux de la Grande Chartreuse* (Montreuil, 1890, Eng trans by H Thurston, S J , with valuable notes 1898), C L Marson, *Hugh, bishop of Lincoln* (1901) ; R M Woolley, *St Hugh of Lincoln* (1927). A complete bibliography is given in U. Chevalier, *Bio-bibliographie* (1905) , *see* also A. Potthast, *Bibliotheca med aev* , 1380

Another St Hugh of Lincoln was a child about ten years old when he was found dead on premises belonging to a Jew It was said that the boy had been scourged and crucified in imitation of the death of Christ, and many Jews were punished The incident is referred to by Chaucer in the *Prioresses Tale* and by Marlowe in the *Jew of Malta*

See J. Jacobs, *Little St. Hugh of Lincoln* (1884).

HUGH OF ST. CHER (*c* 1200–1263), French cardinal and Biblical commentator, was born at St Cher, near Vienne, and, while a student in Paris, became a Dominican in 1225. Later, as provincial of his order, he won the confidence of the popes Gregory IX , Innocent IV and Alexander IV., who charged him with several important missions Created cardinal-priest in 1244, he played an important part in the council of Lyons in 1245, contributed to the reform of the Carmelites (1247), and the condemnations of the *Introductorius in evangelium aeternum* of Gherardino del Borgo San Donnino (1255), and of William of St. Amour's *De periculis novissimorum temporum* He died at Orvieto on March 19, 1263 He directed the first revision of the text of the Vulgate begun in 1236 by the Dominicans; this first "correctorium," vigorously criticized by Roger Bacon, was revised in 1248 and in 1256, and forms the base of the celebrated *Correctorium Bibliae Sorbonicum* With others of his order he edited the first concordance of the Bible, *Concordantiae Sacrorum Bibliorum* or *Concordantiae S Jacobi* His *Postillae in sacram scripturam juxta quadruplicem sensum, litteralem, allegoricum, anagogicum et moralem* was published frequently in the 15th and 16th centuries, and his exegetical works appeared at Venice in 1754 in 8 vols.

See Quetif-Echard, *Scriptores ordinis praedicatorum;* Denifle, in *Archiv fur Litteratur und Kirchengeschichte des Mittelalters,* iv. *L'Année dominicaine,* iii. (1886) ; *Chartularium universitatis Parisiensis,* i.

HUGH OF ST. VICTOR (1096–1141), mystic philosopher and theologian, was born at Hartingam, Saxony. After spending some time in a house of canons regular at Hamersleben, in Saxony, where he took the habit, he went to the Abbey of St. Victor in Paris There he rose to be canon, in 1125 *scholasticus,* and perhaps even prior, and it was there that he died on March 11, 1141. Hugh initiated that mysticism of the school of St. Victor which filled the whole of the second part of the 12th century; but in reaction to the theories of Roscelin and Abelard, his mysticism was the orthodox system of a subtle and prudent rhetorician. In theology, he paved the way for the great *Summae* of the 13th century by his excellent dogmatic synthesis, entitled *De sacramentis:* Creation and restoration are the critical events in the history of the world. By the former the world was constituted, by the latter it regains its lost glory. The work of creation can be known by a study of the profane sciences; that of restoration is revealed in Holy Scriptures His sacramental teaching clarified many points later adopted by his successors Hugh did not profess the contempt for the profane sciences which his followers the Victorines expressed. His division of these sciences into theoretical, practical, mechanical and logical, and his moderate realism occupy a subordinate position to his interest in psychology Like Augustine, he starts from consciousness of the self, which he believes bears witness to the existence, the substantiality, and the spirituality of the soul. Knowledge of the self is the fruit of introspection, knowledge of the external world is the fruit of the zealous exercising of natural talent, and knowledge of God the fruit of contemplation. For Hugh the existence of God is provable both from internal and from external experience, especially that of the changeability of creatures

Besides the *De Sacramentis,* Hugh's chief works are the encyclopaedic *Didascalion,* the *De Unione corporis et spiritus,* the mystical treatises *De arca Noe morali, De arca Noe mystica, De vanitate mundi, De arrha animae, De amore sponsi ad sponsam,* etc , the commentaries on Scriptural books and on the *Celestial Hierarchy* of the Pseudo-Dionysius

The 1648 Rouen edition of his *opera* was reprinted in Migne's *Patrol Lat.,* vols 175–177 *See* B. Hauréau, *Les Oeuvres de Hugues de St. Victor* (1859; 2nd ed , 1886) ; article by H Denifle in *Archiv fur Literatur und Kirchengeschichte des Mittelalters,* iii (1887) ; A Mignon, *Les Origines de la Scholastique et Hugues de St. Victor* (1895) ; J Kilgenstein, *Die Gotteslehre des Hugo von St Victor* (1898) ; Ostler, *Die Psychologie des Hugo von St Viktor* (1906) , Pourrat, *La Theologie sacrammentaire* (1907) ; M Grabmann, *Die Gesch der Scholast Methods* (1909–11), and complete bibliography in Überweg, *Gesch. der Philosophie* (Bd ii. 1928).

HUGO, GUSTAV VON (1764–1844), German jurist, was born at Lörrach in Baden, on Nov 23, 1764 He became extraordinary professor of law at Gottingen in 1788, ordinary professor in 1792. In the preface to his *Beiträge zur zivilistischen Bücherkenntnis der letzten vierzig Jahre* (1828–29) he gives a sketch of the condition of the civil law teaching at Gottingen at that time He was the founder of that historical school of jurisprudence which was continued and further developed by Savigny. His *magna opera* are the *Lehrbuch eines zivilistischen Kursus* (7 vols , 1792–1821), in which his method is thoroughly worked out, and the *Zivilistisches Magazin* (6 vols., 1790–1837). He died at Gottingen on Sept. 15, 1844.

See Eyssenhardt, *Zur Erinnerung an Gustav Hugo* (1845).

HUGO, VICTOR MARIE (1802–1885), French poet and novelist, was the third son of Captain (subsequently General) Joseph Léopold Sigisbert Hugo by his wife Sophie, daughter of M. Trébuchet of Nantes. In the autobiographical notes which the poet dictated to his wife and which were published in 1863 under the title *Victor Hugo raconté par un témoin de sa vie,* a wholly apocryphal account of the origins of the Hugo family is given. History discloses only that the poet's grandfather, Joseph Hugo, was a carpenter at Nancy, that his great grandfather was a peasant-farmer in the Vosges. His mother's family were of Breton, and indeed Celtic origin, and the fact that Victor Hugo was thus "d'un sang breton et lorrain à la fois," may account for the curious blending in his character of imagination and insensitiveness, of recklessness and caution, of extravagance and parsimony. At the time of the poet's birth his father, who was suspected by Bonaparte of being a supporter of Moreau, had been relegated to the command of a battalion at Besançon. It was here, in the Maison Barette on the Place St. Quentin, that Victor Hugo was born on Feb. 26, 1802.

Victor Hugo's life divides itself into seven distinct though

unequal periods. There is his exciting Napoleonic childhood (1802–15); his infant-prodigy period in Paris (1815–22); his royalist period (1822–27); the three turbulent years of the romantic crusade (1827–30); the 15 successful years under Louis Philippe (1830–45); his political period, and his 18 years of exile (1852–70); and the final apotheosis when he lived on as the bard and prophet of the Third Republic (1870–85).

Childhood (1802–1815)—The events of Hugo's childhood are important and must be recorded in some detail It was an exaggeration on his part to say that:—

> Parmi les chars poudreux, les armes éclatantes
> Une muse des camps m'emporta sous les tentes . . .

but it is a fact that his early years were inflamed by many journeys and excitements, and that his whole subsequent attitude towards life was much affected by the contrasts and vicissitudes, by the actual flash and jingle, of the Napoleonic era. His father had attached himself to Joseph Bonaparte and accompanied that monarch first to Naples and then to Madrid Of the Italian journey, undertaken at the age of five, little remained for Hugo beyond some faint memories of Rome and Naples, of the snow and sledges upon the Mont Cenis, of the nut-trees among the rocks at Avellino The Spanish journey of 1811 left an infinitely deeper impress General Hugo was by then a count of the Empire He was governor of Madrid, and King Joseph's confidential adviser. he was count of Cifuentes and marquis of Siguenza· he possessed on paper large properties in Castile and a fortune of one million réals There was no limit to the honours or prosperity which such a father could obtain, and the Spanish journey was thus undertaken in a blaze of anticipation and with all the conveniences and attentions accorded to highly important personages Such glories left an indelible impression, but they were not of long duration Victor and his brother Eugène were sent to the College of Nobles in Madrid, where they were supposed to consort with the Spanish aristocracy The latter, however, regarded them as foreigners and invaders, whereas the Jesuits who were in charge of the college imagined that they were Protestants and eyed them askance It was not a happy period, and it produced in Hugo an aristocracy-complex, a love-hatred of aristocracy, which, working on his persistent egoism, became one of the many constituents of his later demagogics For the moment, however, his vanity reacted to these humiliations only in the form of national arrogance —

> Chez dix peuples vaincus, je passais sans défense
> Et leur respect craintif étonnait mon enfance . . .
> Quand je balbutais le nom cheri de la France
> Je faisais pâlir l'étranger.

By the spring of 1812 the French position in Madrid, in spite of the pallor of the inhabitants, became insecure· General Hugo felt it safer to send his wife and children back to Paris

In the intervals of these Italian and Spanish expeditions, Mme. Hugo educated her children in Paris She was a hard and stingy woman,—imperious, independent and cold Her politics were anti-Bonapartist, she was royalist and Vendéenne Her religion was Voltairean, inclining to deism Her influence upon her children was immense and she succeeded for many years in imposing upon them her dislike of Napoleon, her very acute dislike of their own father. They were happy there, in the large garden of No 12 Impasse des Feuillantines, where they climbed the trees, and played with little Adèle Foucher, and had pleasant discursive lessons from Père de la Rivière, and listened to the long stories of General Lahorie, an aged conspirator whom their mother was hiding from the police With the fall of Napoleon the fortunes of the Hugo family declined suddenly: their many castles in Spain melted into the air: General Hugo was interned on an allowance of £40 a year at Blois, where he established an alternative Mme Hugo, and became thereafter for his sons "le brigand de la Loire." Mme., no longer countess, Hugo found herself in reduced circumstances: she left the Feuillantines and took a small flat in the rue Bonaparte. And Victor Hugo, for his part, was sent to the Pension Cordier, rue Marguérite, to prepare for the Ecole Polytechnique. These circumstances of his early years have been recorded in some detail since their grandeur and their instability help to explain many outstanding faults in Hugo's genius and character. His intermittent education, the constant disagreements between his father and mother, the contrast between the splendours of his father's prospects and the meagre squalor of the result, the violent tawdriness of the whole Napoleonic system, account in their several ways for the superficiality of his knowledge and convictions, for his flashy exaggerations, for his passion for contrast, for the actual vulgarity of his character and mind. For the first 13 years of his life he was continually in a dramatic, and therefore in a false, position. a twist was thereby given to his egoism which developed into a foolish, and subsequently an embittered, form of conceit.

The Infant Prodigy (1815–1822)—His three years at the Pension Cordier, the lectures which he attended simultaneously at Louis-le-Grand, were important to Hugo as constituting the only systematic or thorough education that he ever obtained He was excellent at mathematics, superficial in his classical studies, and a voracious reader. The tragedies of Voltaire which had hitherto been his main source of reading, were now supplemented by Ossian, by Calderon, by Chateaubriand On July 10, 1816 we find him writing "I wish to be Chateaubriand or nothing" His literary ambition was thus aroused at the age of 14 and during his school-boy years he composed all manner of verses, odes, satires, acrostics, riddles, epics and madrigals There was a tragedy, *Irtamène*, in the manner of Voltaire a long poem on the flood a melodrama entitled *Inez de Castro* a comic opera and a series of translations from Ossian and the classics In 1817 he obtained an honourable mention from the Académie Française for a poem on the theme of "Happiness procured by study and application," and, thus encouraged, he embarked upon his first novel *Bug-Jargal*, which dealt with a blood curdling episode in the negro revolt at San Domingo In 1819 he was accorded by the Academy of the Jeux Floraux at Toulouse the first prize for a poem on the restoration of the statue of Henry IV, and it was on this occasion that Chateaubriand is said to have called him "l'enfant sublime" His eldest brother Abel Hugo had by then begun to edit a short-lived journal entitled *Le Conservateur Littéraire* To this journal Victor Hugo contributed not only the text of his novel *Bug-Jargal*, but a great mass of valueless prose and verse which poured precociously from his teeming brain. He was already secretly engaged to his early playmate Adèle Foucher; the death of his mother in June 1821, and his refusal to accept any money from his father, brought him face to face with actual penury: for a whole year he existed on 700 francs in an attic in the rue du Dragon, an experience which he subsequently exploited in the person of Marius in *Les Misérables*· and during these months he wrote with dogged perseverance, with that self-confidence which throughout his life never failed him.

The Royalist Period (1822–1827)—In June 1822, at the age of twenty, Victor Hugo published his first volume of poetry under the title *Odes et Poésies diverses* Apart from some sentimental verses addressed to Adèle Foucher (*le Vallon de Chérizy*, *A toi*, *le Regret*) the pieces collected in this volume were designed to catch the ear of the court. This design succeeded Fifteen hundred copies were sold in four months The little volume reached the hands even of Louis XVIII who with tears in his eyes read the stilted odes on the death of the Duc de Berry or on the birth of the Duc de Bordeaux Victor Hugo was accorded a pension of £40 from the privy purse, a salary which in the following year was doubled He felt justified in pressing his suit on Adèle Foucher. the parents consented· the marriage took place at St Sulpice on Oct 14, 1822: Victor Hugo was reconciled with his father who thereupon ceased to be the "brigand de la Loire" and became "ce héros au sourire si doux". and Eugène Hugo, who was also in love with Adèle, went mad during the wedding and had to be confined in an asylum, where he died in 1837 Money was required to support Hugo's wife and impending family Early in 1823 he published a second "tale of horror" under the title *Han d'Islande* and in 1824 he founded the *Muse française* The contributors to this journal formed the *Cénacle*, a literary club which met in the rooms of Charles Nodier, librarian of the Arsenal, and of which the leading members were Hugo, Alfred de Vigny,

Nodier, Soumet, Emile Deschamps and Delphine Gay. Of these young writers it was Nodier only who was frankly revolutionary and romantic The others hedged. Victor Hugo himself, who had just been made a Chevalier of the Légion d'Honneur and who had personally been invited to attend the coronation of Charles X. at Rheims, was again in a false position. The year 1825, however, marks the first definite break on his part with the classic traditions of the restoration court. He came more and more under the influence of Nodier; he visited Switzerland in the company of that romantic; he visited Lamartine at St Pont. he read German ballads. In 1826 he published *Bug-Jargal,* and to a new edition of the *Odes* which appeared the same year he added the *Ballades* in which the transition from classicism to romanticism is clearly adumbrated His early admiration of Chateaubriand bore a comparatively tardy fruit.

The Romantic Crusade (1827–1830).—It must be remembered that Hugo was a cautious man, and one who would have hesitated to put himself at the head of the new romantic movement had he not been assured not only of leadership but also of success. By the end of 1826 the originators of the French romantic movement, Chateaubriand and Lamartine, had retired into political life; a second and more vigorous wave of romanticism was about to overwhelm French literature; Hugo was quick to realise the tidal force of this new movement and quick to determine that he himself should ride upon its crest. The great decisions of Hugo's life were always taken under the impulse of an inspired opportunism His convictions were adjusted rapidly to the new formula, and into the expression of this formula he flung the irresistible force of his imagination and his rhetoric. The influence of the *Cénacle*, the influence of Nodier, the far more forceful and encouraging influence of Sainte-Beuve, all contributed to this new orientation: the affectionate relations which he now established with his father revived the excited Bonapartism of his early years. and, no less importantly, the success of Weber's *Freischutz* in 1826, and the still greater success of Miss Smithson's Shakespearean season in 1827, convinced him that the Parisian public were ready for something exciting, for something explosive, for something which had nothing whatever to do with complimentary odes to Charles X. His break with the court was signalized by the publication in the *Débats* of his *Ode à la Colonne*, a fine diatribe in which he championed Napoleon's marshals against the insults which had been offered them by the Austrian ambassador By Feb 1827 he had already written the first draft of *Cromwell*, and during the months that followed he was engaged on writing the preface to that play which constituted the "declaration of rights" of the romantic movement. The essence of this manifesto is its wholly justified attack upon the stagnation which had come over French literature owing to the tyranny of the classical formula and the rigid rules of Boileau. With impassioned rhetoric Hugo argued that art was evolutionary and dynamic, that the old formula stood only for rigidity and decay. "The object," he wrote, "of modern art is not beauty but life." This famous preface, which was published in Oct 1827, at once rendered Hugo the prophet and protagonist of the new school It was less difficult, however, to formulate these new conceptions than to put them into practice *Cromwell* itself was not suited for the stage, and an adaptation of Scott's *Kenilworth* which he produced under a pseudonym early in 1828 with the title of *Amy Robsart* was a ghastly failure. With his quick sensitiveness to public opinion Hugo abandoned drama for the moment, and adopting the then popular theme of the Greek War of Independence he composed and published *Les Orientales*, a series of poems on the Levant which, while they reflected no personal experiences, were yet so beautifully cadenced and designed that they at once achieved an immediate popularity. This volume in which he had the insight, thanks to Sainte-Beuve, to revive the forgotten metres of Ronsard and his imitators, was issued in Jan 1829, one of the most active, and certainly one of the most important years of Hugo's life. In this year he produced *Les Orientales, Le Dernier jour d'un Condamné,* and *Marion de Lorme*: and he wrote the whole of *Hernani*, a great portion of *Nôtre Dame de Paris* and most of the lyrics which were subsequently included in the *Feuilles d'Automne. Marion de Lorme* was banned for political reasons by the censor, but on Feb. 25, 1830 *Hernani* was produced at the *Théatre Français* with Mlle. Mars in the part of Doña Sol. The 45 representations of this eloquent melodrama are known in French literary history as "Les batailles d'Hernani." It may be questioned whether the opposition of the classics was as determined as has been represented: but there can be no question regarding the violence of the *claque* which Hugo, Mme Hugo and Théophile Gautier had organized. Sainte-Beuve, who was already in love with Mme. Hugo, disapproved of all this self-advertisement. "Je suis blasé," he wrote, "sur Hernani " But Hugo for his part had achieved not fame only, but fortune. the play brought him 15,000 francs. he was acclaimed by Chateaubriand as "the rising sun": he had opened the flood-gates of romanticism to Alexandre Dumas, to Alfred de Vigny, and to George Sand: and he moved with his wife and children to a larger house near the Champs Elysées. Unfortunately, however, the Revolution of July momentarily distracted public attention from Victor Hugo.

Success (1830–1845).—With the advent of the monarchy of July, under the sly complacency of Louis-Philippe, we leave the *Sturm und Drang* period of Hugo's life and pass into a phase of 15 years' success He published *Nôtre Dame de Paris* in April of 1831 and acquired thereby great popularity in circles where poetry was unread and where controversial drama was not appreciated. In December of that year he again, and rightly, aroused the admiration of the intellectuals by his *Feuilles d'Automne*. Fortune smiled upon him: his four children, Léopoldine, Charles, Francois-Victor and Adèle were living depositaries of sentimentality: he was surrounded by friends and disciples, by de Musset, de Nerval, Alexandre Dumas and Petrus Borel he was sufficiently in opposition to Louis Philippe to be regarded as a martyr while not actually becoming one. and he moved into another and more romantic apartment, now the Musée Victor Hugo, in the Place des Vosges. In Nov. 1832, he produced *le Roi s'amuse*, which would have been a failure had it not been banned by the censor on the second night. On Feb 2, 1833 he gave *Lucrezia Borgia* at the Porte St. Martin, and was accorded a public ovation: the part of Princess Negroni was taken by Juliette Gauvain, known, under the name of Juliette Drouet, as a leading courtesan Hugo decided to redeem this woman, and for several years he confined her in a little flat which he alone was allowed to visit; she is the heroine of his most lovely lyrics and she remained his mistress for more than 50 years. Mme. Hugo, who was not allowed any similar indulgence in regard to Sainte-Beuve, acquiesced unhappily in this arrangement. *Lucrezia Borgia* was the last but one of Hugo's successes on the stage, *Marie Tudor* and *Angelo* both failed in 1833; for a moment the triumph of *Ruy Blas* in 1838 recalled the days of *Hernani*, but a final end was put to the romantic drama by the complete collapse of *Les Burgraves* in 1843.

During these years, however, his reputation as one of the greatest of French lyric poets was firmly established. The *Feuilles d'Automne* of 1831 was succeeded by the *Chants du Crépuscule* of 1835, by *Les Voix intérieuses* of 1837, and *Les Rayons et les Ombres* of 1840 In 1839 Hugo presented himself for election to the French Academy. M Dupaty was selected in his place. In 1839 he again stood as a candidate, but it was M. Molé who was chosen. A third time, in 1840, it was M. Flourens, and not Victor Hugo, who was elected. It was only at his fourth attempt, in 1841, that he secured admission. These years of popular, if not official, success and adulation were not good for Victor Hugo: his temperamental egoism increased, and his former austerity was succeeded by a period of indulgence which provoked frequent scandals. The year 1843 was marked by a double tragedy. the failure of *Les Burgraves* was complete and crushing: and in the autumn of the same year his daughter Léopoldine, who had just married, was drowned in the Seine. In later years, this tragedy echoed for Victor Hugo in what are perhaps the finest of all his lyrics (*Trois Ans Après* and the Villequier series in the second volume of *Les Contemplations*), but for the moment he was stunned. He abandoned poetry for politics, and in 1845 he was created a peer of France.

Politics and Exile (1845–1870).—Victor Hugo, unlike Cha-

teaubriand or Lamartine or Byron, was not good at politics. In the tribune of the House of Peers he ranted and raved and indulged in phrases of such bombastic rhetoric that even his brother peers failed to take him seriously. After the revolution of 1848 he stood for the presidency of the Republic but obtained only a very few votes. During the *coup d'état* of December 1851, he made a scene in an omnibus, and he addressed the troops in the Place de la Bastille from a four-wheeler. He was a member of the committee of Insurrection and behaved during the two days of December with courage but without good sense. He was rescued by Juliette Drouet, and finally on Dec. 14, 1851 he escaped to Brussels in the disguise of a workman. In Aug. 1852 he proceeded to Jersey, where he lived at Marine Parade ("la roche où j'ai ployé mon aile") and from where he published *Napoléon le Petit* (1852) and *Les Châtiments* (1853) which, whatever its weakness and exaggeration as a satire, contains some of the most marvellous of his metrical triumphs. In 1855 he moved to Guernsey where, the next year, he bought Hauteville House Here he resided, revelling in his martyrdom, for 17 years In 1856, at the age that is of 54, he published *Les Contemplations* which contain what is perhaps the most durable section of his lyric verse, and two years later he composed the first section of the *Légende des Siècles*. In 1862 he published *Les Misérables*, and in 1866 *Les Travailleurs de la Mer* and in 1869 *L'homme qui rit*. The last years of his exile had been saddened by the desertion of his family his wife went to live in Brussels where she died in 1868: his daughter Adèle ran away with an English officer; only Mme Drouet, in her cottage next to Hauteville House, remained faithful to the veteran egoist. The establishment of the Republic released Victor Hugo from exile. He returned in triumph to Paris in Sept 1870

Last Years (1870–1885).—His re-entry into the political life of his country was not of long duration. He was elected to the National Assembly but resigned on being unable to obtain a hearing During the Commune he moved to Brussels where his offer to house the communist exiles led to a riot and his expulsion by the Belgian Government. On his return to Paris he was elected to the Senate, but took no part in the debates. It was easier and safer for him to remain in his house in the Avenue d'Eylau and to watch while one by one the beacons of his apotheosis were lit around him His fame was universal: his faculties undimmed by age. In his 80th year he published those still fresh and lovely verses of the *Quatre Vents de l'Esprit*: he attended the triumphant jubilee of *Hernani;* and on his 80th birthday he was acclaimed by six hundred thousand of his fellow citizens Juliette Drouet, faithful to the end, died in 1883: and on May 31, 1885 Victor Hugo himself was buried in the Panthéon His body, in accordance with his last behest, had been placed in a pauper's coffin; for a night it lay in state under the Arc de Triomphe; the pomp and drama of his funeral was symbolic of his strangely histrionic mind

The output of his last years was, in quantity if not in quality, amazing. It can be catalogued as follows.—*Actes et Paroles* (1872); *L'Année Terrible* (1872); *Quatre-vingt-treize* (1874); *Légende des Siècles* (second series 1877); *L'Art d'être grand-père* (1877); *L'Histoire d'un crime* (1877); *Discours pour Voltaire* (1878); *Le Pape* (1878); *La Pitié suprême* (1879); *L'Ane* (1880); *Religions et Religion* (1880); *Les Quatre Vents de l'Esprit* (1881); *Torquemada* (1882); *Légende des Siècles* (3rd series 1883). Of the many posthumous works published by his friends Paul Meurice and Auguste Vacquerie the most interesting is the volume of autobiographical notes entitled *Choses vues,* and the collection of poetry published under the name of *Toute la Lyre.* The other posthumous collections served only to harm the poet's reputation.

The idolatry with which Victor Hugo was acclaimed by his worshippers has produced an inevitable reaction. Under the influence of this reaction his bad qualities—his vulgarity, his bombast, the tenuity of his thought and feeling, his sheer blatant egoism—have obscured his remarkable gifts. It is possible perhaps to make a juster estimate. From the historical point of view Victor Hugo is unquestionably one of the greatest figures in French literature. His influence was not only very deep but also extremely wide: it is possible to find in Hugo's work the germ of practically every subsequent movement, whether Parnassian, Symbolist or Decadent; such diverse figures as Baudelaire, Verlaine and even Rimbaud owe him heavy debts; he was without doubt the greatest literary influence in 19th century France. It is true that this influence bore almost wholly on technique, but technique in French poetry is of primary importance Victor Hugo was not quite the revolutionary ("le démagogue horrible et débordé") that he pretended, but he *did* re-introduce the lovely metres and cadences of the 16th century, he *did* break the tyranny of Boileau, and he *did* render the French ear sensitive to the delicate vowel changes and balances in which their language is so rich Thus although his drama is dead, and his novels can scarcely be compared with those of Balzac, Sand or even Dumas, yet the great mass of his verse, whether lyric, satiric or narrative, will always retain, not only its beauty but its strength. Most of Hugo's boasts about himself, about that "ego Hugo" who was the centre of all his thoughts, are not only insufferable, but inaccurate: he was right, however, and absolutely right, when he described himself as placed "au centre de tout comme un écho sonore." His receptive faculty was unlimited: his interpretive faculty was of a high standard, it was his selective faculty which was at fault. The fact that he could, with dangerous facility, cast into beautiful and convincing form what the average person of 1840–80 felt inarticulately, accounts not only for his unequalled popularity, but for his own unfortunate conviction that he was the prophet of his country and his age.

> "Moi," he exclaims in a characteristic passage·—
> "Moi, qui me crus apôtre . . .
> "La France, dans sa nuit profonde
> "Verra ma torche flamber"

Interpretation and melody, however, are not enough Victor Hugo possessed a trivial character and an uninteresting mind A high quality of either mind or character are not perhaps essential to the finest poetry, but the absence of both must always reduce a poet to the second category. Hugo was a master of language, he was a great literary figure, he might perhaps have been a great mystic had he been less worldly, but as it is, when asked who was the greatest French poet of the 19th century we must reply, in the words of a recent French cynic, "Unfortunately, Victor Hugo" (H Nr)

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HUGO, a city of south-eastern Oklahoma, U S A, 8 m from the Red river, on Federal highway 70 and two lines of the Frisco railway; the county seat of Choctaw county. The population in 1920 was 6,368 (86% native white). It is the shipping and trading centre for a fruit-growing, farming and lumbering region; and it has railroad shops, planing mills, creosote works, cotton gins and compresses, cottonseed-oil mills and grain elevators.

HUGUENOTS, the name given from about the middle of the 16th century to the Protestants of France. According to Henri Éstienne (*Apologie d'Herodote,* 1566), the word is a nickname. The Protestants at Tours, he says, used to assemble by night near the gate of King Hugo, whom the people regarded as a spirit. A monk, therefore, in a sermon declared that the Lutherans ought to be called *Huguenots,* as kinsmen of King Hugo, inasmuch as they would only go out at night as he did. This name became popular from 1560 onwards

The French reform movement has often been regarded as an offshoot of Lutheranism, and up to the middle of the century its adherents were known as Lutherans. But it should not be forgotten that so early as 1512 Jacobus Faber (*q.v.*) of Étaples published his *Santi Pauli Epistolae xiv . . . cum commentariis,* which enunciates the cardinal doctrine of reform, justification by faith, and that in 1523 appeared his French translation of the New

Testament As early as 1525 Jacques Pavannes, the hermit of Livry, and shortly afterwards Louis de Berquin, the first martyrs, were burned at the stake But no persecution could stop the Reform movement, and on the walls of Paris and even at Amboise, on the very door of Francis I.'s bedroom, there were found placards condemning the mass (1534) On Jan 29, 1535, an edict was published ordering the extermination of the heretics and resulting in a general emigration. Three years later the first French Protestant church, composed of 1,500 refugees, was founded at Strasbourg

Of all these exiles the most famous was John Calvin (*q v.*), the future leader of the movement, who fled to Basle, where he is said to have written the famous *Institutio christianae religionis*, preceded by a letter to Francis I in which he pleaded the cause of the reformers The first Protestant community in France was that of Meaux (1546) organized on the lines of the church at Strasbourg of which Calvin was pastor The Catholic Florimond de Raemond paid it the beautiful tribute of saying that it seemed as though "la chrétienté fut revenue en elle à sa primitive innocence"

Persecution, however, became more rigorous The Vaudois of Cabrières and Mérindol had been massacred in 1545 by the orders of Jean de Maynier, Baron d'Oppède, lieutenant-general of Provence, and at Paris was created a special court in the parlement for the suppression of heretics, a court which became famous in history as the *Chambre ardente* (1549) The church at Paris was founded in 1556, and in spite of persecution the reformers increased in numbers In 1558 at Poitiers it was decided that all the Protestant churches in France should formulate by common accord a confession of faith and an ecclesiastical discipline The church at Paris was commissioned to summon the first synod, which, in spite of the danger, was convened on May 25, 1559 The Synod of Paris derived its inspiration from the constitution introduced by Calvin at Geneva, which has since become the model for all the Presbyterian churches Ecclesiastical authority resides ultimately in the people, for the faithful select the elders who are charged with the general supervision of the church and the choice of pastors The churches are independent units, and there can be no question of superiority among them, at the same time they have common interests and their unity must be maintained by an authority which is capable of protecting them The association of several neighbouring churches forms a local council (*colloque*). Over these stands the provincial synod, on which each church is equally represented by lay delegates and pastors Supreme authority resides in the national synod, composed of representatives, lay and ecclesiastic, elected by the provincial synods The democratic character of this constitution of elders and synods is particularly remarkable in view of the early date at which it began to flourish

The synod of 1559 was the beginning of a remarkable increase in the Reform movement; at that synod 15 churches were represented; two years later, in 1561, the number was 2,150—an increase which carried the struggle into the arena of national politics

The conspiracy of Amboise, formed with the object of kidnapping the king (March 1560) resulted in the death of the plotters and was followed by the proclamation of the Edict of Romorantin, which laid an interdict upon the Protestant religion But the reformers had become so powerful that Coligny, who was to become their most famous leader, protested in their name against this violation of liberty of conscience For a moment, at the colloquy of Poissy (Oct 1561), at which Roman Catholic and Protestant divines were assembled together, it seemed as though a *modus vivendi* would be established The attempt failed, but by the edict of Jan 1562 religious liberty was assured to the Huguenots This, however, was merely the prelude to civil war, the signal for which was given by the Guises, who slaughtered a number of Huguenots assembled for worship in a barn at Vassy (March 1, 1562); and the duke of Guise, entering Paris in triumph, transferred the court to Fontainebleau by a daring *coup d'état* in defiance of Catherine de' Medici, the queen regent. It was then that Condé declared there was no hope but in God and his arms, and, with the Huguenot leaders, signed at Orleans (April 11, 1562) the manifesto in which, having declared their loyalty to the Crown, they stated that as good and loyal subjects they were driven to take up arms for liberty of conscience on behalf of the persecuted saints Until the end of the century the history of France is that of the struggle between the Huguenots upholding "The Cause" (*La Cause*) and the Roman Catholics fighting for the Holy League (*La Sainte Ligue*) The leading events only are related here (*see* also FRANCE: *History*). The war lasted, with intermissions in 1563 and 1568, until 1560, when, after the defeat of the Huguenots at Jarnac, Condé was assassinated. But Jeanne d'Albret renewed the courage of the vanquished by presenting to them her son, Henri de Bourbon, the future Henry IV.; and Coligny, whose heroic courage rose with adversity, collected the remnants of the Protestant army and by a march as able as it was audacious, moved on Paris. The Peace of St Germain followed, on Aug. 8, 1570

For a moment it seemed reasonable to hope that the war was over. Coligny had said that he would prefer to be dragged through the streets of Paris than to recommence the fighting. Henri de Bourbon was to marry Marguerite of France Peace seemed to be assured when on the night of Aug 24, 1572, after a council at which Catherine de' Medici, Charles IX, the duke of Anjou, and other leaders of the league assisted, there occurred the Massacre of St Bartholomew (*q v*), in which Coligny and all the leading Huguenots were slain The Paris massacre was repeated throughout France, and the Protestants were slain in thousands The survivors resolved upon a desperate resistance A Huguenot political party was formed at Milhau in 1573, definitely constituted at La Rochelle in 1588, and lasted until the peace of Alais in 1629 The delegates selected by the churches bound themselves to offer a united opposition to the violence of the enemies of God, the king and the state It is a mistake to suppose that they desired to overthrow the monarchy But it is true that among themselves they formed a kind of republic which, according to the historian J A de Thou, had its own laws dealing with civil government, justice, war, commerce, finance They had a president called the protector of the churches, an office held first by Condé and afterwards by the King of Navarre up to the day on which he became king of France as Henry IV. (1589) The fourth religious war, which had broken out immediately after the Massacre of St Bartholomew, was brought to an end by the pacification of Boulogne (July 16, 1573), which granted a general amnesty The recollections of the horrors of St Bartholomew's night had hastened the death of Charles IX, the last of the Valois Under Henry III the most debauched and effeminate of monarchs, the war broke out anew. It lasted, with one brief intermission in 1576, until March 22, 1594, when Henry of Navarre entered Paris as Henry IV, successor of Henry III, who had been assassinated by a monk in 1589 The league was utterly defeated. Thus the Huguenots after forty years of strife obtained by their constancy the promulgation of the Edict of Nantes (April 13, 1598), the charter of religious and political freedom (*See* NANTES, EDICT OF)

Twelve years afterwards, on May 14, 1610, Henry was assassinated by Ravaillac, leaving his great work incomplete During the minority of Louis XIII power resided in the hands of counsellors who favoured the Catholic party. The Huguenots once more took up arms under the leadership of Henri de Rohan (*q v*) Richelieu had entered the king's council on May 4, 1624; the destruction of the Huguenots was his policy, and he pursued it to a triumphant conclusion On Oct 28, 1628, La Rochelle, the last stronghold of the Huguenots, was obliged to surrender, after a siege rendered famous for all time by the heroism of its defenders and of its mayor The peace of Alais, which was signed on June 28, 1629, marks the end of the civil wars.

Louis XIV.—The Huguenots had ceased to exist as a political party and, assured that liberty of conscience would be granted them, showed themselves loyal subjects. On the death of Louis XIII., the declaration of July 8, 1643, had guaranteed to the Protestants "free and unrestricted exercise of their religion," thus confirming the Edict of Nantes. The Roman Catholic clergy, however, had never accepted the Edict of Nantes, and all their efforts

were directed to obtaining its revocation. As long as Mazarin was alive the complaints of the clergy were in vain, but when Louis XIV. attained his majority there commenced a legal persecution which was bound in time to bring about the ruin of the reformed churches. The Edict of Nantes, which was part of the law of the land, might seem to defy all attacks, but the clergy found means to evade the law by demanding that it should be observed with literal accuracy, disregarding the changes which had been produced in France during more than half a century. The clergy in 1661 successfully demanded that commissioners should be sent to the provinces to report infractions of the edict, and thus began a judicial war which was to last for more than 20 years All the churches which had been built since the Edict of Nantes were condemned to be demolished All the privileges which were not explicitly stated in the actual text of the edict were suppressed. More than 400 proclamations, edicts, or declarations attacking the Huguenots in their households and their civil freedom, their property and their liberty of conscience, were promulgated during the years which preceded the revocation of the Edict of Nantes In spite of all sufferings which this rigorous legislation inflicted upon them they did not cease to resist, and in order to compel them to accept the "king's religion," the *dragonnades* (1683–86) were organized, which effected the forcible conversion of thousands of Protestants who gave way under the tortures which were inflicted upon them It was then that Louis XIV declared that "the best of the larger part of our subjects, who formerly held the so-called reformed religion, have embraced the Catholic religion, and therefore the Edict of Nantes has become unnecessary" On Oct. 18, 1685, he pronounced its revocation Thus under the influence of the clergy was committed one of the most flagrant political and religious blunders in the history of France, which in the course of a few years lost more than 400,000 of its inhabitants. Many emigrated to England or Prussia and became very useful citizens of their adopted countries

Persecution had succeeded in silencing, but it could not convert the people. Despair armed the Cévennes, and in 1702 the war of the Camisards broke out, only to end in the defeat of the insurgents (*see* CAMISARDS and CAVALIER, JEAN). The Huguenots seemed to be finally conquered. On March 8, 1715, Louis XIV announced that he had put an end to all exercise of the Protestant religion; but in this very year, on Aug 21, while the king was dying at Versailles, there assembled together at Monoblet, in Languedoc, under the presidency of Antoine Court, the "Restorer of Protestantism," then only 20 years of age, a conference devoted to the re-establishment of the church. This was the first "synod of the Desert" (*See* COURT, ANTOINE)

Year by year the churches became more numerous In 1756 there were already 40 pastors, several years later, in 1763, the date of the last "synod of the Desert," their number had increased to 65. As the 18th century advanced public opinion began to revolt from the persecution of the Huguenots The torture of Jean Calas, who was condemned on a false charge of having killed his son because he desired to become a Catholic, caused general indignation, of which Voltaire became the eloquent mouthpiece, and the edict of Nov. 1787, in spite of the fierce opposition of the clergy, renewed the civil rights of the Huguenots by recognizing the validity of their marriages Two years later the Declaration of the Rights of Man affirmed the liberty of religion. By the law of the 18th of Germinal, year X, the legal standing of the Protestant church was recognized, but it was denied the character of free church, which it had hitherto claimed.

The Protestants, on the day on which liberty of conscience was restored, could measure the full extent of the misery which they had endured. Of this people, which in the 16th century formed more than one-tenth of the population of France, there survived only a few hundred thousand In 1626 there were 809 pastors in the service of 751 churches; in 1802 there were only 121 pastors and 171 churches; in Paris there was only a single church with a single pastor. The church had no faculty of theology, no schools, no Bible societies, no asylums, no orphanages, no religious literature Everything had to be created afresh, and this work was pursued during the 19th century with energy and faith

LATER HISTORY

At the fall of the Empire (1815) the reaction of the White Terror once more exposed the Protestants to outrage, and again a number fled from persecution and sought safety in foreign countries Peace having been established, attention was then focused on religious questions, and the period was marked in Protestantism by a remarkable awakening On all sides churches were built and schools opened. During that period were founded the great religious societies.—Société biblique (1819), Société de l'instruction primaire (1829), Société des traités (1821), Société des missions (1822) On the other hand, the old union of the reformed churches had ceased to exist since the revolution of July. Ecclesiastical strife broke out and never entirely ceased. A schism occurred first in 1848, owing to the refusal of the synod to draw up a profession of faith The comte de Gasparin and the pastor, Frédéric Monod, seceded and founded the Union des Églises Évangéliques de France, separated from the State, of which E de Pressensé was to become the most famous pastor. Under the Second Empire (1852–70) the divisions between the orthodox and the liberal thinkers were accentuated and resulted in a separation, which followed on the reassembly of the national synod, authorized in 1872 by the government of the Third Republic The old Huguenot Church was thus separated into two parts, having no other link than that of the Concordat of 1802, and each possessing its own peculiar organization

The law of Dec 9, 1905, which separated the Church from the State, was accepted by the great majority of Protestants as a legitimate consequence of the reform principles, and its application caused no difficulty with the State In 1907 the National Union of the Reformed Churches of France, consisting of ten regional unions, was founded in Paris; these unions are combined with others in the Protestant Federation of France, which convenes a General Assembly of all affiliated churches every five years The restoration of Alsace and Lorraine to France involved the inclusion of the Lutheran and Reformed Churches of those provinces in the main body of French Protestants, increasing the membership to nearly one million These churches are established and supported by the French state, in accordance with the régime existing before the Franco-German War of 1870–71.

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HUGUES, CLOVIS (1851–1907), French poet and socialist, was born at Menerbes in Vaucluse. For a revolutionary article in *Fraternité* he was condemned in 1871 to three years' imprisonment and a fine of 6,000 francs. From 1875 onwards he edited *La Jeune République* In 1877 he fought a duel in which he killed his adversary, a rival journalist. Elected deputy by Marseilles in the general elections of 1881, he was at that time the sole representative of the Socialist Party in the chambers He was re-elected in 1885, and in 1893 became one of the deputies for Paris, retaining his seat until 1906 He died on June 11, 1907. His principal works are: *Poèmes de prison* (1875), written during his detention; *Soirs de bataille* (1883), *Jours de combat* (1883), and *Le Travail* (1889); the novels, *Madame Phaéton* (1885) and *Monsieur le gendarme* (1891); and the dramas, *Une étoile* (1888) and *Le sommeil de Danton* (1888).

HUICHOL. This tribe in the mountains of northern Jalisco is one of the few in Mexico that has preserved not only its speech and race but its native religions and culture relatively uncontaminated by conquest and contact They practise the *peyote* cult; their decorative and ritual symbolism is rich They are, with the neighbouring Cora, members of the so-called Piman or Sonoran division of the Uto-Aztecan family. They number somewhat over, and the Cora somewhat under, 3,000

See C Lumholtz, *Unknown Mexico* (1902), *Symbolism of the Huichol Indians* (1900).

HUILA: *see* ANGOLA.

HUITZILOPOCHTLI (wē-tsē-lō-pocht'lē), the supreme being in the religions of ancient Mexico, and also the god of war. He was the mythic leader and chief divinity of the Aztecs, dominant tribe of the Nahua nation As a humming-bird Huitzilopochtli was alleged to have led the Aztecs to a new home. His idol was a huge block of basalt (still thought to be preserved in Mexico), on one side of which he is sculptured in hideous form, adorned with the feathers of the humming-bird. The ceremonies of his worship were of the most bloodthirsty character, and hundreds of human beings were sacrificed annually before his shrine, their limbs being eaten by his worshippers When his temple was dedicated in 1486 it is traditionally reported that 70,000 people were killed (*See* MEXICO.)



BY COURTESY OF THE MUSEUM OF THE AMERICAN INDIAN, NEW YORK

HUITZILOPOCHTLI, AZTEC GOD OF WAR, FROM A TIZOC STONE IN THE NATIONAL MUSEUM AT MEXICO CITY

HULDA, in Teutonic mythology, goddess of marriage, a beneficent deity, patroness and guardian of maidens (*see* BERCHTA).

HULKE, JOHN WHITAKER (1830–1895), British surgeon and geologist, was born on Nov. 6, 1830 He was educated at the Moravian College at Neuwied, at King's College school, and at the hospital, becoming M R C.S in 1852. In the Crimean War he was appointed (1855) assistant-surgeon at Smyrna and subsequently at Sebastopol. On returning home he was successively medical tutor at his old hospital, assistant-surgeon to the Royal Ophthalmic Hospital, Moorfields (1857–68), and surgeon (1868–90), and after 1870 surgeon at Middlesex hospital. His skill as an operator was widely known, but he made his special mark as an ophthalmologist. He was elected F.R.S. in 1867 for his researches on the anatomy and physiology of the retina in man and the lower animals, particularly the reptiles. He subsequently devoted his spare time to geology and especially to the fossile reptilia, describing many remains of Dinosaurs He died in London on Feb. 19, 1895.

HULL, ISAAC (1773–1843), commodore in the U.S. Navy, was born at Derby (Conn), on March 9, 1773. When only 14 he went to sea as a cabin boy. At 19 he commanded his first ship, and in 1798 received a commission in the U S. navy as lieutenant. He served two years on the "Constitution," the ship which he later commanded, chased Barbary pirates as commander of the "Argus," and when the War of 1812 broke out he had already commanded the "Constitution" for six years, carrying the U S minister to France in 1811, and specie to Holland in payment of interest on a debt due from the United States. His ship was shadowed by British men-of-war On July 19, 1812, five days out, the "Constitution" met a British blockading squadron. There followed one of the most remarkable sea chases ever recorded. For three days and nights Hull kept his ship ahead, using every device known to seamanship, outwitting his pursuers by brilliant manoeuvres, towing, and kedging The British gave up the pursuit. On Aug 2 he set sail without orders and encountered the British frigate "Guerrière," which he captured For this Hull received a gold medal, and the "Constitution" the nickname of "Old Ironsides" Resigning his command, Hull became a member of the navy board; later he commanded the navy yards at Boston and Washington, and squadrons in the Mediterranean and the Pacific. After 37 years of active service he retired and made his home in Philadelphia (Pa.), where he died Feb 13, 1843.

See A. T Mahan, *Sea Power in its Relations to the War of 1812* (1905); and T R. Roosevelt, *The Naval War of 1812* (1882).

HULL, a city (1875) and railway junction of the province of Quebec, Canada, and the capital of Wright county, opposite the city of Ottawa Pop (1921) 24,117 The magnificent water-power of the Chaudière Falls of the Ottawa is utilized for the lighting of the city, the operation of a system of electric railways connecting Hull with Ottawa and Aylmer, and a number of large saw-mills, pulp, paper and match manufactories Three bridges unite Ottawa and Hull. Champlain was the first white man to set foot on the site of Hull, but long before he came it was a favourite meeting-place for the Indians. Philemon Wright, of Woburn, Massachusetts, was the first man to settle here in 1800 The report he sent back was so favourable that a number of other families followed from the same place and laid the foundations of the future city

HULL (officially KINGSTON-UPON-HULL), a city and county of a city, municipal, county and parliamentary borough and seaport in the East Riding of Yorkshire, England, at the junction of the river Hull with the Humber, 22 m from the open sea, and 181 m N of London by the L N E railway Pop (1921) 287,150. The city area is 9,042 acres The town stands on a level plain so low as to render embankments necessary to prevent inundations. The older portion is completely enclosed by the Hull on the east, the Humber on the south, and by docks on the north and west. Here are a few old houses and also narrow streets typical of the mediaeval mercantile town, though modern improvements have destroyed some of them

The first mention of Hull occurs under the name of Wyke-upon-Hull in a charter of 1160, by which Maud, daughter of Hugh Camin, granted it to the monks of Meaux, who in 1278 received licence to hold a market here every Thursday, and a fair on the eve, day and morrow of Holy Trinity and 12 following days Shortly afterwards, Edward I., seeing its value as a port, obtained the town from the monks in exchange for other lands in Lincolnshire, and changed its name to Kingston-upon-Hull. To induce people to settle here, he gave the town a charter in 1299. This made the town a free borough, and provided that the king would send his justices to deliver the prison when necessary; and it granted two weekly markets on Tuesday and Friday, and a fair on the eve of St. Augustine, lasting 30 days. Commissioners were sent by the king in 1303 to enquire how and where the roads to the new town could best be made, and in 1321, Edward II. granted a licence to enclose the town with a ditch and "a wall of stone and lime."

While inspecting former charters, Edward III, in 1381,

granted the burgesses the right to hold the borough with fairs, markets and free customs at a fee-farm of £70, and power to choose a mayor and four bailiffs each year. So that they might obtain a supply of fresh water, Hessle, North Ferriby and other places were granted to the burgesses of Hull in 1440, and the county of the town of Kingston-upon-Hull was created, and included these places. In 1541 the town was visited by Henry VIII., who ordered a castle and other places of defence to be built. Edward VI. granted the manor to the burgesses in 1552, but the town was not incorporated until 1576. A new charter was granted by James II. in 1688. During the Civil Wars, although the majority of the inhabitants were Royalists, Hull was garrisoned by the Parliamentarians, and Charles I. was refused admission by the governor, Sir John Hotham. In 1643 it was besieged for six weeks, and the new governor, Ferdinando Fairfax, 2nd Baron Fairfax, obliged the Royalist army to retreat by opening the sluices and flooding the surrounding country.

Holy Trinity church is one of the largest English parish churches, with the transepts and choir in Decorated style. The choir is largely of brick, and thus affords an unusually early example of the use of this material in English ecclesiastical architecture. The nave is a fine example of Perpendicular style. The church of St. Mary, Lowgate, was founded in the 14th century, but is almost wholly a reconstruction. A Friends' meeting-house was built in 1919, a synagogue in 1914 and a large Wesleyan Methodist hall in 1910. The principal public buildings are the town hall in Lowgate, and the Royal Institution, containing a library and museum, and accommodating the Literary and Philosophical Society. The Grammar school was founded in 1486. One of its masters was Joseph Milner (1744–97), author of a history of the church, and among its students were Andrew Marvell, the poet (1621–78) and William Wilberforce (1759–1833). The latter is commemorated by a column and statue near the dock offices, and by the preservation of the house of his birth in High street This house belongs to the corporation, and was opened in 1906 as the Wilberforce and Historical museum. The city hall and municipal art galleries were opened in 1910, and the Guildhall enlarged in 1915.

With its Grammar school, the Hull and East Riding college, Hymer's college, the Trinity House Marine school (established in 1716), the Humber Industrial school ship, "Southampton," and technical and art schools, Hull is the educational centre for the whole of East Riding. The need for a centre for higher education was recognized by the Rt. Hon. T. R. Ferens, in 1925, when he gave £250,000 towards the establishment of a university college. He had previously given land on the Cottingham road, on the outskirts of the city, as a site for a new technical college, but this has been used for the new University college buildings which were opened in 1928. Charities and benevolent foundations are numerous. Trinity House, a charity for seamen of the merchant service, was founded by the Trinity House Guild (instituted in 1369) and the present building was erected in 1753. It contains a noteworthy collection of paintings and a museum, much of which was destroyed by fire in 1924 The Charterhouse belongs to a foundation for the support of the old and feeble, established in 1384 by Sir Michael de la Pole, afterwards earl of Suffolk. The infirmary was founded in 1782. In 1912 a home for incurables was built and in 1914 a new poor law hospital.

The original harbour occupied that part of the river Hull which faced the old town, but in 1774 an Act was passed for forming a dock on the site of the old fortifications on the right bank of the Hull. This afterwards became known as Queen's dock, and with Prince's and Humber docks, it completes the circle round the old town. The small railway dock opens from Humber dock. East of the Hull lie the Victoria dock and extensive timber ponds, and west of the Humber dock basin and parallel to the Humber, lies Albert dock. Others are the Alexandra, St. Andrew's and fish docks. The port was enlarged in 1914 by the opening of the King George's dock, with a large grain silo and fine equipment, covering an area of 53 ac., and with provision for future extension to 85 acres. The docks are owned by the L.N.E. railway and cover a water area of 236 ac., with 10 m. of quays. The ports of Hull and Goole have been administratively combined since 1888 under the Humber Conservancy Board. Hull has become one of the largest ports of Great Britain, having shipping commerce with all parts of the world It is one of the principal ports for the manufactures of Lancashire and Yorkshire, and has direct communication by canal and rail with the coalfields of the West Riding. Large quantities of grain are imported from Russia and America, and timber is imported from Norway and Sweden. Iron, fish, butter and fruit are other important imports.

Hull was an early seat of the whale "fisheries," and sea fishing is still extensively prosecuted There are some 300 steam trawlers in the fishing fleet, which did valuable service during the World War. The extensive and varied traffic of Hull was much affected by the war, as the city was in the area of the North sea operations, but the volume of trade had almost recovered in 1928. The numerous industries include iron-founding, shipbuilding and engineering, and the manufacture of chemicals, vegetable oil, colours, cement, paper, starch, soap and cotton goods; there are also tanneries and breweries. Passenger steamship services run from Hull to the principal Norwegian and Swedish ports. A ferry serves New Holland on the Lincolnshire shore.

Hull was represented in the parliament of 1295, and has sent members ever since, save that in 1384 the burgesses were exempted from returning any member on account of the expenses which they were incurring through fortifying their town The parliamentary borough returned two members in 1885, three in 1913, and now the borough is divided into four divisions—east, central, north-west and south-west, each of which returns one member. Hull became the seat of a suffragan bishop in the diocese of York in 1891. This was a revival, as the office was in existence from 1534 till the death of Edward VI. The county borough was created in 1888

HULLAH, JOHN PYKE (1812–1884), English composer and teacher of music, was born at Worcester on June 27. He was a pupil of William Horsley from 1829, and entered the Royal Academy of Music in 1833. He wrote an opera to words by Dickens, *The Village Coquettes,* produced in 1836; *The Barbers of Bassora* in 1837, and *The Outpost* in 1838, the last two at Covent Garden From 1839, when he went to Paris to investigate various systems of class-teaching in music, he identified himself with Wilhem's system of the "fixed Do," and his adaptation of that system was taught with enormous success from 1840 to 1860. His highly popular compositions consisted mainly of ballads; but his greatest service to the art was the hard work he did to improve musical education, to secure the performance of good music and maintain high artistic standards Among his writings may be mentioned his admirable report for the Council of Education on musical education abroad (1878) and his *Grammar of Vocal Music* (1843); and among his other publications, the two great collections of choral music which he made and edited—*Part Music* and *Vocal Scores.*

HULL HOUSE: *see* SOCIAL SETTLEMENTS.

HULME, WILLIAM (1631–1691), English philanthropist, was born near Manchester, and died on Oct. 29, 1691 He founded the Hulme Trust in memory of his son, to maintain "four exhibitioners of the poorest sort of bachelors for the space of four years," at Brasenose college, Oxford The value of the property greatly increased, and the income from it now maintains the Hulme Grammar school in Manchester, supports a residential college, Hulme Hall, attached to the university of Manchester, and provides a number of scholarships at Brasenose college

See J. Croston, *Hulme's Charity* (1877).

HÜLS, a town of Germany, in the Prussian Rhine province, 4 m. N. of Crefeld and 17 m. N.W. of Düsseldorf by rail Pop. (1925) 6,786. It has manufactures of machinery, leather and silk.

HULSE, JOHN (1708–1790), English divine, was born at Middlewich, Cheshire. He succeeded to estates in Cheshire which he in turn bequeathed to Cambridge University mainly for the establishment of a Hulsean lectureship.

HUMACAO, a prosperous and important town in the eastern part of Porto Rico. The population in 1920 was 6,183, and in 1928, 6,885. The population of the municipal district was 20,229

in 1920 The town is beautifully situated in a valley, surrounded on three sides by mountains, with the ocean six miles to the east, from which the ocean breezes make climatic conditions nearly perfect. The lowlands of the district are very fertile and are principally devoted to growing sugar-cane and tobacco, while on the mountain slopes coffee is produced. The town is connected with the other parts of the island by excellent highways, with superior motor bus service. Good schools are provided, and the town has water service, electric lights, hospitals and a library

HUMANE SOCIETY, ROYAL. This society was founded in England in 1774 for the purpose of rendering "first aid" in cases of drowning and for restoring life by artificial means to those apparently drowned. The society, the chief offices of which are at 4, Trafalgar square, London, has 300 depôts throughout the kingdom, supplied with life-saving apparatus The chief and earliest of these depôts is the Receiving House in Hyde Park, on the north bank of the Serpentine, which was built in 1794 on a site granted by George III. Boats and boatmen are kept to render aid to bathers, and in the winter ice-men are sent round to the different skating grounds in and around London. The society distributes money-rewards, medals, clasps and testimonials to those who save or attempt to save drowning people It further recognizes "all cases of exceptional bravery in rescuing or attempting to rescue persons from asphyxia in mines, wells, blasting furnaces, or in sewers where foul gas may endanger life" It further awards prizes for swimming to public schools and training ships Since 1873 the Stanhope gold medal has been awarded "to the case exhibiting the greatest gallantry during the year." During the year 1927, 506 persons were rewarded for saving or attempting to save 524 lives from drowning The society is maintained by private subscriptions and bequests. (*See* also DROWNING AND LIFE-SAVING.)

HUMANISM, in general any system of thought or action which assigns a predominant interest to the affairs of men as compared with the supernatural or the abstract (from Lat *humanus,* human, connected with *homo,* mankind). The term is specially applied to that movement of thought which in western Europe in the 15th century broke through the mediaeval traditions of scholastic theology and philosophy, and devoted itself to the rediscovery and direct study of the ancient classics This movement was essentially a revolt against intellectual, and especially ecclesiastical authority, and is the parent of all modern developments whether intellectual, scientific or social (*see* RENAISSANCE).

The name has also been applied in recent years to a form of Pragmatism (*q v*) which is usually known on the European continent as Hominism (*q v.*).

HUMANITARIANS, in the theological sense, is a term applied chiefly to a school of theologians who repudiated the doctrine of the Trinity and held an extreme view of the person of Christ as simply human although miraculously endowed The adoption of this position by men like Nathaniel Lardner, Joseph Priestley and Theophilus Lindsey in the middle of the 18th century led to the establishment of the first definitely organized Unitarian churches in England (*see* UNITARIANISM).

HUMAYUN (1508–1556), Mogul emperor of Delhi, succeeded his father Baber in India in 1530, while his brother Kamran obtained the sovereignty of Kabul and Lahore. Humayun was thus left in possession of his father's recent conquests, which were in dispute with the Indian Afghans under Sher Shah, governor of Bengal. After ten years of fighting, Humayun was driven out of India and compelled to flee to Persia through the desert of Sind, where his famous son, Akbar the Great, was born in the petty fort of Umarkot (1542). Sher Shah was killed at the storming of Kalinjar (1545), and Humayun, returning to India with Akbar, then only 13 years of age, defeated the Indo-Afghan army and reoccupied Delhi (1555). India thus passed again from the Afghans to the Moguls, but six months afterwards Humayun was killed by a fall from the parapet of his palace (1556), and left his kingdom to Akbar The tomb of Humayun is one of the finest Mogul monuments in the neighbourhood of Delhi, and it was here that the last of the Moguls, Bahadur Shah, was captured by Major Hodson in 1857.

HUMBER, an estuary on the east coast of England, formed by the rivers Trent and Ouse, the northern shore belonging to Yorkshire and the southern to Lincolnshire. These rivers join near Faxfleet and flow east for 18 m., then south-east for 19 m. to the North sea The width of the estuary is 1 m. at the head, widening to 3½ m at 8 m. above the mouth, where it increases to 8 m. in width On the north side at the mouth is a large shallow bay enclosed by Spurn Head (*q v.*). Except where the Humber cuts through a low chalk ridge, between north and south Ferriby, the shores and adjacent lands are nearly flat. The water is muddy; and the course for shipping has to wind about to avoid numerous shoals The course is carefully buoyed and lighted, for the Humber is an important highway of commerce, having on the Yorkshire bank the great port of Hull, and on the Lincolnshire bank those of Immingham and Grimsby, while Goole, to which there is a channel 22 ft deep at spring tides, lies on the Ouse a little above the junction with the Trent Canals connect with south Yorkshire, the Trent and the Midlands. A tidal bore is sometimes seen on the Humber. On the Yorkshire side the action of the river towards the mouth alters the shore-line constantly Many villages have disappeared, notably Ravenspur, which was once a port and the scene of the landing of Bolingbroke (1399)

HUMBERT, RANIERI CARLO EMANUELE GIOVANNI MARIA FERDINANDO EUGENIO (1844–1900), King of Italy, son of Victor Emmanuel II. and of Adelaide, archduchess of Austria, was born at Turin, capital of the kingdom of Sardinia, on March 14, 1844. His education was entrusted to Massimo d'Azeglio, Pasquale Stanislao Mancini and others Entering the army on March 14, 1858 as a captain, he was present at Solferino in 1859, and in 1866 commanded a division at Custozza Attacked by the Austrian cavalry near Villafranca, he formed his troops into squares and drove the assailants towards Sommacampagna, remaining himself throughout the action in the square most exposed to attack With Bixio he covered the retreat of the Italian army, receiving the gold medal for valour. On April 21, 1868 he married his cousin, Margherita Teresa Giovanna, princess of Savoy. On Nov. 11, 1869 Margherita gave birth to Victor Emmanuel, prince of Naples, afterwards Victor Emmanuel III. of Italy.

Ascending the throne on the death of his father (Jan. 9, 1878), Humbert adopted the style "Humbert I of Italy" instead of Humbert IV, and consented to the burial of his father at Rome in the Pantheon, and not in the royal mausoleum of Superga. He began a tour of the kingdom On entering Naples (Nov. 17, 1878) he was attacked by a fanatic named Passanante. The king warded off the blow with his sabre, but Cairoli, the prime minister, in attempting to defend him, was severely wounded The would-be assassin was condemned to death, but the king commuted the sentence to penal servitude for life. In 1881 King Humbert, again accompanied by Cairoli, resumed his interrupted tour, and visited Sicily and the southern Italian provinces. In 1882 he took part in the national mourning for Garibaldi, whose tomb at Caprera he repeatedly visited. When, in the autumn of 1882, Verona and Venetia were inundated, he hastened to the spot, directed salvage operations, and provided large sums of money for the destitute He showed similar devotion at the Ischia earthquake of 1883, and the cholera epidemic at Naples in 1884.

Compared with those of his grandfather, Charles Albert, and of his father, Victor Emmanuel, the reign of Humbert was tranquil. Scrupulously observant of constitutional principles, he followed, as far as practicable, parliamentary indications in his choice of premiers, only one of whom—Rudini—was drawn from the Conservative ranks He approved the conclusion of the Triple Alliance, and in repeated visits to Vienna and Berlin, established and consolidated the pact. Towards Great Britain his attitude was invariably cordial, and he considered that the Triple Alliance should be supplemented by an Anglo-Italian naval *entente.* His support of the policy of colonial expansion tended to diminish his popularity after the disaster of Adowa on March 1, 1896. His popularity was, however, enhanced by the firmness of his

attitude towards the Vatican, as exemplified in his telegram declaring Rome "intangible" (Sept 20, 1886), and affirming the permanence of the Italian possession of the Eternal City Above all King Humbert was a soldier, jealous of the honour and prestige of the army to such a degree that he promoted a duel between his nephew, the count of Turin, and Prince Henry of Orleans (Aug. 15, 1897) on account of the aspersions cast by the latter upon Italian arms. Humbert's claims to popular affection were enhanced by his munificence in the relief of innumerable private wants into which he had made personal inquiry The regard in which he was universally held was abundantly demonstrated on the occasion of the unsuccessful attempt upon his life made by the anarchist Acciarito near Rome on April 22, 1897, and still more after his assassination at Monza by the anarchist Bresci on July 29, 1900 Good-humoured, active, tender-hearted, somewhat fatalistic, but, above all, generous, he was spontaneously called "Humbert the Good" He was buried in the Pantheon in Rome, by the side of Victor Emmanuel II., on Aug 9, 1900

See Stillman, *The Union of Italy, 1815–1895* (1898), Pedrotti, *Vita e regno di Umberto I re d'Italia* (1901)

HUMBERT, GEORGES LOUIS (1862–), French general, was born at Gazeran (Seine et Oise) on April 8, 1862, and entered the military academy of St Cyr in Oct 1881 In March 1912 he was made a general of brigade, and in 1913 was sent to Morocco On the outbreak of the World War he was given command of the 1st Moroccan division, which he held during the battle of the Marne On Oct. 27, 1914 he was confirmed in the rank of general of division and given command of the XXXII Army Corps On July 22, 1915 he took over the III Army In Oct. 1919 he was appointed governor of Strasbourg and commandant of the Alsace territory, and in the January following was made a member of the superior war council

HUMBLE-BEE: *see* BUMBLE-BEE

HUMBLE PETITION AND ADVICE, a memorial presented to Oliver Cromwell by the English parliament called in 1656 In its original version the parliament petitioned the Protector to assume the title of king This Cromwell was unwilling to do the petition was therefore amended, and after being passed on May 25, 1657, received the Protector's assent On June 26 an Additional Petition modified the previous document

The most important clause was that in which the parliament vindicated its right to control its own elections—a privilege flagrantly violated by Cromwell's exclusion of some 100 members from this very parliament —

That the ancient and undoubted liberties and privileges of Parliament (which are the birthright and inheritance of the people, and wherein every man is interested) be preserved and maintained, and that you will not break nor interrupt the same, nor suffer them to be broken or interrupted, and particularly that those persons who are legally chosen by a free election of the people to serve in Parliament, may not be excluded from sitting in Parliament to do their duties, but by judgement and consent of that House whereof they are members

By Article 5 the Protector was accorded the right to name the members of the other House, but all future members were to be nominated in accordance with the consent of the House itself—a clause which in effect entrenched the Puritan Party in the other House against all attack In the disputes which arose over this fundamental difficulty Cromwell dissolved parliament in 1658

HUMBOLDT, ALEXANDER (FRIEDRICH HEINRICH ALEXANDER) Baron von (1769–1859), German naturalist and traveller, was born at Berlin, on Sept. 14, 1769, son of a major in the Prussian army. His education devolved upon his mother, who was left a widow in 1779 His researches into the vegetation of the mines of Freiberg led to the publication in 1793 of his *Florae Fribergensis Specimen;* and the results of prolonged experiments on the phenomena of muscular irritability, then recently discovered by L. Galvani, were contained in his *Versuche über die gereizte Muskel- und Nervenfaser* (Berlin, 1797), enriched in the French translation with notes by Blumenbach.

In 1794 he was admitted to the intimacy of the famous Weimar coterie, and contributed (June 1795) to Schiller's new periodical, *Die Horen,* a philosophical allegory entitled *Die Lebenskraft, oder der rhodische Genius* In 1790 he visited England with George Forster, the companion of Cook on his second voyage In 1792 and 1797 he was in Vienna, in 1795 he made a geological and botanical tour through Switzerland and Italy Meanwhile he had been appointed assessor of mines at Berlin, in 1792. He rapidly rose to the highest post in his department, and was entrusted with important diplomatic missions After the death of his mother in 1796 he severed his official connections, to fulfil his desire to travel He left for Marseilles with Aimé Bonpland, the botanist, hoping to join Bonaparte in Egypt, but the two travellers eventually went to Madrid, where the unexpected patronage of the minister d'Urquijo determined them to make Spanish America the scene of their explorations.

They sailed in the "Pizarro" from Corunna, in 1799, stopped six days at Teneriffe for the ascent of the Peak, and landed at Cumana There Humboldt observed, on the night of the 12–13th of November, that meteor-shower which forms the starting-point of our knowledge of the periodicity of the phenomenon, thence he proceeded with Bonpland to Caracas, and in 1800 he left to explore the course of the Orinoco He covered in four months 1,725 m. of wild and uninhabited country, established the existence of a communication between the water-systems of the Orinoco and Amazon, and the exact position of the bifurcation. On Nov 24 the two friends set sail for Cuba, and after a stay of some months regained the mainland at Cartagena Ascending the Magdalena, and crossing the Cordilleras, they reached Quito on Jan 6, 1802 They made the ascent of Pichincha and Chimborazo, and an expedition to the sources of the Amazon *en route* for Lima At Callao Humboldt observed (8 Nov 9) the transit of Mercury, and studied the fertilizing properties of guano, the introduction of which into Europe was mainly due to his writings. After a year in that province, and a short visit to the United States, they returned (1804) to Europe

In this expedition Humboldt laid the foundation in their larger bearings of the sciences of physical geography and meteorology. By his delineation (in 1817) of "isothermal lines," he suggested the idea and devised the means of comparing the climatic conditions of various countries He first investigated the rate of decrease in mean temperature with increase of elevation above the sea-level, and afforded, by his enquiries into the origin of tropical storms, the earliest clue to the detection of the more complicated law governing atmospheric disturbances in higher latitudes; while his essay on the geography of plants was based on the then novel idea of studying the distribution of organic life as affected by varying physical conditions His discovery of the decrease in intensity of the earth's magnetic force from the poles to the equator was communicated (Dec 7, 1804) to the Paris Institute His services to geology were mainly based on his study of the volcanoes of the New World He showed that they fell naturally into linear groups, presumably corresponding with vast subterranean fissures, and by his demonstration of the igneous origin of rocks previously held to be of aqueous formation, he contributed largely to the elimination of erroneous views.

After a short trip to Italy with Gay-Lussac to investigate the law of magnetic declination, and a sojourn of two years and a half in Berlin, he settled (1808) in Paris for the purpose of securing the scientific co-operation required for the arrangement of the material he had collected on his travels This colossal task occupied him for 21 years, and even then remained incomplete With the exception of Napoleon Bonaparte, he was the most famous man in Europe. Academies, both native and foreign, were eager to enroll him among their members Frederick William III. of Prussia gave him a court sinecure He refused the appointment of Prussian minister of public instruction in 1810 In 1814 he accompanied the allied sovereigns to London Three years later he was summoned by the king of Prussia to attend him at the congress of Aix-la-Chapelle Again in the autumn of 1822 he accompanied the king to the Congress of Verona, proceeded to Rome and Naples, and returned to Paris in the spring of 1823

In Paris Humboldt found scientific sympathy, and the social stimulus which his mind craved. When at last he received a sum-

mons to join the court at Berlin he obeyed regretfully. He never ceased to rail against the bigotry without religion, aestheticism without culture, and philosophy without common sense, which he found dominant in Berlin At first he sought relief from the "nebulous atmosphere" of his new abode by frequent visits to Paris; but as years advanced his excursions were reduced to accompanying the monotonous "oscillations" of the court between Potsdam and Berlin On May 12, 1827, he settled permanently in the Prussian capital, where his first efforts were directed towards the investigation of the nature and law of "magnetic storms"—a term invented by him to designate abnormal disturbances of the earth's magnetism. His appeal to the Russian government in 1829 led to the establishment of a line of magnetic and meteorological stations across northern Asia, while his letter to the duke of Sussex, then (April 1836) president of the Royal Society, secured for the undertaking the wide basis of the British dominions. Thus that scientific conspiracy of nations which is one of the noblest fruits of modern civilization was by his exertions first successfully organized

In 1811, and again in 1818, projects of Asiatic exploration were proposed to Humboldt, first by the Russian, and afterwards by the Prussian government; but it was not until he had entered upon his 60th year that he resumed his early *rôle* of a traveller. Between May and Nov 1829 he with Gustav Rose and C. G. Ehrenberg, traversed the Russian empire from the Neva to the Yenesei, travelling 9,614 m in 25 weeks The journey was too rapid to be profitable. Its most important fruits were the correction of the prevalent exaggerated estimate of the height of the Central-Asian plateau, and the discovery of diamonds in the gold-washings of the Ural

Between 1830 and 1848 Humboldt was frequently sent on diplomatic missions to the court of Louis Philippe, with whom he always maintained cordial personal relations. The death of his brother, Wilhelm von Humboldt (*q v*), saddened the later years of his life After the accession (1840) of Frederick William IV, Humboldt was more and more in demand at court, and was much hindered in his own work

The first two volumes of the *Kosmos,* the great work of his life, were published, and in the main composed, between 1845 and 1847, the third and fourth between 1850 and 1858, a fifth appeared posthumously in 1862. The idea of a work which should convey, not only a graphic description, but an imaginative conception of the physical world—which should support generalization by details, and dignify details by generalization—had first taken shape in lectures in 1827–28. These formed, as his biographer expresses it, "the cartoon for the great fresco of the *Kosmos,*" and cover the whole scientific knowledge of the time. The supreme and abiding value of his work consists in its faithful reflection of the mind of a great man

In 1857 Humboldt had a slight apoplectic stroke He died on May 6, 1859, and received a state funeral Humboldt never married. To his brother's family he was much attached. In his later years the sway of an old and faithful servant held him in more than matrimonial bondage, and four years before his death he executed a deed of gift transferring to this man Seifert the absolute possession of his entire property Humboldt's early zeal for the improvement of the condition of the miners in Galicia and Franconia, his consistent detestation of slavery, his earnest patronage of rising men of science, bear witness to the large humanity which formed the ground-work of his character. The faults of his old age are shown in his letters to Varnhagen von Ense. The chief of these was his habit of smooth speaking, almost amounting to flattery, which contrasted with the caustic sarcasm of his confidential utterances After every deduction has been made Humboldt was a great representative of the scientific side of the culture of his country.

The *Voyage aux régions équinoxiales du Nouveau Continent, fait en 1799–1804, par Alexandre de Humboldt et Aimé Bonpland* (Paris, 1807, etc.), consisted of 30 vols, and comprised subordinate but important works Among these may be enumerated *Vue des Cordillères et monuments des peuples indigènes de l'Amérique* (2 vols. folio, 1810); *Examen critique de l'histoire de la géographie du Nouveau Continent* (1814–34); *Atlas géographique et physique du royaume de la Nouvelle Espagne* (1811); *Essai politique sur le royaume de la Nouvelle Espagne* (1811); *Essai sur la géographie des plantes* (1805, now very rare); and *Relation historique* (1814–25), an unfinished narrative of his travels, including the *Essai politique sur l'île de Cuba.* The *Nova genera et species plantarum* (7 vols. folio, 1815–25), containing descriptions of above 4,500 species of plants collected by Humboldt and Bonpland, was mainly compiled by C. S. Kunth, J. Oltmanns assisted in preparing the *Recueil d'observations astronomiques* (1808), Cuvier, Latreille, Valenciennes and Gay-Lussac co-operated in the *Recueil d'observations de zoologie et d'anatomie comparée* (1805–33). Humboldt's *Ansichten der Natur* (Stuttgart and Tubingen, 1808) went through three editions in his lifetime, and was translated into nearly every European language. The results of his Asiatic journey were published in *Fragments de géologie et de climatologie asiatiques* (2 vols 1831), and in *Asie centrale* (3 vols. 1843)—an enlargement of the earlier work.

The publication of his *Briefe an Varnhagen von Ense* (Leipzig, 1860) was followed by *Briefwechsel mit einem jungen Freunde* (Berlin, 1861); *Briefwechsel mit Heinrich Berghaus* (3 vols, Jena, 1863); *Correspondance scientifique et littéraire* (2 vols, Paris, 1865–69), "Lettres à Marc-Aug Pictet," published in *Le Globe,* tome VII (Geneva, 1868), *Briefe an Bunsen* (Leipzig, 1869); *Briefe zwischen Humboldt und Gauss* (1877); *Briefe an seinen Bruder Wilhelm* (Stuttgart, 1880); *Jugendbriefe an W. G. Wegener* (Leipzig, 1896), besides some other collections of less note An edition of Humboldt's principal works was published in Paris by Th Morgand (1864–66) *See* also Karl Bruhns (and others), *Alexander von Humboldt, eine wissenschaftliche Biographie* (3 vols., 1872, with bibliography, Eng. trans by Lassell, 1873); Karl von Baer, *Bulletin de l'acad des sciences de St-Pétersbourg,* XVII. 529 (1859), R Murchison, *Proceedings, Geog Society of London,* VI (1859); L Agassiz, *American Jour of Science,* XXVIII. 96 (1859); *Proc. Roy. Society,* X XXXIX.; A. Quetelet, *Annuaire de l'acad des sciences* (Brussels, 1860), p. 97; J. Madler, *Geschichte der Himmelskunde,* II. 113; J. C. Houzeau, *Bibl. astronomique,* ii. 168. (A. M. C, X.)

HUMBOLDT, KARL WILHELM VON (1767–1835), German philologist and man of letters, the elder brother of Alexander von Humboldt, was born at Potsdam, on June 22, 1767. After studying at Berlin, Gottingen and Jena, in the last of which places he formed a close and lifelong friendship with Schiller, he married Fräulein von Dacherode, and in 1802 was appointed by the Prussian Government first resident and then minister plenipotentiary at Rome While there he published a poem entitled *Rom.* His critical essay on Goethe's *Hermann und Dorothea,* published in 1800, had already placed him in the first rank of authorities on aesthetics, and, together with his family connections, had much to do with his appointment at Rome; while in the years 1795 and 1797 he had brought out translations of several of the odes of Pindar, which were held in high esteem. On quitting his post at Rome he was made councillor of State and minister of public instruction. He soon, however, retired to his estate at Tegel, near Berlin, but was recalled and sent as ambassador to Vienna in 1812 In 1813, as Prussian plenipotentiary at the congress of Prague, he was mainly instrumental in inducing Austria to unite with Prussia and Russia against France; in 1815 he was one of the signatories of the capitulation of Paris, and drafted the treaty between Prussia and Saxony, by which Prussian territory was largely increased. In 1816 he was at Frankfort, but was summoned to London in the midst of his work, and in 1818 had to attend the congress at Aix-la-Chapelle The reactionary policy of the Prussian Government made him resign his office of privy councillor and give up political life in 1819, and from that time forward he devoted himself solely to literature and study

In 1816 he had published a translation of the *Agamemnon* of Aeschylus, and in 1817 corrections and additions to Adelung's *Mithridates,* that famous collection of specimens of the various languages and dialects of the world. Among these additions that on the Basque language is the longest and most important, Basque having for some time specially attracted his attention. Wilhelm von Humboldt introduced Basque to the notice of European philologists, and made a scientific study of it possible. He visited the Basque country itself, the result of his visit being the valuable "Researches into the Early Inhabitants of Spain by the help of the Basque language" (*Prüfung der Untersuchungen über die Urbewohner Hispaniens vermittelst der vaskischen Sprache,* 1821). Another work on what has sometimes been termed the metaphysics of language appeared from his pen in 1828, under the title of *Über den Dualis;* but the great work of his life, on the ancient Kawi language of Java, was interrupted by his death on April 8, 1835. The imperfect fragment was edited by his brother and

Dr. Buschmann in 1836, and contains the introduction on "The Heterogeneity of Language and its Influence on the Intellectual Development of Mankind," which was afterwards edited and defended against Steinthal's criticisms by Pott (2 vols., 1876). This essay, which has been called the textbook of the philosophy of speech, first clearly laid down that the character and structure of a language expresses the inner life and knowledge of its speakers, and that languages must differ from one another in the same way and to the same degree as those who use them. Other linguistic publications of Humboldt, which had appeared in the *Transactions* of the Berlin Academy, the *Journal* of the Royal Asiatic Society, or elsewhere, were republished by his brother in the seven volumes of Wilhelm von Humboldt's *Gesammelte Werke* (1841–52). These volumes also contain poems, essays on aesthetic subjects and other creations of his prolific mind.

Many volumes of Humboldt's interesting correspondence with his contemporaries have been published. The principal publications are the Correspondence with Schiller (1830; new ed. by Lutzmann, 1889); with Goethe (ed. Bratranek, 1876); with J. R. Forster (ed. Forster, 1889); with F. H. Jacobi (ed. Leitzmann, 1892); with A. W. Schlegel (ed. Leitzmann, 1908), with Karoline von Humboldt (ed. Sydow, 3 vols., 1906–09); and a selection of letters to various correspondents (ed. K. Sell, 1924). A new edition of his *Gesammelte Werke* (1841–72, 7 vols.) was prepared for the Prussian Academy (15 vols., 1903–18). Of the many works dealing with W. von Humboldt *see* B. Gerhardt, *W. v. Humboldt als Staatsmann* (1896–99, 2 vols.), O. Harnack, *W. v. Humboldt* (1913), Leitzmann, *W. v. Humboldt* (1919).

HUMBUG, an imposture, sham, fraud. The word seems to have been originally applied to a trick or hoax, and appears as a slang term about 1750. The origin was unknown at that date.

HUME, ALEXANDER (*c.* 1557–1609), Scottish poet, second son of Patrick Hume of Polwarth, Berwickshire, was born probably at Reidbrais, a family house. In *An Epistle to Maister Gilbert Montcreif* (Moncrieff) he relates the course of his disillusionment. He says he spent four years in France before beginning to study law in the courts at Edinburgh (l. 136). After three years' experience there he abandoned law in disgust and sought a post at court (*ib.* l. 241). Still dissatisfied, he took orders, and became in 1597 minister of Logie, near Stirling, where he lived until his death. His best-known work is his *Hymns, or Sacred Songs* (1599).

The editions of Hume's verse are: (*a*) by Robert Waldegrave (1599), (*b*) a reprint of (*a*) by the Bannatyne Club (1832), and (*c*) by the Scottish Text Society (ed. A. Lawson) (1902). The last includes Hume's prose tracts.

HUME, ALLAN OCTAVIAN (1829–1912), English ornithologist and Indian administrator, son of Joseph Hume (*q.v.*), was born on June 6, 1829 and educated at Haileybury and London University. Entering the Indian civil service in 1849 he had a distinguished career in India. After his retirement in 1882 he devoted himself to furthering the aspirations of Indians. The Indian National Congress (*see* INDIA. *History*), which held its first session at Bombay in 1885, owes its existence to his exertions. He was the author of several works on ornithology, and presented his collections to the British Museum. He died at Norwood on July 31, 1912.

See W. Wedderburn, *Allan Octavian Hume C.B.; Father of the Indian National Congress* (1913); *Allan O. Hume: a Sketch of his Life and Services to India* (1912); and H. V. Lovett, *A History of the Indian Nationalist Movement* (1920).

HUME, DAVID (1711–1776), British philosopher, historian and political economist, was born at Edinburgh, on April 26 (O.S.), 1711. His father was owner of a small estate named Ninewells in Berwickshire. David was educated at home until 1723 when he entered Edinburgh university. An attack of hypochondria and a few unhappy months in a business house in Bristol led him in 1734 to visit France, where during the first three years of his stay at La Flèche, his speculations were worked into systematic form in the *Treatise of Human Nature,* the first two volumes of which appeared in Jan. 1739. The third volume, containing book iii., *Of Morals*, was published in the following year. Hume's own words best describe its reception. "It fell dead-born from the press, without reaching such distinction as even to excite a murmur among the zealots." In the *Treatise,* which contains the most complete exposition of his philosophy, Hume refused to take for granted the rationality of the existence of the external world and critically examined the concepts of substance and cause. Naturally he was disappointed that the world did not see as clearly as he did the connection between the concrete problems agitating contemporary thought and the abstract principles on which their solution depended.

After the publication of the *Treatise* Hume retired to Ninewells and occupied himself with politics and political economy. In 1741 he published vol. i. of his *Essays* which had immediate success. A second edition and a second volume followed in 1742. After failing to secure the chair of moral philosophy at Edinburgh in 1744, Hume became tutor, or keeper, to the marquis of Annandale, a harmless literary lunatic. This position, financially advantageous, was absurdly false, and finally Hume had to sue for arrears of salary.

In 1746 he became secretary to Gen. St. Clair, and was a spectator of the ill-fated expedition to France in that year. He again retired to Ninewells to prepare his *Philosophical Essays* (afterwards entitled *An Inquiry concerning Human Understanding*). In 1748 he accompanied Gen. St. Clair as secretary in the embassy to Vienna and Turin, and in the same year were published the *Philosophical Essays*, the most famous of his works, though less great than his original *Treatise*. The *Essays* contain, in more detail, application of philosophical principles to concrete problems, such as miracles, providence, immortality; but the briefer treatment of the discussions of book i. of the *Treatise* is a defect which renders the *Treatise* the more important work.

In 1749 Hume returned to Ninewells, enriched with "near a thousand pounds," but two years later moved to Edinburgh where he spent the greater part of the next 12 years. These years are the richest so far as literary production is concerned. In 1751 he published his *Political Discourses*, which had a great and well-deserved success both in England and abroad, and the recast of book iii. of the *Treatise*, called *Inquiry concerning the Principles of Morals*, of which he says that "of all his writings, philosophical, literary or historical, it is incomparably the best." At this time also we hear of the *Dialogues concerning Natural Religion* (posthumously printed 1779) which he had been induced to hold back on account of their sceptical spirit.

In 1751 Hume again failed to secure a professor's chair, but in the following year he received, in spite of accusations of heresy, the librarianship of the Advocates' Library in Edinburgh, small in emoluments (£40 a year) but rich in opportunity for literary work. Two years later he was preparing his *History of England* which he began with James I., considering that the political differences of his time took their origin from that period. On the whole his attitude in respect to disputed political principles seems not to have been at first consciously unfair. The *History* appeared in five volumes between 1754 and 1762. Hume was bitterly disappointed at the reception of the first volume. But within a few years the sale brought in a larger revenue than had ever before been known in his country to flow from literature, and placed him in comparative affluence. At the same time Hume's dissatisfaction had an important effect, for from the publication of the first two volumes dates his virulent hatred of everything English, of society in London, Whig principles, Whig ministers and the public generally (*see* Burton's *Life*, ii. 268, 417, 434). He was convinced that there was a conspiracy to destroy everything Scottish. The remainder of the *History* became little better than a party pamphlet.

Volume ii., published in 1756, carrying on the narrative to the Revolution, was better received than the first; but Hume then resolved to work backwards, and to show from a survey of the Tudor period that his Tory notions were grounded upon the history of the constitution. In 1759 this portion of the work appeared, and in 1761 the work was completed by the history of the pre-Tudor periods. The numerous editions of the various portions gave him opportunity of revision, which he employed to remove the "villainous seditious Whig strokes," and "plaguy prejudices of Whiggism." But, whatever its faults, the *History* was the first attempt at a comprehensive treatment of historic facts, the

first to introduce the social and literary aspects of a nation's life as only second in importance to its political fortunes.

While the *History* was in process of publication, Hume produced in 1757 *Four Dissertations: The Natural History of Religion, Of the Passions, Of Tragedy, Of the Standard of Taste* Of these the second is a subtle piece of psychology, containing the essence of book ii of the *Treatise,* and the first is a powerful contribution to the deistic controversy, carrying the war into the province of the theory of the general development of religious ideas, and contending that polytheism was the earliest as well as the most natural form of religious belief, and that theism or deism is the product of reflection upon experience.

In 1763 Hume accompanied Lord Hertford to Paris, doing the duties of secretary to the embassy, with the prospect of the appointment to that post He was received with honour, and made many friends, among others D'Alembert and Turgot, the latter of whom profited much by Hume's economic essays In 1766 he returned to Edinburgh In 1767 he became under-secretary to Gen Conway at the Foreign Office and spent two years in London He settled finally in Edinburgh in 1769, having now through his pension and otherwise an income of £1,000 a year The solitary incident of note in this period of his life is the quarrel with Rousseau Hume did his utmost to secure for Rousseau a comfortable retreat in England, but his usually sound judgment seems at first to have been quite at fault with regard to his protégé. The quarrel which all the acquaintances of the two philosophers had predicted soon came, and no language had expressions strong enough for Rousseau's anger, which was, in fact, unreasonable In one of his letters Hume describes his life in Edinburgh The new house which was built under his own directions at the corner of what is now called St. David Street after him, became a centre of cultivated society Hume's cheerful temper, his equanimity, his kindness to literary aspirants and to those whose views differed from his own won him universal respect and affection He welcomed the work of his friends (*e.g.,* Robertson and Adam Smith), and warmly recognized the worth of his opponents (*e g*, George Campbell and Reid) He assisted Blackwell and Smollett in their difficulties and became the acknowledged patriarch of literature In the spring of 1775 Hume was struck with a tedious and harassing though not painful illness, of which he died on Aug. 25, 1776

Theory of Knowledge.—In the *Treatise* Hume attempted to apply the fundamental principles of Locke's empirical psychology to the construction of a theory of knowledge and the experimental method to the whole science of human nature For him, as for Locke, the problem of psychology was the exact description of the contents of the individual mind, and the determination of the conditions of the origin and development of its conscious experience Viewing the contents of mind as matter of experience, Hume could discover only the distinction expressed by the terms *impressions* and *ideas* Ideas are secondary in nature, copies of data supplied we know not whence All that appears in conscious experience as primary, as arising from some unknown cause, and therefore relatively as original, Hume designates by the term *impression,* and claims to imply by such terms no theory whatsoever as to the origin of this portion of experience There is simply the fact of conscious experience, ultimate and inexplicable The faculties of combining, discriminating, abstracting and judging, are merely expressions for particular modes of having mental experience, *i e*, are modifications of *conceiving.* By this theory, Hume is freed from all the problems of abstraction and judgment. A comparative judgment is simplified into an isolated perception of a peculiar form, and a series of similar facts are grouped under a single symbol, representing a particular perception, and only by the accident of custom treated as universal

Conscious experience then contains merely the succession of isolated impressions and their fainter copies, ideas bound together by merely natural or external links of connection, the principles of association among ideas The foundations of cognition must be discovered by observation or analysis of experience so conceived. Firstly, there are certain principles of cognition which appear to rest upon and to express relations of the universal elements in conscious experience, viz., space and time. The propositions of mathematics seem to be independent of special facts of experience, and to remain unchanged even when the concrete matter of experience varies. They are formal. In the second place, cognition, in any real sense of that term, implies connection between the present fact of experience and other facts, whether past or future. It appears to involve, therefore, some real relation among the portions of experience, on the basis of which relation judgments and inferences as to matters of fact can be shown to rest. The theoretical question is consequently that of the nature of the supposed relation, and of the certainty of judgments and inferences resting on it Hume's well-known distinction between relations of ideas and matters of fact corresponds fairly to this separation of the formal and real problems in the theory of cognition, although that distinction is in itself inadequate and not fully representative of Hume's own conclusions

With regard, then, to the first problem, the formal element in knowledge, Hume's chief discussions concern the nature of the space and time relations in our experience and the mode in which the primary data, or facts of mathematical cognition, are obtained The nature of space and time as elements in conscious experience is considered by Hume in relation to the special problem of their supposed infinite divisibility The ultimate elements of experience must be real units, capable of being represented or imagined in isolation Whence then do these units arise? In what classes of impressions do we find the elements of space and time? By this conception of conscious experience, Hume has to give some explanation of the nature of space and time which shall identify these with impressions, and at the same time to recognize the fact that they are not identical with any single impression or set of impressions. Certain impressions, the sensations of sight and touch, he says, have in themselves the element of space, for these impressions have a certain mode of arrangement. This mode is common to coloured points and tangible points, and, considered separately, is the impression from which our idea of space is taken All impressions and all ideas are received, or form parts of a mental experience only when received in a certain order, the order of succession. This manner of presenting themselves is the impression from which the idea of time arises Hume here deliberately gives up his fundamental principle that ideas are but the fainter copies of impressions, for it can never be maintained that order of disposition is an impression, and, secondly, he fails to offer any explanation of the mode in which *coexistence* and *succession* are possible elements of cognition in a conscious experience made up of isolated presentations and representations For the consistency of his theory, however, it was indispensable that he should insist upon the real, *i e.,* presentative, character of the ultimate units of space and time.

How are the primary data of mathematical cognition to be derived from any experience containing space and time relations in the manner just stated? It is important to notice that Hume distinctly separates geometry from algebra and arithmetic, *i e.,* he views extensive quantity as being cognized differently from number He holds that geometry is an empirical doctrine, a science founded on observation of concrete facts The rough appearances of physical facts, their outlines, surfaces and so on, are the data of observation, and only by a method of approximation do we come near to the propositions of pure geometry He definitely repudiates a view often ascribed to him, and certainly advanced by many later empiricists, that the data of geometry are hypothetical. The foundation of all the science of number is the fact that each element of conscious experience is presented as a unit, and we are capable of considering any fact or collection of facts as a unit. This *manner of conceiving* is absolutely general and distinct and accordingly affords the possibility of an all-comprehensive and perfect science, the science of discrete quantity. Hume nowhere explains the origin of the notions of unity and number, but merely asserts that through their means we can have absolutely exact and arithmetical propositions. Upon the nature of the reasoning by which in mathematical science we pass from data to conclusions, Hume gives no explicit statement.

His theory of mathematics is a practical condemnation of his empirical theory of perception. He has not offered even a plausible explanation of the mode by which a consciousness made up of isolated momentary impressions and ideas can be aware of coexistence and number, or succession. The relations of ideas are accepted as facts of immediate observation, as being themselves perceptions or individual elements of conscious experience, and to all appearance they are regarded by Hume as being in a sense analytical, because the formal criterion of identity is applicable to them. It is applicable, however, not because the predicate is contained in the subject, but on the principle of contradiction. If these judgments are admitted to be facts of immediate perception, the supposition of their non-existence is impossible

Real Cognition and Causation.—Real cognition, Hume points out, implies transition from the present impression to something connected with it This thing can only be an impression, not itself present, but represented by its copy or idea Now the supreme all-comprehensive link of connection is that of causation. The idea in question is, therefore, the idea of something connected with the present impression as its cause or effect. But this is explicitly the idea of the said thing as having had or as about to have existence—in other words, belief in the existence of some matter of fact. What, for a conscious experience so constituted is the precise significance of such a belief in real existence? Clearly the real existence of a fact is not demonstrable, for whatever is may be conceived not to be Existence of any fact, not present as a perception, can only be proved by arguments from cause or effect But as each perception is in consciousness only as a contingent fact, which might not be or might be other than it is, the mind can conceive no necessary relations or connections among the several portions of its experience.

If, therefore, a present perception leads us to assert the existence of some other, this can only mean that in some natural, *i e*, psychological, manner the idea of this other perception is excited, and that the idea is viewed by the mind in some peculiar fashion. The natural link of connection Hume finds in the similarities presented by experience One fact or perception is discovered by experience to be uniformly or generally accompanied by another, and its occurrence therefore naturally excites the idea of that other. The ease and rapidity of the mental transition is the sole ground for the supposed necessity of the causal connection between portions of experience The idea of necessity is not intuitively obvious; the ideas of cause and effect are correlative in our minds, but only as a result of experience

The Self in Cognition.—The final problem of Hume's theory of knowledge is the discussion of the real significance of the two factors of cognition, self and external things. If there is nothing in conscious experience save what observation can disclose, while each act of observation is itself an isolated feeling (an impression or idea), it is manifest that a permanent identical thing can never be an object of experience Whatever permanence or identity is ascribed to an impression or idea is the result of association with one of those "propensities to feign" which are due to natural connections among ideas We regard as successive presentations of one thing the resembling feelings which are experienced in succession Identity, then, whether of self or object, there is none, and the supposition of *objects*, distinct from impressions, is but a further consequence of our "propensity to feign."

In the *Appendix* to the *Treatise*, Hume confesses that, in confining all cognition to single perceptions and supplying no purely intellectual faculty for modifying and classifying their results, he has destroyed real knowledge altogether He sees distinctly that if conscious experience be taken as containing only isolated states, no progress in explanation of cognition is possible, and that the only hope of further development is to be looked for in a radical change in our mode of conceiving experience

Theology and Ethics.—The important *Dialogues on Natural Religion* introduce three interlocutors, Demea, Cleanthes and Philo The first represents a certain *a priori* view, then regarded as the safest bulwark against infidelity, of which the main tenets were that the being of God was capable of *a priori* proof, and that, owing to the finitude of our facilities, the attributes and modes of operation of deity were incomprehensible The second is the typical deist of Locke's school, holding that the only possible proof of God's existence was *a posteriori* from design, and that such proof was, on the whole, sufficient The third represents the type of completed empiricism or scepticism, holding that no argument, either from reason or experience, can transcend experience, and consequently that no proof of God's existence is possible Cleanthes, who maintains that the doctrine of the incomprehensibility of God is hardly distinguishable from atheism, is compelled by Philo to reduce to a minimum the conclusion capable of being inferred from experience as regards the existence of God. Philo stresses the weakness of the analogical argument, points out that the demand for an ultimate cause is no more satisfied by thought than by nature itself, shows that the argument from design cannot warrant the inference of a perfect or infinite or even of a single deity, and finally maintains that, as we have no experience of the origin of the world, no argument from experience can carry us to its origin, and that the apparent marks of design in the structure of animals are only results from the conditions of their actual existence So far as the *a priori* argument is concerned, reason can never demonstrate a matter of fact, and, unless we know that the world had a beginning in time, we cannot insist that it must have had a cause Demea then brings forward the ordinary theological topic, man's consciousness of his own imperfection, misery and dependent condition. Nature is throughout corrupt and polluted, but "the present evil phenomena are rectified in other regions and in some future period of existence" Cleanthes, pointing out that from a nature thoroughly evil we can never prove the existence of an infinitely powerful and benevolent Creator, hazards the conjecture that the deity, though all-benevolent, is not all-powerful Philo, however, pushing his principles to their full consequences, shows that unless we assumed (or knew) beforehand that the system of nature was the work of a benevolent but limited deity, we certainly could not, from the facts of nature, infer the benevolence of its Creator.

For Hume, ethics is not a purely rational science, since all our motives are desire for pleasure Actions are virtuous when they contribute to the happiness of ourselves and others Among virtues useful or agreeable to their possessor he includes discretion, industry, frugality, sobriety and considerateness Among those useful or agreeable to others are justice, fidelity to compacts, and veracity, the first two being "artificial" virtues due to civilization and worthy of approbation because of their useful consequences Because motives are involved in all action, Hume desires the freedom of the will

Hume's theory of knowledge expresses what may be called psychological individualism or atomism; his ethics and doctrine of religion are but the logical consequences of this theory. So far as metaphysic is concerned he has given the final word of the empirical school, and all additions, whether from the specifically psychological side or from the general history of human culture, are subordinate in character It is no exaggeration to say that the later English school of philosophy represented by J S. Mill made in theory no advance beyond Hume, the groundwork of the *System of Logic* is a mere reproduction of Hume's doctrine of knowledge, and the treatment in the posthumous essays on theism is in substance identical with that of the *Dialogues on Natural Religion*

Economics.—Hume's services to economics may be summed up in two heads: (1) he established the relation between economic facts and the fundamental phenomena of social life, and (2) he introduced into the study of these facts the new historical method Thus, without naming it, he describes the subject-matter and indicates the true method of economic science Of his economic essays, published in *Political Discourses* (1752) and *Essays and Treatises on Several Subjects* (1753), the most important are those on Commerce, on Money, on Interest, and on the Balance of Trade In dealing with money, Hume refutes the mercantile school, which had tended to confound it with wealth From the internal, as distinct from the international aspect, the absolute quantity of money, supposed as of fixed amount, in a country, is of no consequence, while a quantity larger than is required for

the interchange of commodities is injurious, as tending to raise prices and to drive foreigners from the home markets. It is only *during the period of acquisition* of money, and before the rise in prices, that the accumulation of precious metals is advantageous. This principle is perhaps Hume's most important economic discovery. Dealing with the phenomena of interest, he exposes the old fallacy that the rate depends upon the amount of money in a country The reduction in the rate in general must result from "the increase of industry and frugality, of arts and commerce." In the matter of free-trade and protection he compromises. On the one hand, he condemns "the numerous bars, obstructions and imposts which all nations of Europe, and none more than England, have put upon trade" On the other hand, he approves of a protective tax on German linen in favour of home manufactures, and of a tax on brandy as encouraging the sale of rum and so supporting our southern colonies. With regard to taxation he says that the best taxes are those levied on consumption, especially on luxuries, for these are least heavily felt. He denies that all taxes fall finally on the land. Superior frugality and industry on the part of the artisan will enable him to pay taxes without mechanically raising the price of labour For the modern expedient of raising money for national emergencies by way of loan he has a profound distrust A national debt, he maintains, enriches the capital at the expense of the provinces; further, it creates a leisured class of stockholders, and possesses all the disadvantages of paper credit. Hume enunciated the principle that "everything in the world is purchased by labour, and our passions are the only cause of labour" Further, in analysing the complex phenomena of commerce, he is superior sometimes to Adam Smith, in that he never forgets that the ultimate causes of economic change are the "customs and manners" of the people, and that the true solution of problems is to be sought in the elementary factors of industry.

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See also G Compayré, *La Philosophie de D Hume* (1873), E. Pfleiderer, *Empirismus und Skepsis in D Humes Philosophie* (1874); L. Stephen, *English Thought in the 18th Century* (1876); G von Gižycki, *Die Ethik D. Humes* (1878), T Huxley, *Hume* (1879), G Lechartier, *D. Hume, moraliste et sociologue* (1900); M. Teisseire, *Les essais économiques de Hume* (1902); A Schalz, *L'oeuvre économique de Hume* (1902); J. Seth, *English Philosophers* (1912); A Thomsen, *Hume, sein Leben und seine Philosophie* (1912), W R Sorley, *History of English Philosophy* (1920), C. W Hendel, *Studies in the Philosophy of Hume* (Princeton, 1925), A. E. Taylor, *Hume and the Miraculous* (1927). There is a full bibliography in Überweg, *Grundriss der Gesch. der Philosophie*, vol iii (1914)

HUME, JOSEPH (1777–1855), British politician, was born on Jan. 22, 1777, of humble parents, at Montrose, Scotland. After completing his course of medical study at the university of Edinburgh he sailed in 1797 for India, where he made a fortune. In 1812 he purchased a seat in parliament for Weymouth and voted as a Tory When upon the dissolution of parliament the patron refused to return him he brought an action and recovered part of his money Six years elapsed before he again entered the House, and during that interval he adopted the doctrines of James Mill and the philosophical reformers of the school of Bentham. He joined Francis Place (*q v*) and others in seeking to establish schools for them on the Lancastrian system, and promoting the formation of savings banks. In 1818, soon after his marriage with Miss Burnley, the daughter of an East India director, he was returned to parliament as member for the Border burghs He was afterwards successively elected for Middlesex (1830), Kilkenny (1837) and for the Montrose burghs (1842). Hume became the self-elected guardian of the public purse, by challenging and bringing to a direct vote every single item of public expenditure. It was he who caused the word "retrenchment" to be added to the Radical programme "peace and reform." He fought the old combination laws that hampered workmen and favoured masters; he brought about the repeal of the laws prohibiting the export of machinery and of the act preventing workmen from going abroad. He constantly protested against flogging in the army, the impressment of sailors and imprisonment for debt He took up the question of lighthouses and harbours; in the former he secured greater efficiency, in the latter he prevented useless expenditure. He died on Feb 20, 1855.

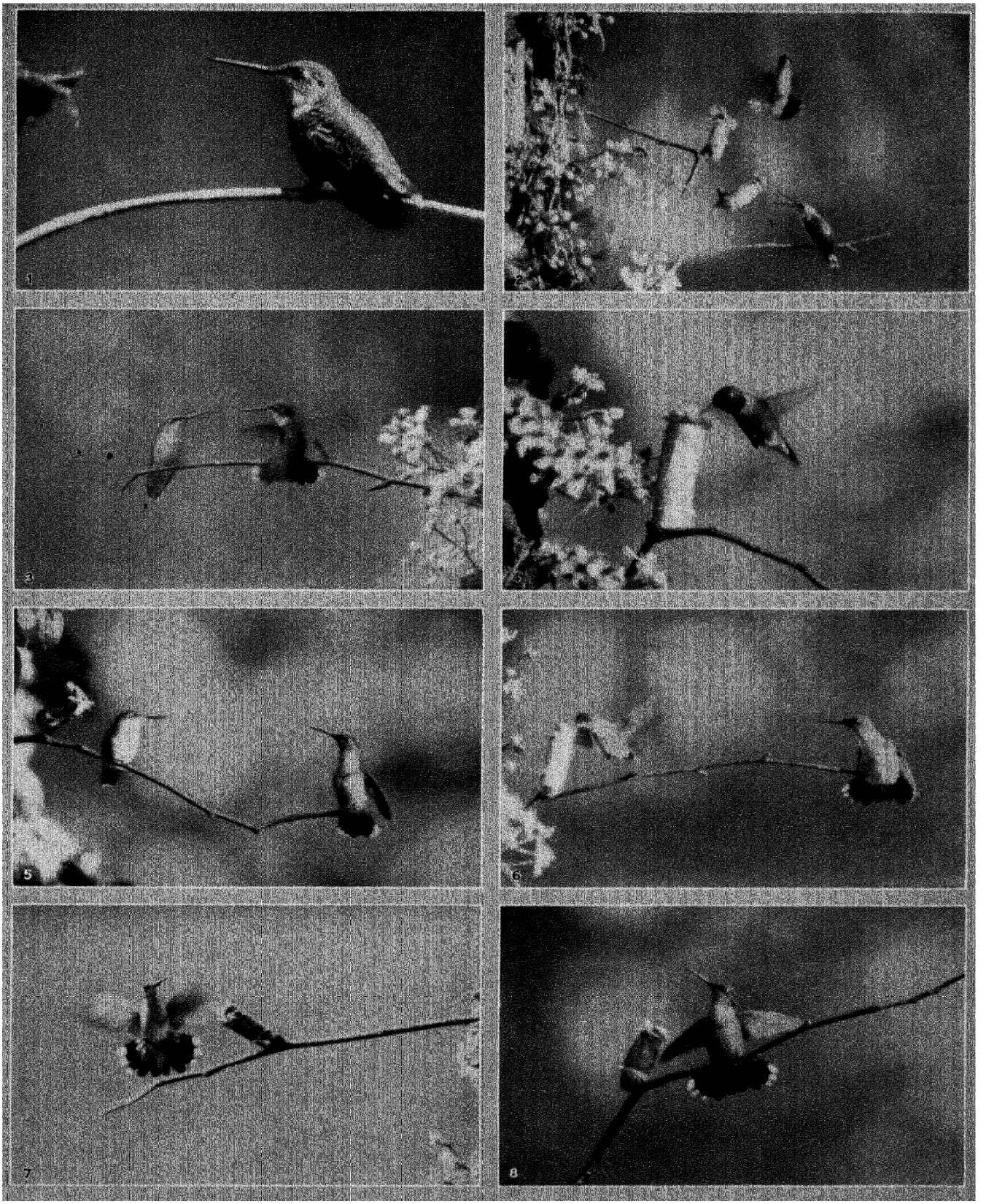
A *Memorial* of Hume was published by his son Joseph Burnley Hume (London, 1855).

HUMILIATI, the name of an Italian monastic order created in the 12th century Its origin is obscure A group of Lombards came to Rome with the intention of obtaining the pope's approval of the rule of life which they had spontaneously chosen; while continuing to live in their houses in the midst of their families, they wished to lead a more pious existence than of old, to abandon oaths and litigation, to content themselves with a modest dress, and all in a spirit of Catholic piety. The pope approved their resolve to live in humility and purity, but forbade them to hold assemblies and to preach in public; the chronicler adding that they infringed the pope's wish and thus drew upon themselves his excommunication Their name Humiliati ("Humiles" would have been more appropriate) arose from the fact that the clothes they wore were very simple and of one colour. This lay fraternity spread rapidly and soon put forth two new branches, a second order composed of women, and a third composed of priests, to which Innocent III granted a rule. His object was to reconcile the order with the Waldenses (*q v*), and, indeed, the rule reproduces several of the Waldensian propositions, ingeniously modified in the orthodox sense, but still very easily recognizable It forbade useless oaths and the taking of God's name in vain; allowed voluntary poverty and marriage; regulated pious exercises; and approved the solidarity which already existed among the members of the association Finally, by a singular concession, it authorized them to meet on Sunday to listen to the words of a brother "of proved faith and prudent piety," on condition that the hearers should not discuss among themselves either the articles of faith or the sacraments of the church The bishops were forbidden to oppose any of the utterances of the Humiliati brethren, "for the spirit must not be stifled" So broad a discipline must of necessity have led back some waverers into the pale of the church, but the tradition of the independent Humiliati is confused with the history of the Waldenses throughout the later 12th century The celebrated decretal promulgated in 1184 by Pope Lucius III at the council of Verona against all heretics condemns at the same time as the "Poor Men of Lyons" "those who attribute to themselves falsely the name of Humiliati," at the very time when this name denoted an order recognized by the papacy. This order, though orthodox, was always held in tacit and ever-increasing suspicion, and, in consequence of grave disorders, Pius V suppressed the entire congregation in February 1570–71.

See Tiraboschi, *Vetera humiliatorum monumenta* (Milan, 1766); K. Muller, *Die Waldenser* (Gotha, 1886); W. Preger, *Beiträge zur Geschichte der Waldenser* (Munich, 1875); also art. "Humiliati" in the *Catholic Encyclopaedia.* (P. Al.)

HUMITE, a group of three related minerals consisting of basic magnesium fluo-silicates, with the formulae: chondrodite, $Mg_3[Mg(F,OH)]_2[SiO_4]_2$; humite, $Mg_5[Mg(F,OH)]_2[SiO_4]_3$; clinohumite, $Mg_7[Mg(F,OH)]_2[SiO_4]_4$. Humite crystallizes in the orthorhombic and the two others in the monoclinic system, but between them there is a close crystallographic relation; the lengths of the vertical axes are in the ratio 5:7:9, and this is also the ratio of the number of magnesium atoms present in each of the three minerals Such a relation between the crystallographic constants and the chemical composition is commonly known as a morphotropic relation.

The three minerals are strikingly similar in appearance, and can only be distinguished by the goniometric measurement of the complex crystals. They are honey-yellow to brown or red in colour, and have a vitreous to resinous lustre; hardness 6–6·5, specific gravity 3·1–3·2. The name humite, after Sir Abraham Hume



BY COURTESY OF MARGARET L. BODINE

RUBY-THROATED HUMMING BIRD (*TROCHILUS COLUBRIS*) THE ONLY HUMMING BIRD FOUND EAST OF THE MISSISSIPPI

This species is among the smallest of the family, averaging 3½ inches from the tip of the bill to the end of the tail. The underparts of both male and female are gray, the head and back iridescent green, the plumage of the male (fig. 4) being further enriched with a ruby red throat. The birds were lured to the scene of the photographs by tiny brightly coloured bottles of sugared water, fastened on a vine

(1749–1839), was given in 1813 to the small and brilliant honey-yellow crystals found in the blocks of crystalline limestone ejected from Monte Somma, Vesuvius; all three species have since been recognized at this locality. Chondrodite (from χόνδρος, "a grain") was a name early (1817) in use for granular forms of these minerals found embedded in crystalline limestones in Sweden, Finland and at several places in New York and New Jersey. Large hyacinth-red crystals of all three species are associated with magnetite in the Tilly Foster iron-mine at Brewster, New York; and at Kafveltorp in Örebro, Sweden, similar crystals (of chondrodite) occur embedded in galena and chalcopyrite.

HUMMEL, JOHANN NEPOMUK (1778–1837), German composer and pianist, was born on Nov. 14, 1778, at Pressburg, in Hungary. In 1785 his father became conductor at Schikaneder's theatre in Vienna Schikaneder was a friend of Mozart and the librettist of the *Magic Flute*, and introduced Hummel to Mozart who gave the boy instruction for two years. At nine years old Hummel toured Europe with his father as a "Wunderkind"; in his eleventh year he began to compose. After his return to Vienna he completed his studies under Albrechtsberger and Haydn; and at a later period he learned song-writing from Salieri. From 1804 to 1811 he was Kapellmeister to Prince Eszterhazy. Beethoven's Mass in C was performed in 1810, and a remark passed by Hummel caused an estrangement between the two which was only healed just before Beethoven's death. The years 1811 to 1815 were spent in Vienna, and after the peace Hummel began to tour Europe as pianist and conductor, having enormous success everywhere. He died in 1837 at Weimar, where for a long time he had been the musical conductor of the court theatre. Hummel wrote, amongst other things, several operas, both tragic and comic, and two grand masses (*Opp.* 80 and 111). More important are his compositions for the pianoforte (his two concertos in A minor and B minor, and the sonata in F sharp minor), and his chamber music (the celebrated septet, and several trios, etc.). His experience as a player and teacher of the pianoforte was embodied in his *Great Pianoforte School* (Vienna), and the excellence of his method was attested by his pupils, Henselt and Ferdinand Hiller. Hummel continued the traditions of the earlier Viennese school of Mozart and Haydn; his style alike as pianist and composer was marked by purity and correctness rather than by passion and imagination.

HUMMING-BIRD, the name applied to the beautiful little birds forming the family *Trochilidae*, which is confined to America. Their nearest allies are the swifts (*Micropodidae*). Of their internal characters, the most notable is the extreme development of the breast-bone and its keel in connection with the rapid wing-beat from which the birds derive their English name. This is particularly noticeable in the smaller forms. In the larger the wing-beat is slower (*see* Darwin, *Voyage of the Beagle*). The humming birds form a very homogeneous group, all small in size, varying in length from 8½in. in *Patagonagigas* to 2⅛in. in *Mellisuga minima*, which weighs under 2 grms. Within their limits, however, the *Trochilidae* present a remarkable diversity of form; the colouring is usually of a brilliance unequalled by larger birds (though the "hermits," forming the genus *Phaethornis*, are plainly coloured), and only to be described by comparisons with precious stones. The females are usually less brilliantly coloured than the males. Tails, wings and crests are all subject to modification, as is the length of the bill The tongue is protrusible and forms an organ for the capture of insects and the imbibing of nectar.

It is advisable to mention that the birds called humming-birds in Africa and India are sun-birds (*Nectariniidae*), while in England the humming-bird hawk-moth (*Macroglossa stellarum*) is occasionally taken for a true Trochilid.

The humming-birds are distributed almost all over America, reaching Tierra del Fuego in the south and Sitka (as a summer visitor) in the north; but their metropolis is on the slopes of the northern Andes in Colombia. The "hermits" are confined to the Amazon valley, which is otherwise very poorly supplied with these birds. Eighteen species inhabit the United States, but some of these only just cross the frontier. On Mount Chimborazo and elsewhere humming-birds are found at an elevation of 16,000ft., just below the level of perpetual snow This is remarkable, as the heat-loss from such small birds is so great that it is to be expected that they should be confined to warm climates.

The habits of the humming-birds have been admirably treated by Waterton, Wilson, Audubon, Gosse, Wallace, Bates and others. The nest is solidly built, usually of vegetable down and spiders' webs It is generally a cup-shaped structure, though the form is very variable and some species suspend their nests from stems, leaves or tendrils. The eggs, almost invariably two in number, are white and almost symmetrically pointed The mother bird is very solicitous for her offspring.

See J. Gould, *Monograph of the Trochilidae*

HUMMOCK, a small rounded knoll of ice rising above the general level of an ice-field, making sledge transport in the polar regions extremely difficult Hummocky ice is caused by slow unequal pressure in the main body of the packed ice, and by local variations of texture and temperature at a later period.

HUMOUR, in the modern use of the term, signifies a perception of the comic or incongruous of a special sort; generally distinguished from wit, as being on the one side more subtle, or on the other side more vague. It is thus a term which not only refuses to be defined, but in a sense boasts of being indefinable; and it would commonly be regarded as a deficiency in humour to search for a definition of humour. The modern use of the term, however, is by no means the primary or necessary use of it; and it is one of the cases, rarer than is commonly supposed, in which derivation offers at least an approach to definition Everybody knows that humour, in the Latin sense of "moisture," was applied here as part of the old physiological theory, by which the characters of men varied according to the proportions of certain different secretions in the human body; as, for instance, that the predominance of phlegm produced the phlegmatic humour. By the time of the full consolidation of the English language, it had thus become possible for Ben Jonson and others to use the word "humour" rather in the sense of "the ruling passion" With this there necessarily went an idea of exaggeration; and by the end of the process the character of a humorist was more or less identical with what we should call an eccentric The next stages of the development, which are rather slow and subtle, correspond to the various degrees in which the eccentric has become conscious of his eccentricity. England has always been especially rich in these eccentrics; and in England, where everything was less logical and more casual than in other countries, the eccentric long remained, as we should say, half unconsciously and half consciously humorous. The blend, and the beginnings of the modern meaning, may perhaps be dated at about the time of the Waverley Novels, when Guy Mannering complains of Councillor Pleydell as "a crack-brained humorist." For Pleydell is indeed laughed at for his little vanities or whims; but he himself joins in the laugh and sees the humour of his humour. Since then the word has come to be used more and more exclusively of conscious humour; and generally of a rather deep and delicate appreciation of the absurdities of others. Nevertheless there clings to the word humour, especially when balanced against the word wit, a sort of tradition or atmosphere that belongs to the old eccentrics whose eccentricity was always wilful and not infrequently blind. The distinction is a fine one; but one of the elements remaining in this blend is a certain sense of being laughed at, as well as of laughing It involves some confession of human weakness; whereas wit is rather the human intellect exerting its full strength, though perhaps upon a small point. Wit is reason on its judgment seat; and though the offenders may be touched lightly, the point is that the judge is not touched at all. But humour always has in it some idea of the humorist himself being at a disadvantage and caught in the entanglements and contradictions of human life. It is a grave error to underrate wit as something trivial; for certain purposes of satire it can truly be the sword of the spirit, and the satirist bears not the sword in vain. But it is essential to wit that he should bear the sword with ease; that for the wit the weapon should be light if the blow be heavy; that there should be no question of his being encumbered with his instrument or

laying open his guard. But humour can be of the finest and yet lay open its guard or confess its inconsistency. When Voltaire said, commenting on the judicial murder of Byng, "In England they kill one admiral to encourage the others," it would immediately be recognized as wit; though there is not a little in it that must be recognized as humour. But we rightly class Voltaire as a wit, because he represents the consistent human reason detecting an inconsistency. We shall be very wrong if we despise him as a wit; for that French clearness has depths of irony; there is, for instance, more than is seen at a glance in the very word "encourage." But it is true that the wit is here a judge independent of the judges, unaffected by the king or the admiral or the English court martial or the mob. He is abstract justice recording a contradiction. But when Falstaff (a model of the humorist become or becoming conscious) cries out in desperate bravado, "They hate us youth," the incongruity between the speech and the corpulent old humbug of a speaker is present to his own mind as well as to ours. He also discovers a contradiction, but it is in himself; for Falstaff really did bemuse himself with youthful companionship which he knew to be like a drug or a dream; and indeed Shakespeare himself, in one at least of the sonnets, becomes bitterly conscious of the same illusion There is therefore in humour, or at least in the origins of humour, something of this idea of the eccentric caught in the act of eccentricity and brazening it out; something of one surprised in disarray and become conscious of the chaos within. Wit corresponds to the divine virtue of justice, in so far as so dangerous a virtue can belong to man. Humour corresponds to the human virtue of humility and is only more divine because it has, for the moment, more sense of the mysteries.

If there be so much of enlightenment to be gathered from the history of the word, there is very little to be gathered from any of the attempts at a scientific history of the thing The speculations on the nature of any reaction to the risible belong to the larger and more elementary subject of laughter and are for the department of psychology, according to some, almost for that of physiology. Whatever be their value touching the primitive function of laughter, they throw very little light on the highly civilized product of humour. It may well be questioned whether some of the explanations are not too crude even for the crudest origins; that they hardly apply even to the savage and certainly do not apply to the child It has been suggested, for example, that all laughter had its origin in a sort of cruelty, in an exultation over the pain or ignominy of an enemy; but it is very hard even for the most imaginative psychologist to believe that, when a baby bursts out laughing at the image of the cow jumping over the moon, he is really finding pleasure in the probability of the cow breaking her leg when she comes down again The truth is that all these primitive and prehistoric origins are largely unknown and possibly unknowable; and like all the unknown and unknowable are a field for furious wars of religion Such primary human causes will always be interpreted differently according to different philosophies of human life. Another philosophy would say, for instance, that laughter is due not to an animal cruelty but to a purely human realization of the contrast between man's spiritual immensity within and his littleness and restriction without; for it is itself a joke that a house should be larger inside than out. According to such a view, the very incompatibility between the sense of human dignity and the perpetual possibility of incidental indignities produces the primary or archetypal joke of the old gentleman sitting down suddenly on the ice We do not laugh thus when a tree or a rock tumbles down, because we do not know the sense of self-esteem or serious importance within But such speculations in psychology, especially in primitive psychology, have very little to do with the actual history of comedy as an artistic creation.

There is no doubt that comedy existed as an artistic creation many thousands of years ago, in the case of peoples whose life and letters we can sufficiently understand to appreciate the fine shades of meaning; especially, of course, in the case of the Greeks. It is difficult for us to say how far it existed in civilizations more remote of which the records are for us more stiff and symbolic; but the very limitation of symbolism which makes it hard for us to prove its existence should warn us against assuming without evidence that it did not exist. We know more about Greek humour than about Hittite humour, at least partly for the simple reason that we know Greek better than we know any sort of colloquial Hittite; and while what applies to Hittite applies in a less degree to Hebrew, a case like that of early Hebrew presents something of the same problem of limitation. But without any attempts to settle such problems of scholarship, it is hard to believe that the highest sense of human satire was not present in the words of Job: "Truly you are wise and wisdom will die with you"; or that no perception of a poetic contrast was felt by so great a poet when he said of Behemoth, commonly identified with the hippopotamus: "Canst thou play with him as with a bird?" It is probable that the Chinese civilization, in which the quality of the quaint and the fantastic has flowered with a beautiful luxuriance for many centuries, could also quote fairly early examples of the same order of fancy.

In any case, humour is in the very foundations of our European literature, which alone is quite sufficiently a part of ourselves for the full appreciation of so subtle and sometimes sub-conscious a quality. Even a schoolboy can see it in such scenes of Aristophanes as that in which the dead man sits up in indignation at having to pay the toll of the Styx and says he would rather come to life again; or when Dionysus asks to see the wicked in hell and is answered by a gesture pointing at the audience. Before the period of intellectual controversies in Athens, indeed, we generally find in Greek poetry, as in the greater part of all human folk-lore, that the joke is a practical joke. To a robust taste, however, it is none the less of a joke for that. For the joke of Odysseus calling himself Noman is not, as some suppose, a sort of trivial pun or verbalism; the joke is in the gigantic image of the raging Cyclops, roaring as if to rend the mountains, after being defeated by something so simple and so small. And this example is worth noting, as representing what is really the fun of all the fairy-tales; the notion of something apparently omnipotent made impotent by some tiny trick. This fairy-tale idea is undoubtedly one of the primitive fountains from which flows the long winding stream of historic humour. When Puss In Boots persuades the boastful magician to turn into a mouse and be eaten, it almost deserves to be called wit.

After these two early expressions, the practical joke of the folk-tale and the more philosophic fun of the Old Comedy, the history of humour is simply the history of literature. It is especially the history of European literature; for this sane sense of the incongruous is one of the highest qualities balancing the European spirit. It would be easy to go through the rich records of every nation and note this element in almost every novel or play, and in not a few poems or philosophical works. There is naturally no space for such a survey; but three great names, one English, one French and a third Spanish, may be mentioned for their historical quality, since they opened new epochs and even their few superiors were still their followers. The first of these determining names is that of Chaucer, whose urbanity has done something to conceal his real originality. Mediaeval civilization had a very powerful sense of the grotesque as is apparent in its sculpture alone, but it was in a sense a fighting sentiment; it dealt with dragons and devils; it was alive, but it was very decidedly kicking. Chaucer brought into this atmosphere a cool air of true comedy; a sort of incongruity most incongruous in that world. In his personal sketches we have a new and very English element, of at once laughing at people and liking them. The whole of humorous fiction, if not the whole of fiction, dates from the Prologue of the *Canterbury Tales*.

Rather later, Rabelais opened a new chapter by showing that intellectual things could be treated with the energy of high spirits and a sort of pressure of physical exuberance, which was itself humorous in its very human abandon. He will always be the inspiration of a certain sort of genial impatience, and the moments when the great human mind boils over like a pot. The Renaissance itself was, of course, such a boiling, but the elements were some of them more poisonous; though a word should be said for

the tonics of that time, the humour of Erasmus and of More.

Thirdly, there appeared with the great Cervantes an element new in its explicit expression; that grand and very Christian quality of the man who laughs at himself. Cervantes was himself more chivalrous than most men when he began to mock at chivalry. Since his time, humour in this purely humorous sense, the confession of complexity and weakness already remarked upon, has been a sort of secret of the high culture of the West. The influence of Cervantes and Rabelais and the rest runs through all modern letters, especially English; taking on a shrewd and acid tang in Swift, a more delicate and perhaps more dubious taste in Sterne, passing on through every sort of experiment of essay or comedy, pausing upon the pastoral gaiety of Goldsmith or going on finally to bring forth, like a great birth of giants, the walking caricatures of Dickens. Nor is it altogether a national accident that the tradition has here been followed in England. For it is true that humour, in the special and even limited sense here given to it, humour as distinct from wit, from satire, from irony or from many things that may legitimately produce amusement, has been a thing strongly and specially present in English life and letters That we may not in turn depreciate the wit and logic of the rest of the world, it will be well to remember that humour does originate in the half-conscious eccentric, that it is in part a confession of inconsistency; but, when all is said, it has added a new beauty to human life. It may even be noted that there has appeared especially in England a new variety of humour, more properly to be called Nonsense

Nonsense may be described as humour which has for the moment renounced all connection with wit. It is humour that abandons all attempt at intellectual justification; and does not merely jest at the incongruity of some accident or practical joke, as a by-product of real life, but extracts and enjoys it for its own sake "Jabberwocky" is not a parody on anything; the Jumblies are not a satire on anybody; they are folly for folly's sake on the same lines as art for art's sake, or more properly beauty for beauty's sake; and they do not serve any social purpose except perhaps the purpose of a holiday Here again it will be well to remember that even the work of humour should not consist entirely of holidays But this art of nonsense is a valuable contribution to culture; and it is very largely, or almost entirely, an English contribution So cultivated and competent a foreign observer as M. Emile Cammaerts has remarked that it is so native as to be at first quite unmeaning to foreigners. This is perhaps the latest phase in the history of humour; but it will be well even in this case to preserve what is so essential a virtue of humour, the virtue of proportion Humour, like wit, is related however indirectly, to truth and the eternal virtues; as it is the greatest incongruity of all to be serious about humour, so it is the worst sort of pomposity to be monotonously proud of humour; for it is itself the chief antidote to pride; and has been, ever since the time of the Book of Proverbs, the hammer of fools

(G. K. C.)

American Humour, the name given to the peculiar vein of humour which has been characteristic in the literature of the United States and which has constituted one of its most eminent features. It may be said to consist principally of a peculiar and distinctive point of view, a willingness to see things as they are, a detachment from traditional reverences and conventional beliefs It would seem reasonable to suppose that such a point of view naturally opened up before the vision of Europeans, settled in a new land and able to look with an unprejudiced eye upon the institutions and the ideas of the country from which they came. Thus the *Innocents Abroad* (1869), by Samuel Clemens (Mark Twain), is in reality a picture of Europe as seen from the summit of the Rocky Mountains.

Nearly all humour is accompanied by some form of wit as a vehicle of its verbal expression. American humour developed, as its concomitant, certain modes of wit which naturally went with it,—the verbalism of bad spelling, of slang speech and of exaggerated statement. These, too, reflect their origin in the environment of a new country, among people largely ignorant and wholly careless of the reverence of scholarship. The wit is the lesser part of the product—the mere shell to hold the kernel, and often wears thin and becomes unintelligible and even tiresome to later readers

It is difficult to assign an exact beginning for the appearance of American humour as such. There is plenty of it in the writings of Benjamin Franklin (1706–90), as for example in his *Autobiography* and his *Poor Richard's Almanack* (1732–57) Seba Smith, a graduate of Bowdoin College, in his *Life and Writings of Major Jack Downing* (1833), gave a definite lead, followed with even greater success by Judge Haliburton (1796–1865) of Nova Scotia (the famous Sam Slick), sometimes called, on insufficient evidence, the father of American humour His *"Clockmaker, or Sayings and Doings of Samuel Slick of Slickville"* contains a vast mass of philosophy and anecdote retailed by a supposed Yankee clockmaker, intensely amusing to his generation, though scarcely readable in any large quantity to-day. The earlier half of the 19th century produced a number of humorists in prose and verse of a secondary order such as John Godfrey Saxe (1816–87) and Robert Newell (Orpheus C. Kerr, 1836–1901) But it remained for the period just following the Civil War to see the climax reached in the works of Artemus Ward (Charles Browne, 1834–67), Bret Harte (1839–1902) and Samuel L. Clemens (1835–1910). Ward made a sudden and phenomenal reputation as a joke-maker and a comic lecturer, carried London by storm (1866) and died an early and tragic death at Southampton (1867) Bret Harte's humorous poems, *Plain Language from Truthful James,* still survive, while Mark Twain's name and fame are household words Honourable mention may be made also for the same period of Henry Shaw (Josh Billings, 1818–85) and of Edgar Wilson (Bill Nye, 1850–96) The closing years of the century saw the appearance of Mr Finley Peter Dunne disguised as "Mr Dooley," a vehicle of entertaining conversation, Irish in form but American within

The humorists of America to-day are too numerous for exhaustive enumeration. Every journal carries its columnful But it is not invidious to mention as typical Irvin Cobb (1876), Franklin P. Adams and Montague Glass. (S. Lea.)

HUMPATA: *see* Angola.

HUMPED CATTLE: *see* Zebu.

HUMPERDINCK, ENGELBERT (1854–1921), German composer, was born at Siegburg on Sept 1, 1854, and studied music under F. Hiller at Cologne, and under F. Lachner and J. Rheinberger at Munich. In 1879 a Mendelssohn scholarship enabled him to go to Italy, where he met Wagner and was invited to assist in the production of *Parsifal* at Bayreuth After some years of travel he returned to Germany and settled at Frankfurt, where he was professor of composition at the Hoch Conservatorium and musical critic of the *Frankfurter Zeitung.* He had already made his mark as a composer in Germany with his orchestral work, *Humoreske* (1880), and the choral compositions *Das Glück von Edenhall* (1884) and *Die Wallfahrt nach Kevlaar* (1887), when he produced the charming children's opera, *Hänsel und Gretel* (1893), and became famous throughout Europe. In 1900 Humperdinck removed to Berlin, where he was head of a *Meisterschule* for composition He died at New Strelitz on Sept. 27, 1921 Humperdinck's later works, like *Hänsel und Gretel,* owed much to folk-tunes, and showed a similar technical mastery, but none of them approached it in popular success, though *Königskinder* was well received.

See O. Besch, *Engelbert Humperdinck* (1915).

HUMPHREY (or Humfrey), **LAWRENCE** (1527?–1590), president of Magdalen College, Oxford, and dean successively of Gloucester and Winchester, was born at Newport Pagnel He was elected demy of Magdalen College in 1546 and fellow in 1548 He was one of the most promising pupils of Peter Martyr, and on Mary's accession obtained leave from his college to travel abroad. He lived at Basel, Zurich, Frankfurt and Geneva, making the acquaintance of the leading Swiss divines, whose ecclesiastical views he adopted He returned to England at Elizabeth's accession, was appointed regius professor of divinity at Oxford in 1560, and was recommended by Archbishop Parker and others for election as president of Magdalen The fellows

refused at first to elect so pronounced a reformer, but they yielded in 1561, and Humphrey gradually converted the college into a stronghold of Puritanism. In 1564 he and his friend Thomas Sampson, dean of Christ Church, were called before Parker for refusing to wear the prescribed ecclesiastical vestments; and a prolonged controversy broke out, in which Bullinger and other foreign theologians took part as well as most of the leading divines in England. In spite of Bullinger's advice, Humphrey refused to conform; and Parker wished to deprive him as well as Sampson. But the presidency of Magdalen was elective and the visitor of the college was not Parker but the bishop of Winchester; and Humphrey escaped with temporary retirement Parker, in fact, was not supported by the council; in 1566 Humphrey was selected to preach at St. Paul's Cross, and was allowed to do so without the vestments. In that year, on the occasion of Elizabeth's visit to Oxford he wore his doctor's gown and habit, which the queen told him "became him very well"; and his resistance now began to weaken He yielded on the point before 1571 when he was made dean of Gloucester In 1578 he was one of the divines selected to attend the diet at Schmalkalden, and in 1580 he was made dean of Winchester. In 1585 he was persuaded by his bishop, Cooper, to restore the use of surplices in Magdalen College chapel He died on Feb 1, 1590, and was buried in the college chapel.

See Bloxam's *Register of Magdalen College*, iv. 104–132; Cooper's *Athenae Cantabrigienses;* Wood's *Athenae Oxonienses;* Gough's *Index to Parker Soc. Publ;* Strype's *Works; Cal. State Papers* (Dom. 1547–90); *Acts of the Privy Council;* Burnet's *Hist. Ref.;* Collier's *Eccles. Hist.;* Dixon's *Church Hist.* vol. vi.; *Dict. Nat. Biog.*

HUMPHREYS, ANDREW ATKINSON (1810–1883), American soldier and engineer, was born at Philadelphia on Nov. 2, 1810. He was the son of Samuel Humphreys (1778–1846), chief constructor U S navy, and grandson of Joshua Humphreys (1751–1838), the designer of the "Constitution" and other famous frigates of the War of 1812, sometimes known as the "father of the American navy." Graduating at West Point in 1831, he devoted himself chiefly to engineering. In the earlier part of the Civil War Humphreys was employed as a topographical engineer with the Army of the Potomac and rendered conspicuous services in the Seven Days' battles. It is stated that he selected the famous position of Malvern Hill, before which Lee's army was defeated. Soon after this he was assigned to command a division, and at the battle of Fredericksburg he distinguished himself greatly in the last attack of Marye's heights. He took part in the battle of Chancellorsville, and at Gettysburg commanded a division under Sickles A few days later he became chief of staff to Gen. Meade, and this position he held throughout the Wilderness campaign. Towards the end of the war Gen. Humphreys succeeded Gen Hancock in command of the famous II. Corps The short campaign of 1865, which terminated in Lee's surrender, afforded him a greater opportunity of showing his capacity for leadership. After the war, now brevet major-general, he returned to duty as chief engineer of the U S. army, and retired in 1879. He died at Washington on Dec 28, 1883 Amongst his works may be mentioned *From Gettysburg to the Rapidan* (1882) and *The Virginia Campaigns of 1864–1865* (1882).

See Wilson, *Critical Sketches of some Commanders* (Boston, 1895); Henry Hollingsworth Humphreys, *Andrew Jackson Humphreys: a Biography* (1924).

HUMPHRY, OZIAS (1742–1810), English miniature painter, was born at Honiton and educated at the grammar school of that town. Attracted by the gallery of casts opened by the duke of Richmond, Humphry came to London and studied at Shipley's school; and later he left for Bath, where he lodged with Linley and became a great friend of his beautiful daughter, afterwards Mrs. Sheridan. In 1766 he was in London warmly encouraged by Sir Joshua Reynolds, who was always interested in Devonshire painters He was a great friend of Romney, with whom in 1773 he went to Italy, staying, on his way to Dover, at Knole, where the duke of Dorset gave him many commissions. In 1785 he went to India, visiting the native courts, painting a large number of miniatures and making many beautiful sketches. His sight failed him in 1797, and he died in Hampstead in 1810.

See *The History of Portrait Miniatures*, by G. C. Williamson, vol. ii. (1904). (G. C. W.)

HUMUS (a Latin word meaning the ground), a product of decomposing organic matter. It is especially present in peat bogs, and also occurs in surface soils, to which it imparts a brown or black colour. It is one of the most important soil-constituents from the agricultural point of view; it modifies the properties of the soil by increasing its water-holding capacity and altering its colloidal nature. The chemical composition is very complex and has been much disputed.

See *Trans. Faraday Society* 17, p. 200–296 and 272–287 (1922); also E. J. Russell, *Soil Conditions and Plant Growth* (5th ed., 1927).

HUNALD, Duke of Aquitaine, succeeded his father Odo, or Eudes, in 735 He refused to recognize the high authority of the Frankish mayor of the palace, Charles Martel, whereupon Charles marched south of the Loire, seized Bordeaux and Blaye, but eventually allowed Hunald to retain Aquitaine on promise of fidelity. At Charles's death in 741 Hunald declared war against the Franks, crossed the Loire and burned Chartres. Menaced by Pippin and Carloman, Hunald begged for peace in 745 and retired to a monastery, probably on the Isle of Ré. We find him later in Italy, where he allied himself with the Lombards and was stoned to death. He had left the duchy of Aquitaine to Waifer, who was probably his son, and who struggled for eight years in defending his independence against King Pippin At the death of Pippin and at the beginning of the reign of Charlemagne, there was a last rising of the Aquitanians This revolt was directed by a certain Hunald, and was repressed in 768 by Charlemagne and his brother Carloman. Hunald sought refuge with the duke of the Gascons, Lupus, who handed him over to his enemies. In spite of the opinion of certain historians, this Hunald seems to have been a different person from the old duke of Aquitaine

See J. Vaissette, *Histoire générale de Languedoc*, vol i. (ed. of 1872 *seq*); Th. Breysig, H. Hahn, L. Oelsner, S. Abel and B. Simson, *Jahrbucher des deutschen Reichs.* (C. Pf.)

HUNAN, an important province of central China to the south of the Yang-tze but within its basin, the southern boundary following the sinuous crests of the Nan-shan (or Nan-ling) which forms the divide between the Yang-tze and Si-kiang drainage systems. The economic life of Hunan is essentially based on the valleys of two large rivers which converge on the Tung-ting lake, itself a reservoir and feeder of the Yang-tze.

Of these the Siang-kiang, rising in the Nan-ling and flowing due north to the lake, is the most important of all the southern tributaries of the Yang-tze It has formed throughout Chinese history one of the two great corridor routes through the South China Highlands to the Si-kiang and the Canton delta, the water-parting ranges being crossed by the Che-ling pass at the head of the valley. It was a very early avenue of advance for the Chinese colonists from the Yang-tze valley and the prevailing language is Mandarin, but Mandarin of an older type than that of the south-west, peopled in much later centuries by immigrants from North China. In the strategic relations of central and south China the Siang valley has always been of critical importance and it was one of the main lines of advance of the Nationalist armies from Kwang-tung to Hankow in the winter of 1926–27. It was selected as the route for the main Peking-Hankow-Canton Trunk railway which has been completed along it to a point above Changsha, the capital city of the province. The river itself is of great use for navigation, although subject to considerable variations of level according to the season. River steamers drawing up to 8 ft. of water sail from Hankow up the Siang to Changsha and Siangtan except during the winter months. Launches ply upstream during most of the year to Hengchow, and above that city the river and its tributaries are navigable for junks for long distances.

The second great river of Hunan is the Yuen-kiang which, rising in the Kwei-chow plateau, drains the western third of the province and flows into the Tung-ting lake at its south-western extremity. Although more impeded by rapids than the Siang, the Yuen is navigable for small boats right into Kwei-chow province, and is the great artery for the transport of timber from the forests of

Kwei-chow and south-west Hunan to Hankow where there is a heavy demand for it for industrial and domestic purposes. It comes mainly in the form of rafts, floated down the Yuen into the Tung-ting Lake and thence to the Yang-tze. The Yuen valley affords the chief route from the Central Yang-tze to Kwei-chow and south-west China generally. A third river, the Tzu-kiang or Tan-ho (river of rapids) drains central Hunan between the Siang and Yuen basins and also flows into the Lake, but it is so impeded by rapids as to be of very little value for navigation and the trade of the middle and upper parts of its valley is chiefly carried on by the Siang route. Its focal point is Pao-king connected by road with Heng-chow on the Siang and Changteh, the chief collecting centre for the Yuen.

The great majority of the population of Hunan is concentrated in these three valleys and the lowlands around the Tung-ting lake on to which they converge. Yo-chow, at the outlet of the lake is the connecting link with Hankow and the Yang-tze trade. The agricultural production in the lowlands and especially in the reclaimed land around the lake is rich and varied, yielding a surplus available for commerce. Rice grown on the lake shores, in the valley bottoms and on the terraced slopes of the hills is the chief crop, and tea from the slopes of the valleys of the Lower Siang and its tributaries is an important commercial product, as is also tea oil. The cultivation of the mountain valleys is mainly of subsistence crops which include wheat, kaoliang, peas and groundnuts.

Hunan is of far more than agricultural importance. The most accessible coalfields of all south China, in the present state of communications, lie along the Siang valley. Those in the main valley itself, around Hengchow and Siangtan, and in the valley of the Lei tributary, are as yet worked only for local consumption but they are of great potential importance, partly on account of their quality, but especially because of their position on the half-completed Hankow-Canton trunk railway. A smaller field, the Pinghsiang, is even now worked by modern methods, and this, although actually within Kiangsi province, communicates through Hunan with its main market in the cities of Wu-Han by the Chuchow-Pinghsiang railway, a branch of the main line. Hunan ranks seventh among the provinces of China in coal reserves and in coal production In addition to this wealth in coal, Hunan appears to have considerable reserves of such metallic ores as tin, lead-zinc and antimony. The tin-fields of the Nan-shan are not yet exploited and the lead-zinc ores of the upper Siang valley are worked only to a limited degree, but the province supplies the bulk of the antimony production of the world. The ores are mined in the valley of the Tzu-kiang and refined at Changsha.

The Hunanese have long had a reputation in China for strong provincial patriotism. The *Literati* class is well represented and a feature of the countryside is the large number of estates belonging to the Hunanese gentry, some of whom have played a notable part in public affairs. The population of the province according to the Post Office estimate of 1920 is over 28 millions, and three cities, Changsha, Changteh and Siangtang are reported as having over 200,000 inhabitants.

HUNDRED. In England the term "hundred" is particularly applied to an ancient territorial division intermediate between the *villa* and the county. Such subordinate districts were also known in different parts of the country by other names; *e.g.*, *wapentakes* in Yorkshire, Lincolnshire, Nottinghamshire, Derbyshire, Rutland and Leicestershire; *wards* in Northumberland, Durham and Cumberland; while some of the hundreds of Cornwall were formerly called *shires*. In some parts of England a further intermediate division is to be found between the hundred and the county. Thus we have the *trithing* or *riding* (*q.v.*) in Yorkshire, the *lathe* in Kent, and the *rape* in Sussex. In Lincolnshire the arrangement is peculiar. The whole county was divided into the three sub-counties of Lindsey, Kesteven and Holland. The significance of the name hundred is a matter of some difficulty. The old theory, and perhaps the best, is that the hundred denoted first a group of a hundred families, and then the district which these families occupied. This is not inconsistent with another view, according to which the hundred was originally a term of measurement denoting a hundred hides of land, for there is good reason for considering that the hide was originally as much land as supported one family. It is important to notice that in the document compiled before the Norman Conquest, and now known as the *County Hidage*, the numbers of hides in all the counties are multiples of a hundred, and that in many cases the multiples agree with the number of hundreds ascribed to a county in Domesday Book. The hundreds of Devon, however, seem never to have contained a hundred hides; but various multiples of five, such as 20, 40 and 60. Here, and in some of the other western counties, the hundreds are geographical divisions, to which a varying number of hides was attributed for fiscal purposes.

In the middle ages the hundred was chiefly important for its court of justice; and the word *hundredum* was as often applied to the court as to the district over which the court had jurisdiction. According to the compilation known as *Leges Henrici*, written shortly before 1118, it was held 12 times a year, but an ordinance of 1234, after stating that it had been held fortnightly in the reign of Henry II., declares that its ordinary sessions were henceforth to take place every three weeks (*Dunstable Annals*, 139). Existing court rolls show that from the 13th to the 15th centuries it usually sat 17 times a year, in some hundreds in a fixed place, in others in various places, but in no regular course of rotation. Twice a year a specially full court was held, to which various names such as *hundredum legale* or *hundredum magnum* were applied. This was the sheriffs' turn held after Easter and Michaelmas in accordance with the Magna Charta of 1217. The chief object of these sessions was to see that all who ought to be were in the frank-pledge, and that the articles of the view of frank-pledge (*q.v.*) had been properly observed during the preceding half-year. Each township of the hundred was represented by a varying number of suitors who were bound to attend at these half-yearly sessions without individual summons. If the proper number failed to appear the whole township was amerced, the entry on the rolls being frequently of the form *"Villata de A. est in misericordia quia non venit plenarie."* All the 17 courts, including the two full courts, had jurisdiction in trespass covenant and debt of less than 40 shillings, and in these civil cases such of the freeholders of the county as were present were judges But the sheriff or the lord of the hundred was the sole judge in the criminal business transacted at the full courts.

Owing to the great fall in the value of money the hundred court began to decay rapidly under the Tudor sovereigns. They were for the most part extinguished by the County Courts Act, 1867, which enacts that no action which can be brought in a county court shall thenceforth be brought in a hundred or other inferior court not being a court of record. Until lately the most important of the surviving duties of the hundred was its liability to make good damages occasioned by rioters. By the Riot (Damages) Act, 1886, the liability was thrown on the police rate.

See Pollock and Maitland, *Hist. Eng. Law;* J. H. Round, *Feudal England* (1895); *Annales monastici*, "Rolls" series, iii. (Dunstable), 139; F. W. Maitland, *Domesday Book and Beyond* (1897). (G. J. T.)

HUNDRED DAYS, the name commonly given to the period between March 20 1815, the date on which Napoleon arrived in Paris after his return from Elba, and June 28 1815, the date of the restoration of Louis XVIII. The phrase *Cent Jours* was first used by the prefect of Paris, the comte de Chabrol, in his speech welcoming the king *See* NAPOLEON, and FRANCE: *History.*

HUNDRED YEARS' WAR, THE. This name has been given by historians, not quite accurately, to the long struggle between England and France which, interrupted by two treaties and numerous truces, went on in an intermittent fashion from 1338 to 1453. Its fundamental cause was the anomaly by which the Plantagenet kings of England held an immense fief in southern France, the remains of the heritage of their ancestress Eleanor of Aquitaine. It was natural that successive kings of France should endeavour to reunite to their crown-lands all the broad counties along the Garonne which had slipped out of the direct control of the Carolingian monarchs during the dark ages. It was equally natural that the kings of England should endeavour to cling to their ancient inheritance. Their task was made possible by the

fact that so late as the 14th century French national consciousness was still undeveloped, and most of the towns and many of the nobles of the South preferred the rule of an absentee duke of Aquitaine at London—who left them to manage for themselves for the most part—to that of the king at Paris with his grasping lawyers and tax-gatherers always on the spot

The real character of the Hundred Years' War was disguised to a certain extent by the absurd claim of Edward III. and his successors to the crown of France—a claim adopted without sincere conviction from purely political reasons Indeed Edward did not assume the title of King of France till the war had been running for several years (1338–40), and he sold his pretensions for solid consideration in land at the treaty of Brétigny (1360). That Henry V almost succeeded in turning the shadow into substance for a few years in the 15th century had nothing to do with King Edward's original claim. Henry conquered half France as the head of a French political faction rather than as an English dynastic claimant, and his son was only recognized as king at Paris so long as French party-spirit was stronger than French national spirit, whose resurrection was displayed in the career of Joan of Arc The real character of the struggle is well shown by the fact that after Paris had been recovered by the enemy in 1436, Bordeaux still held out for its English "Duke of Aquitaine" for 15 years more, and after having been once subdued, rose again in the name of King Henry VI., and fought for another year in the cause of southern particularism.

The dynastic side of the Hundred Years' War is a depressing story. Of its widespread economic and commercial effects this is not the place to speak, though they had much to do with the making of modern England Its military aspect is most important, not only in the history of England and France, but in that of the general development of the art of war in Europe Its opening years saw the end of the supremacy of feudal cavalry as the dominating power in battle; its last years witnessed the first instances of general actions decided by artillery.

PERIOD I. 1338–45

Friction between the king of England as duke of Aquitaine and the duke's overlord at Paris had been intermittent for the last century. In 1338 it had reached one of its not infrequent crises, but the main cause of rupture was the help given by Philip of Valois to Edward's Scottish enemies In retaliation Edward stirred up the Flemings and other Netherland neighbours of France, and bought the help of the Emperor Lewis of Bavaria His first attempts, however, to invade northern France with an army composed for the most part of the emperor's vassals in the Low Countries were complete failures. And no profit was got by Edward's proclamation of himself as rightful king of France—a step which he took in order that the Flemings might be able to say that they were not engaged in a treasonable attack on their suzerain. For Flanders, unlike the rest of the Netherlands, owed homage to France (1340). The only profit which Edward got out of the first period of the contest was the complete destruction of the French fleet at the battle of Sluys (June 25, 1340), which gave him the command of the sea for 30 years,—no small boon, for in the early days of the war French squadrons had raided and sacked Southampton, Portsmouth, Hastings and other seaports. But on land there was no decisive fighting—though Edward was eager to try against the French the tactics which the English had learned in their Welsh and Scottish wars, and of which he himself had given a victorious example at Halidon Hill (1333) But Philip of Valois accepted no general action, and Edward was unlucky in his sieges of Tournai and other places on the northern border of France. The Flemish campaigns were a complete failure, nor did Edward meet with much success in an attempt to attack France on another flank—the duchy of Brittany—where he supported the claimant in a contested succession who had not the approval of King Philip With his exchequer drained dry and his parliament growing discontented, Edward consented to a two-year truce, which covered the years March 1343–March 1345.

PERIOD II. 1346–60 CRÉCY AND POITIERS

Very different was the course of military affairs when the two years of fitful truce ran out, and Edward invaded Normandy (July 1346) apparently with the object of drawing off the French from a dangerous attack on Guienne then in progress—but strategical objects are sometimes attributed to mediaeval generals on insufficient evidence. After wasting the whole duchy and capturing the rich town of Caen, Edward marched to the very gates of Paris; but when the whole power of France had been gathered against him, he judged that he had better not fight save under the most favourable tactical conditions. He swerved north, forced the passage of the Somme near its mouth, and then stood at bay, under the forest of Crécy, on a very cleverly chosen position, along a ridge of chalk downs, with a long easy slope like a *glacis* in front of him, and his flanks covered by the houses and enclosures of the villages of Crécy and Wadicourt. Edward had deliberately adopted the formation which had served the English well in their Scottish wars—central blocks of dismounted men-at-arms, with long wings of archers thrown out on each side. After a preliminary skirmish, in which Philip's advanced line of Genoese crossbowmen was shot to pieces by the English archery—who could give them six missiles for one—the cavalry charges began (Aug 26, 1346). The fight of Crécy (*q.v.*) consisted in a dreadful slaughter by concentrated archery-shot of successive squadrons of the French knighthood; each feudal contingent pushed to the front as it came on the field, and charged up the long slope, to be riddled and finally brought to a stop by the thick flights of cloth-yard arrows which poured in from the flanks as well as the front. The futility of cavalry charges against trained archery in a favourable position was completely demonstrated, and Edward III. did not even need to put his reserves into action. Night only brought the battle to an end—and saw the wrecks of King Philip's chivalry disperse, leaving in front of the English line the bodies of John, king of Bohemia, the blind adventurer—the duke of Lorraine, ten counts and 1,500 gentlemen of coat armour—not to speak of thousands of mercenaries and retainers

This frightful disaster to the cavalry arm shook to pieces the old theory of feudal war, which rested on the assumption that mailed knights charging in mass could ride over infantry of any sort. The English had taken to heart the results of Bannockburn, where cavalry had a severe lesson, and had gone over to the new tactics. Converging archery volleys, by highly trained professional bowmen, could prevent horsemen from closing, if the ground was favourable and steady supports of dismounted men-at-arms were in the line to give the archers confidence and flank-protection

King Edward only utilized his victory at Crécy to carry out the siege of Calais, whose surrender after a long and obstinate defence gave him a permanent bridge-head across the Channel for further invasions of France (Aug. 4, 1347). Next summer both England and France were smitten by the awful plague of the Black Death, which swept away a fifth or a third of the population of both countries and upset all social conditions. It was no wonder that truces were concluded, which lasted for over two years; and were renewed—despite some local bickerings and raids by both sides—till 1354 Negotiation with John of France, who succeeded his father, Philip of Valois, in 1350, for a permanent peace, coming to nothing, Edward resumed his policy of invasions of France, but apparently was aiming at breaking the enemy's spirit by destructive raids rather than at the reduction of provinces, for the armies made broad trails of devastation across the land, but did not linger to besiege large towns. In this spirit he wasted northern France in 1355, while his son Edward the Black Prince harried Languedoc almost as far as the shore of the Mediterranean. The French refused battle and shut themselves up in fortified places. Next year the king's second son, John of Lancaster, ravaged Normandy, while the Prince of Wales made a second great sweep through central France as far as the gates of Bourges and Tours. While returning laden with plunder, towards Bordeaux, he found himself in contact near Poitiers (*q.v.*) with John of France and an army thrice as great as his own. The king had abandoned his passive defensive policy of the last two years, and had resolved to risk a general action, despite the English archery. Twice in recent combats on a small scale, at

Saintes (1351) and Mauron (1352), the French, when facing English archery, had dismounted the main body of their men-at-arms, and kept on horseback only small detachments of picked horsemen, who tried to turn the line, or to slip in by rapid movement without meeting the full effect of the volley John tried these same tactics, judging, truly enough, that the fully armoured knight was much less vulnerable on foot than when mounted, and might hope to close with his enemy, if the latter was distracted by preliminary manoeuvres of lightly moving horsemen.

Unfortunately for King John, the Prince of Wales had got into a position which was absolutely unassailable by cavalry, the front line being covered by a long hedge along the brow of the hill of Maupertuis, with but a single gap in it. But the dismounted knights did reach the hedge, though much thinned by the arrow-flight, and very bitter and prolonged fighting took place all along it But the first French line was beaten back at last, the second flinched and turned away, and only the third, under King John himself, fought out the battle to the end It finally broke up and retired, leaving King John and his younger son Philip prisoners. This was not so entirely an archery battle as Crécy, but could not have been won without the archers

Poitiers might have been as indecisive a victory as Crécy, so far as the ending of the war was concerned, if it had not been that the French king had been captured, and naturally desired to ransom himself. It cured his subjects of any wish for general actions, and for the next four years they allowed the armies of King Edward to range about the land doing mischief to the open country, and shut themselves up in walled towns and castles, till the enemy had eaten up the countryside and was forced to move on for want of food This destructive but inconclusive system of raids might apparently have gone on for an indefinite time, if King John had not made up his mind that captivity was intolerable, and offered to sign almost any terms of peace that King Edward chose to inflict upon him He assented in the Treaty of London (March 1359) to conditions so humiliating that the French States General refused to ratify them. But in the following winter King Edward conducted a raiding tour all through Picardy, Champagne and the Isle de France with such ferocity that the spirit of the enemy was broken, and the regent of France and the States General assented to the terms which King John had already accepted, and preliminaries of peace were signed at the village of Brétigny, near Chartres, on May 8, 1360.

By this instrument Edward resigned his claim to the French crown in return for receiving back the whole duchy of Aquitaine, as it had been held by his ancestress, Queen Eleanor, free of vassalage to the king of France. He most unwisely reclaimed many counties which had been for a century and a half in French hands, and had quite lost all remembrance of their Plantagenet dukes—Poitou, the Limousin, Quercy, Rouergue, Marche, the Angoumois—a vast holding peopled by unwilling subjects. In addition Edward kept his conquest of Calais, and received back the county of Ponthieu by the mouth of the Somme, which had belonged to his grandmother, Eleanor of Castile, the queen of Edward I. But humiliating as were these renunciations, the French felt even more bitterly the charge of 4,000,000 gold crowns imposed as the ransom of their king. John, though a well meaning man enough, was an incapable sovereign, and, as everyone said, was not worth the money. Moreover he died only a few years after the treaty had been drawn up. Naturally only the early instalments of the ransom money were ever paid. Odd as it may seem, the complete ratification of the treaty was never put on paper, though Edward duly dropped his French title and received all the lands that he had been promised. He handed over Aquitaine to be ruled by his son, the Black Prince, as a fief of England

PERIOD III. FROM THE TREATY OF BRÉTIGNY (1360) TO THE PEACE OF 1396

For nine years after the Treaty of Brétigny there was nominal peace between England and France, though it did not prevent English and French auxiliaries taking part against each other in the civil war of the duchy of Brittany and the kingdom of Castile. It was, in great measure, the unwisdom of the Black Prince's invasion of Spain—where he won, by force of archery, a great victory at Navarrete in 1367, but spent all his treasure and wrecked his own health—that led to the renewal of the French War He had raised heavy sums in taxation from his unwilling subjects of the newly annexed regions, and in 1369 they rebelled, called for the aid of Charles V as their rightful lord, and received it. There followed 11 years of unlucky war, in which the English gradually lost all the lands which had been ceded at Brétigny, and were reduced to their original holding in Guienne The enemy, captained by the great Constable of France, Bertrand du Guesclin, always refused open battle—the terror of archery was still ever present. But while permitting the English to march unopposed in devastating raids through France, and observing a strict defensive behind walls when the invaders were in the field, the Constable worked on a deliberate plan of picking up by sudden surprises, often helped by treachery from within, outlying castles and cities where the enemy had no adequate garrisons, and from which his raiding army was far distant. The Black Prince, who might have made a good defence of his duchy, had collapsed under his Spanish fevers during the first campaign of the renewed war, and after taking the field once in a litter, and sacking the rebellious town of Limoges (1370), returned to England a broken invalid. The conduct of the war fell into the hands of John of Gaunt, duke of Lancaster, the Black Prince's younger brother. John was a convinced exponent of his father's old policy of bringing France to terms by continued circular raids and devastations. It failed completely, though the invasions themselves were sometimes of the most sweeping sort; in 1373 he marched, unfought, from Calais to Bordeaux, right past the gates of Paris. But he brought to Guienne only the wreck of an army; thousands had perished by the way from privation or in petty ambushes. Lancaster persisted in the same policy, and he and his younger brother, Thomas of Woodstock, led several more raids—almost as lengthy as the adventure of 1373 and quite as fruitless Meanwhile region after region in the south was falling away to the French, and the command of the sea, won at Sluys in 1340, ceased to be certain after a naval defeat off La Rochelle in 1372.

Edward III died in senile decay in 1377—his enemy Charles V and Du Guesclin, the great Constable of France, both in 1380. After this the war slackened down In England, and in France also, the Crown had fallen to a boy-king, oppressed with several ambitious and unscrupulous uncles, and in each country domestic politics took precedence of military adventure. It will be remembered that 1381 saw Wat Tyler's rebellion and all its wild scenes of massacre and reaction But though there was no serious fighting after 1386, when there was much fear of a French invasion, and though the French encroachment in Aquitaine had nearly ceased, and a series of truces started in 1392, the war went on in theory till 1396 Then Richard II having got the better of his uncles, concluded the peace of Paris with Charles VI. In form this odd document was only a truce for 30 years, on the territorial *status quo*, by which Richard kept Bordeaux and Bayonne and the Gascon lands between them, but tacitly abandoned all the other lost French dominions of his grandfather As the agreement was technically only a truce, he was not forced to the humiliation of renouncing his vain title of King of France. But his marriage with Isabella, the young daughter of Charles VI., sufficiently showed that the 30 years' truce was really a permanent settlement of peace.

PERIOD IV. FROM 1396 TO 1414

When, three years only after the treaty of Paris, Richard II. was overthrown, imprisoned and finally murdered by his cousin Henry of Bolingbroke, it appeared at first quite likely that the fate of the French king's son-in-law would lead to war. But no open war followed—partly because Charles VI. relapsed into one of his intermittent fits of insanity, but much more because civil strife broke out in France between the Orleanist and the Burgundian parties, who were too much interested in each other's affairs to spare much attention for those of England. The Orleanist party, however, intermittently indulged in acts of hostility—sending auxiliaries to help the enemies of Henry IV.—the Scots

and the Welsh rebel Owen Glendower; and in 1403 the Constable and Admiral of France—both Orleanists—raided Plymouth and several Channel ports. In 1406, Orleanists and Burgundians, uniting for once, made attempts, the one on Guienne, the other on Calais—but both were foiled, and when in 1408, Burgundy murdered Orleans, the fight between their factions grew so much more bitter that molestations of the English coasts ceased, and civil war became permanent in France. Henry IV was then able to revenge himself in much the same surreptitious ways that the French had been using in his earlier years. He played a most unscrupulous game—lending troops to Burgundy in 1411 and to the Orleanists in 1412, on the general principle that it was profitable to England that the French should have plenty of trouble at home.

PERIOD V. FROM 1414 TO 1422

Henry IV., long broken in health, died on March 20, 1413, leaving his usurped crown to the most capable and ambitious of all the Plantagenets, his son, Henry of Monmouth, the conqueror of France—a model of formal piety from the moment that he came to the throne, a great soldier and a very unscrupulous politician. He very deliberately resolved to attack France, with the idea that a successful foreign war was the best means of keeping his own unruly subjects in good temper After making a secret pact with John of Burgundy, he sent ambassadors to Paris to renew all the old claims of Edward III ; not only was all Aquitaine to be returned to him, but he was to be given the hand of one of the king's daughters with a competent dowry, and to receive the long-forgotten arrears of the ransom-money of King John, the prisoner of Poitiers The French were in the throes of civil war, and to stave off invasion made liberal offers of restoration of lands in Aquitaine, and even prepared to discuss the marriage question Henry professed himself shocked at their meanness and declared war (April 1415).

On Aug 10, 1415, Henry V. set sail for Normandy with a well equipped army of 12,000 men, of whom two-thirds were archers. He was a strategist of a very different sort from Edward III. and John of Gaunt, and set before himself the splendid if tedious task of conquering France castle by castle and county by county, not that of indulging in futile raids of devastation. On landing he sat down before Harfleur, the town which commanded the mouth of the Seine (Le Havre did not yet exist), and captured it by force of artillery and mining after a month's siege. This gave him a bridge-head in Normandy, whose conquest was his first aim. As autumn was now drawing on, he had to choose between going into winter quarters in Normandy or marching to Calais. He chose the latter course, probably with the idea that the French would try to stop him and risk a battle, which he desired most of all things He was not wrong; after he had crossed the Somme with difficulty, he found the whole levy of the Orleanist faction in front of the village of Agincourt (*q.v.*) blocking the road to Calais (Oct. 25). Here was fought the last and most decisive of the great battles of the English archery. D'Albret, Constable of France and the duke of Orleans, used the tactics of Poitiers—an attack by a picked body of horse against the English front, followed by the advance of three solid lines of dismounted men-at-arms And the result was the same as at Poitiers—the horsemen being shot down with ease. Henry found the French—weighed down by their heavy armour, on a front of ploughed fields sodden with October rain—lurching at a snail's pace towards him. After the archery had played upon them with good effect, he saw them flinch, and charged in upon them, knights and archers all together. They were rolled over in heaps and slaughtered miserably. The Constable was slain, the young Charles of Orleans—head of his faction—and the duke of Bourbon, taken prisoners. The Orleanist faction was for the moment almost annihilated, but finally made head under new leaders—the apathetic dauphin Charles becoming its nominal head, but the new Constable, Bernard of Armagnac, the real leader. And all such resistance as Henry was to meet was from this weakened party. The duke of Burgundy, under a secret agreement with the national enemy, held aloof from the war. Hence the renewed English invasion of France went on with steady progress—Normandy was conquered in three campaigns, 1417–1418–19, with many sieges but no open battle in the field. Henry continued to make offers similar to those which he had formulated in 1414—he must have back all the old lands of Edward III. and the hand and dowry of the mad king's daughter, Catharine.

The whole aspect of affairs then suddenly changed owing to a murder. The Dauphin lured John of Burgundy to a conference on the Bridge of Montereau, and there the duke was assassinated under circumstances of calculated treachery (Sept 1, 1419). Wildly indignant and left without a leader, the Burgundian faction suddenly threw itself into the arms of the English, and offered to accept Henry as ruler of France; their only desire was to avenge the murder of Montereau. The young Philip of Burgundy put himself at the head of the movement. Hence the Treaty of Troyes (May 21, 1420), by which Henry, on marrying the Princess Catharine, was to be acknowledged as "heir of France," whose crown was to be entailed on their issue, the insane Charles VI. being allowed to retain the royal title till his death. The dauphin was to be completely disinherited "on account of his enormous crimes." The marriage being consummated (June 2), Henry found himself in possession of all those parts of France where the Burgundian faction was predominant—including Paris and a great part of the east and north. But everywhere towns and regions which adhered to the other faction lay in patches among the Burgundian lands. The dauphin was recognized as regent and representative of his incapable father, everywhere south of the Loire.

As head of the Burgundian party, and leading armies half of which consisted of his French supporters, Henry started on the tedious task of conquering in detail all the provinces where his title was denied In 1420–21–22 he had taken Sens, Montereau, Melun, Dreux, Compiègne and Meaux, and was pushing ever southward, when he succumbed (Aug. 31, 1422) to an attack of fever and dysentery contracted in the trenches during the siege of Meaux His insane father-in-law died only two months later, so that the infant Henry of Windsor, his only child by the Princess Catharine, was hailed as king of France, no less than of England, in his cradle.

PERIOD VI. 1423–53. EXPULSION OF THE ENGLISH

The next 20 years saw the slow destruction of the work of Henry V. which had been from the first a triumph of misdirected military genius, assisted by the perverse spirit of French faction Even if he had driven Charles across the Pyrenees or the Alps, it is incredible that his two realms could have held together after his death.

There was little to rouse sympathy or loyalty in the hearts of the French when a king in his second year and an English regent replaced the formidable Henry of Monmouth. The marvel is that the struggle went on so long after his death. But John, duke of Bedford, the little king's uncle, was a soldier of merit and the dauphin's favourites were not. Hence Bedford's victories of Cravant (Aug. 1, 1423) and Verneuil (Aug. 17, 1424), won with armies which were half French in composition, kept the unnatural fabric of the Anglo-French union together, and in 1428 Bedford's advance reached the Loire and laid siege to Orleans. The high-water mark of progress had been attained. But the force before Orleans was but a few thousands strong, and northern France was sick of the English domination. The Burgundians, after ten years, were beginning to forget the murder of Montereau and to remember that they were Frenchmen.

Only on these considerations can the astounding career of Joan of Arc become comprehensible. When the prophetess, or the witch as the English called her, presented herself before the puzzled dauphin and preached her crusade to his doubting ear, she represented the spirit of outraged and indignant France. He resolved to give her mission a trial. Obeying the "voices" which bade her march straight for Orleans under her white banner, she and her company entered the city (April 29, 1429), and she directed a series of sorties which broke the English lines, and finally caused the siege to be raised. This sudden display of spirit produced surprise and then panic among the enemy. "Before that day 200 English would drive 500 French before them—

but now 200 French would beat and chase 400 English." A series of disasters followed, ending in the battle of Patay (June 19, 1429), where, at Joan's orders, the French charged in "before the archers could fix their stakes," and destroyed a third or more of the army of Lord Talbot. She then conducted the dauphin to Reims, where, as she had promised him, he was duly crowned king: every town where there was not a large English garrison threw open its gates as she passed.

Probably the insurrection would have spread over the whole of northern France if Joan had been properly backed by her master's ministers and captains But they secretly derided her inspiration in which the soldiers and peasantry believed, gave her grudging support, and when she failed in a surprise attack on Paris, removed her from her position as adviser and inspirer of the army. The revolt continued, however, to spread, though Joan herself, conducting a raid for the relief of Compiègne, fell by ill-chance into the hands of the Burgundians, who sold her to the regent Bedford. He handed her over to a spiritual court composed of French clergy of the opposite faction, and after many months of captivity she was condemned as a sorceress and heretic, and burned at Rouen on May 29, 1431.

But though Joan suffered the death of a martyr, the movement which she had set going never ceased, though its progress was slow when it was no longer conducted by an enthusiast, but by politicians and captains of mercenary bands But the basic fact in the situation was that the Burgundians were gradually dropping away from the English alliance. Duke Philip himself finally consented to make terms with his father's murderer at the Peace of Arras (1435) and in the following year Paris fell into the hands of the French—the burgher militia having refused to man their walls, and allowing the enemy to enter, while the small English garrison took refuge in the Bastile, and were starved out in a few days (April 1436). The regent Bedford was spared the humiliation of seeing his life's work undone—he had died in the previous autumn at Rouen

The most astounding thing in the last weary period of the Hundred Years' War is that the fall of Paris was not immediately followed by the expulsion of the English from the whole of France. The struggle went on for no less than 17 years longer: The English Government in stupid national pride refused to make peace, as they might, by surrendering their boy king's French title, and contenting themselves with retaining the ever-loyal Guienne, Calais, and perhaps Normandy, where they had fortified themselves very strongly. Charles of France was apathetic and his resources ran low, on account of the general exhaustion of his realm; nevertheless it is surprising that those hard-fighting veterans, the earls of Warwick and Shrewsbury and the young duke Richard of York, kept Normandy practically intact, considering that the parliament at home grudged both men and money for the war, and that every French town revolted when revolt was possible. There was a long episode of truce in 1444–48, when—a peace party having at last appeared in England, led by the earl of Suffolk—an accommodation was almost secured, the young king was married to a French princess, Margaret of Anjou, and the English claims dwindled down to the retention of Normandy and Guienne But the negotiations failed, and war broke out again in 1449.

This time the end had come; the duke of Somerset, commanding in Normandy, was an incapable general, but a much better man might have failed when the enemy came against him with overwhelming numbers and a great train of artillery which blew castle after castle to pieces. By 1450 most of the towns of Normandy had fallen, and the duke was being beleaguered in Caen. To relieve him there came over from England a small army, the last but one that crossed the sea during the Hundred Years' War. It was led by two veteran soldiers, Sir Matthew Gough and Sir Thomas Kyriel, but only numbered 3,500 men. On its way towards Caen it was encountered and annihilated by French forces under the Constable Richemont and the count of Clermont at Formigny (April 15, 1450). This was a battle on a small scale, but of high tactical import: the English had formed themselves in their usual order in a position covered by orchards and houses—dismounted men-at-arms in the centre, archers in long flanking wings. The French, instead of charging, brought up light field-guns opposite the archers and, keeping out of arrow range, played on the English line with roundshot till their opponents were goaded into advancing into the open to capture the guns They were then charged in flank; a general hand to hand mêlée followed, and the French were completely victorious. Of all Kyriel's army only a few hundred got away. This was the end of the English in Normandy—Somerset surrendered Caen on June 24 Nothing now remained to King Henry VI. in the north save Calais.

The next year saw the French army directed against Guienne; no succour came from England, Jack Cade's rebellion was recently over and a bitter parliamentary contest between the dukes of York and Somerset was raging. The outworks of Bordeaux fell in May 1451, the city itself most unwillingly opened its gates on June 30 Bayonne, the last stronghold of Aquitanian loyalism, fell on Aug 20 It looked as if the war had come to an end. But particularism was still strong. within six months of the fall of Bordeaux, Gascon nobles and burghers were visiting London to implore the aid of an English army and pledging themselves for revolt. The duke of York, as head of the English war party, prevailed on the king's council to make a final effort, and in Oct 1452 the veteran Talbot, earl of Shrewsbury, the last surviving general of Henry V, came ashore in the Gironde with 3,000 men On his arrival Bordeaux and all the minor towns rose in insurrection and expelled their French garrisons But in the following summer the whole force of France was turned southward, and the fate of the duchy was settled. The French army, besieging the loyalist town of Castillon, had strengthened itself with trenches, palisades and guns of position against any relieving force. Talbot came against it with every man that he could raise, English or Gascon, but finding the enemy resolved not to leave his lines and fight in the open, risked an assault Archery was of no use against entrenchments, and the relieving army tried to break through by main force in a great column Its head was torn to pieces by a concentrated fire of artillery, and Talbot himself, overthrown by a roundshot, went down outside the trench. The assault having failed, the enemy sallied out from all sides of his lines and overwhelmed his leaderless troops The last levy of Guienne and its English auxiliaries perished wholesale (July 17, 1453).

Yet so great was the hatred of the Bordelais for the French that they held out in despair for nearly three months after Castillon, and only surrendered when it became certain that no more help from England could be expected (Oct. 19, 1453). King Henry had just been struck with the first sudden access of the insanity which he inherited from his grandfather, Charles VI. of France, and the Wars of the Roses were about to begin. For 20 years no English ruler had the power or the leisure to think of sending troops to continue the long war overseas. This was the reason why secret emissaries from Guienne found no encouragement in London It was a marvel that Calais did not share the fate of Bordeaux, and was still destined to remain English for a century, though in the stress of the Wars of the Roses, Queen Margaret of Anjou meditated selling it in exchange for a French mercenary army. If Charles VII had been a man of energy, and not *"le bien servi,"* he might have mastered the last English foothold in France. But though war continued for a few years more, and the Senéchal of Normandy sacked Sandwich so late as 1457, the struggle petered out obscurely, and ended in a truce made by the Lancastrian party with Louis XI, whom they secured as their ally in English civil strife So ended a contest which had been an unmitigated curse both to England and to France.

(C. W. C. O.)

HUNEKER, JAMES GIBBONS (1860–1921), American musical critic, was born at Philadelphia, Jan. 31, 1860. A graduate of Roth's Military Academy, Philadelphia, he was a law student for a time, subsequently studying the piano in Philadelphia, Paris and New York. He became teacher of the piano at the National Conservatory, New York city, 1886–98, and musical and dramatic critic for the New York *Recorder* and *The Morning*

Advertiser. From 1900 to 1912 he was musical and dramatic critic for the New York *Sun*. In 1912 he joined the New York *Times* but returned to *The Sun* in 1919. He died in Brooklyn (N.Y.), Feb. 9, 1921. His writings on music, literature and art are notable for their style and popular appeal. Those published include *Chopin: the Man and his Music* (1900); *Overtones: Music and Literature* (1904); *Franz Liszt: a Study* (1911); *Ivory, Apes and Peacocks* (1915). He also supplied the text for Joseffy's edition of Chopin's works.

HUNGARIAN LANGUAGE. This language, a member of the Finno-Ugrian family of languages, is known in Hungarian as Magyar (pronounced Madyar), and is spoken by ten and a half millions of people, of whom half a million are in the United States.

Old Hungarian used a script akin to Old Turkish Runish script, but this was superseded about A.D. 1000 by the Roman character at the time of the adoption of Christianity.

The letters without exception retain the same sound value and are clearly pronounced in accented and in unaccented syllables.

The short vowels are *a, e, i, o, ö, u* and *ü*. They are pronounced thus: *a* like *a* in wall; *e* like *a* in man; *i* like *i* in little; *o* like *o* in corn; *ö* like French *eu* in Europe; *u* like *u* in full and *ü* like French *u* in buffet.

The long vowels are *ā, ē, ī, ō, ȫ, ū, ű̄* and are pronounced thus: *ā* like *a* in father; *ē* like *ai* in wait; *ī* like *ie* in field; *ō* like *o* in home; *ȫ* like French *eu* in *peux; ū* like *oo* in too and *ű̄* like *u* in French *nature*.

The simple consonants are *b, c, d, f, g, h, j, k, l, m, n, p, r, s, t, v, z*. The compound consonants are *cs (cz), dz, dzs, gy, ly, ny, sz, ty, zs*. *C* is pronounced like *ts* in bits; *g* like *g* in good; *j* like *y* in yard; *r* is rolled and *s* pronounced like *sh* in short. The other simple consonants are spoken as in English. The compound letters are pronounced thus: *cs (cz)* as *ch* in child; *oz=ts; dz* as *d* in English; *dzs* as *j* in jolly; *gy* as *d* in duty; *ly, ny, ty,* simply as two letters as in English; *zs* as *s* in pleasure.

Accent.—In single words the accent is always on the first syllable as *apa* (father), *cleven* (living). In syntactical compounds as noun and adjective, verb and adverb, noun and postposition, the accent remains on the first syllable.

Special Features.—Original Hungarian words never begin with a double consonant, except onomatopoeic words as *krákog* (to cough). The vowels are classed as high (*e, ē, i, ö, ü*) and low (*a, ā, o, u*). In conjugation, declension and combination the vowels are harmonized to conform to the vowel of the main root, thus: *ben* (in) with *haz* (house) is *ban: házban;* with a *kert* (garden) is *a kertben; vár* (to wait), *kér* (to ask), *tör* (to break) form *vártok—kértek, törtök*. Similar vowel changes express various meanings as *ez* (these), *az* (that); *itt* (here), *ott* (there). There is no grammatical gender. Compounds and verbal modifications are effected by a large number of suffixes. The active verb has two conjugations, definite and indefinite. The former is used when there is no object or when the object is not exactly defined. Causatives, frequentatives, potentials and diminutives are formed by affixes. Syntactical relations are mainly produced by affixes to the noun root. Thus *fej* (the head), *fejtöl* (of the head), *fejnek* (to the head), *fejjel* (with the head), *fejben* (in the head). In some cases the suffix remains separate as postposition, thus: *a ház elött* (before the house), *a ház mögött* (behind the house).

The relations of possession and number are indicated by suffixes, as *házam* (my house), *háza* (his or her house), *házunk* (our house), *tollam* (my pen), *tollaim* (my pens), *tollunk* (our pen), *tollaink* (our pens), *tollad* (thy pen), *tollaid* (thy pens).

Adjectives are not changed, thus: *a nagy ház* (a great house), *a nagy házak* (of a great house), *a nagy házban* (in a great house).

There is no word "to have": a dative form is used as in Latin, *nekem van könyvem* (to me is my book=I have a book). Hungarian has developed independently of its congeners for at least 2,000 years and is therefore marked by sharp differences especially in its phonetic system (*see* FINNO-UGRIAN LANGUAGES). Morphologically it has lost a dual form, still preserved in Ostjak and Wogul which also retain the objective conjugation. The singular substantive is used after numerals and adjectives of quantity. The Christian name and title are used after the family name, thus: *Olmosy, Karoly tanár úr* (lit. Olmosy, Charles Professor Mr.).

VOCABULARY

Some 400 words form the common or original stock of the Finno-Ugrian languages and may be classified as (1) Numerals, (2) Pronouns, (3) Parts of the body, (4) Family terms, (5) Natural phenomena, (6) Plants, (7) Animals, (8) Tools and weapons, (9) Industries, (10) Property, (11) Places, etc. The words for horse (*ló*) and saddle (*nyereg*) belong to the original stock, testifying to the nature of the culture of their early ancestors.

The language was enriched about the time of Christ by the development of compound words and the use of suffixes, while a third period of development took place as the result of the spread of writing and learning (1750–1850).

Loan Words.—Contacts with alien cultures at various historical periods have added to the original stock. Thus, at an early period before the separation of the Finno-Ugrian groups, relations existed with an Eastern or Satem Indo-European group, from which some such words as *száz* (hundred), *szarv* (horn). The general Ugrian stock (*c.* 200 B.C.) borrowed such words as *arany* (gold), *hét* (seven), *ezer* (thousand). Hungarian took definite shape while living near to the Caucasus and in the 1st century A.D. came into contact with an Iranian language, predecessor of Ossete, and obtained such words as *asszony* (woman), *vár* (fort), *vásár* (market), *hid* (bridge), *tölgy* (oak). Turkish has provided many words since the 5th century—when the neighbouring Turko-Bulgarian peoples taught them agriculture and pastoralism. *Búza* (wheat), *árpa* (barley), *eke* (plough), *alma* (apple), *szöllö* (grape), *bor* (wine), *bika* (bull), *ökör* (ox), *ürü* (mutton), *gyapju* (wool), *balta* (hatchet), *tükör* (mirror), *kapu* (door), *tenger* (sea), *betü* (letter). Personal names such as *Álmos, Árpád, Tas, Turul* were borrowed later under the first kings (11th to 13th centuries). A second Turkish invasion added such words as *koboz* (lute) and *árkany* (lasso). The third invasion, under the Osmanlis (15th to 17th centuries) brought *kávé* (coffee), *findzsa* (cup), *csizma* (boots). From Slavonic sources came words specially related to Christianity, to ecclesiastical and political organization, economic life and industries. German settlements and the long political relationship with the Hapsburgs added generally to the stock, while Old French—learnt by students in Paris—contributed somewhat. From Latin—for some time the speech of church and school, of education and legal administration—came a few words, especially in old Latin forms. Italy has provided terms in art, France in fashion, England in sport.

Etymological.—Analysis of current speech and of the written language shows that of 1,000 words 884 are Hungarian in origin, 38 come from Romance speech, Slavonic sources yield 33, German gives 15, while from Turkish (10) and other sources come 20 words; in all 88% Hungarian and 12% foreign. Another less favourable computation allows 65% to Hungarian and 35% to foreign sources.

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HUNGARIAN LITERATURE. The Catholic ecclesiastics who settled in Hungary during the 11th century were mainly instrumental in establishing Latin as the predominant language of the court, the higher schools and public worship, and Latin continued to monopolize the chief fields of literature until the revival of the native language at the close of the 18th century. Amongst the earliest Latin works that claim attention are the "Chronicle" (*Gesta Hungarorum*), by the "anonymous notary" of King Béla, probably Béla II. (1131–1141), called in the light of recent

research "Petrus Magister" or "Paulus Magister," an ecclesiastic who had learned the profession of notary in Paris. His work describes the early ages of Hungarian history. Other early chronicles are the *Carmen miserabile* of Rogerius; the *Liber Cronicorum* of Simon Kézai (end of the 13th century), the so-called "Chronicon Budense," *Cronica Hungarorum*, printed at Buda in 1473, and the *Chronicon Rerum Hungaricarum* of John Thuróczi. An extraordinary stimulus was given to literary enterprise by King Matthias Corvinus, who attracted both foreign and native scholars to his court. Foremost amongst the Italians was Antonio Bonfini, whose work, *Rerum Hungaricarum Decades IV.*, comprising Hungarian history from the earliest times to the death of King Matthias, was published with a continuation by Sambucus (Basle, 1568). Marzio Galeotti, the king's chief librarian, wrote an historical account of his reign. The most distinguished of the native scholars was John Csezmiczei, *alias* Janus Pannonius, who composed Latin epigrams, panegyrics and epic poems. The best edition of his works was published by Count S. Teleki at Utrecht in 1784.

As there are no traces of literary productions in the native or Magyar dialect before the 12th century, the early condition of the language is concealed from the philologist. It is, however, known that the Hungarians had their own martial songs, and that their princes kept lyre and lute players who sang festal odes in praise of the national heroes. In the 11th century Christian teachers introduced the use of the Roman letters, but the employment of the Latin language was not formally decreed until 1114. (*See* Bowring, *Poetry of the Magyars*, Introd. xix.) It appears, moreover, that up to that date public business was transacted in Hungarian, for the decrees of King Coloman the Learned (1095–1114) were translated from that language into Latin. Among the literary relics of the 13th century are the *Halotti Beszéd* funeral discourse and prayer in Hungarian.

From the *Margit-legenda*, or "Legend of St. Margaret," composed in the early part of the 14th century, it is evident that from time to time the native language continued to be employed as a means of religious edification. Under the kings of the house of Anjou, the Magyar became the language of the court. The literary documents of this era have been published in a series called *Nyelvemléktár* under the aegis of the Hungarian Academy. The words of old Hungarian have been collected in the *Lexicon linguae hungaricae aevi antiquioris* (1890) and in the *Lexicon Vocabulorum Hungaricorum* (1902). To the early part of the 15th century must be assigned the legends of "St. Francis" and of "St. Ursula," and possibly the original of the *Ének Pannónia megvételéröl*, an historical "Song about the Conquest of Pannonia." But not until the dawn of the Reformation did Magyar begin in any sense to replace Latin for literary purposes. The period placed by Hungarian authors between 1437 and 1530 marks the first development of Magyar literature.

About the year 1437 two Hussite monks named Tamás and Bálint (*i.e.*, Thomas and Valentine) adapted from older sources a large portion of the Bible for the use of the Hungarian refugees in Moldavia. Other relics belonging to this period are the oath which John Hunyady took when elected governor of Hungary (1446); the *Siralomének Both János veszedelmén* (Elegy upon John Both), written by a certain "Gregori"; and the *Emlékdal Mátyás király Halálára* (Memorial Song on the Death of King Matthias, 1490). To these may be added the rhapsody on the taking of "Szabács" (1476); the *Katalin-Legenda*, a metrical "Legend of St. Catherine of Alexandria," extending to over 4,000 lines, and who shows already traces of the criticism of the Renaissance and of a mentality opposed to the philosophy of the middle ages; and the *Feddő enek* (Upbraiding Song) by Francis Apáthi.

Reformation Period.—In the next literary period (1530–1606) several translations of the Scriptures are recorded. Karádi in 1569 brought to light the earliest national drama, *Balassi Menyhért*. Among the native poets, mostly mere rhyming chroniclers of the 16th century, the best and most prolific writer was Tinódi. Székely wrote in prose, with verse introduction, a "Chronicle of the World" under the title of *Cronica ez világnac yeles dolgairól* (Cracow, 1559). Csáktornya and Kákony imitated the ancient classical poets, and Erdösi introduced the hexameter. During the latter part of the 16th century and the beginning of the 17th two poets of a higher order appeared in Valentine Balassa, the earliest Magyar lyrical writer, a disciple of Petrarch and of the humanist poets, a poet of platonic love, and his contemporary John Rimay.

The melancholy state of the country consequent upon the persecutions of Rudolph I., Ferdinand II. and Leopold I., as also the continual encroachment of Germanizing influences under the Habsburgs, were unfavourable to the development of the national literature during the next literary period, dating from the Peace of Vienna (1606) to that of Szatmár (1711). A few names were, however, distinguished in theology, philology and poetry. In 1626 a Hungarian version of the Vulgate was published at Vienna by the Jesuit George Káldi, and another complete translation of the Scriptures, the so-called *Komáromi Biblia* (Komorn Bible) was made in 1685 by the Protestant George Csipkés, though it was not published till 1717 at Leyden. On behalf of the Catholics the Jesuit Peter Pázmán and others were the authors of various works of a polemical nature. Especially famous was the *Hodaegus*, *Kalauz* of Pázmán, which first appeared at Pozsony (Pressburg) in 1613. Among the Protestant writers were Németi, Alvinczy, Alexander Felvinczy, Mártonfalvi and Melotai, who was attached to the court of Bethlen Gábor. Telkibányai wrote on "English Puritanism" (1654). Párispápai compiled an Hungarian-Latin Dictionary (Löcse, 1708), and Apáczai-Csere, a Magyar Encyclopaedia (Utrecht, 1653). In polite literature the heroic poem *Zrinyiász* (1651), descriptive of the fall of Sziget, by Nicholas Zrinyi, marks a new era in Hungarian poetry. Zrinyi, who in his prose works reveals himself to be a disciple of Machiavelli, expressed in his grandiose writings the spirit of Catholic reform coupled with a baroque taste. The lyric and epic poems of Stephen Gyöngyösy, who sang the deeds of Maria Széchy, are samples rather of a general improvement in the style than of the purity of the language. From the appearance of the first extant printed Magyar work at Cracow in 1527 to the end of the period just treated, more than 1800 publications in the native language are known.

The period comprised between the peace of Szatmár (1711) and the year 1772 is far more barren in literary results than even that which preceded it. The exhaustion of the nation from its protracted civil and foreign wars, the extinction of the court of the Transylvanian princes where the native language had been cherished, and the prevalent use of Latin in the schools, public transactions and county courts, all combined to bring about a complete neglect of the Magyar language and literature. Among the few prose writers of distinction were Clément Mikes who has bequeathed us the most exquisite prose of the century in his memoires in letter form (1717–58), where may be observed the influence of the English *Spectator;* the historian Michael Cserei; and Peter Bod, who besides his theological treatises compiled a history of Hungarian literature (1766). But the most celebrated writer of this period was the Jesuit Francis Faludi. On account of the classic purity of his style in prose, Faludi was known as the "Magyar Cicero." Not only as a philosophic and didactic writer, but also as a lyric and dramatic poet he surpassed all his contemporaries. Another pleasing lyric poet of this period was Ladislaus Amade, and of considerable merit are the sacred lyrical melodies of Paul Rádai in his *Lelki hódolás* (Spiritual Homage, 1715).

The next three literary periods stand in special relationship to one another, and are sometimes regarded as the same. The first two, marking respectively the progress of the "Regeneration of the Native Literature" (1772–1807) and the "Revival of the Language" (1807–30), were introductory to and preparatory for the third or "Academy," period, which began about 1830.

Regeneration of the Literature.—In consequence of the general neglect of the Magyar language during the reigns of Maria Theresa and her successor Joseph II., the more important prose productions of the latter part of the 18th century were written either in Latin or in German. The reaction in favour of the native literature manifested itself at first chiefly in the creation of various schools of poetry. Foremost among these stood the so-called "French" school, founded by George Bessenyei, the author of

several dramatic pieces, and of an imitation of Pope's *Essay on Man*, under the title of *Az emberneк próbája* (1772). Bessenyei introduced the use of rhymed alexandrines in place of the monotonous Zrinian measure. Other writers of the same school were Laurence Orczy and Abraham Barcsay. The songs and elegies of Paul Anyos show great depth of feeling. Versifiers and adaptors from the French appeared also in Counts Adam and Joseph Teleki, and Joseph Péczeli, who translated Young's *Night Thoughts*. The chief representatives of the strictly "classical" school were David Baróti Szabó, Nicholas Révai, Joseph Rájnis and Benedict Virág. Among the works of Baróti Szabó is an abridged version of *Paradise Lost* (1802) Baróti, moreover, published (1810–13) a translation of Virgil's *Aeneid* and *Eclogues*. The "classical" school reached its highest state of culture under Virág, whose poetical works, consisting chiefly of Horatian odes and epistles, obtained for him the name of the "Magyar Horace." The *Poetai Munkai* (Poetical Works) of Virág were published at Pest in 1799. Of his prose works the most important is the *Magyar Századok* or "Pragmatic History of Hungary" (Buda, 1808). Vályi-Nagy, the first Magyar translator of Homer, belongs rather to the "popular" than the "classical" school. His translation of the *Iliad* appeared at Sárospatak in 1821. The establishment of the "national" or "popular" school is attributable chiefly to Andrew Dugonics. His national romances, especially *Etelka* (Pozsony, 1787) and *Az arany pereczek* (Pest and Pozsony, 1790), attracted public attention, and were soon adapted for the stage. Joseph Gvadanyi's trilogy *Falusi Nótárius* (Village Notary, 1790), as also his *Rontó Pál és gr. Benyovszky történeteik* (Adventures of Paul Rontó and Count Benyovszky), are humorous and readable, but careless in style. Of a more general character, and combining the merits of the above schools,—are the works of the authors who constituted the so called "Debrecen Class"; *e.g.*, Michael Fazekas, author of an epic, *Ludas Matyi* (1817). Other precursors of the modern school were the poet and philologist Francis Verseghy; the gifted didactic prose writer, Joseph Kármán, who had published a sentimental novel in the manner of Werther, *Fanni hagyományai* (Memoirs and letters of Fanni 1794); the lyric poets, Szentjóbi, Szabó, Bacsányi (*q.v.*) and Dayka. Still more celebrated were Mihály Csokonai (*q.v.*) and Alexander Kisfaludy (*q.v.*). The first volume of Alexander Kisfaludy's *Himfy*, a series of short lyrics of a descriptive and reflective nature, appeared at Buda in 1801, under the title of *Kesergö szerelem* (Unhappy Love), and was received with great enthusiasm; nor was the success of the second volume *Boldog szerelem* (Happy Love, 1807), inferior. The *Regék*, or "Tales of the Past" (1807) still further increased Kisfaludy's fame; but in his dramatic works he was not equally successful. Journalistic literature in the native language begins with the *Magyar Hirmondó* (Harbinger) started by Matthias Ráth at Pozsony in 1780. Among the magazines the most important was the *Magyar Muzeum*, established at Kassa (Kaschau) in 1788 by Baróti, Kazinczy and Bacsányi. The *Orpheus* (1790) was the special work of Kazinczy, and the *Urania* (1794) of Kármán.

Revival of the Language.—Closely connected with the preceding period is that of the "Revival of the Language" (1807–30), with which the name of Francis Kazinczy (*q.v.*) is especially associated. He perfected the work of restoration begun by Baróti and amplified by Révai. Poetry and *belles lettres* still continued to occupy the chief place in the native literature, but under Kazinczy and his immediate followers a correctness of style and excellence of taste hitherto unknown soon became apparent. Kazinczy, in his efforts to accommodate the national language to the demands of an improved civilization, availed himself of the treasures of European literature, but thereby incurred the opposition of ardent nationalists. The opinions of his enemies were ventilated in a lampoon styled *Mondolat*. Daniel Berzsenyi, whose odes are among the finest in the Hungarian language, was the correspondent of Kazinczy, and like him a victim of the attacks of the *Mondolat*. But the fervent patriotism, elevated style, and glowing diction of Berzsenyi soon caused him to be recognized as a truly national bard. His friend, John Kiss, possesses some merit as the translator of Pope and Thomson. As a sonnet writer none stands higher than Paul Szemere. The lyric poems of Francis Kölcsey can hardly be surpassed, whilst his orations exhibit not only his own powers, but the singular excellence of the Magyar language as an oratorical medium. Andrew Fáy is chiefly remembered for his *Eredeti Mesék* (Original Fables). The dramatic works of Charles Kisfaludy, brother of Alexander, won him enthusiastic recognition as a regenerator of the drama. His plays bear a distinctive national character. Not without interest to Englishmen is the name of Gabriel Döbrentei (*q.v.*), the translator of *Macbeth*, represented at Pozsony in 1825. Joseph Katona, author of the historical tragedy *Bánk Bán* (1820), is considered to be the greatest of the Hungarian dramatic poets. As authors of special works on philosophy, we find Samuel Köteles, John Imre, Joseph Ruszek, Daniel Ercsei and Paul Sárvári; as a theologian John Somossy; as an historian and philologist Stephen Horváth, who endeavoured to trace the Magyar descent from the earliest historic times; as writers on jurisprudence Alexander Kövy and Paul Szlemenics. For an account of the historian George Fejér, the laborious compiler of the *Codex Diplomaticus*, *see* FEJÉR.

Academy Period.—The establishment of the Hungarian Academy of Sciences (Nov. 17, 1830) marks the commencement of a new period. The language, nursed by the academy, developed rapidly, and showed its capacity for giving expression to almost every form of scientific knowledge. By offering rewards for the best original dramatic productions, the academy, provided that the national theatre should not suffer from a lack of classical dramas. During the earlier part of its existence the Hungarian academy devoted itself mainly to the scientific development of the language and philological research. Since its reorganization in 1869 the academy has, however, paid equal attention to the various departments of history, archaeology, national economy and the physical sciences The encouragement of polite literature was more especially the object of the Kisfaludy Society, founded in 1836, which published a complete translation of Shakespeare.

Foremost among epic poets, though not equally successful as a dramatist, was Mihaly Vörösmarty (*q.v.*), who combines great power of imagination with elegance of language. Generally less varied and romantic, though easier in style, are the heroic poems *Augsburgi ütközet* (Battle of Augsburg) and *Aradi gyulés* (Diet of Arad) of Gregory Czuczor, who was, moreover, very felicitous as an epigrammatist. In the epics of John Garay and the lyrics of Joseph Bajza are the first traces of the awakening of the classicism of Petöfi and Arany. As an original but rather heavy lyric and didactic poet we may mention Peter Vajda. Of a more distinctly national tendency are the lyrics of John Kriza and John Erdélyi, but the reputation of the latter was more especially due to his collections of folk-lore made on behalf of the Kisfaludy society. More popular than any of the preceding, and well known in England through Sir John Bowring's translation, are the lyrics of Alexander Petöfi (*q.v.*).

With Petöfi the greatest poet of the age is Jean Arany (1817–82) who by his short epic poems earned the name of "the ballad Shakespeare." He is considered the master of classical style. Among other poets of the period should be mentioned Coloman Tóth, author of several epic and dramatic pieces; John Vajda; Joseph Lévay, known also as the translator of Shakespeare; Paul Gyulai, not only a lyric and epic poet, but an impartial critical writer; Ladislaus Szelestey; Antony Várady, a patriotic and religious poet; Emil Ábrányi, known also as the translator of Rostand; Alexander Endrödy, the author of *Kurucdalok* (Rebel Songs); Joseph Kiss, in his ballads a disciple of d'Arany, but an original poet in his Jewish poems, and later founder of the ultra-modern revue *A Hét* (The Week, 1890); and Charles Szasz, better known as a translator than as an original poet.

Plays and Novels.—Meanwhile dramatic literature found many champions, of whom the most energetic was Edward Szigligeti, *proprie* Joseph Szathmáry, who enriched the Hungarian stage with more than 100 pieces. Of these the most popular are comedies and serio-comic national dramas. A less prolific but more classical writer appeared in Charles Obernyik, whose *George Brankovics* is one of the best historical tragedies in the

language. Several of the already mentioned lyric and epic poets were occasional writers also for the drama. To these we may add Sigismund Czakó, Lewis Dobsa, Joseph Szigeti, Ignatius Nagy, Joseph Gaal, Charles Hugo, Lawrence Tóth, Emeric Vahot, Alois Degré, Stephen Toldy and Lewis Dóczi, author of the popular prize drama *Csók* (The Kiss). *Az ember tragoediája* (The Tragedy of Man), by Emeric Madách (1861), is a dramatic poem of a philosophical and contemplative character, which even now remains a repertory piece at the National Theatre. Among successful dramatic pieces may be mentioned the *Falu rossza* (Village Scamp, 1875), of Edward Tóth, which represents the life of the Hungarian peasantry, and *Iskariot* (1876) by Anthony Várady. In the years between 1860 and 1880 a school called the "neo-romantic" reigned in the theatre (Jókai, Rákosy and Berczik), while the so-called popular drama was revived by Francis Csepreghy and Géza Gárdonyi

Original romance writing, which may be said to have commenced with Dugonics and Kármán at the close of the 18th, and to have found a representative in Francis Verseghy at the beginning of the 19th century, was afterwards revived by Fáy in his *Bélteky ház* (1832), and by the contributors to certain literary magazines, especially the *Aurora*, an almanack conducted by Charles Kisfaludy, 1821–30, and continued by Joseph Bajza to 1837. The Magyar novels, although enlivened by touches of humour, have generally rather a serious historical or political bearing. Especially is this the case with Nicholas Jósika's *Abafi* (1836), *A csehek Magyarországon* (The Bohemians in Hungary), and *Az utolsó Bátori* (The Last of the Báthoris), published in 1847. The same may be said of Baron Joseph Eötvos's *Karthauzi* (1839) and *Falu jegyzője* (1845), translated into English (1850) by O. Wenckstern. Of the novels produced by Baron Sigismund Kemény, considered to be the greatest Hungarian novelist, who mingled in his historical works realism and romanticism, the most important are *A rajongók* (Fanatics, a Jewish sect in Transylvania in the 16th century) published in 1850, and *Zord Idő* (The Disastrous Era, 1862).

The graphic descriptions of Hungarian life in the middle and lower classes by Lewis Kuthy won for him temporary renown. Another popular writer of great originality was Gereben Vas. The fertile writer Paul Kovács excels more particularly in humorous narration. Pleasing humorous sketches are contained also in Ignatius Nagy's "Caricatures" or *Torzképek* (1844). But by far the most prolific and talented novelist that Hungary can boast of is Maurus Jókai (*q.v.*), whose power of imagination and brilliancy of style, no less than his true representations of Hungarian life and character, have earned for him a European reputation. Towards the end of the romantic period the versified novel with heroes in the manner of Byron and Pushkin became the mode. In this new genre the following deserve mention: *Romhányi* by Paul Gyulai, *Tündérök* (The Fairy Zone, 1876) by John Bulla, *Délibábok hőse* (Hero of the Mirages, 1873) by Ladislas Arany, *Találkozások* (Rencounters, 1877) by John Vajda and *Ráskai Lea* (1887) by Zsolt Beöthy.

Science and History.—As regards works of a scientific character, the Magyars until recently were confessedly behindhand as compared with many other European nations. Indeed, before the foundation of the Hungarian academy in 1830, few such works claiming general recognition had been published in the native language. Even in 1847 astronomy, physics, logic and other subjects of the kind had to be taught in several of the lyceums through the medium of Latin. The violent political commotions of the next few years allowed but little opportunity for the prosecution of serious studies; the subsequent quieter state of the country, and gradual re-establishment of the language as a means of education, were, however, more favourable to the development of scientific knowledge.

In the department of philosophy Hungary could boast a few authors of independent and original thought. Of these one of the most notable is Cyril Horváth, whose treatises published in the organs of the academy display a rare freedom and comprehensiveness of imagination. The philosophical labours of the already mentioned John Erdélyi and of Augustus Greguss won for them well-deserved recognition, the latter especially being famous for his aesthetical productions, in which he appears to follow out the principles of Vischer.

The labours of Stephen Horváth in the preceding period had prepared the way for future workers in the field of historical literature. Specially meritorious among these are Michael Horváth, Ladislaus Szalay, Paul Jászay and Count Joseph Teleki The *Magyarok története* (History of the Magyars), first published at Pápa (1842–46), is the most famous of Michael Horváth's numerous historical productions Ladislaus Szalay's *Magyarország története* (History of Hungary, 1852–61) is a most comprehensive work, showing more particularly the progress of Hungarian legislative development in past times Count Joseph Teleki is famed chiefly for his *Hunyadiak kora* (The times of the Hunyadys, 1863). In particular departments of historical literature we find Alexander Szilágyi, some of whose works, like those of Ladislaus Kőváry, bear on the past of Transylvania; Charles Lányi and John Pauer, authors of treatises on Roman Catholic ecclesiastical history; John Szombathi, Emeric Révész and Balogh, writers on Protestant church history; William Fraknói, biographer of Cardinal Pázmán, and historian of the Hungarian diets; and Aaron Sziládi, Joseph Podhradczky, Charles Szabó, John Jerney and Francis Salamon, who have investigated and elucidated many special historical subjects. For the mediaeval history of Hungary the *Mátyáskori diplomatikai emlékek* (Diplomatic Memorials of the Time of Matthias Corvinus), issued by the academy under the joint editorship of Ivan Nagy and Baron Albert Nyáry, affords interesting material. Among the many historians of Magyar literature Francis Toldy *alias* Schedel holds the foremost place. For philological and ethnographical research into the origin and growth of the language none excels Paul Hunfalvy He is, moreover, the warm advocate of the theory of its Ugrio-Finnic origin, as established by the Uralian traveller Anthony Reguly, the result of whose labours Hunfalvy published in 1864, under the title *A Vogul föld és nép* (The Vogul Land and People). Between 1862 and 1866 valuable philological studies bearing on the same subject were published by Joseph Budenz in the *Nyelvtudományi Közlemények* (Philological Transactions).

As compilers and authors of works in various scientific branches allied to history, may be particularly mentioned—in statistics and geography, Alexius Fényes, Emeric Palugyay, John Hunfalvy, Charles Keleti, Leo Beöthy and Paul Király; in travel, Ignatius Goldziher, Ladislaus Magyar, John Xantus, John Jerney, Count Andrássy, Ladislaus Podmaniczky, Paul Hunfalvy; in astronomy, Nicholas Konkoly; in archaeology, Bishop Arnold Ipolyi, Florian Rómer, Emeric Henszlmann, Baron Albert Nyáry and Francis Pulszky; in Hungarian mythology, Bishop Ipolyi and Anthony Csengery; in numismatics, John Erdy and Jacob Rupp; and in Jurisprudence, Augustus Karvassy, Theodore Pauler, Gustavus Wenczel, John Fogarasi and Ignatius Frank.

Notwithstanding the exertions of Paul Bugát to arouse an interest in the natural sciences by the establishment in 1841 of the "Hungarian Royal Natural Science Association," no general activity was manifested in this department of knowledge, so far as the native literature was concerned, until 1860, when the academy organized a special committee for the advancement of mathematical and natural science. The principal contributors to the "Transactions" of this section of the academy were—for anatomy and physiology, Coloman Balogh, Eugene Jendrassik, Joseph Lenhossék and Lewis Thanhoffer; for zoology, John Frivaldszky, John Kriesch and Theodore Margó; for botany, Frederick Hazslinszky, Lewis Jurányi and Julius Klein; for mineralogy and geology, Joseph Szabó, Max Hantken, Joseph Krenner, Anthony Koch and Charles Hoffman; for physics, Baron Lorando Eötvös, Coloman Szily and Joseph Sztoczek; for chemistry, Charles Than and Vincent Wartha; for meteorology, Guido Schenzl Among the authors of scientific monographs should be mentioned the names of Otto Hermann, Anthony Kerpely and Thomas Kosutány.

Literature Since 1880.—The number of Magyar writers has since 1880 increased to an extent hardly expected by the reading public in Hungary itself. In 1830 there were only ten Magyar

periodical publications; in 1880 we find 368; in 1885 their number rose to 494; in 1890 to 636; and at the beginning of 1895 no fewer than 806 periodical publications, written in the Hungarian language, appeared in Hungary. Since that time (1895) the number of periodical as well as of non-periodical literary works has been constantly rising, although, as in all countries with a literature of rather recent origin, the periodical publications are, in proportion to the whole of the output, far more numerous than the non-periodical. This remarkable increase in the quantity of literary work was, on the whole, accompanied by a fair advance in literary quality.

In lyrical poetry the influence of Heine, Schopenhauer and Nietzsche made itself felt, while the inner tradition followed the ways traced out by Petöfi and Arany: the fight between the modern influences from abroad and the classical Hungarian traditions, began, though feebly, in this early period. Among the poets who first came to the fore in the '60s several were active after 1880: Victor Dalmady, Ladislas Arany, Emil Ábrányi. Julius Reviczky (1855–99) inclined to the occidental rather than to the specifically Magyar type of poets, initiating an aristocratic and pessimistic school of poetry. Others were Joseph Kiss, Alexander Endrődi and Odon Jakab; Louis Pósa, the charming children's poet; Andor Kozma, Hungary's greatest satirical poet; Gustave Csengey, Jean Dengi, Antoine Radó and Louis Palagyi; Eugène Heltai, the initiator of the light "chanson" in the Parisian manner; Jules Rudnyánszky, Árpád Zemplényi, Emil Makai, etc.

Among Hungarian novels we may distinguish four dominant *genres*. The first is represented almost exclusively by Maurus Jókai (*q.v.*). To the school so perfectly represented by Jókai belong Árpád Kupa, Róbert Tábori, Julius Werner, etc. The second class of Hungarian modern novelists is led by the well-known Koloman Mikszáth, a poet endowed with originality, a charming *naiveté*, and a freshness of observation from life. A close observer of the multifarious low life of Hungary, Mikszáth has, in his short stories, given a delightful yet instructive picture of all the minor varied phases of the peasant life of the Slavs, the *Palócok*, the Saxons, the town artisan. Amongst his numerous works may be mentioned *A jó palóczok* ("The Good Palóczok," Slav peasants); *Egy választás Magyarországon* ("An Election in Hungary"); *A tekintetes vármegye* ("The Worshipful County") and *Szent Peter esernyője* ("St. Peter's Umbrella." Eng. trans. by Miss B. W. Worswick). Mikszáth has had considerable influence upon other writers. Such are Victor Rákosi (*Sipulus tárcái*, "The Essays of Sipulus"; Alexius Benedek, the author of numerous distinctly sympathetic and truly Magyar tales, fables and novels, one of the most gifted and deserving literary workers of modern Hungary; Géza Gárdonyi Stephen Bársony, etc. The third class of Magyar novelists comprises those cosmopolitan writers who take their method of work, their inspiration and even many of their subjects from foreign authors. A people with an intense national sentiment, such as the Hungarians, do not as a rule incline towards permanent admiration of foreign-born or imported literary styles; and accordingly the work of this class of novelists has frequently met with very severe criticism on the part of various Magyar critics. Yet it can scarcely be denied that several of the "foreign" novelists have contributed a wholesome, if not quite Magyar, element of form or thought to literary narrative style in Hungary. Probably the foremost among them is Sigismund Justh (*A puszta könyve*, "The Book of the *Puszta*," prairie of Hungary; *Fuimus*). Other novelists belonging to this school are: Desiderius Malonyai, Julius Pekár (*Dodó főhadnagy problémái*, "Lieutenant Dodó's Problems) Thomas Kóbor, Stephen Szomaházy, Zoltán Thury, Sigismund Gyarmathy, etc. In the fourth class may be grouped such of the latest Hungarian novelists as have tried, and on the whole succeeded, in clothing their ideas and characters in a style peculiar to themselves. Besides Stephen Petelei and Zoltán Ambrus must be mentioned especially Francis Herczeg, who has published a number of very interesting studies of Hungarian social life (*Simon Zsuzsa*, "Susanna Simon"; *Fenn és lenn*, "Above and Below"); and Alexander Bródy (*Don Quixote kisasszony*, "Miss Don Quixote"; *Faust orvos*, "Faust the Physician").

Dramatic literature, liberally supported by the king and the Government, and aided by magnificent theatres in the capital and also in the provinces (the finest provincial theatre is in Kolozsvár, in Transylvania), developed remarkably. In the modern drama three great and clearly differentiated groups may be distinguished. First the neo-romantic group, whose chief representatives are Eugen Rákosi and Louis Dóczi. To the same school belong Louis Bartók, Anton Váradi and Alexander Somló. The next group of Hungarian dramatists is dominated by the master spirit of Gregor Csiky (*q.v.*). Among Csiky's most promising disciples is Francis Herczeg (already mentioned as a novelist), author of the successful society comedy, *A Gyurkovics leányok* ("The Misses Gyurkovics") and *Három testör* ("Three Guardsmen"). Árpád Berczik's *Nézd meg az anyját* ("Look at her Mother"), *A protekczió* ("Patronizing"), also followed on the lines of Csiky. The third group of dramatic writers take their subjects, surroundings and diction from the folk-life of the villages (*népszinmü*, "folk-drama"). The greatest of these dramatists has so far been Edward Tóth (*Toloncz*, "The Ousted Pauper").

Philosophy and Science.—In philosophy there has been a remarkable increase of activity, partly assimilative or eclectic and partly original. Peter Bihari and Maurice Kármán have in various writings spread the ideas of Herbart. After the school of Comte, yet to a large extent original, is the *Az ember és világa* ("Man and his World") of Charles Böhm, who in 1881 started a philosophical review (*Magyar Filozofiai Szemle*), subsequently edited by Joseph Bokor. Realism, more particularly of the Wundt type, is represented by Emericus Pauer, *Az ethikai determinismus* ("Ethical Determinism"), and Eugen Posch (*Az időről*, "On Time"). On a Thomistic basis John Kiss edited a philosophical review (*Bölcseleti Folyóirat*); on similar lines have worked Ákos Mihályfi, Augustin Lubrich and others. Neo-Hegelianism was cultivated by Eugen Schmitt, efficiently assisted by Joseph Alexander Simon. F. Medveczky (formerly a German author under the name of Fr. von Bärenbach) espoused Neo-Kantism (*Társadalmi elméletek és eszmények*, 1887, "Social Theories and Ideals"). The Hungarian scholar Samuel Brassai published, in 1896, *Azigazi pozitiv filozofia* ("The True Positive Philosophy"). Amongst the ablest and most zealous students of the history of philosophy are Bernhard Alexander, under whose editorship, aided by Joseph Bánóczi, a series of the works of the world's great thinkers appeared, and Andrew Domanovszky, author of an elaborate History of Philosophy, etc.

Juristic literature has been stimulated by the activity in positive legislation. On Jan. 1, 1900, a new criminal code, thoroughly modern in spirit, was put in force; and in 1901 a Civil Code Bill, to replace the old Hungarian customary system, was introduced. Among the newer writers on common and commercial law may be mentioned Wenczel, Zsögöd, Gustave Schwartz, Alexander Plósz, Francis Nagy; on constitutional law, Korbuly, Ernest Nagy, Kmety, Ferdinandy, Béla Grünwald, Julius Andrássy and Emeric Hajnik; on administration, Georg Fésüs and Csiky; on finance, Mariska and Exner. Among the later writers on statistics are Konek, Keleti, Láng, Földes, Jekelfalussy, Ráth and Vizaknai.

Among the more important political works are the various monographs of Gustavus Beksics on the Dualism of Austria-Hungary, on the "New Foundations of Magyar Politics" (*A magyar politika uj alapjai*, 1899), on the Rumanian question, etc.; the writings of Ákos Beöthy, Victor Concha (systematic politics), Géza Ferdinandy (historical and systematic politics), Béla Földes (political economy), Julius Mandello (political economy), Alexander Matlekovics (Hungary's administrative service; *Államháztartás*, 3 vols.), J. Pólya (agrarian politics), and the late Augustus Pulszky.

In history there has been great activity. The millennial festivities in 1896 gave rise to the publication of what was then the most extensive history of the Hungarian nation (*A magyar nemzet története*, 1895–1901), ten large and splendidly illustrated volumes, edited by Alexander Szilágyi, with the collaboration of the best specialists of modern Hungary, Joseph Hampel, J. B. Kuzsinszky, Géza Nagy, H. Marczali, Anton Pór, Schönherr, V. Fraknói,

Árpád Károlyi, David Angyal, Coloman Thaly, Géza and Aladár Ballagi.

Literary criticism was actively pursued. Among the more authoritative writers Paul Gyulai and Zsolt Beöthy represented the conservative school; younger critics, *e.g.*, Zoltan Ferenczy and Ladislas Négyessy, have shown themselves somewhat too ready to follow the latest Norwegian or Parisian sensation.

20th Century Literature.—Hungarian literature at the beginning of the 20th century was on the brink of a revolution. The intellectual life of the country was undergoing a crisis. After 1,000 years of a history, sometimes glorious but more often tragic, Hungary was faced by new difficulties which threatened her very life: the social question, the defence of her civilization and her language against the Slav and Teutonic races, and the antagonism between the essentially rural nature of the Hungarian people and the Americanism and cosmopolitanism of the capital, Budapest.

Writers were divided into two camps: the traditionalists and the moderns. This division still persists. The older generation, inspired by Hungarian nationalism, had joined in the celebration of the country's 1,000th anniversary in 1896 and had accepted modern civilization but remained firmly opposed to cosmopolitanism and radicalism. They still longed for the Hungarian steppes and the old folk songs. From this generation originated what is known as the Turanian movement, which draws its inspiration and its themes from the East and endeavours to arouse in the Hungarian people the consciousness of their non-European origin. The numbers of this older generation diminish year by year. The patriotic and classical poets, Joseph Lévay (1825–1918) and Alexander Endrödi (1850–1920), towards the end of their lives burst again into song. In 1910 Hungary lost the novelist Koloman Mikszáth, the most notable successor of Jókai. Among contemporary writers of this school are the poets Jules Vargha and André Kozma, the novelist Ferencz Herczeg and the critic and essayist Eugene Rákosi, their organ being the review *Budapesti Szemle*.

In opposition to the older generation were the moderns, who hailed the advent of capitalism and industrialism in place of the old provincial spirit. These intellectual radicals wished to eliminate from literature all national characteristics, and to promote the cause of realism with its materialistic philosophy. They turned their faces towards the West, not the chauvinistic West, but the home of cosmopolitanism and anti-nationalism. The moderns gathered their forces in the early years of the 20th century, using as their rallying point a review with the symbolic title *Nyugat*, edited by Ignotus. Round it gathered the young poets of the symbolist and romantic school. Chief among these men was André Ady, an original Magyar genius, whose primitive and prophetic gifts place him in the first rank of Hungarian poets. Influenced as he was by French symbolism as well as by the works of Zola, he drew inspiration also from the days before the school of Arany, from the melancholy, sometimes crudely expressed, Protestant hymns of the 16th century, from the songs of the rebels against the Austrians, from the archaic and primitive beauties of the Hungarian Bible. He tilts against conventional morality and describes love with all the voluptuousness of the realist: a trait which is, in fact, common to all the moderns. He is distinguished by a certain aristocracy of mind, as, for instance, in his attitude towards the Nietzschean cult of the Ego, but in his general outlook, and in his hedonistic glorification of blood and treasure, and above all, in his sympathy for the poor and despised, he inclines towards Socialism.

Compared with him, modern lyrical poets such as Michael Babits, Jules Juhász, Désiré Kosztolányi, Árpád Tóth, Gabriel Oláh, Ernö Szép have confined themselves to pure aestheticism, seeking to express the emotions of a cultivated, almost neurasthenic, minority. The realistic novelists found a successor in Sigismond Móricz, whose preoccupation with brutish peasants and corrupt petty tradesmen reflect his political tendencies. His work is the antithesis of that of idealistic novelists such as Géza Gárdonyi (d. 1923) and Cécile Tormay.

When the World War broke out, these two camps, the traditionalists and the moderns, were still divided by a great gulf. Cosmopolitan literature was silent for a time. The poets of tradition hailed the conflict with acclamation. One poet, a soldier, Géza Gyóni, in a language learnt from the moderns, turning his back on *l'art pour l'art*, succeeded in expressing the horrors and pathos of the War. The moderns were not long in making themselves heard, but, as might have been expected, their pacifist leanings were only accentuated by what had happened.

The final disaster, and the revolution of Oct. 1918 unmasked the political connections of *Nyugat;* its contributors joined hands with the rabble. In the intoxication of the first success the moderns threw off the mask Their review declared itself to be definitely on the side of the revolution and of Count Karolyi. They looked forward to the end of the old feudal agricultural Hungary, the Hungary of officialdom, of the nobility and of the nationalist writers grouped around both.

During its four months' reign Bolshevism kept literature under strict control. Newspapers were suppressed and the right of publication withdrawn. A single publisher held all the world of thought in fee· the State printed nothing but propagandist papers and pamphlets. The socialized theatres were forced to produce plays in celebration of the revolution. Futurist and expressionist writers alone were protected and subsidized by the "literary directory." This upheaval brought no good to literature. Expressionism pushed to extremes led nowhere.

The Growth of Nationalism.—After the brief Soviet régime literature set itself to assist in the task of national regeneration. With no definite theories of art or literary programme it expressed the grief of the divided country and its longing for the lost provinces. Although historic Hungary was divided into five parts, Magyar literature kept its unity. In political Hungary the novel took the place of the lyrical poetry of the pre-War period. Désiré Szabó, in his loftily conceived work, describes the great cataclysm of the World War and the determined defence made by the Hungarians, in both the material and moral spheres, against the foreign invader.

Hungarian literature from this time onward endeavoured to break the bonds of torpid decadence and of anti-national radicalism, and to place before a people, struggling in the shadows of adversity, a new conception of the world which should be healthy, energetic and modern, thus again proving that Hungarian literature has always been something more than a mere exercise in aesthetics. Modern drama is striving to create new and lasting values, both poetic and philosophical. Romanticism has reappeared, and talented dramatists such as Ferencz Herczeg, Ferencz Molnár, Louis Biró and Melchior Lengyel have attained to well-deserved success in the theatres of Europe, and even in those of America.

In discussing Hungarian literature we must not forget that of the lost provinces of Hungary. In Transylvania in particular there has been a remarkable renaissance. The reawakening of a feeling for the mother country has also made itself felt in the Northern Carpathians. There, poets such as the Transylvanian Végvári often express under pseudonyms the sadness which, as Magyars, they cannot but feel. The remote districts saw a veritable renaissance of lyricism: Louis Aprily in Transylvania, Ladislas Mécs and Ladislas Ölvedi in Slovakia.

Latterly it is the novel that has interested Hungary above all else. Lyric poets strive to write "great" novels such as those of Kosztolanyi, who wrote a romance about *Nero the Decadent* (*A Vércs költö,* The Poet soiled with Blood). Babits, who essayed to compose an epic in prose and verse of the three generations of modern Hungary (*Halálfiai,* Son of Death) and Louis Kassak, the ex-workingman writer, with his autobiographical romance (*Egy Ember élete,* A Man's Life). There was an equal harvest of critical works, and nowadays the appearance of an essay causes more stir than did a poem before the War. A desperate fight has developed about the poet Ady, in which all the critics of the country are taking part, *e.g.*, Jean Horváth, Elemér Császár, Albert Berzeviczy, Alexandre Makkai, Eugène Dóczy, Ladislas Négyesy, Julius Szekfü, Eugéne Rákosi, to name only the most important. The younger generation wishes to break down the ideology of the past and to adapt itself to the new aims

of the nation. Count Klebelsberg has happily expressed its aims in the word "neo-nationalism." There was a similar renaissance of philosophical thought which manifested itself throughout the whole domain of intellectual life. The leader of this idealistic philosophy is Ákos Pauler. Besides the periodicals (*Napkelet, l'Orient, Minerva, Magyar Szemle, Revue Magyare, Széphalom, Parnasse*) a portion of the daily press contributes to this constitutional "progressivism." The object of all is to maintain a higher cultural level than that of the neighbouring peoples. There are historians of the first rank in Berzeviczy, Skekfü, Hóman, Lukinich, and Szinnyei, Melich and Gombocz are distinguished linguists. The cultural congress of the Finnish, Esthonian and Hungarian people held at Budapest in 1928 has shown that in future not only will Hungary look towards the West for its culture but it will engage in cultural co-operation with the Turko-Finnish peoples.

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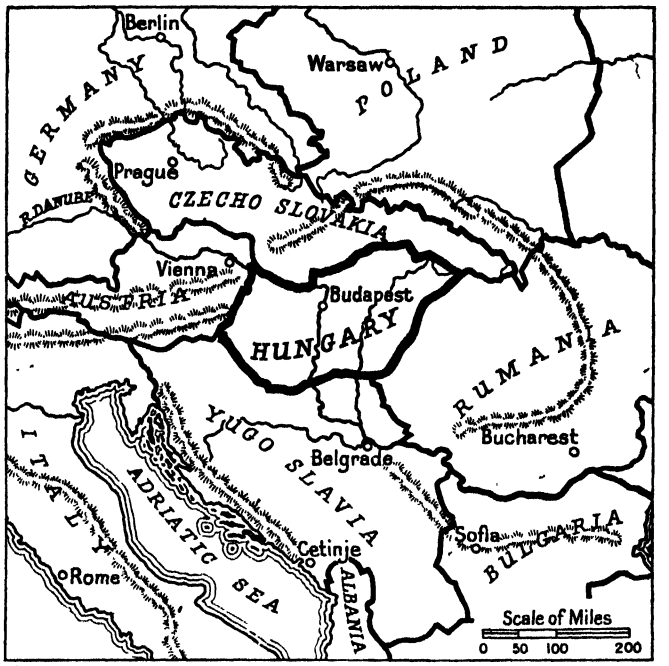
HUNGARY, one of the succession states of the old Austro-Hungarian empire, is a landlocked country in central Europe lying between the Alps and the Carpathians and including parts of the two great tectonic basins of the middle Danube. Area, 35,911 sq.m.

Physical Structure.—Broadly considered the physical structure is simple. The structural backbone is formed by a spur of the central and limestone zones of the Alps, which forms the Hungarian Mittelgebirg. Commencing in the Bakony forest (2,340 ft.), between the river Raab and Lake Balaton it trends from south-west to north-east, being continued by the detached ranges of Vertés (1,575 ft.) and Pilis (2,476 ft.). The stratified formations are quite varied ranging from Permian to Recent and are associated with basalt, andesite and other volcanic rocks, which increase in proportion towards the Danube. This group of highlands separates the Little Hungarian plain (Kis-Alföld) to the north-west from the downlands of the Drava-Danube angle to the south-east. The former, of which only that part on the right of the Danube now belonging to Hungary will be considered, is drained by the lower Raab and its tributaries and floored by Pliocene strata heavily overlaid by Recent deposits, coarse river gravels, sands and alluvium with patches of loess. Except where swampy as in the region of the Little Schütt island of the Danube and the Hanság marshes this is a rich wheat and sugar-beet district passing gradually east, west and south through rolling downs to forested hills, where occasional stores of lignite and iron-ore supply the fundamentals of manufacture.

South and east of Lake Balaton (*q.v.*) the true downland of Transdanubia occurs. Here, too, intensive agriculture is favoured by vast deposits of loess and loam, deeply seamed by parallel north-west to south-east streams, whose water ultimately reaches the Danube directly or by way of the Drava and the Sió. Rising as a mountainous island from this undulating territory is the massif of the Mecsék hills where outcrops of numerous post-Carboniferous formations Triassic and Jurassic limestones combine with granites, diorites and other igneous rocks to diversify the landscape while on the eastern flank of the hills coal supplies add to the number and character of its human activities. Occasional patches of alkaline soil along the river courses suggest the conditions so common east of the Danube. This river forms the northern frontier from just below Bratislava to the confluence with the Ipel, a left-bank tributary. A few miles below, at Višegrad, it turns around the Pilis heights and takes its southward course. East of the river lies the Great Hungarian plain (Nagy-Alföld) but its southern third, *i.e.*, the Bačka, between the Danube and Tisa, and the Banat, east of the Tisa, is no longer under Hungarian rule.

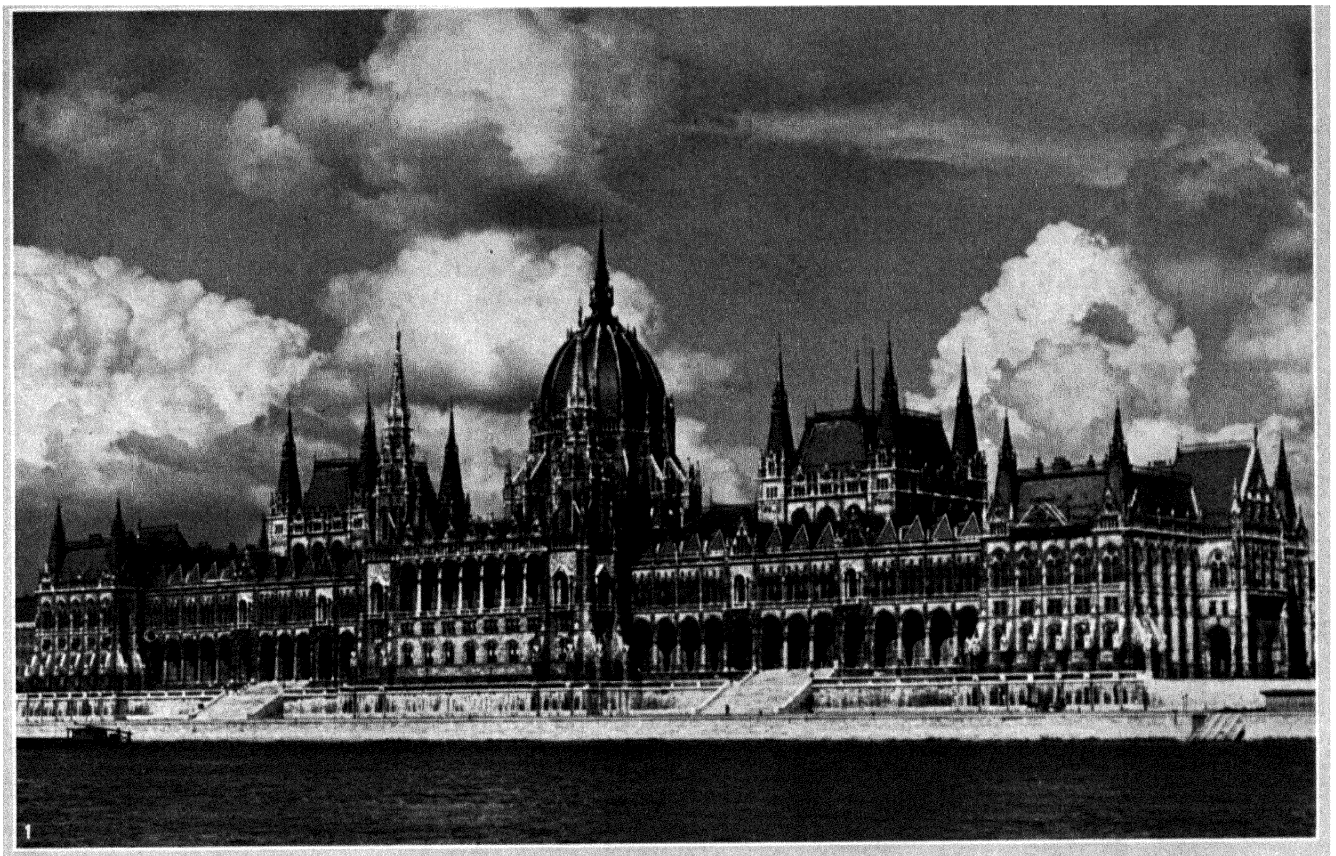
Despite the uniformity of relief great variations exist in soil conditions, and therefore in agricultural pursuits, on this plain. For the most part alluvium and alluvial loess are the principal soils but near its northern edge Tertiary deposits, mainly of

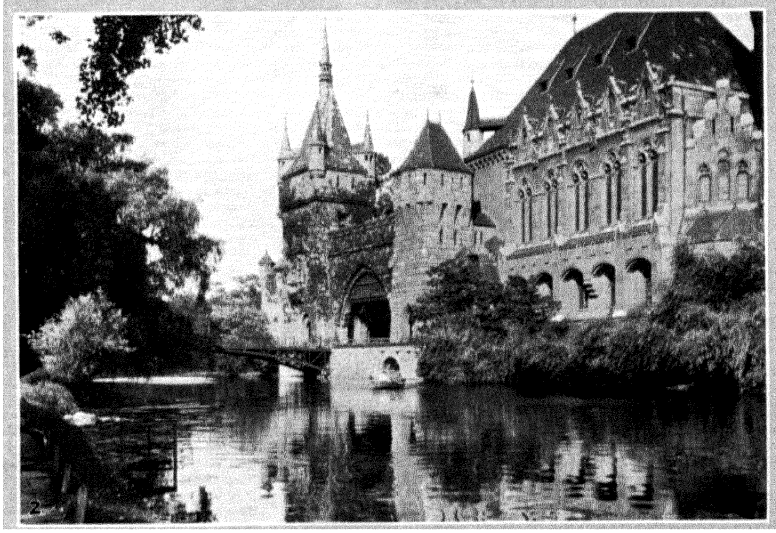


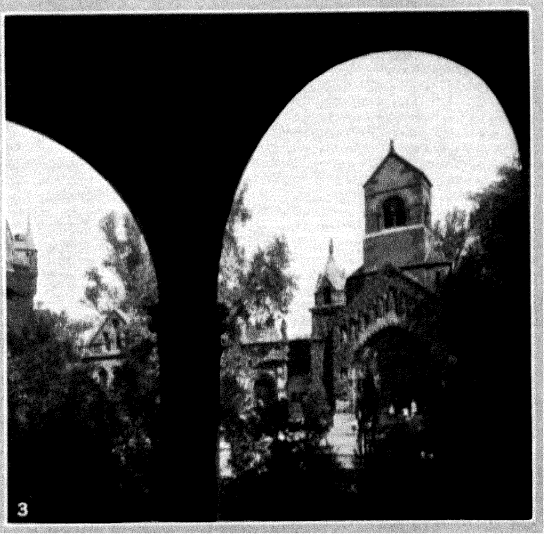
THE BOUNDARIES OF THE PRESENT KINGDOM OF HUNGARY, APPROVED BY THE PEACE CONFERENCE IN 1920

Miocene age, appear at the surface particularly along the line of the northern highlands, where they are associated with coarse alluvial fans and eruptive rocks, the latter dating from the volcanic activity accompanying the fractures and subsidence which originated the basin. Alternations of marine and lacustrine conditions during Miocene and Pliocene time built up thick deposits of débris from the surrounding highlands, coarsely graded from the margins to the centre of the basin, and these were in part covered by wind-borne material, loess and sand, in which subsequent drainage has developed broad alluvial-floored channels. Drainage, the work of the Danube, Tisa and their tributaries, is indecisive and is supplemented by an extensive system of canals, dikes and river-regularization, yet despite these efforts large areas are still liable to floods and to the formation of alkaline soils. The northern highlands continue in broken form the line of the Mittelgebirges, with the contrast that they are richer in eruptive rocks. From the Danube eastward to the Zagyva rise the Börzsöny (3,080 ft.), and the Cserhat (2,130 ft.), groups, between the Zagyva and the Hernad, the Matrá (3,315 ft.), mainly trachytes, and the Bükk, a complex of Carboniferous shales, Jurassic limestones and volcanics, while beyond the Hernad to the frontier stretches part of the Eperjes-Tokaj volcanic range, renowned for the fertility of its soil and the quality of its vineyards.

The climate of Hungary is transitional between oceanic and continental. The three great climatic regions of Europe, the West European, East European and Mediterranean, here struggle for supremacy. The mean annual temperature ranges from 48° F in the north to 52° F in the south and in general the country shows a positive isanomalous temperature. The annual range of temperature varies from 40–47° F, but may in exposed districts of the Nagy-Alföld greatly exceed the higher figure. The distribution of precipitation over the land shows a decrease in amount eastwards. The greatest quantity is received on the western slopes of the Bakony forest where from 30–35 in. fall per annum; the driest region is the middle Tisa with less than 15 in. in dry years, though sheltered regions such as the south-east slopes of the







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THREE ARCHITECTURAL MONUMENTS OF BUDAPEST

1. The Houses of Parliament, built by Aimery Steindl in 1893–1902, in Parliament Square on the Rudolph Quay of the Danube. This is a Gothic structure 870 feet in length, with a dome 325 feet high, and is one of the most imposing as well as one of the largest legislative palaces in the world
2. The Agricultural Museum, an exact replica of Vajda-Hunyad, a Renaissance castle in Transylvania. This is one of a group of buildings in the City Park of Budapest, representing the chief characteristics of Hungarian architecture of all periods
3. A replica by Ignatius Alpar of the porch of the abbey church at Jak; another unit in the architectural group in the City Park

Hegyalja are very dry. Most rain falls in May and June (June, 13% of year's total) with a tendency towards a secondary maximum, caused by Mediterranean influences, in late autumn (October, 10% of year's total), particularly in the Drava-Danube angle. On the Nagy-Alföld the rainfall occurs mainly during occasional storms but elsewhere it is more evenly distributed. The high summer temperatures while excellent for wheat and maize are dangerous when rainfall is below the average, and when this is associated with heavy winds disastrous sandstorms and crop destruction follow. One of the characteristics of the climate of most value to the people is the long autumn whereby the ripening of delicate crops, *e.g.*, vine and other fruits, is assured. The critical feature of the climate from the agricultural point of view is the uncertainty of sufficient rainfall; history shows a series of droughts and famines owing to the small margin of safety.

The response of natural vegetation to these climatic conditions is clear where original examples unaltered by man are found. The characteristic covering of the Transdanubian lands is deciduous woodland, oak, beech, lime and chestnut, but these disappear rapidly towards the Nagy-Alföld where *steppe* conditions prevail. These are probably of human production for along the stream courses small "gallery" woods of alder-willow association are common.

Population and Settlement.—The population of Hungary (1926, estimated at 8,457,852; area, 35,911 sq.m.) is predominantly of Magyar speech and origin, the estimated 1926 percentages according to speech being Magyar 89·8, German 6·8, Slovak 1·7, others 1·7. According to religious belief 64·3% are Roman Catholics, 2·3% Greek Catholics, 27% Protestants and 5·6% Jews. The German minority is not concentrated but exists as enclaves principally in Budapest, along the western frontier and in the Bakony forest and the Danube-Drava angle. The Slovaks, too, are distributed but in small groups in and near the capital and in the county of Bekes of the south-eastern frontier zone. The Jewish element, a powerful economic influence, is urban and representatives are found in most of the large towns, especially in the capital.

The Danube in its north-south course from Visegrad to the Yugoslav frontier divides Hungary into two contrasted regions. West of the river in Transdanubia, the old Pannonia, a tradition of culture, relatively free from interruption, is carried back to pre-Roman days and is based upon settled conditions and agricultural prosperity. Further, conditions of climate are here more favourable than on the Nagy-Alföld where natural difficulties and periodic invasions have disturbed settlement and retarded the development of intensive agriculture. The capital, too, with its eyes on the West and susceptible to the same cultural influences that have shaped Transdanubia, is less representative of life on the great plain where habits, customs and costumes retain much of their primitive stamp. The difference of physical conditions and history are reflected in the land utilization, the forms of settlement and house-types. Thus Transdanubia falls into three regions, the *Kisalföld* where on a denuded plain about 350–425 ft. above sea-level the population carries on an advanced and balanced agriculture based on wheat, rye, fodder plants and cattle-rearing, the central highland belt including the Lake Balaton district where forestry, fishing, mining and tourist traffic supplements a similar intensive agriculture and the Danube-Drava angle, which resembles the second region but has more advanced mining and agriculture.

On these three regions the unit of settlement is the village, either the *Haufendorf* or the *Runddorf* on the plains and the *Strassendorf* along the valleys of the highlands. On the Nagy-Alföld two great regions are recognizable, the Danube-Tisa interstream area, with its lines of dunes and marshy hollows, often floored with alkaline soil, and scanty drainage and, at a lower level, the true steppe east of the Tisa with its vast stretches of cereal land and cattle pastures. On these regions are the great "farmer-towns" of Hungary, enormous agglomerations of people, mainly agricultural, grouped in settlements, the results of grouping for defence, that are but slowly developing the characteristics of true urban centres. Such are Debrecen Kecskemét, Czegled and Szeged, where many of the population live, while practising an extensive agriculture or semi-nomadic cattle-herding miles distant on the plain. In recent times small isolated houses (single *tanyas*) and self-contained villages (grouped *tanyas*) have commenced to rise in the vast spaces between these towns and to develop from seasonal to permanent homes. In these isolated districts tradition dies hard and a sturdy peasantry treasures a conservatism of outlook that, fostered by difficulties of communication, resists the impact of modern ideas. Both regions of the Nagy-Alföld sweep up to the rich vine-clad and forested slopes of the northern highlands where mining and tourists enlarge the human interests.

Agriculture.—Agriculture is the basis of Hungarian life. Of the entire population of Hungary in 1926 about 55·8% were engaged in agricultural work as compared with 30·1% in industrial and commercial activities. In the five years which preceded the World War, Hungary's agricultural production showed a gradual but constant development in consequence of the draining of flooded areas and the extended use of agricultural machines and artificial manures. This development was arrested by the war, the succeeding revolutions, the occupation of the country by foreign Powers and by the provisions of the Peace Treaty. Owing to the scarcity of labour, draught animals and manure, the arable land, amounting to 5,600,000 hectares, could not be properly cultivated, and a considerable decrease of production resulted. The downward tendency reached its lowest level in the years 1919–20; from that time progress, at first slow and later quicker, was visible, some crops showing a yield which compared favourably with those of pre-war years.

Of the total area 63·6% is arable, 17·9% meadowland and rough pasture and 11·8% forest. Prior to 1918 large estates were very common but since that date they have gradually declined in relative proportion as the result of agrarian reform measures, not always with advantageous results upon the yields of crops. Climatic catastrophes take heavy toll of crops and cause great fluctuations in the annual yields, *e.g.*, in 1913, 28% of the sown area in the Tisa counties failed through storm, flood and drought. Generally, yields have declined since 1918 in response to the acute stress accompanying readjustment. The greatest acreage is devoted to wheat (1926—3,757,337 ac.) which is followed by maize (1926—2,668,236 ac.), rye (1926—1,748,010 ac.), barley (1926—1,063,869 ac.) and potatoes (1926—627,322 ac.). Wheat reaches its greatest intensity along the middle Tisa and in the Körös region but is well-distributed except in the highlands and sandy areas of the Nyirség and Danube-Tisa plateaux where its place is taken by rye, a crop also prominent in Transdanubia. Maize, too, is general with concentrations in the drier regions of high summer temperature, *e.g.*, east of the Tisa and along the fertile borderland of the southern frontier. Potatoes and root crops are closely associated with the intensive farming of Transdanubia and to a lesser extent with the sandy areas.

The following table shows the yield of seven principal crops:—

(In metric quintals)

Crop	Average of the years 1911-15	In 1920	In 1926	In 1927
Wheat	19,950,076	10,322,119	20,386,825	20,639,315
Rye	8,042,139	5,143,169	7,980,011	5,732,785
Barley	7,141,212	4,718,519	5,553,891	5,076,992
Oats	4,404,705	3,237,901	3,600,067	3,152,292
Maize	15,055,696	12,742,081	19,443,212	17,602,402
Potatoes	19,458,893	20,722,294	18,746,228	18,072,151
Sugar beet	15,019,512	6,398,261	14,440,177	12,840,849

The figures for 1927 are provisional.

The values in millions of pounds sterling of the seven principal crops mentioned above amounted in 1920 to 14·2, 1921 to 22·7, 1922 to 29·4, 1923 to 33·0, 1924 to 51·6, 1925 to 56·8, 1926 to 44·6, and in 1927 to 57·2. Before the war the same seven crops produced in the territory of present Hungary (calculated on the basis of the prices of 1913) had a value of £48,400,000. The total value of the agricultural products is now about £80,000,000.

The cultivation of vines, fruit and garden produce is important. More than half of the vineyard area is in the drift sand districts which are immune from phylloxera and the vine acts as a binder. Elsewhere it dominates the volcanic southern slopes of the Mittelgebirges overlooking Lake Balaton and those of the Hegyalja from which comes the famous Tokaj wine. Fruit culture is prominent in Transdanubia and the inter-stream land of the Danube-Tisa, notably at Kecskemét, Czégled and Félegyháza, (apricots, apples), in the Hernad valley (cherries) and the environs of Szeged. The growth of early vegetables for export, fresh or preserved, increases rapidly near the large towns and certain districts specialize in particular products, *e.g.*, melons in the county of Heves, peppers at Szeged and onions at Makó. Commercial plants have always been to the fore and include tobacco on the Nyirség plateau, hemp on the drier regions of the Nagy-Alföld, flax in the moister districts of Transdanubia, sugar-beet (1926—159,901 ac.) in small quantities evenly distributed over the country and hops in the Hernad valley.

The breeding of stock follows cereal production as the most important aspect of Hungarian agriculture. In 1927 the numbers of animals were as follows:—Cattle, 1,805,438; sheep, 1,610,716; pigs, 2,386,664; horses, 903,326. Cattle-rearing exists in two stages of development. On the Nagy-Alföld it is passing from extensive to intensive conditions. Alkaline and other soils unsuited to cereals, such as the Bugacs *puszta* near Kecskemét and the vast Hortobágy steppe west of Debrecen, still pasture enormous numbers of sheep, cattle and horses tended by semi-nomadic herdsmen, many of the cattle being the descendants of the native white longhorned breed, but west of the Danube rearing is intensive, associated with stall-feeding and heavy production of fodder plants and large numbers of Simmenthal cattle appear. Here the organized development of dairy-farming is most advanced though modern methods are spreading fast over the whole country. The national love of horses and their general use in daily life cause them to be bred in many centres. Pigs, chiefly of the *Mangalica* lard-producing breed, are most commonly found on the smaller properties, *e.g.*, in Western Hungary, near the towns as at Budapest and in the maize region of the Körös-Maros. Sheep are bred for milk and coarse wool to supply local needs and are found in greatest numbers on the slopes of the Mittelgebirges and northern highlands and the natural pastures of the Nagy-Alföld. Other stock interests include goats on small holdings, poultry in the wheat districts of the plains, particularly in Transdanubia, where rapid access to the markets of Vienna and Budapest has fostered scientific poultry-farming and bee-keeping. Fish are mainly obtained from the Danube, Tisa and Lake Balaton.

Forestry is of limited importance, for coniferous trees are uncommon and the surrounding highlands are the natural sources of supply. On the plains afforestation with pseudo-acacia and Canadian poplar is increasing to meet the demands for shelter and shade for cattle and houses.

Land mortgage loans granted by the principal financial institutions in Hungary amounted in 1913 to £167·7 million, or 41% of their capital. The land mortgage loans granted by the same concerns at the end of 1924 amounted to only £83,000 or 0·3% of their capital. In other words, the land in Hungary was practically free of all mortgage, owing to the depreciation of the currency. In 1926 the 9·3 million hectares of land in Hungary were worth £582·2 million, of which the 5·6 million hectares of arable land were valued at £406·5 million.

Mineral Wealth.—Hungary has few minerals. No Carboniferous coal exists but Liassic black coal of poor quality is mined in the Mecsek hills. The 1926 output of coal was 6,156,987 metric tons. Lignite is obtained from Tata, south of Esztergom and west of Budapest, the Bükk mountains and at Salgótarján, north of the Cserhat group. Large quantities of fuel however must be imported from Upper Silesia and Czechoslovakia. Iron-ore is mined near the sources of the Hernad at Rudóbánya and upon this depend the iron and steel foundries of the Miskolcz district. Lime and building stone are obtained at various parts of the highland ranges while materials for brickmaking are widespread over the whole country. There are also large deposits of bauxite.

Industries.—The total production of Hungarian industries (present territory) in 1913 amounted to 1,641·6 million gold crowns, and in 1926 to 1,868·8 million gold crowns, *i.e.*, an increase of 13·8%. The production per factory averaged 790,000 gold crowns in 1913 and 620,000 gold crowns in 1926, *i.e.*, a diminution of 21·5%. The value of the average working capacity of one worker was 7,485 gold crowns in 1913 and 9,000 gold crowns in 1926, *i.e.*, a nominal increase of 20·2%.

The dominant industries of Hungary are those based upon agriculture, with flour-milling taking first place. The greatest concentration is in Budapest with nearly a hundred large and modern steam mills while all the large towns have important milling interests. There are also numerous medium-sized and small enterprises distributed throughout the country using wind or water power. The industry is very sensitive to conditions affecting the crop yield and to the tariff policies of neighbouring countries. Sugar-refining has suffered by the loss of its richest areas of supply but is still an important article of export and prepared in 13 factories. The largest refineries are found at Szerencs in the Hernad valley, at Mezöhegyes, Szolnok and Hatvan; there are also several west of the Raab (output 1926—174,625 tons raw sugar). Spirit and alcohol distilleries using potato, maize and sugar-beet as raw material are numerous in Transdanubia and the Nyirség district with great concentration in and near Budapest. The quantity produced is about double the home demand and, since a large surplus of raw materials is available, may be expected to increase. Breweries on a commercial scale are centred at Köbánya near Budapest and through shortage of supplies, chiefly Slovakian hops, have declined in production; they are primarily concerned with the home demand. The annual production exceeds 14 million gallons. In addition a thriving malt industry enjoys a good central European market. Leather, based partly on domestic, partly on foreign hides, is prepared in a number of tanneries (49 in 1924), particularly in Budapest, yet still on a scale insufficient for the country's needs.

Tobacco is prepared principally in the capital and near the large tobacco plantations of the north-east, but not on a scale sufficient to meet domestic needs. Other industries include the preparation of foodstuffs, *e.g.*, salami (Budapest, Debrecen and Szeged), and preserved vegetables, vegetable oils and jams (Budapest and Kecskemét), confectionery, starch and soap, candles and fertilizers, mainly in the capital.

The second group of industries comprises hardware and machinery. Pig-iron and steel are prepared at Salgótarján and Miskolcz (1926 pig-iron—187,812 metric tons; steel—324,679 metric tons) and sent to the engineering shops of Budapest and Györ where the majority of the machine work is concentrated, but foreign supplies are also necessary. Agricultural implements, boats, rolling stock and electrotechnical apparatus are the principal products.

Textile working employs some 35,000 workers in about 200 factories (1924—93,000 spindles, 8,260 looms). Cotton leads and the largest interests are in Budapest, with smaller factories at Pápa, Szombathely, Szeged, etc. Budapest is also a centre of woollen manufactures which are, however, better distributed in the larger towns of Transdanubia. Hemp and flax weaving are very important, the former in the Nagy-Alföld (Szeged, Csanád and Békes), the latter in Transdanubia also; in neither case is the supply sufficient to meet the home demands.

Other forms of industry include limeburning, brickmaking, glassworking in the northern highlands, cement manufacture in the Vertés and Pilis districts and the refining of oil (Budapest).

Foreign Trade.—The figures for the eight years ending 1927 are given in the table on next page.

The adverse balance of over £12,000,000 shown by the provisional figures of 1927 is due largely to the lower foreign prices obtainable for cereals, especially flour. Quantitatively, there does not appear to have been any appreciable decrease in the exports for 1927, and the total agricultural production is increasing. The increase in imports reflects the improvement of internal purchasing power and the efforts of the Government in the direction of freer

Year	Imports	Exports	Excess of imports	Increase of	
				Imports	Exports
	In millions of pounds sterling			Expressed in index numbers	
1920 .	17·3	6·8	10·5	100	100
1921 .	21·6	10·5	11·1	125	155
1922 .	22·4	13·7	8·7	129	201
1923 .	17·6	14·1	3·5	101	206
1924 .	29·2	23·9	5·3	168	350
1925 .	30·8	29·1	1·7	177	426
1926 .	34·2	31·2	3·0	197	456
1927 .	41·5	28·7	12·8	240	422

The figures for 1927 are provisional.

trade, as well as cheaper and larger foreign credits. As the increased imports consist mainly of materials it is reasonable to assume that they will improve national production.

Trade Conventions.—The breaking up of the Austro-Hungarian monarchy, with its single customs union, into seven independent customs territories naturally proved a handicap to close trade relations between Hungary and her neighbours. In the beginning of 1925 an autonomous customs tariff was brought into force. Although the new duties—partly for the protection of home industries and partly as a basis of bargaining—were relatively high, there was a marked increase of imports, indicating that the duties were by no means prohibitive. By the end of 1927 Hungary had concluded commercial agreements with 20 States on the basis of the most favoured nation clause, and definitive commercial treaties with eight other States on the basis of special tariff concessions. Negotiations with other and particularly with neighbouring States were proceeding, though slowly, with a view to substituting the existing provisional agreements by definitive treaties. Among the many obstacles was the unwillingness of adjacent States to avail themselves of the direct transit facilities offered by the Hungarian railway lines. As a result of this diversion of traffic to more roundabout routes, encouraged by artificial rates, Hungary's ton-kilometre railway figures have fallen steadily—an instance of the problems that confront any solution of the economic difficulties in the Danubian basin.

Administration and Education.—Hungary is now a monarchy without a king, governed by a regent, Admiral Horthy. Its legislature comprises two houses, an upper and a lower. The former contains six classes of members, viz.:—(1) Elected representatives of former hereditary members, about 38 in number, (2) Members elected by County and Municipal authorities, about 50, (3) Heads of representative religious communities, about 31, (4) certain distinguished personages, *e.g.*, judges and high State officials, (5) representatives of scientific bodies and chambers of commerce, about 40, and (6) Life members nominated by the regent. The Lower House numbers 245 members, 200 of whom are representative of rural constituencies and elected by open ballot.

The franchise is granted to males of more than 24 years who have satisfactorily completed an elementary school course and to females of more than 30 years if earning their own living, or with a satisfactory proof of higher education, or the wives of graduates of high schools or colleges, or the mothers of three children. Local administration is not so forward and is subject to much governmental control. Two divisions exist, viz.:—(1) communes where the representative body consists half of members elected for six years and half of heavy taxpayers, with an official body whose members are appointed for life. All persons of more than 20 years who have paid State taxes for two years are enfranchised; (2) the counties and towns ranking as independent, each class being a representative body similar to that of the Communes elected for six years, with an executive committee of officials.

Education has rapidly improved in recent years but is compulsory only between the ages of 6 and 12. According to 1920 statistics 15·4% of the population over 6 years was illiterate. Educational institutions are divided into a number of classes including infants, elementary, primary, industrial and commercial, secondary, training colleges, technical high schools, universities and certain special grades, *e.g.*, religious and legal. In the period 1925–26 there were 6,438 elementary schools with 656,349 pupils and 16,705 teachers; 1,092 agricultural schools, 400 schools for apprentices, 366 of these being for industrial workers, the remainder for commercial students, 43 training colleges for elementary teachers, 375 primary schools with 87,161 pupils and 3,892 teachers and 6 training colleges for primary teachers. The middle schools, comprising gymnasia, *real* schools, etc., provide a course covering 8 years and out of 61,757 pupils more than 50,000 are boys. The universities are located at Budapest (1926—5,393 students), Debrecen (952), Pécs (1,005) and Szeged (1,135), while there are also about 120 schools offering specialized agricultural, industrial and commercial courses

Rearrangement of frontiers, following the Treaty of Trianon 1920, has altered the course of much of Hungarian economy especially in the east where the old market towns have been lost, but Budapest (*q.v.*) has always gathered to itself by a zone system of communication and other means many of the threads of life within the present limits of the country and, as the centre and source of inspiration of a State with a "keystone" position astride the middle Danube, can yet do much to restore the country to prosperity, to foster the progress of eastern Europe and to link it more closely with the West.

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The following, though concerned principally with pre-war Hungary, contain useful geographical data:—E. Cholnoky and others, *Ungarn Land und Volk* (Leipzig, 1918); A Hevesy, *Nationalities in Hungary* (London, 1919); F. Heiderich, *Wirtschaftsgeographie Karten und Abhandlungen zur Wirtschaftskunde der (Länder der ehemaligen) österreichisch-ungarischen Monarchie* (Vienna, 1916–22).

(W. S. L.; W. Go.)

Defence.—The strength of the present-day Hungarian Army is governed by the provisions of the Treaty of Trianon, signed in June 1920, which abolished compulsory service, limited the strength of the army to a total of 35,000, including officers and depot troops, laid down a maximum and minimum establishment for army formations, prescribed the length of service for all ranks, limited the manufacture of arms and munitions and forbade their import, and also forbade all natures of "mobilization." The terms were similar to those imposed upon Austria (*q.v.*).

Recruiting is by voluntary enlistment for 12 years service, of which 6 may be spent on furlough, with facilities for extension of service. Until July 1922 all officers had served in the old army, with an obligation not to retire until the age of 40. Vacancies are now filled by cadets who have spent 4 years at the Military School. Service in the Hungarian Police and Royal Hungarian Gendarmerie is for 20 years for officers, 6 for other ranks, with facilities for extension. The budget strength of the army according to latest returns was 34,708 including 1,478 officers and the gendarmerie and police 9,598, including 1,440 officers.

The Higher Command includes the military bureau of the Governor, the ministry of national defence with the army commander-in-chief and inspectors of the different arms, the Budapest fortress command, the Varpalota garrison command and various inspectorates. The peace distribution of the army is on a territorial basis, its functions, according to treaty, being confined to maintaining order and to "controlling the frontiers." There is no military air service. An agreement has been arrived at for the control of civil aviation in Hungary.

See also League of Nations *Armaments Year-book* (Geneva, 1928).

(G. G. A.)

ECONOMY AND FINANCE

Budget.—According to the programme of reconstruction drawn up in mutual agreement by the League of Nations and the Hungarian Government a deficit of £4·2 million was estimated for the

first fiscal year—1924–25—of the reconstruction period, but in fact that financial year closed with a surplus of £3·8 million. For 1925–26 provision was made in the programme of reconstruction for a deficit of £2·1 million, but instead there was a surplus of £3·4 million. These favourable results were improved upon in the fiscal year 1926–27, when—in spite of appreciable reduction in taxation—there was a record surplus of £5·2 million.

Of the 253,800,000 gold kronen which were raised under the auspices of the League of Nations for Hungarian reconstruction only 69,500,000 gold kronen, or less than 28%, were actually used to cover budget deficits and that was in the first half year of the reconstruction period. It was thus possible to use the balance of the loan as a productive investment for the development of Hungary's economic life between 1925 and 1928. In Dec. 1927, the League released the last portion of the loan, viz., 33 million gold kronen, for productive investment in Hungary during the fiscal year 1928–29. The various surpluses of the budgets recorded above were used for the same purpose.

In the fiscal year 1927–28, the following were the principal items of the Budget:—

	Million pounds sterling.
State debts	3·236
Treaty charges	0·209
Expenditure for personnel	9·114
Subsidies to independent administrations for personnel and pensions	1·647
Pensions	3·411
Total, with other expenditure	27,089
Revenue	27,096
Estimated surplus	£0.007

The total expenditure of the State is covered by taxation and departmental receipts. State enterprises are separated from State administration. These enterprises—posts, telegraphs, telephones, state railways, state iron, steel and machine works, state domains and forests, silk production, coal-mining and the postal savings banks—are operated without a charge on the budget. In 1927–28 they were paying their way and had a surplus for investment purposes.

State Debt.—The total Hungarian State debt amounted to £329,800,000 sterling before the war, which represents a burden of £15·7 *per capita* of population. The debt of present Hungary, as constituted under the Peace Treaty, amounted (reparation debt not included) to £57,255,000 sterling at the end of June 1927, due allowance having been made for the allocation of the pre-war debt and of part of the war debt as provided by the Peace Treaty. Of this amount £3,509,000 represents the funded internal debt, £44,575,000 the funded foreign debt and £9,171,000 the floating debt. The burden *per capita* of the population amounts to £6·8, much less than the pre-war burden, mainly in consequence of the depreciation in the value of the internal obligations of the State.

Savings and Credit.—The Hungarian Government contracted no foreign or other loans after the League loan was raised, and steadfastly refused to give its guarantee to any non-Governmental loan. It obtained from parliament wide powers for controlling foreign borrowing by municipal and other bodies. These powers were used drastically, and the Government have only approved foreign borrowing in cases where production would be increased. The eagerness, however, of foreign lenders to give credit to Hungarian enterprise—especially dollar credits—made the position often rather difficult. How the credit situation changed in Hungary can be judged from the fact that whereas in 1925 the first Cities loan could only be contracted in New York at 82, with 7½% interest, in May 1927 the City of Budapest obtained $20,000,000 at a net price of 88½, at 6% interest. Towards the end of 1927 the Association of Hungarian Mortgage Institutes raised $7,000,000 at 93½, with 7% interest. The service of foreign loans represented in 1927 only 2·8% of the national income.

Internal savings accumulated steadily. Deposits in the postal savings bank and in the 13 principal Budapest banks amounted on Dec. 31, 1927, to 56·3% of the pre-war figure—the total being £37,636,200. This contributed to the reasonableness of the rates of interest prevailing in Hungary. These were between 7% and 9½% in Budapest, according to the standing of the borrower, and between 8% and 12% in the rural districts at the end of 1927. The bank rate was unchanged during 1927 at 6% as compared with 12½% in March 1925.

Taxation.—Prior to the middle of 1924, the start of reconstruction, the Hungarian Government had recourse to various taxation expedients and coercive measures in order to protect the revenues from the then ever-depreciating currency. Owing to the war, the revolution and the Rumanian occupation, there were also outstanding arrears due for some three or four years which had lost almost all value in consequence of the intervening depreciation of the krone.

Faced with these conditions, the Government in 1920 raised a forced loan by the stamping of notes—amounting to 50% of the currency then in circulation. In 1921 the turn-over tax was introduced, which amounted at first to 1·5% and later to 3% on the sale price of each article and on each handling. Thus, in many instances, it amounted to a tax of 12%. In 1922 land taxes were made payable in wheat or wheat values with a view to obtaining revenue in a non-depreciating medium. At the beginning of 1924 the Government was again compelled to resort to another forced loan from those liable to property and income tax.

In the course of the reconstruction the collection of taxes in wheat was dropped; in Aug. 1925 the turn-over tax was reduced from 3% to 2%, and in Feb. 1926 the State's participation in house rents was abolished.

In consequence of the constantly increasing State revenues, the Government, at the beginning of 1927, continued the alleviation of the tax burden, which was retarding economic recovery. The land tax and the house tax were both reduced, but the proceeds of the latter continued to rise as house rent restrictions were gradually abolished. The tax-free minimum exemption from income tax was slightly raised, the rates of the taxes were reduced, and the more important foodstuffs were completely exempted from the turn-over tax. In spite of these reductions State revenues did not decrease, thanks to the improvement in general conditions.

In the financial year ending June 30th, 1927, the revenues derived by the State from direct taxes were divided as follows: house tax, 51·8; income tax, 47·9; land tax, 40·6; corporation tax, 13·2; property tax, 12·5; sundry taxes, 0·4; total, 166·4 million pengös.

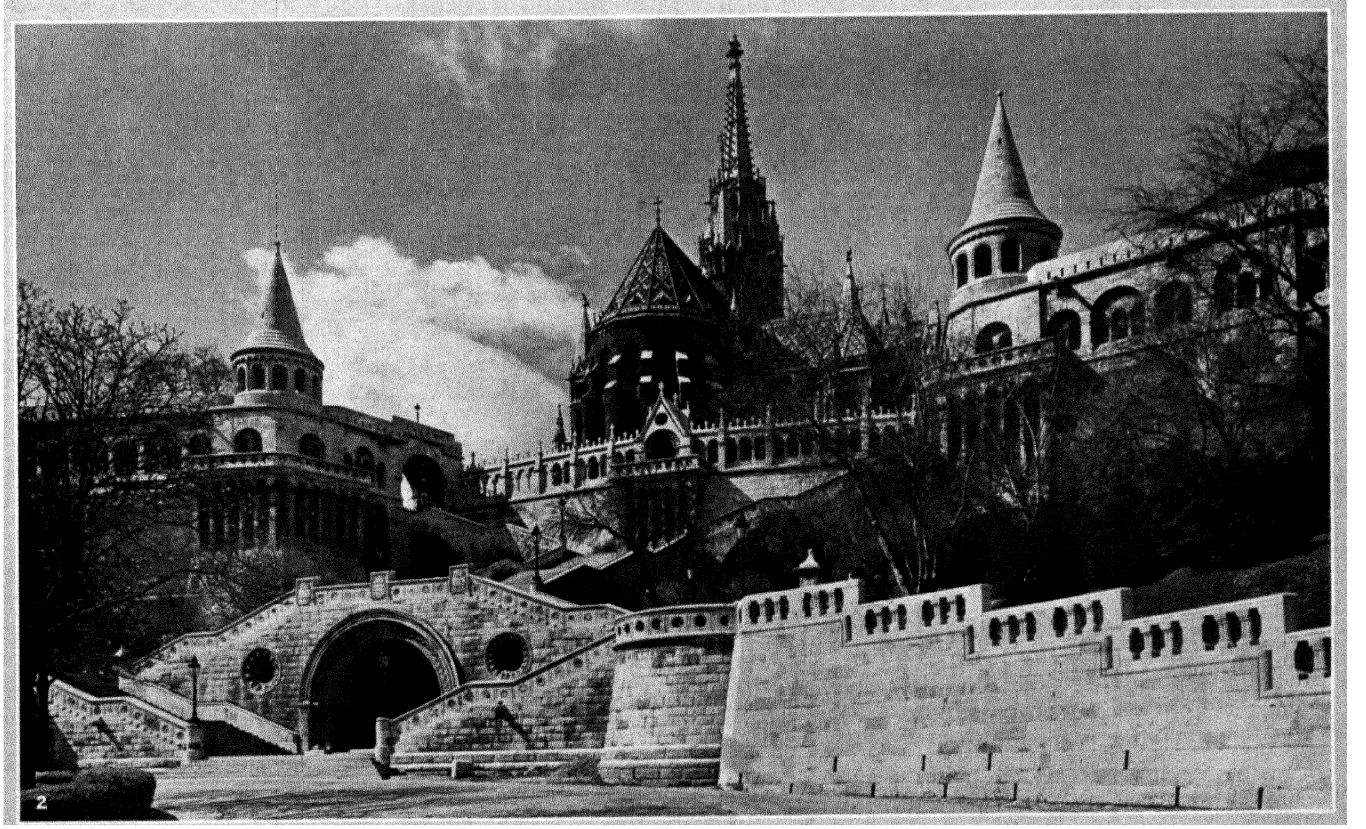
In the same fiscal year indirect taxation yielded 564·4 million pengös. The total burden of State and municipal taxation was roughly estimated at about 88·3 pengös.

Currency.—During the existence of the Dual Monarchy, Hungary and Austria had a joint monetary system and a joint bank of issue. After the outbreak of the revolution the Austro-Hungarian bank was able for some time to continue its work in Hungary, but the Bolshevik régime seized the entire stock of notes. When these began to run short the Soviet republic issued its own notes. After the collapse of Soviet rule in 1919, the Hungarian Government issued the necessary decree to enable the Austro-Hungarian bank to continue its statutory work as "manager of the Hungarian business of the Austro-Hungarian bank."

In March 1920 the Government ordered the stamping of the notes of the Austro-Hungarian bank which were in circulation within the country, and requisitioned 50% of these notes as a forced loan in order to secure, so far as possible, the carrying on of the State administration without constant application to the note printing press. As the creation of a special issuing institution appeared to be inevitable in consequence of the liquidation under the Peace Treaties of the Austro-Hungarian bank, the State itself provisionally established the Royal Hungarian State Note Institute (M. Kir. Allami Jegyintézet), which began its activities on Aug. 1, 1921. The notes of the Austro-Hungarian bank, which had been provided with the Hungarian stamp, were exchanged in the same year against State notes.

When the State Note Institute commenced its work, the financial and economic position was such as to compel the State to cover its budgetary requirements not from revenues but by means of the note printing press. This naturally resulted in the gradual depreciation of the crown. The forced loan raised by stamping





BY COURTESY OF THE AMEROP TRAVEL SERVICE, INC.

VIEWS OF BUDAPEST

1. View of Buda, looking up the Danube. The royal castle is seen high above the city in the centre and at the right the beginning of the Szechenyi suspension bridge, which crosses the river to Pest on the left bank

2. The Fisher Bastion and Coronation Church on the Castle Hill in Buda. The Coronation Church, the oldest in Budapest, dates from the 13th century and is used in all important ceremonies. The Fisher Bastion is part of the mediaeval city wall

notes had covered the budget deficit only for a short time. In 1921 the Government had recourse to a non-recurring capital levy, but by the time most of the proceeds reached the treasury the value of the crown had so depreciated as to nullify these efforts. In the first half of 1921 the exchange rate of the crown rose temporarily in Zürich from 1·05 to 2·85 Swiss francs (100 crowns), owing to the impression created by the taxation and other plans of the then minister of finance, M. Hegedus. When it was seen that these plans were impossible of realization, and as Hungary's balance of payments became more and more unfavourable, the crown continued to fall, until in March 1924 it reached 0·0085 Swiss francs for 100 crowns. As a result of long negotiations the League of Nations loan was raised, and the restoration of normal economic and currency conditions was thus made possible (see *Political History*). All restrictions in foreign exchange were abolished in Oct. 1925.



BY COURTESY OF EWING GALLOWAY

COSTUME WORN IN A MEZOKOVESD VILLAGE

On Dec. 31, 1925, the currency *per capita* of the population was approximately 43 gold crowns. In the latter part of 1925 the new monetary unit was chosen and named the pengö, divided into 100 fillér; 3,800 new units go to 1 kg. of fine gold, so that 1 pengö contains 0·26315789 grammes of fine gold. The currency reform law passed on Nov. 6, 1625, provides for the minting of gold coins for 20 and 10 pengös from an alloy consisting of 900 parts of gold to 100 parts of copper, so that 3,420 pengös will be struck from 1 kg. of this alloy. The National bank is required to buy gold in bars at a fixed price without limit, and on demand. Silver coins of one pengö can be put into circulation to a total nominal value of not more than 45,000,000 pengös.

From Jan. 1, 1927, the pengö was the obligatory unit of account in Hungary. The rate of conversion from the old to the new currency was 12,500 paper crowns to one pengö, or one gold crown—1·1585365 pengö. 1 pengö is therefore equal to 0·03593888 pound sterling or 0·1748985 dollar.

Central Bank.—The re-establishment of an independent bank of issue was in the forefront of the programme of reconstruction. The Hungarian National bank was founded, with a capital of 30,000,000 gold crowns and commenced its activities on June 24, 1924. From that day the State notes then in circulation were regarded as bank notes. Under its statutes the bank is precluded from lending to the State, and is required to maintain against its note circulation, plus sight liabilities minus State debt, a percentage of cover in precious metal and stable foreign exchanges, on an ascending scale, beginning at 20% during the first five years. The bank return of Dec. 31, 1927, showed the proportion of cover to be 46·4%. Since July 1924 the currency has been stable on a sterling basis. In Oct. 1925 the basis of stabilization became gold, and all restrictions on dealings in foreign exchange were abolished.

The following table shows the development of the note circulation:—

Date	Issuing institution	Circulation in paper crowns
Dec. 31, 1920.	Hungarian management of Austro-Hungarian Bank	14,307,808,630
Aug. 1, 1921 .	State Note Institute	15,787,175,750
Dec. 31, 1921.	State Note Institute	25,174,941,187
Dec. 31, 1923.	State Note Institute	931,337,334,630
June 24, 1924.	Hungarian Nat. Bank	2,520,113,700,576
Dec. 31, 1924.	Hungarian Nat. Bank	4,513,989,561,419
Dec. 31, 1925.	Hungarian Nat. Bank	5,193,937,447,500 (415,514,995.79 pengös)
Dec. 31, 1926.	Hungarian Nat. Bank	5,885,874,791,705 (470,869,983.34 pengös)
Dec. 31, 1927.	Hungarian Nat. Bank	486,754,101.32 pengös

On Dec. 31, 1927, there were also in circulation—apart from the above mentioned bank-notes—1 pengö coins, and 50, 20, 10, 2 and 1 filler small coins to the nominal value of 40,258,639.39 pengös.

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(W. Go.)

HISTORY

The history of the countries which were later to constitute the kingdom of Hungary, up to the close of the Roman period, will be found under PANNONIA and DACIA. The Romans were succeeded by Germanic tribes, and they in turn by the Huns (*q.v.*). After the death of Attila (455), his kingdom declined, and Germanic (Gothic) tribes again entered Pannonia and Dacia. The 6th century A.D. found the Lombards established in Pannonia, the Gepidae in Dacia. In 567 the Avars (*q.v.*), allying themselves with the Lombards, crushed the Gepidae, and in the following year occupied Pannonia, the Lombards migrating to Italy. As the Avar kingdom declined, the western and northern portions of Hungary recovered independence under Slavonic rulers. In 791–797 Charlemagne crushed the Avars, and established the first Ostmarks (*see* AUSTRIA) which probably occupied all the land between the Danube and the Save. North of the Danube, the important Slavonic kingdom of Moravia (*q.v.*) was founded about 828, while the heritage of the Avars east of the Danube is believed, on slight authority but with great probability, to have been under the suzerainty of the Bulgars.

Arrival of the Magyars.—In 894 the Magyars (*q.v.*) made their first authenticated raid into Moravia. The early history of this race is still a matter of learned dispute. Their own traditions declare them to have entered Hungary first with the Huns; leaving it, to have sojourned somewhere in eastern Europe (both the Caucasus and the Volga are mentioned in these traditions) and then to have crossed the Don, passed by Kiev, and re-entered Hungary through the Vereczka pass. It is certain that they were in south-east Russia in the 9th century, if not before, and probably between the Don and the Kuban rivers; and they appear at one time to have been vassals of the Khazars (*q.v.*). Driven westward by the Petchenegs (*q.v.*) they arrived at the mouth of the Danube in 889; expelled thence by the Petchenegs and Bulgars, they entered Pannonia for final settlement in 895 or 896, under their leader, Arpád. They easily subdued the scattered population of the central plain, crushed the empire of Great Moravia in 906, and defeated the German forces gathered to meet them in 907. They were now firmly established in Hungary; although Transylvania was probably not truly conquered until at least a century later.

During the following 70 years we know little of the internal history of the Magyars. Arpád died in 907, and his immediate successors, Zsolt (907–947) and Taksony (947–972), are little more than chronological landmarks. During this period the Magyar horsemen ravaged Thuringia, Swabia and Bavaria, and defeated the Germans on the Lechfeld in 924, whereupon the German king, Henry I., bought them off for nine years, employing the respite in reorganizing his army. In 933 the war was resumed, and Henry defeated the Magyars at Gotha and at Ried (933). The only effect of these reverses was to divert them elsewhere. In 934 and 942 they raided the Eastern empire, and were bought off under the very walls of Constantinople. In 943 Taksony led them into Italy, and in 955 they ravaged Burgundy. The same year the emperor Otto I. overwhelmed them at the famous battle of the Lechfeld (Aug. 10, 955). This catastrophe convinced the leading Magyars of the necessity of accommodating themselves as far as possible to the empire, especially in the matter of religion. Christianity had already begun to percolate Hungary. The only question was which form of Christianity were the Magyars to adopt, the eastern or the western? Alarmed at the sudden revival of the Eastern empire, which under the Macedonian dynasty extended once more to the Danube, thus becoming the immediate neighbour of Hungary, Duke Géza, who succeeded Taksony in 972, resolved to accept Christianity from the more distant emperor of the West. Accordingly an embassy was sent to Otto II. at Quedlinburg in 973, and in 975 Géza and his family were baptized.

During his reign, however, Christianity did not extend much beyond the limits of his court.

Stephen I.—Géza's successor, Stephen I. (*q.v.*), was one of the great constructive statesmen of history. His reign (997–1038) resulted in the firm establishment of the Hungarian church and the Hungarian State: in 1001 Pope Silvester II. recognized Magyar nationality by endowing the young Magyar prince with a kingly crown. Hungary was divided into dioceses, with a metropolitan see at Esztergom (Gran). But the Benedictines, whose settlement in Hungary dates from the establishment of their monastery at Pannonhalma (*c.* 1001), were the chief pioneers. The monks built villages for the colonists who flocked to them, teaching the people western handicrafts and methods of agriculture; and they were soon followed by foreign husbandmen and handicraftsmen, who were encouraged to come to Hungary by reports of the abundance of good land there and the promise of privileges.

In endeavouring to establish his kingship on the Western model Stephen based his new principle of government, not on feudalism, but on the organization of the Frankish empire. Central and western Hungary (the south and north-east still being desolate) were divided into 46 counties. At the head of each county was placed a count nominated by the king, whom he was bound to follow to battle, and to whom he was responsible. Two-thirds of the revenue of the county went into the royal treasury, the remaining third the count retained for administrative purposes. It is significant for the whole future of Hungary that no effort was or could be made by Stephen to weld the heterogeneous races under his crown into a united kingdom; the non-Magyars, unless, as was frequently the case, granted special privileges, were ruled by the royal governors as subject races, forming—in contradistinction to the "nobles"—the mass of the peasants, upon whom until 1848 nearly the whole burden of taxation fell. The right, not often exercised, of the Magyar nobles to meet in general assembly and the elective character of the Crown, Stephen also did not venture to touch.

A troubled 40 years (1038–77) divides the age of St. Stephen from the age of St. Ladislas. In 1046 and 1061 there were two dangerous pagan risings, while from the south and south-east two separate hordes of fierce barbarians (the Petchenegs in 1067–68, and the Cumans in 1071–72) burst over the land. For a time Hungary was in great danger of being forced into dependence on the German empire. In 1041 the emperor, Henry III., made an excuse of the fugitive king Peter's appeal for help, to ravage Hungary, and after his victory at Ménfö (July 5, 1044) he restored Peter and received an oath of fealty from him. In 1051 and 1052 Henry again invaded Hungary but was defeated by Andrew I. (1046–66) and his brother Béla, afterwards king Béla I. (1060–63). Finally the attention of the emperor, Henry IV., was distracted from his Hungarian ambitions by the outbreak of the investiture conflict (1076), when Géza I. shrewdly applied to Pope Gregory VII. for assistance, and submitted to accept his kingdom from him as a fief of the Holy See. The immediate result of the papal alliance was to enable Hungary, under both Ladislas I. (1077–95) and his capable successor Koloman (Kálmán) (1095–1116), to extend her dominion abroad by conquering Croatia and part of the Dalmatian coast. By a series of laws Ladislas improved the administration of justice and the local government of the counties, while Koloman regulated and simplified the whole system of taxation, and promoted trade by a systematic improvement of the ways of communication. The *magna via Colomanni regis* was in use for centuries after his death

Rivalry with the Eastern Empire.—Throughout the greater part of the 12th century the chief impediment in the way of the external development of the Hungarian monarchy was the Eastern empire, which, under the first three princes of the Comnenian dynasty, dominated south-eastern Europe. On the accession of Manuel Comnenus in 1143 the struggle became acute. Manuel, who was the grandson of St. Ladislas and had Hungarian blood in his veins, aimed at the suzerainty of Hungary, by placing one of his Magyar kinsmen on the throne. He successfully supported the claims of three pretenders to the Magyar throne, and finally made Béla III. (1173–96) king of Hungary, on condition that he left him, Manuel, a free hand in Dalmatia. The intervention of the Greek emperors had important consequences for Hungary. Politically it increased the power of the nobility at the expense of the Crown, every competing pretender endeavouring to win adherents by distributing largesse in the shape of Crown-lands. Ecclesiastically, it weakened the influence of the Catholic Church in Hungary, the Greek Orthodox Church, which permitted a married clergy and did not impose the detested tithe, attracting thousands of adherents even among the higher clergy. But the Eastern empire ceased to be formidable on the death of Manuel (1180), and Hungary helped materially to break up the Byzantine rule in the Balkan peninsula by assisting Stephen Nemanya to establish an independent Serbian kingdom, originally under nominal Hungarian suzerainty. Béla conquered Galicia and took the title "Rex Galiciae"; he endeavoured to strengthen his own monarchy by introducing the hereditary principle, crowning his infant son, Emerich, as his successor during his own lifetime, a practice followed by most of the later Arpáds.

The Golden Bull.—Unfortunately his two immediate successors, Emeric (1196–1204) and Andrew II. (1205–35), weakened the royal power in attempting to win support by lavish grants of the Crown domains, they increasing the already excessive influence of the Magyar oligarchs. In 1222 the so-called Golden Bull was promulgated. It has been called the Magna Carta of Hungary, but really constituted an attempt to defend the monarchy by strengthening the lesser nobles against the magnates. Feudalism was attacked by decrees that the title and estates of the lords-lieutenant of counties should not be hereditary. On the other hand, the principle of the exemption of all the nobles from taxation was confirmed, as well as their right to refuse military service abroad.

Béla IV. (1235–1270) is best known as the regenerator of the realm after the subsidence of the Tatar deluge of 1241–42 (*see* BÉLA IV.), but his two great remedies, wholesale immigration and castle-building, only sowed the seeds of fresh disasters. Thus the Cuman colonists, mostly pagans, whom he settled in vast numbers on the waste-lands, threatened to overwhelm the Christian population; while the numerous strongholds, which he encouraged his nobles to build as a protection against future Tatar invasions, subsequently became so many centres of disloyalty. To bind the Cumans still more closely to his dynasty, Béla married his son, Stephen V. (1270–72), whom he had crowned "junior rex" in 1254, to a Cuman girl. Neither Stephen nor his son, Ladislas IV. (1272–90), was strong enough to make headway against the disintegrating influences all around him. The latter was so completely caught in the toils of the Cumans that the Holy See was forced to intervene to prevent the relapse of the kingdom into barbarism, and Ladislas perished in the crusade that was preached against him. His successor, the last Arpád, Andrew III. (1290–1301), though he conducted a successful war against the emperor Rudolph, who claimed Hungary for his son Albert, as a vassal State, was yet incapable of controlling the Hungarian magnates. After eight years' civil war (1301–08) the crown of St. Stephen finally passed into the capable hands of Charles Robert of Anjou.

During the Arpád dominion the nomadic Magyar race had adopted western Christianity and founded a national monarchy on the western model. While the monarchy was absolute, and thus able to concentrate in its hands all resources of the State, Hungary successfully withstood pagan reaction from within and pressure from without. But the weakness of the later Arpáds, the depopulation of the realm during the Tatar invasion, and the civil discords of the 13th century, brought to the front a powerful class of barons which gradually absorbed the ancient county system, while the ancient royal tenants became the feudatories of the great nobles. This political revolution met with determined opposition from the Crown, which resulted in the utter destruction of the Arpáds.

House of Anjou.—It was reserved for the two great princes of the house of Anjou, Charles I. (1308–42) and Louis I., "the Great" (1342–82), to rebuild the Hungarian State. Their task was made easier by the decimation of the Hungarian magnates during the civil wars. Both these monarchs were absolute. The national

assembly (Országgyülés) was still summoned occasionally, but the real business of the State was transacted in the royal council, where the able men of the middle class, principally Italians, held confidential positions. The lesser "gentry" were protected against the tyranny of the magnates, and the growth of towns encouraged by grants of privileges. Under Charles the whole fiscal system was reformed, and Louis established a system of protective tariffs. A law of 1351 which, while it confirmed the Golden Bull in general, abrogated the clause (iv.) by which the nobles had the right to alienate their lands, was enacted to preserve the large feudal estates as part of the new military system. Louis's efforts to increase the national wealth were largely frustrated by the Black Death, which ravaged Hungary from 1347 to 1360, and again during 1380–81, carrying off at least one-fourth of the population.

The foreign policy of the Angevin kings was on the whole successful. Charles married Elizabeth, the sister of Casimir the Great of Poland; he reconquered the Banate of Macsó from Serbia, and subdued Bosnia in 1328. Louis, by virtue of a compact made by his father 31 years previously, added the Polish crown to that of Hungary in 1370. Thus, during the last 12 years of his reign, the dominions of Louis the Great included the greater part of Central Europe, from Pomerania to the Danube, and from the Adriatic to the Dnieper.

The Angevins were less successful towards the south, where the first signs of the Turkish menace were appearing. In 1353 the Ottoman Turks crossed the Hellespont from Asia Minor; in 1360 they conquered southern Bulgaria. In 1371 they penetrated to the heart of old Serbia. In 1380 they threatened Croatia and Dalmatia. Hungary herself was now directly menaced. The Arpád kings had encircled their whole southern frontier with military colonies, largely composed of non-Magyar nationalities. But a redistribution of territory had occurred in these parts, which converted most of the old banates into semi-independent and violently anti-Magyar principalities, while in Walachia and Moldavia the growing Vlach nation threw off the shadowy Hungarian yoke altogether in the 14th century (*see* RUMANIA). In Bosnia the persistent attempts of the Magyar princes to root out the sect of the Bogomils (*q.v.*) had alienated the Bosnians, and in 1353 Louis was compelled to buy the friendship of Tvrtko by acknowledging him as king of Bosnia. Both Serbia and Bulgaria were by this time split up into half a dozen principalities which, for religious and political reasons, preferred paying tribute to the Turks to acknowledging the hegemony of Hungary. Thus, towards the end of his reign, Louis found himself cut off from the Greek emperor, his sole ally in the Balkans, by a chain of bitterly hostile Greek-Orthodox States, extending from the Black sea to the Adriatic.

At the death of Louis the Great in 1382, his young daughter Mary, who was betrothed to Sigismund of Luxembourg, was crowned queen; but the Horváthys, a great Croatian noble family, offered the crown to Charles III. of Naples, who accepted it, and was crowned as Charles II. on Dec. 31, 1385. Thirty-eight days later he was murdered at the instigation of the queen-dowager, Elizabeth, who was determined to rule Hungary during her daughter's minority. In July of the same year Elizabeth was murdered in her turn, by the Horváthys. Mary herself would doubtless have shared the same fate, but for the speedy intervention of her fiancé, Sigismund, whom a diet, by the advice of the Venetians, had elected king on March 31, 1387. He married Mary in June the same year, and she shared the crown with him till her death in 1395. Louis the Great's other daughter, Hedwig, was crowned queen of Poland (1384) and forced to marry Jagello, grand-duke of Lithuania.

Sigismund.—During the long reign of Sigismund (1387–1437), who was crowned Holy Roman emperor in 1410, Hungary was confronted with the Turkish peril. The insubordination of the feudal levies was largely responsible for the defeat of the combined armies of Christendom, under Sigismund's leadership, at Nicopolis, in 1396; and the king was hampered, at a time when he might have taken advantage of the collapse of the Turks before the Tatars under Tamerlane, by the enmity of the pope, who saddled him with a fresh rebellion of the Magyar nobles (who set up Ladislas of Naples as king in 1403, but were suppressed at Pápocz), and two wars with Venice, resulting ultimately in the total loss of Dalmatia (*c.* 1430). After the recovery of the Turks under Mohammed I. and Murad II. (1421–51), Sigismund, realizing that Hungary's strategy must be strictly defensive, elaborately fortified the whole southern frontier, and converted the little fort of Nándorfehérvár (Belgrade), at the junction of the Danube and Save, into an enormous first-class fortress. In 1435 he carried out an army-reform project, by which the nobles and principal towns were bound to maintain a *banderium* of 500 horsemen, or a proportional part thereof, thus supplying the Crown with a standing army.

Sigismund's need of money forced him to conciliate the diet, which was essentially an assembly of notables, lay and clerical, though free and royal towns were invited to send deputies to the diet of 1397. Sigismund was on good terms with his nobles, who supported him against attempted exactions of the popes; but it was at this time that feudalism began to spread over Hungary and especially in the wild tracts where the king's writ did not run. Simultaneously from the west came the Hussite propagandists teaching that all men were equal, and that all property should be held in common. The result was a series of dangerous popular risings (the worst in 1433 and 1436) in which heresy and communism were inextricably intermingled. With the aid of inquisitors from Rome, the evil was literally burnt out, but not before provinces, especially in the south and south-east, had been utterly depopulated. They were repeopled by Vlachs.

Sigismund was succeeded in 1438 by Albert V., duke of Austria, who had married his only daughter, Elizabeth. In the same year he was elected king of the Romans and crowned king of Bohemia. In 1439 he died of dysentery, in the course of a campaign against the Turks. The widowed queen was about to bear a child, which if it turned out to be a son, would be heir to the throne; but the leading nobles, fearing the results of a long minority, offered the crown to Wladislav III., king of Poland, who accepted it in March 1440 and was crowned in July as Wladislav I. In the meantime Queen Elizabeth had given birth to a son, who was crowned in May as Ladislas V., and she appealed for help to the emperor Frederick III. and to the Hussite leader, John Giskra. The resulting civil war was terminated only by the death of Elizabeth on Dec. 13, 1443.

John Hunyadi.—All this time the pressure of the Turks upon the southern provinces of Hungary had been continuous, but their efforts had so far been frustrated by the ban of Szörény, John Hunyadi, the fame of whose victories, notably at Nagyszeben in 1442 and near Sofia in 1443, encouraged the Holy See to place Hungary for the third time at the head of a general crusade against the infidel. The king accepted the leadership of the Christian league, and was on the point of quitting his camp at Szeged for the seat of war, when envoys from Sultan Murad arrived with the offer of a ten years' truce on such favourable conditions that Hunyadi persuaded the king to conclude the peace of Szeged in July. Two days later the papal legate, Cardinal Cesarini, absolved the king from his promise to observe the peace, and in November the latter suffered death and overwhelming defeat at Varna. (*See* HUNYADI, JÁNOS.)

The diet of 1446 now elected Hunyadi governor of Hungary. Before he could turn his attention to the Turks, Hunyadi had to negotiate with Jan Giskra, a Hussite mercenary who held the wealthy mining towns, nominally for the infant king, Ladislas V., still detained at Vienna by his kinsman, the emperor, while the western provinces were held by Frederick himself. At the same time Hunyadi was thwarted by the great nobles, who resented the position to which he had risen. He lost the battle of Kosovo in 1448 owing to treachery, and it was at his own expense that he fortified Belgrade in 1454, forcing Mohammed II. to raise the siege and return to Constantinople in 1456. Hunyadi died in camp in the same year, and after the murder of his elder son, Laszlo (1457), and the death of Ladislas V. six months later, Matthias Hunyadi, the younger son, was elected king as Matthias I. (*q.v.*) on Jan. 23, 1458.

In 1459 the emperor Frederick II. was elected king of Hungary by a party of nobles, but by a treaty of 1462 he was finally forced

to recognize Matthias as king. After a victorious campaign against the Turks in 1463, Matthias turned his attention to Bohemia. In 1468, with the sanction of the emperor and of the pope, who had declared Podiebrad of Bohemia to be a usurper, he entered that country, and in 1469 was crowned king by the Catholic nobles; but by the Peace of Olmütz (1478) Matthias was obliged to recognize the right of Wladislav, Podiebrad's successor, to share the title of king, and to rule over all except Moravia, Silesia and Lausitz. To do all this Matthias was compelled to take in hand the question of army reform. Putting aside the old feudal levies, he formed the nucleus of a standing army by recruiting mercenaries from the Magyars, Czechs and Croatians. Matthias used this army as a police force to maintain order and to collect taxes where they were refused.

Despite the enormous expense of maintaining the army, Matthias, after the first ten years of his reign, was never in want of money. By this time the gentry took part in the legislature. But the poorer deputies frequently agreed to make grants for two or three years in advance, so as to be saved the expense of attending every year, and allowed the king to assess as well as to collect the taxes, which consequently tended to become regular and permanent. Matthias re-codified the Hungarian common law, cheapened and accelerated legal procedure, and created an efficient official class. He founded the University of Pressburg (Academia Istropolitana, 1467) and revived the declining University of Pécs. He also laboured strenuously to develop and protect the towns, multiplied municipal charters, and materially improved the means of communication. His Silesian and Austrian acquisitions were also very beneficial to trade, throwing open as they did the Western markets to Hungarian produce.

Throughout Matthias's reign the Eastern question was never acute; on the Turkish invasion of Transylvania in 1479, he won another great victory at the Field of Bread (Kenyermezo) on Oct. 13, and only after his death did the Ottoman empire become a menace to Christendom. His hands were tied by the unappeasable enmity of the emperor and the emperor's allies. In 1477, and again in 1485, Matthias was provoked to lay siege to Vienna; the second time, when the city fell (June 1), Matthias annexed Austria, Styria and Carinthia, and transferred his court to Vienna, where, on April 6, 1490, he died.

Period of Decline.—In the reign of János (John) Corvinus, the natural son and successor of Matthias, came the reaction against the latter's purely personal, and therefore artificial, dominion (*see* CORVINUS, JÁNOS). The nobles and prelates, who detested the severe and strenuous Matthian system, found a monarch after their own heart in Wladislav Jagello, since 1471 king of Bohemia, who as Wladislav II. (1490–1516) was elected unanimously king of Hungary by the assembly of Rákos on July 15, 1490. Wladislav was, from first to last, the puppet of the Magyar oligarchs. At the diet of 1492 he consented to live on the receipts of the treasury, which were barely sufficient to maintain his court, and engaged never to impose any new taxes on his Magyar subjects. The dissolution of the standing army, including the Black Brigade, was the immediate result of these decrees, and the disgraceful peace of Pressburg was concluded between Wladislav and the emperor Maximilian on Nov. 7, 1491, whereby Hungary retroceded all Matthias's Austrian conquests, together with a long strip of Magyar territory, and paid a war indemnity equivalent to £200,000.

The 36 years which elapsed between the accession of Wladislav II. and the battle of Mohács are the most melancholy and discreditable period of Hungarian history. The prelates and magnates enjoyed inordinate privileges, while openly repudiating their primal obligation of defending the State against extraneous enemies. The great nobles were often at perpetual feud with the towns, whose wealth they coveted. Everywhere the civic communities were declining. Many of them, notably Visegrád, were deprived of the charters granted by Matthias. The whole burden of taxation rested on the shoulders of the peasants.

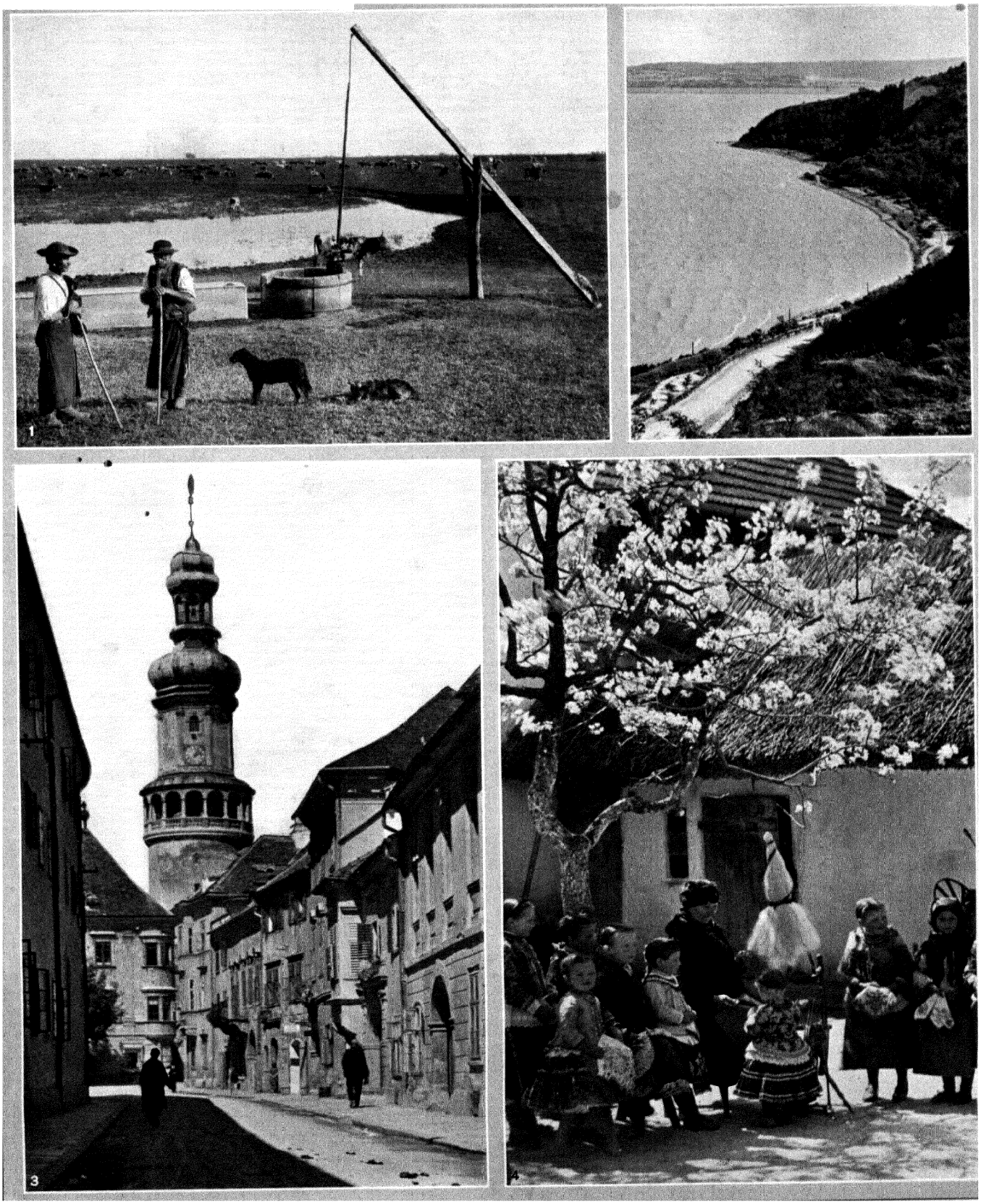
The condition of the peasants at this time was very wretched, and in 1514 large numbers of them, who had been assembled by Bakocz for a crusade against the Turks, broke out into rebellion instead, under the leadership of György Dozsa (*q.v.*). After the suppression of the rising by the nobility, under John Zapolya, the "Savage Diet" met to punish the rebels. The peasants were henceforth bound to the soil and committed absolutely into the hands of "their natural lords." About the same time, at the instance of the diet in 1507, Verböczy drew up the *Tripartitum*, the famous codification of Hungarian customary law, which sanctioned the liberties of the great class of Hungarian nobles as against the sovereign and the peasantry. Though never formally passed into law, it continued until 1845 to be the only document defining the relations of king and people, of nobles and their peasants, and of Hungary and her dependent States.

Subjection by the Turks.—Wladislav II. died on March 13, 1516. His son Louis, a child of ten, was pronounced of age, but the government remained in the hands of Cardinal Bakócz till his death in 1521, when the supreme authority was disputed between the lame palatine, István Báthory, and his rival, the leader of the middle-class party, István Verböczy (*q.v.*), who alternately held the office of palatine, while, in the background lurked János Zapolya (*see* JOHN ZAPOLYA, KING OF HUNGARY), voivode of Transylvania, patiently waiting till the death of the feeble and childless king (who, in 1522, married Maria of Austria) should open for him a way to the throne. Everyone felt that a catastrophe was approaching. The first blow fell on Aug. 29, 1521, when Sultan Suleiman captured the southern fortresses of Sabác and Belgrade. For another five years, while Suleiman was occupied with the conquest of Egypt and the siege of Rhodes, the final assault was suspended. But in the spring of 1526 came the tidings that the Sultan had quitted Constantinople to conquer Hungary. On July 28 Péterwardein fell after a valiant resistance. The diet at Buda proclaimed the young king dictator. Louis at once formed a camp at Tolna, whence he issued despairing summonses to the lieges, and, by the middle of August, some 25,000 ill-equipped gentlemen had gathered around him. On the advice of Tomori, archbishop of Kalocsa, the only noble who had made any effort at defence, Louis decided not to wait for reinforcements from Zapolya, who was still hesitating; he marched southwards to the plain of the Mohács, where, on Aug. 29, the Hungarians, after a two hours' fight, were annihilated; the king perished on his flight from the field. The sultan refused to believe that the pitiful array he had so easily overcome could be the national army of Hungary. Advancing with extreme caution, he occupied Buda on Sept. 10, but speedily returned to his own dominions, carrying off with him 105,000 captives. By the end of October the last Turkish regular had quitted Magyar soil, and one quarter of Hungary was as utterly destroyed as if a flood had passed over it. (C. A. M.)

PARTITION OF HUNGARY AND TURKISH RULE

The Turks having retired, John Zápolya, voivode of Transylvania, was elected king by the diet (Oct. 14, 1526), but he was a powerless dependent on Turkish support, and a second diet in 1527 elected Ferdinand I. (1527–64), archduke of Austria (emperor from 1556), who had married King Louis's sister. Suleiman supported Zápolya, and an internecine struggle went on till 1538, when by the secret treaty of Nagyvarad (Grosswardein) Hungary was divided, Ferdinand taking Croatia, Slavonia and the western counties, and Zápolya the remaining two-thirds, with the royal title, and Buda as his capital. Zápolya died in 1540 and his infant son, John Sigismund (1540–71), was elected, in spite of the peace of Nagyvarad, which formally acknowledged Ferdinand's right to the succession. Ferdinand asserted his right and laid siege to Buda in spite of the remonstrances of Martinuzzi (*q.v.*), Zápolya's able adviser, who knew that Suleiman would not allow the emperor to reign at Buda.

This brought a new Turkish invasion which lasted till 1547, when the exigencies of a war with Persia induced Suleiman to grant a truce. Hungary was partitioned, Ferdinand keeping his former share subject to payment of an annual tribute; Transylvania and some adjacent counties were assigned to John Sigismund, with the title of prince; the rich central plain of Hungary, the Alföld, was annexed to the Turkish empire. This settlement lasted with some changes for 150 years. Throughout this time the



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HUNGARIAN SCENES

1. A cattle ranch of the Nagy Alföld or Great Hungarian plain, a vast stretch of fertile pasture and grain land in central Hungary
2. View on the Danube
3. A street in Sopron, an ancient city in western Hungary, on the Austrian frontier; in the background is the tower of the Town Hall
4. Peasant woman with children in a Hungarian village

national sentiment and what remained of national liberties found their best expression in Transylvania, where Turk and Habsburg were equally hated. The efforts of the Habsburgs to conquer Transylvania led to fresh Turkish invasions in 1552 and 1556, the latter being Suleiman's last descent on Hungary, and memorable for the heroic defence of Szigetvár by Miklós Zrinyi. The truce of Adrianople suspended hostilities from 1568 to 1593, but frontier warfare was incessant and Habsburg relations with Transylvania were almost always bad. The Habsburg ruling over other States, and regarding "royal" Hungary (*i.e.*, their own portion of that country) as an unimportant border province, were constantly wounding Magyar sentiment. The office of palatine was suspended; and the country was governed from Vienna. Under Maximilian (1564–76) and Rudolph II. (1576–1608) the Magyar nobles were harassed and spoliated under trumped-up charges of treason, and the latter added religious to political persecution.

The Reformation.—The teaching of the Reformation had been steadily gaining ground; the corrupt Church had lost its hold on the people; the nobles, mostly Calvinists, coveted its riches, and Lutheran doctrines prevailed largely among the parochial clergy. In Turkish Hungary all creeds were tolerated, though the Catholics were always suspected as pro-Habsburg; in Transylvania toleration for both confessions was obtained in 1557. But the Counter-Reformation and the rise of the Jesuits changed the situation. The extirpation of Protestantism was the objective, and as Protestantism was then identical with Magyarism the fate of each was equally involved, and the protests of the local diets were ignored. The persecution was fiercest during the "Long War" (1593–1606), a confused struggle in which Transylvania was pitted against the Turks, the emperor Rudolph II., and Michael of Moldavia. Sigismund II., Bathory, prince of Transylvania (1581–1600), gained a brilliant victory over the Turks, whose power was declining, but Transylvania was finally subdued by the imperial general, Basta. A reign of terror at once began, intended to Germanize the principality, and bring it back to Catholicism. Every kind of robbery and extortion was practised on the richer land owners and adherents of the reformed creeds.

Fortunately a deliverer appeared in Stephen Bocskay (*q.v.*), a wealthy nobleman and originally an adherent of the emperor. Elected prince of Transylvania on May 5, 1605, he called the Turks to his aid, over-ran northern Hungary, and raided Austrian territory. At the peace of Vienna, June 23, 1606, he obtained for his people religious liberty and political autonomy, an amnesty and restoration of the confiscated estates, and his own recognition as sovereign prince of an enlarged Transylvania. He also negotiated the truce of Zsitvatörök (Nov. 1606) between the emperor and the sultan, which on payment of £400,000 freed the former from the humiliating annual tribute to the Porte, and established a working equilibrium between the three parts of Hungary, whose position was further improved when the archduke Matthias, who had negotiated the treaty with Bocskay, was elected king of royal Hungary in 1608, as Matthias II. (1608–19).

Transylvanian Hegemony.—For the next 50 years Transylvania (*q.v.*) continued as the bulwark of Magyar liberty. Circumstances were favourable, as the whole strength of the empire was absorbed by the Thirty Years' War, and the princes who succeeded Bocskay were men of great ability, who gained for their country a power out of proportion to its real strength. Gabriel Bethlen (*q.v.*), who reigned from 1613 to 1629, was three times at war with the emperor, and twice crowned king of Hungary. His successor George Rákóczy I. (1630–48) also invaded royal Hungary, and at the peace of Linz (Sept. 16, 1645) forced the reluctant emperor to grant full autonomy and religious liberty to Catholics and Protestants, and to acknowledge the sway of Rákóczy over the north Hungarian counties, the threat of calling in the Turks ensuring submission.

The power of Turkey, after a long decline, again became formidable when the able and energetic vizier, Mohammed Kuprili (*q.v.*), became supreme at Constantinople in 1656. He deposed George Rákóczy II. (1648–60), who had ruined his principality in a mad venture for the throne of Poland, and by 1661 Transylvania had become a Turkish feudatory State. Royal Hungary was next invaded by his son, Fazil Ahmed, but with little success, the Turks being heavily defeated by Montecuculi at St. Gothard on Aug. 1, 1664, and the Peace of Vasvár (Aug. 10) gave Hungary a respite from invasion for 20 years.

Catholic Reaction.—Far more important was the change which about this time was bringing Hungary back to Catholicism. The soul of the movement was the great Jesuit preacher and writer, Peter Pázmány (*q.v.*), primate from 1616 to 1637. His policy was to convert the nobles and gentry, assured that in the end the people would follow their example. The educational system of the Jesuits gave them a great advantage and the crown of Pázmány's labours was the foundation of a great Catholic university at Nagyszombát (1635), and a Hungarian translation of the Bible, to supersede the current Protestant version.

The reaction in religion coincided with a sustained attack on political liberty. Nationalist aspirations were naturally opposed to a system of imperial government based on Divine right, and for 100 years the upper classes were subject to a cruel discipline. They were treated as an inferior race, excluded from office, their privileges over-ridden. Leopold I. (1657–1705) left the government of the country in the hands of two bigoted Magyar prelates, Gyorgy Szelepesényi and Lipót Kollonic. The abortive conspiracy of Peter Zrinyi, who with three other magnates was publicly executed (1671), was followed by wholesale arrests and confiscations, and for a time legal government was susperseded (patent of March 3, 1673) by a committee presided over by Kollonic. Large numbers of Protestant ministers were haled before this tribunal for alleged conspiracy; of these 236 were "converted" or confessed to acts of rebellion. The rest stood firm and were sentenced to death, commuted to slavery in the Neapolitan galleys, in spite of urgent protests from Sweden and the German Protestant States.

Liberation from the Turks.—In 1678 Count Tököli was the leader of a dangerous revolt which, for some time, made him master of northern Hungary. Encouraged by Tököli's success, the vizier, Kara Mustapha, and the war party at Constantinople resolved to complete the conquest of the rest of the country. Alarmed for the safety of Vienna, and stirred up by Pope Innocent I., Leopold reluctantly allied himself with John III. Sobieski, king of Poland, and gave the command of his armies to Prince Charles of Lorraine. The war lasted 16 years, and after beginning with the siege of Vienna (July 14–Sept. 12, 1683) and its relief by Sobieski, put an end to the Turkish dominion in Hungary. In 1684 the Pope succeeded in uniting the empire, Poland, Venice and Muscovy in the Holy League against the Turks, and was rewarded by a series of triumphs, culminating in the recapture of Buda (1686) and Belgrade, and the recovery of Bosnia (1689). In 1690 the Turks rallied under the vizier, Mustapha Kuprili, brother of Fazil Ahmed, regained Serbia and Bulgaria, placed Tököli on the throne of Transylvania, and took Belgrade by assault (Oct. 6); but in 1691 Kuprili was defeated and slain at Slankamen by the margrave of Baden. For six years the war languished but in 1697 Prince Eugene of Savoy routed the Turks at Zenta (Jan. 26, 1699), leaving the emperor the whole of Hungary except the "Banat," the territory enclosed by the rivers Theiss and Maros.

Francis Rakoczy.—The expulsion of the Turks and the peace of Karlowitz left the Magyars sullen and embittered. They had little share in the victories, which had been gained by foreign armies; the war taxation had been crushing, and this combined with the ruthless repression of civil and religious liberty to make the whole nation ripe for rebellion. Yet Leopold judged the time opportune for changing Hungary from an elective to a hereditary monarchy (Oct. 1687), and for abrogating the clause in the Golden Bull which authorized armed resistance to unconstitutional acts of the sovereign. The terrorized and weakened diet was incapable of resistance, so the immediate effect of the Peace of Karlowitz was to strengthen the existing despotism. Bishop Kollonic was at the head of affairs, and his plan was to repopulate the regained territories, which were in a state of terrible dilapidation, by a vast immigration of German and Croatian colonists. Magyar landlords were forcibly deprived of their estates, which were divided among the newcomers. No redress could be obtained and the whole nation was seething with discontent. The opportunity

to break out came when the emperor, involved in the War of the Spanish Succession, withdrew almost all his troops from Hungary. There was an immediate rebellion, which found a leader in Francis Rákóczy II. (*q.v.*) (1704–11), elected prince by the diet on July 6, 1704. The armies he raised were numerous but ill-equipped, and without artillery. Louis XIV. aided him with money, but the defeat of the French at Blenheim enabled the emperor to send an army into Hungary, and in 1705 Rákóczy was badly defeated. In 1707 two Rákóczian diets deposed the Habsburgs and formed an interior Government with Rákóczy at its head, till a national king could be elected, but Joseph I. (1705–11), who succeeded Leopold, refused to come to terms with his subjects, though pressed to do so by his allies.

In 1708 Rákóczy was again defeated at Trenesen, this time decisively, though a guerrilla war still went on. But in 1711 Joseph died and was succeeded by his brother, Charles VI. (1711–40), a man of different stamp. A congress met at Szátmár (April 27, 1711), and peace was restored on the basis of a general amnesty, full religious liberty, and the inviolability of Magyar rights and privileges.

UNION UNDER THE HABSBURGS

The Pragmatic Sanction.—The peace of Szátmár ended the long strife between the Magyars and the Habsburgs and opened a new era of reconciliation. The next century and a half witnessed the reopening of the great central plain, the Magyarization of its mixed races, German, Croat, Slovak, Serb, and other nationals, and the formation there of a compact and vigorous race, speaking one language, attached to the same institutions. The first changes, however, strengthened the Government rather than the nation. Thus in 1715 a standing army was set up, the diet, however, retaining the right of fixing the number of recruits and voting the necessary supplies. Important judicial and military reforms were carried and the magistrates and officials made responsible to the king alone, and all measures adopted were of a centralizing tendency. But it was to the diet assembled at Pressburg that Charles III. appealed in 1723 to grant the Pragmatic Sanction which settled the succession in favour of his daughter, Maria Theresa. The law as enacted set up a contract which remained the basis of the relations between Crown and nation till 1848. Hungary was declared to be an integral part of the Habsburg dominions, and Charles swore to preserve the Hungarian Constitution intact, with all its rights, laws and privileges.

During the reign of Charles VI. there were two Turkish wars. The first, beginning in 1716, was terminated by the peace of Passarowitz (July 21, 1718), by which the Temesköz was freed from the Turks, and Serbia, northern Bosnia and Little Walachia were once more incorporated with Hungary. But by the peace of Belgrade (Sept. 1, 1739), which terminated the second war, all these conquests, except the Banate of Temesvar were lost.

Enlightened Despotism.—With Maria Theresa (1740–80), the age of enlightened despotism began. Deeply grateful for Magyar services in the War of the Austrian Succession, she used her authority to benefit her people; but she would not share it with them. She appointed no palatine, nor was any diet summoned after 1764, but her people loved and trusted the great queen and felt themselves safe in her hands. Large sums were spent on schools and universities, and her benevolence extended to the serfs, who found in the feudal prescription of 1767, which restored to them the right of transmigration, a measure of protection against the exactions of their landlords. To all the Magyars she was especially gracious, and her court was crowded with the nobles who had stood by her in the stormy commencement of her reign. Joseph II. (1780–90) had the same ideals as his mother but less practical sense. He aimed at the amalgamation of all his dominions under an absolute sovereign, the whole to be uniform in language, laws and administration. Almost all the reforms he tried to force on his reluctant subjects were salutary; but they offended prejudices and, particularly, privileges. He refused to be crowned, and he roused national feeling by making German the official language in Hungary (1774), and by abolishing the ancient county assemblies, and set the privileged classes against him by proclaiming equal liability to taxation, and by attempting to improve the relations between the peasants and landlords. Before his death in 1790, he retracted some of his edicts and restored the Constitution. Leopold II. (1790–92) found his country on the brink of a revolt, and his first task was to undo Joseph's work, to restore the privileges of the Magyar nobles, and to confirm the national liberties by the laws of 1790–91. The reconciliation was timely, for Francis I. (1792–1835), who succeeded Leopold, received a declaration of war from the French Legislative Assembly immediately after his succession. Further reform was checked, for the time, by the Government's reactionary policy, due to the Jacobin terror. The Magyars stood loyally by the empire during the revolutionary years, unshaken by Napoleon's attempts to seduce them from their allegiance. Ignaz Jozsef Martinovics and the Hungarian Jacobins vainly conducted revolutionary propaganda.

Hungarian Revival.—When peace came Hungarian feeling remained conservative, though there were undercurrents, literary and artistic, noble and plebeian, which set towards the liberalism which was pervading western Europe. But in 1823 an unconstitutional war tax and levy of recruits caused a burst of indignation, and the withdrawal of the edicts at the diet summoned in 1825. It led also to the formation of a Liberal party eager for reforms and strongly opposed to Metternich's system of inertia. The chief leaders were Széchenyi (*q.v.*), Deák, Count Batthyány, Baron Eötvös, and the fiery and eloquent Louis Kossuth (*q.v.*). Each successive diet showed a growth in Liberal strength, and on the accession of Ferdinand I. (1835–48) the Government took strong repressive measures, and Kossuth and other leaders were imprisoned. But the nation was not to be cowed; the Diet of 1839 insisted on their release, laws were passed making Hungarian the official language, and relieving the peasants from some of their feudal obligations.

After 1843 there was some disintegration in the Liberal ranks; Kossuth's violent speeches and articles in the first Hungarian political newspaper, *Pesti Hirlap*, which he started in 1841, and his advocacy of armed reprisals alarmed Széchenyi and the moderates, though as usual the extremists prevailed. New concessions were wrung from the reluctant Government, mixed marriages being legalized, and the nobles losing their monopoly of official positions.

Revolution of 1848.—Continued dissensions among the Liberals led to the formation of a Centre Party by the Moderates, and Széchenyi even joined the Government. However, just before the election of 1847, Deák succeeded in reuniting all Liberals on the common platform of the "Ten Points" afterwards known as the March laws: responsible government; popular representation; the incorporation of Transylvania; right of public meeting; absolute religious liberty; universal equality before the law; universal taxation; the abolition of serfdom with compensation to the landlords; abolition of the *aviticum*—an obsolete land-tenure. The elections gave the Progressives a complete victory, and all efforts to bring about a compromise with the Government were fruitless, and it was proposed to dissolve the diet. But in Feb. 1848 tidings reached Pressburg of the revolution at Paris and its repercussions throughout Germany, where every Government was threatened with overthrow. Kossuth's motion for the appointment of an independent responsible ministry was accepted by the lower house. The emperor hesitated, but on March 13 the Vienna revolution broke out and Metternich fled to England, and yielding to pressure or panic the harassed monarch appointed Count Louis Batthyány premier of the first responsible Hungarian ministry, which included Kossuth as minister of finance and Széchenyi as minister of home affairs. The March laws were enacted at Pressburg and received the royal assent (April 10), and Hungary became a virtually independent State. The aspirations of the Magyars were assured the support of the German Democrats who, for the moment, were in power at Vienna, but in the national movement a cleavage now appeared.

Jellačić and the Non-Magyar Races.—The increasing Magyar national chauvinism and especially the attempt to impose the Magyar language universally, had stimulated a national reaction among the Southern Slavs, Slovaks and Rumans; each sought for themselves a separate national existence, and the franchises of the

new constitution had been so limited that the Slavs seemed to be threatened with political annihilation. The Imperial Government was at first hostile to this movement, hoping that its concessions to the Magyars would secure their support against revolution elsewhere; a hope that seemed justified by Batthyány's consent to send Hungarian troops for the war in Italy. That the emperor was led to encourage Slav aspirations was due partly to the violence of the Kossuth party, now dominant at Budapest, partly to the influence of Baron Jellačić (*q.v.*), who was made Ban of Croatia in April. Jellačić, a soldier and a loyal servant of the emperor, advised him to break the power of the Magyar and German revolutionaries by means of the Slavs who were equally hostile to both, and set up against the dualism favoured at Budapest and Vienna the federal system favoured by the Slavs. This policy he pursued with masterly skill. His first acts were to repudiate the authority of the Hungarian diet, to replace Magyar officials with ardent "Illyrians" (as the advocates of the Southern Slav movement were then called), and to proclaim martial law. Under pressure from the palatine and Batthyány, the emperor ordered him, on May 7, to desist from his separatist plans and to take his orders from Budapest. He not only refused to obey, but, probably with the connivance of the Government, convened the Croatian diet at Agram on June 5, of which the first act was to declare the independence under the Habsburgs of the South Slav districts of Austria and Hungary. Dismissed from his office on June 10 at the instance of Batthyány, Jellačić went to Innsbruck, whither Ferdinand had retired, and in an interview convinced him of the loyalty of his intentions, and returned to Croatia with practically unfettered discretion. Meantime the Hungarian Government had been playing into his hands. At a time when everything depended on the army, they had destroyed the main tie which bound the Austrian court to their interests by tampering with the fidelity of the Hungarian army to the Crown. A National Guard had been created, and the disaffected troops bribed by increased pay to desert their colours and join the new force, and in June the garrison of Budapest had taken an oath to the new constitution. All hope of crushing revolutionary Vienna with Magyar aid being at an end, Jellačić was free to carry out his policy of uniting the forces of the Southern Slavs with the imperial army. The alliance was cemented in July by a military demonstration of which Jellačić was the hero, and followed by a Government announcement that the basis of the Austrian State was "the recognition of the equal rights of all nationalities."

Jellačić Invades Hungary.—The Hungarian diet, which met on July 2, at once took up the challenge. It was dominated by Kossuth, whose inflammatory orations, denouncing the treachery of the Slavs, precipitated a crisis which the moderates of the cabinet were powerless to avert. At his instance the diet refused to vote supplies for the Croat troops, and ordered a levy of 200,000 men and a national defence loan of £4,500,000. Desultory fighting had already begun in the south, and a bloody insurrection of the Rumans began in Transylvania, and in September Ferdinand, emboldened by Radetzki's victory at Custozza (July 25) and the resulting truce in Italy, refused his sanction to the measure passed by the diet in July. Jellačić, reinstated in all his honours, crossed the Drave on Sept. 11, with 36,000 Croat troops and advanced to Lake Balaton. This made the Kossuth party supreme at Budapest; Széchenyi had lost his reason; Deák and Eötvös retired into private life, and Batthyány unhappily consented to remain in office, though hardly in power. The Palatine, Archduke Stephen, resigned his office on Sept. 24, and as a last effort for compromise, and with Batthyány's approval, General Count Lamberg was sent to take command of all the troops, Magyar and Slav, and to bring about an armistice. The diet, on Kossuth's motion, and on a technical point, ordered the troops not to obey their new commander. Next day Lamberg was torn to pieces on the bridge of Budapest by an infuriated mob. War was now inevitable; Batthyány retired, and a royal proclamation on Oct. 2 placed Hungary under martial law, with Jellačić as commander-in-chief. He was defeated at Pákozc on Sept. 29, and on an order to certain Viennese regiments to march to his assistance, a new insurrection broke out in Vienna on Oct. 3, and the emperor again fled from the capital. His army, under Prince Windischgrätz, laid siege to Vienna, and as the revolutionists of Austria and Hungary were closely allied, a large body of the new Honved militia was despatched by the committee of national defence which had replaced the defunct Hungarian cabinet. They were defeated at Schwechat (Oct. 31), and Vienna surrendered the following day.

The War of Independence.—The Austrian army having triumphed, the reactionary Schwarzenberg ministry was appointed in November to wipe out all traces of the revolution. Next month the feeble but well-meaning emperor abdicated in favour of his nephew, Francis Joseph (1848–1916). The new emperor was a youth of 18, who could be little more than the mouthpiece of Schwarzenberg's policy and might claim to be uncommitted to the constitutional obligations reluctantly accepted by his uncle. The Budapest diet refused to acknowledge the title of the new sovereign, declaring it to be invalid under Hungarian law, and called the nation to arms to resist the encroachment. This gave the revolt a show of legality and served to conciliate the military chiefs, who hated the idea of a republic, and refused to consider themselves rebels; actually, till the close of the revolt, Kossuth was ruler of Hungary.

The army of Prince Windischgrätz entered Hungary on Dec. 15, and was allowed to occupy the western counties and Budapest (Jan. 5, 1849), with little opposition, the Magyar Government and diet retiring to Debreczen behind the Theiss. A last attempt at reconciliation was made by moderates of the diet, but Windischgrätz insisted on unconditional submission; Deák, Batthyány and their friends retired into private life. Kossuth's plan of campaign was to give battle in the marshy regions of the interior, but there was no real accord between him and the Magyar military chiefs. The first sign of discord was a proclamation issued on Jan. 15 by Görgei (*q.v.*) who commanded on the upper Danube, declaring the war to be a struggle for constitutional rights and denouncing republican aspirations. This was at the beginning of a campaign in mid-winter, in which Görgei showed remarkable military talents; but his success caused jealousy in official quarters, and Dembinski, a Polish refugee, was given the chief command in Feb. 1849. The Austrian army advanced, and after a bloody two days' battle at Kápolna (Feb. 26–27) Dembinski was forced to retreat behind the Theiss. He resigned the command and was succeeded by Görgei, who led the Honved army to a series of victories. Ably seconded by Klapka and Damjanich, he pressed forward and Szolnok, Isaszeg and Nagysarlo were stages in a triumphal progress which ended in the raising of the siege of Komárom and the recapture of Buda on May 25. Meanwhile the changing fortunes of the war had destroyed all hope of compromise. Early successes and the victory of Kápolna had confirmed the Austrian court in its policy of unifying the empire. A proclamation was issued in March in the emperor's name, establishing a constitution for the empire, in which Hungary, cut up into half-a-dozen administrative districts, was little more than the largest of several subject provinces. This manifesto reached Debreczen simultaneously with the news of the recapture of Buda. It was met with a proclamation, equally ill-judged, in which Kossuth and the diet declared the independence of Hungary and the exclusion of the house of Habsburg from the throne, and elected Kossuth president of the Hungarian republic (April 14). This rash step completed the alienation of the military from the civil administration; henceforth Görgei acted in complete independence.

Intervention of Russia.—Meanwhile their disasters in Hungary had compelled the Austrians to accept the assistance which Nicholas, tsar of Russia, offered in the spirit of the Holy Alliance. An Austro-Russian alliance was announced in May and a common plan of campaign arranged The Austrian general, Count Haynau, was to attack from the west, the Russian prince Paskevitch from the north, the two encircling armies converging on the mid-Theissian counties. The Magyars were hopelessly outnumbered and divided among themselves; they had no plan of campaign and no commander, Görgei having been deposed by Kossuth. Haynau's victorious advance compelled a decision;

the Government, abandoning Budapest, retired first to Szeged and finally to Arad. The Russians were by this time approaching the Theiss. The last pitched battle of the war was fought at Temesvar, when Dembinski was utterly routed (Aug. 9), and on the 13th Görgei, who had been appointed dictator, surrendered with his whole army to the Russian general, Rüdiger, at Világos. The rest of the army and the fortresses followed his example, and the garrison of Komárom capitulated after a heroic defence. Kossuth, Dembinski, Bem and others took refuge in Turkey. Görgei had secured his personal safety, but his unfortunate companions-in-arms underwent the penalties of martial law as administered by the "butcher Haynau." On Oct. 6, 1849, 13 generals were hanged or shot at Arad, and Batthyány, who had taken no part in the war, was shot at Budapest the same day. The anniversary is still a day of national mourning. This holocaust ushered in a régime of military tribunals, dragooning and wholesale confiscations.

The "Bach System" and "Provisorium."—From 1851 to 1860 Hungary lived under a despotism called the "Bach System," after Baron Bach, the Austrian minister of the interior. Historic Hungary did not exist for the bureaucrats, mostly German, Czech or Galician, who administered the counties under an imperial council responsible to the emperor alone. Such of the reforms of 1848 as ministered to material prosperity were not neglected, and a new and better system of finance was inaugurated. But the system took no root in the soil; the soul of the nation rejected it, and the slightest impact from within or without could not fail to overthrow it.

Meanwhile the ill-compacted empire sustained repeated shocks. The Crimean War isolated her in Europe and cost her the friendship of Russia; the Italian War in 1859 had shown her military weakness; the headship of Germany was passing to Prussia. Some concession to the subject races was thought advisable. In 1857 the emperor visited Hungary, and the estates of political offenders were restored to them. In 1859 it was decreed that the language spoken in the higher schools should be regulated according to circumstances of nationality, and the October Diploma of 1860 offered the shadow of local autonomy and a constitution as a sop to allay Magyar discontent. It won some favour from those Magyar magnates who had not broken with the court, but the nation rejected it on the advice of Deák, now the most influential man in Hungary. The February Patent (1861), the work of Anton von Schmerling, had somewhat more substance in it; after long debate it was rejected, again by the advice of Deák, by a diet assembled at Pressburg. In an address to the Crown, drawn up by him, the diet prayed for the restoration of the political and territorial integrity of Hungary, the coronation of the king, and the restitution of the fundamental laws. Thereupon the diet was dissolved on Aug. 21, and the taxes were levied by military execution: the so-called *Provisorium* had begun.

But the international situation became so urgent that the court was again driven to concessions. The emperor came to Buda in June 1865 and a provisional Government was formed; the February constitution was suspended and in December the diet was summoned. A composition with Austria was generally desired, and by none more than by Deák, who commanded the votes of two-thirds of the deputies. A committee was appointed to draft a new Constitution, based on the Pragmatic Sanction (1722), but its labours were interrupted by the Seven Weeks' War with Prussia. The Peace of Prague (Aug. 1866), which excluded Austria from Italy and Germany, made the fate of the Habsburg monarchy absolutely dependent on a compromise with the Magyars. The negotiations were carried out by Deák and Baron Beust, and were far advanced on the reassembly of the diet in November. In Feb. 1867 a responsible independent Hungarian ministry was formed under Count Julius Andrássy (*q.v.*), and in March the new Constitution was adopted by 200 votes to 89.

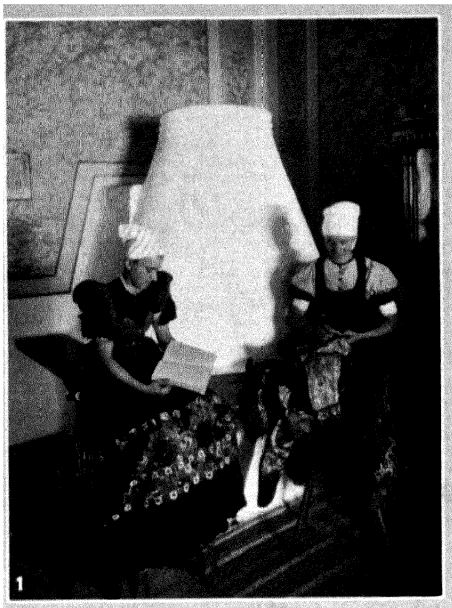
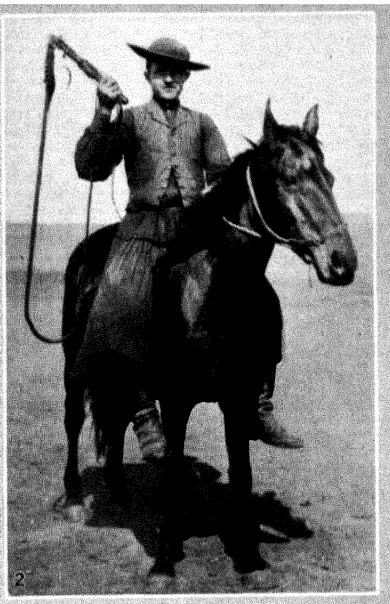
(X.)

THE DUALIST PERIOD

The Compromise of 1867.—The Compromise (Law 12 of 1867) established the so-called Dualist system between Austria and Hungary; the two countries had hitherto been united only in their common dynasty (the legal sanction for which was afforded by the Pragmatic Sanction of 1722) and by the work of the central authorities in Vienna, whose activities, however, in so far as applied to Hungary, constituted an infringement of Hungarian law and sovereignty. Under the Compromise Hungary recognized this situation to this extent, that matters vital to national defence were entrusted to three common Ministries, to be held alternately by Austrians and Hungarians: these being Foreign Affairs, War and Finance (the last-named resting chiefly on the customs receipts); while Hungarian sovereignty was recognized in the appointment of an independent Ministry, responsible to the Hungarian parliament. Dualism, in the eyes of its creator, Deák, meant complete parity, combined with a sort of *de facto* union Hungarian parliament. Dualism, in the eyes of its creator, Deák, prevailed on Francis Joseph to "deign to grant the other lands" (*i.e.*, Austria) "constitutional rights" (Law. A. 12, 1867). The common ministries were submitted to the control of "delegations" or committees of the Austrian and Hungarian parliaments. On the basis of this constitution Francis Joseph had himself crowned king of Hungary on June 8, 1867.

First Phase of Dualism.—The difficulties of Dualism became apparent even under the first minister-president, Count Julius Andrássy (*q.v.*). Led by the archduke Albert, governor-general of Hungary after the defeat of 1849, the generals who had attained such influence at the court of Vienna in the absolutist period opposed the efforts of what they called the "trans-Leithan half of the empire" to attain parity, particularly in military matters. It was only after a long struggle that Andrássy succeeded in recovering the military frontier from the military administration and restoring in it the old county system. The same court and military circles wished to join France against Prussia in 1870 in a war of revenge. Andrássy, as Hungarian minister-president, prevented this, and thus saved the new State of Austria-Hungary from being drawn into the French disaster, and the war from spreading to other States. In Hungary itself many elements were hostile to dualism and to any community of existence with Austria. They listened to the voice of Kossuth, the leader of 1848, now living in voluntary exile. Shortly before Francis Joseph's coronation, Kossuth, in his open "Cassandra letter," had accused Deák of treachery to the rights of the nation. The pure Magyars of the Alföld supported Kossuth and elected a parliamentary opposition which took its stand on the so-called "1848 constitutional basis" and called for revision or revocation of Dualism and a pure personal union with Austria. The 1848 politicians adopted a negative attitude towards all demands of the State throughout the period of Dualism, voted against the budgets and military estimates, and attempted to discredit the Dualist Governments as traitors to the nation.

Threatened at once in Vienna and in Hungary, and supported solely by the emperor-king, who throughout his life remained strictly loyal to his coronation oath, and upheld the Law 12 of 1867, the Hungarian minister-presidents, from Andrássy on, were often forced to employ subterfuges to secure the majorities necessary for the conduct of affairs. As the 1848 ideas were most prevalent in the poorer classes, the franchise was from the first so restricted as to confine all political influence to educated circles. The maintenance of Dualism was secured, first and foremost, by enlisting the "gentry," who had lost the greater part of their estates through the agrarian reform decreed under Art. 9 of the Law of 1848, and executed during the period of absolutism of 1852–53 with the deliberate purpose of breaking the Hungarian aristocracy. As State officials and deputies, this class now became the chief supporters of the Dualist Governments. After Andrássy had become common minister for foreign affairs in 1871, his successors in the premiership of Hungary ruled with the help of the "gentry" and the new Jewish capitalists. The rich natural resources of Hungary had begun to be exploited, railways had been built, mines and factories started, and the profits increased the solidity of the '67 Governmental party, while the '48 party were, where possible, excluded from it. It was, however, only after the death of Deák, a Puritan who refused to take any office, that this was developed into a regular system by Koloman Tisza



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TYPES FROM DIFFERENT PARTS OF HUNGARY

1. Interior of a home in Mezökövesd, showing women wearing the elaborately embroidered peasant costume. In the background is a porcelain stove of the kind generally used in peasant houses
2. A "Csikos" or herdsman of the Hortobágy, the vast steppe west of the town of Debreczen. These horsemen are famous for daring riding and skill with the lasso
3. A couple from Mezökövesd, a market town about 140 miles from Budapest, in northern part of the great plains, where the traditional costumes and customs are fully preserved
4. Girls of Mesökövesd in Sunday dress
5. Church-going costume for the women of a small town of Hungary
6. The children of a gypsy settlement dancing in the town square. The music and dances are traditional, having been handed down from father to son for many generations
7. Two gypsies of Hungary. These nomadic people are numerous all over central Europe and an effort is being made to gather them into settlements, at least for the harsh winter months

(*q.v.*), whose prolonged period of office (1875–90) made the Government party resting on the landed gentry and capital (the "Liberal Party" or "Free Principle Party") into a permanent institution. He introduced strict discipline into his party, which was most necessary, since the Government was forced year by year, in the interests of Dualism, to pass unpopular laws, such as the military estimates for the "common" army, with its headquarters in Vienna and German word of command. Hungary was making rapid strides in prosperity and culture (this was the "classic" age of Hungarian literature, founded by the great writer Arany), and deeply resented the system under which the supreme decisions on foreign policy and war were withdrawn from the nation and debated in Vienna in the German tongue, the constitutional influence due to the Hungarian premier not always receiving due weight. The German-speaking army in Hungary was the occasion of continual conflicts; there were repeated students' riots and patriotic demonstrations against army decrees, or against the maintenance of the Hentzi monument in Budapest (Hentzi was the Austrian general who defended Buda in 1849 against Görgei's national army); these flames being vigorously fanned by old Kossuth from Turin. Koloman Tisza fell over a bill affecting Kossuth's rights of Hungarian citizenship.

Second Phase of Dualism.—His successors, Count Julius Szápáry (1890–92), Alexander Wekerle (1892–95), Baron Desider Bánffy (1896–99), and Koloman Széll (1899–1903), had still greater difficulties to face. Resistance was increasing, both in Austria and in Hungary. The first fatal mistake had been to provide for a revision of the Austro-Hungarian customs tariff every ten years. In the parliamentary discussions on these occasions—they were particularly stormy in 1897—the differences between agrarian Hungary and industrial Austria grew acute; the Hungarians complained that their country was treated as a colonial market for the Austrian factories, and they increasingly demanded an independent customs territory. Similar difficulties arose over the commercial treaties with foreign States, which had also to be concluded in common with Austria, and in army questions, the latter due mainly to the preference shown to German and Slav officers for high positions. No Hungarian was able to reach a leading position on the Austro-Hungarian general staff up to the end of the World War. Thus dislike of Dualism grew more acute in Hungary; not only the Kossuth Party worked in this direction, but also other politicians who, while remaining loyal to the Compromise, yet looked on it as elastic and aimed at altering its provisions by constitutional methods: creating an independent customs territory, giving the Hungarian element in the army its due, and creating an autonomous national bank. Among these were Count Albert Apponyi (*q.v.*), and later, the younger Count Julius Andrássy (*q.v.*). Francis Joseph, however, would allow no alteration in the Compromise, and these efforts could thus lead only to embittered parliamentary struggles. The number of malcontents increased after the Wekerle Government introduced a reform of the marriage law on liberal lines in 1894; a new opposition party, the Catholic Peoples' Party, came into being, led by Count Ferdinand Zichy (1829–1911), and supported by wide circles of Hungarian, German and Slovak peasantry. The minister-president, Bánffy, was only able to break the power of this party in the elections of 1896 by the most extreme means, forcible intervention by the gendarmerie. In the same year the nation and its king celebrated together its jubilee, the millenary of the occupation of Hungary by the Magyars. Yet events were shaping towards a rupture with the sovereign and the Compromise. When Count Stephen Tisza (*q.v.*), as minister-president, attempted to make parliamentary discussion possible in the interests of the army estimates by changing the standing orders and was defeated at the elections (1905), the king first tried the expedient attempted in Austria, of reforming the franchise, to put the nationalist gentry and middle classes in a minority against the workmen and national minorities. When this attempt (Baron Géza Fejerváry's Ministry, 1905–06) broke down on the resistance of the counties, he entrusted the power to the united parties of the Opposition (Wekerle's Ministry, 1906–10), who promised to respect the Compromise. This coalition ministry included both Apponyi, Andrássy and Francis Kossuth, son of the old revolutionary, now dead. Public opinion, however, failing to receive from this ministry the anticipated changes in the Compromise, soon abandoned it. At the next elections the old '67 Party returned in triumph, and remained in power till the World War, after being reorganized by Stephen Tisza, who was minister-president for the second time, 1913–17.

It was only with great difficulty, however, that Tisza succeeded in carrying the army estimates in the last years preceding the World War. In the '48 Party the influence of the leaders compromised in the Wekerle Ministry was now superseded by that of Count Michael Károlyi (*q.v.*), who introduced extreme tendencies into the Party of Independence. At the same time, symptoms of social unrest appeared. The Socialist Party, which was Marxist in creed, made several unsuccessful efforts to find new followers among the agricultural labourers; but in the first decade of the 20th century it found an ally in the Radical Party, composed of semi-Socialistic bourgeoisie, doctors, lawyers and merchants, which aimed at a complete remodelling of social conditions with the assistance of general suffrage. Its leader, Oscar Jászi, failed to win the nationalist middle classes for his movement, and his propaganda, which was in part directed against the Church, only deepened the conflicts between the Hungarian middle classes and the Jews out of which his party was largely recruited.

National Struggles.—At the same time the question of the national minorities, for which Europe at that time possessed no universally accepted principles, also became acute. After the long period of Turkish rule in the 16th and 17th centuries, the diminished ranks of the Hungarians had been replaced in many parts of the country by Germans, Serbs, Rumanians and Slovaks, who were encouraged, and in some cases introduced, by the Viennese Government. In earlier times there was no linguistic struggle, the official language being the neutral one of Latin. Only when, in the age of national reforms, the first half of the 19th century, the Magyar language was, in the struggle against the Government in Vienna, made the official language of Hungary, did the other nations, whose own cultural development was just beginning, feel themselves put at a disadvantage. After 1849 the absolutist Government introduced German as the official language, this being again replaced by Magyar in 1867. To protect the interests of the other nationalities, Deák and Baron Eötvös, the minister of education, a humanist philosopher, brought in Law 44, 1868, on "national equality," which ensured persons of language other than Magyar the use of their own language in justice and administration, allowed any language desired by one-fifth of the persons present to be used in the protocols of county and city meetings, and left all persons full liberty to use any language they wished in such meetings. Later, the county representative bodies usually allowed languages other than Magyar to be used only when 50% of those present were non-Magyars; and this led to continual complaints from the Slovak, Rumanian and Serb deputies. The Government was also obliged by law to provide facilities for any person, in any part of Hungary, to receive secondary education in his mother tongue, and also allowed communities, churches and individuals to found and maintain schools, which received equality of status with the State schools. Under this law the Rumanians had six secondary and 2,870 primary schools, which were maintained by the Rumanian Church with State assistance. Of the 16,929 primary schools in Hungary in 1913, 3,970 gave instruction in language other than Magyar; the figures for secondary schools being 215 and 17 respectively. In 1913–14 the Hungarian State paid 3,041,861 crowns to the schools giving instruction in a language other than Magyar. The State, however, thinking primary schools the best means of propagating the Magyar language, established these mostly in the non-Magyar districts, and neglected education in the essentially Magyar Alföld. The new middle classes of non-Magyar nationality which issued from these State schools grew increasingly ambitious of political power. Their leaders were inspired by the example of Austria, where the general suffrage had broken the supremacy of the Germans, and everything was tending towards a federative system with a Slavonic majority. These ambitions were encouraged by the heir

to the throne, the archduke Francis Ferdinand (*q.v.*), whose interest in the unity of the army also led him to wish to break the supremacy of the Magyars. He advocated replacing Dualism by Trialism, creating a third Slavonic State out of the southern Serbo-Croat parts of Austria and Hungary, with Bosnia, and thus putting Hungary in a minority of 1:2. The situation was further complicated by the irredentist agitation conducted by the fellow-countrymen beyond the frontier of the various nationalities (*e.g.*, the Marmaros trial in 1911 respecting Ruthenian irredenta, supported by Russia; the Klausenburg Memorandum trial of 1893 against Rumanian irredentists; the attempt on the life of the Hungarian bishop in Debrecin, Feb. 1914, etc.). The main object of the Government was the preservation of the old frontiers against such endeavours, and even Count Tisza, who in his second term of office made several attempts to reach an understanding with the nationalities, especially the Rumanians, was obliged to the last to oppose general suffrage, because he feared that it would have meant the supremacy of the nationalities, assisted by the Hungarian Socialists (the Magyars numbered 54·5% of the total population), and therewith a federalization of the State. To prevent this, the abortive Andrássy draft of 1908 had attempted to combine general franchise with plural voting for the educated classes.

THE WORLD WAR AND AFTER

The World War found Hungary in the throes of a parliamentary struggle conducted by all shades of the opposition, from Albert Apponyi to Michael Károlyi, against Tisza's attempt, supported by the Crown, to maintain the Compromise intact. Tisza's voice was the only one raised in the Crown councils of July 7 and 19, 1914, after the murder of the heir to the throne, against war and for giving the ultimatum to Serbia such a form as to make the avoidance of war possible. When on the death of Francis Joseph (Nov. 21, 1916), the archduke Charles succeeded him as Charles IV. of Hungary, Tisza's obstinate fidelity to the prosecution of the war at Germany's side displeased the new sovereign. At the outbreak of the war, the parties of the Opposition had sworn a Truce of God; but by 1917 they had forgotten it. Losses, privations and increasing food shortage, together with the absence of any prospect of final victory held out by the Austrian and German generals, kept the population in continuous unrest. On April 25, 1917, the Socialists, Károlyi's party and Jászi's Radicals, founded the Democratic Electoral Bloc. Charles called on Tisza to submit a draft for an extension of the suffrage, whereupon Tisza resigned. The cabinets of Count Maurice Ezterházy (June 15–Aug. 20, 1917) and Alexander Wekerle (Aug. 20, 1917–Oct. 31, 1918) attempted, without real success, to meet the increasing desire for a division of the common institutions of 1867, especially of the army, which was still under Austrian leadership. The nationalist discontent was accompanied by agitation for general suffrage, largely due to the propaganda of Jászi's Radicals, which, after Tisza's fall, was subject to no restraint. In the last two years of the World War, while every able-bodied young man was at the front, these questions of internal politics were debated violently behind the front and in parliament, and the masses, especially in the capital, moved further to the left than they had in the preceding 50 years.

Revolution and Armistice.—After the capitulation of Bulgaria (Sept. 29, 1918), the failure of the Piave offensive (where 46% of the troops engaged were Magyar), and the collapse on the German eastern front, the leaders of the Government, civil and military, abandoned their resistance. On Oct. 25 a "National Council" was formed out of bourgeois Radicals, under the presidency of Michael Károlyi, with the programme of dissolving parliament, introducing general suffrage and concluding a speedy peace. Popular demonstrations demanded a Károlyi Government. The archduke Joseph, whom the king appointed to clear up the situation, gave the minister-presidency to Count John Hadik, who was, however, unable to prevent the National Council, assisted by a few companies of mutinous troops, from occupying the municipal Government of Budapest on Oct. 30 and 31. The military authorities allowed no bloodshed. The king appointed Károlyi minister-president; Jászi and several Socialists entered the cabinet. On Oct. 31 Tisza was murdered in his villa; the Government failed to bring the murderers to justice. Councils of soldiers, students, workmen and peasants, on the Russian model, formed themselves in the Magyar districts, while farther out, Slovak, Rumanian, Croat and Serb National Councils were formed, and took over the administration of the districts concerned. Károlyi's Government hoped by its pacifist attitude to buy peace on all fronts; it disarmed the soldiers returning from the Italian and Russian fronts, and the minister of war, Bela Linder, declared: "I wish to see no soldiers." Jászi negotiated with the Slovak National Councils, whom he hoped to induce to accept a division of Hungary by cantons, on the Swiss model, although they had already joined themselves with the newly-constituted Czech Government and the advancing Rumanian army. The Rumanian, Serb and Czech forces, although quite weak, occupied the frontier districts deep into the solid Magyar territories; the army under the German field-marshal, Mackensen, who had been commanding on the Balkan front, was forbidden to return through Hungary, and Mackensen was himself arrested, to prove that Hungary had abandoned the German alliance. On Nov. 8 Károlyi and Jászi were obliged by General Franchet d'Esperay, at the armistice of Belgrade, to accept the *de facto* occupation of these territories.

The Hungarian Republic.—On Nov. 13 Charles IV., in a proclamation issued from Eckartsau, renounced "participation in the conduct of State affairs"; on Nov. 16 the National Council proclaimed the "Hungarian People's Republic" and dissolved both houses of Parliament. On Nov. 19 Bela Kun (*q.v.*), a former insurance agent, arrived from captivity in Russia, on a forged passport, with the intention of organizing a revolution of the proletariat on the Bolshevik model. The October revolution was the work of the radical bourgeoisie and the industrial workmen; the former, however, had no following among the masses, and soon lost their leading rôle in the cabinet, as leader of which Károlyi, as president of the State, had appointed Dionys Berinkey. The Government possessed no armed forces, and its bourgeois ministers of war, who wished to reorganize the troops still available, were chased out, one after the other, by street demonstrations of the Soldiers' Councils, which were already organized on Bolshevik lines. The impotence of the bourgeois parties gave full scope to the single compactly-organized force in the country—that of the socialistic industrial labourers. Their leaders used their position in the Government to force all State employees into the Marxist trade unions, the membership figures of which rose in October from 251,000 to 721,000, and to 1,500,000 in the first half of 1919. The offices of several bourgeois newspapers were wrecked by the Socialists, so that after a few months it looked as though the urban populations could oppose no resistance to a purely socialistic Government. It was hoped to win over the peasants in the country by promises of agrarian reform, and a mortgaged estate of Count Károlyi's was distributed among them; but this had little effect on the peasants, so that the Government did not venture to introduce general suffrage—the main point in the programme of the National Council—or hold any elections.

Socialist-Communist Alliance.—The Socialists hoped that this anarchy would establish their own power; but this was challenged by the Bolsheviks under Kun, who, assisted by the Soldiers' Council, won over the remaining troops, and on Feb. 20, 1919, attacked the buildings of the Socialist newspaper, killing seven police and injuring 80. The Government, on the insistence of the bourgeoisie, had Kun arrested; but the Socialist leaders realized the strength of the Communist agitation. When, then, the nationalist bourgeoisie and peasants saw that the pacifist attitude of the Government bore no fruit with the Entente, and that Col. Vyx, representing the Entente in Budapest, allowed the Czechs, Serbs and Rumanians to cross the line of demarcation and occupy further portions of Hungarian territory, the bourgeois politicians whom the National Council had thrust aside began to bestir themselves again to organize their forces against further foreign occupation and internal anarchy. In view of this danger the Socialists found it necessary to ally themselves with the

Bolsheviks. The occasion was Col. Vyx's Note of March 20, which allowed the Rumanians to occupy a further 2,000sq.km. of Hungarian territory. It seemed probable that the country would revolt against this demand and overthrow the "pacifist" Government. Károlyi accordingly resigned the presidency on the 21st, and the Socialist minister of education in his cabinet, Sigmund Kunfi, went to Kun in prison and concluded an agreement with him whereby the Socialists and Communists were to take over the power jointly and establish the Soviet Republic of Hungary. The whole Social Democratic Party united *en bloc* with the Communists. Pending the decision of the Third International, the new party was styled the "Socialist Party of Hungary"; it was to take over the power at once in the name of the proletariat; the dictatorship was to be wielded by the Workmen's, Soldiers' and Peasants' Councils; immediate steps were to be taken to organize a "class army" and disarm the bourgeoisie; a reign of terror was to be proclaimed to ensure the rule of the proletariat; and a close military and spiritual alliance made with the Russian Soviet Government.

The Soviet Republic.—The power was taken over from Karolyi, by agreement with the latter, on the night of March 21, with the help of the Marxist workmen. Alexander Garbai, a mason, became president of the Soviet State, but the real ruler was Kun, who acted as people's commissary for foreign affairs. Of the 11 people's commissaries eight were Jews, and the local representatives of the Soviet were also largely Jews; this fact was largely responsible for the subsequent outbreak of anti-Semitism in Hungary. The introduction of Communism embittered all sections of the population except the industrial labourers; on the first day of the Soviet régime all businesses and houses in the towns were confiscated as communal property, and the merchants forced to sell their stocks on credit for the Government, which, however, gave them no new supplies. Trade was declared a State monopoly; but the State had no apparatus ready, so that all forms of purchase and sale died after a few weeks. All banks were expropriated, their depots looted, as were rich residences. The factories were obliged to close down for lack of raw materials, and the workmen transferred to the Red Army. Intellectual workers were organized by the State in unions; writers were paid by the State and forced to work at its orders. All bourgeois newspapers were stopped; only Communist pamphlets were allowed to appear. The chief danger for the Soviet lay in the peasants, who ceased supplying the towns with foodstuffs, and, although the large estates had been expropriated on paper, supported the counter-revolution and made several local risings. To repress these, the Government founded a special corps, the "Lenin-boys," of released convicts, and sent armoured trains into the rebellious districts. The number of murders committed by these terrorists was 585, not counting isolated murders committed by local "revolutionary tribunals." Leading bourgeois politicians were arrested as hostages; in Budapest alone, 481. Many of them fled to Szeged, which was occupied by the French, or to Vienna. To divert the bitterness from himself, Kun sent the Red Army against the Czechs, and drove them out of Kaschau and the surrounding district. On Clemenceau's protest of June 8, however, he withdrew the troops, and on June 13 actually recognized the cession of the northern part of Hungary. The demoralized Red troops were sent on July 20 against the Rumanians. The more patriotic among them, however, deserted home, and the Rumanians began to advance over the Theiss towards Budapest. The Soviet Government, threatened at once by the Rumanians and the counter-revolution, resigned on Aug. 1. Kun, with most of the people's commissaries, fled to Vienna, whence they were presently sent to Russia via Germany.

Rumanian Occupation.—After Kun's flight, it was hard to form a Government. Peidl's purely Socialist Government, which succeeded Kun, was overthrown by some counter-revolutionaries on Aug. 7, who then elected the archduke Joseph governor, while he entrusted them with the Government (Friedrich Government). As the Rumanians had occupied Budapest since Aug. 4, cutting off all communications with the rest of Hungary, this Government was quite powerless, and the archduke was forced by the Entente to retire. While this situation reigned, the Bolshevik officials were expelled in the country districts, without the control of the State authority. A counter-revolutionary Government with a small army had been formed in Szeged during the Bolshevik period, but was unable to come to Budapest on account of the Rumanian troops of occupation. The Rumanians requisitioned army supplies from the occupied districts, and when they retired behind the Theiss on Nov. 14, they took with them live-stock, rolling stock, industrial machinery, and even typewriters from the Government offices, to the total value, as estimated by the Entente commissioner, Col. Loree, of £3,750,000. Four Entente generals were sent to Budapest to protect the Hungarians against injustice. On the departure of the Rumanians, Sir George Clerk, representing the Entente, demanded a cabinet composed of representatives of all parties, and Charles Huszar replaced Friedrich as minister-president (Nov. 25, 1919–March 15, 1920).

Establishment of the Counter-revolution.—The Szegedin army under vice-admiral Nicholas Horthy (*q.v.*) was now able to come to Budapest. Elections were held, on the basis of general, secret suffrage, for a new National Assembly, to sit for two years and restore order after the revolutions. The elections of Jan. 25, 1920, brought a Conservative, Christian, and partly anti-Semite majority, which included many representatives of the peasants. By Art. 1 of 1920 the National Assembly restored the legal continuity of the Constitution, and also formally dissolved the link with Austria; by Art. 45 of 1921 Hungary was proclaimed to be still a kingdom, but the decision respecting the execution of the sovereign power was postponed to a later date, Admiral Horthy, commander-in-chief of the national forces, being elected regent on March 1, 1920.

The first three ministries, those of Huszar, of Alexander Simonyi-Semadam (March 15–July 19, 1920) and of Count Paul Teleki (July 19, 1920–April 14, 1921), had to face many difficulties at home and abroad. At home the reaction and revenge against the Communist régime led to excesses. "Detachments," led by officers, executed Communists without judicial authority; these illegal bodies had to be dissolved by the Government with the help of the police and national army. The victims of this counter-revolutionary persecution numbered 307. These excesses were exploited by Jászi's Octobrists and Kunfi's Social Communists, most of whom had fled to Vienna, as a "White terror"; and the Amsterdam International, at the instance of the Austrian Socialists, proclaimed a boycott against Hungary (June 20–July 3, 1920), but with no great effect. The National Assembly also accepted the Treaty of Trianon, which the Hungarian delegation had had to sign on June 4, 1920, without obtaining a discussion of it with the Entente Powers. The treaty took from Hungary, and gave to her neighbours, 192,000 sq.km. of her area of 283,000; 10,782,000 of her population of 20,886,487, and 30%, or 3,300,000, of the 9,945,000 pure Magyars. The neighbour States expelled to Hungary in all 30,000 of these Hungarians, mostly officials and intellectuals, with their families. They returned without homes or situations, increased the unrest in Hungary, and involved the State in much expense. The peasants were quieted by the agrarian reform (Art. 36 of 1920) carried through by Stephen Szabó-Nagyatád, himself a small peasant, and minister of agriculture in Teleki's cabinet. This measure made 1,300,000 "joch" available for the landless peasants, and provided them with the land for 250,000 houses. The universal impoverishment under the heavy financial conditions of the reparations clauses of the Treaty of Trianon could not, however, be averted. At the end of the Bolshevik period the Hungarian crown stood at 80% under par; after the peace treaty it fell to 0·0003, while the rate for loans rose to 40–50% per mensem. Speculation was rife. No efforts of the successive finance ministers, neither the stamping of the currency notes—a measure taken to avoid a further inflation—nor the sequestration of 20% of the cash deposits of the shares and 17% of the larger estates, could remedy the situation. Trade and industry stagnated, Hungary's neighbours who, with the exception of Austria, had constituted themselves as the "Little Entente," imposed frontier restrictions and threatened on several occasions to re-occupy Hungarian territory, *e.g.*, on the two occasions

(March 7 and Oct. 29, 1921) when King Charles returned to Hungary. On each occasion Charles called on the Ministry and the regent to hand over the power to him. On his second return he appointed a ministry of his own, but was defeated at Buda-örs by Government troops and sent to Madeira by order of the Entente. After the second attempt the National Assembly was obliged, at the wish of the Entente Powers and by an ultimatum from the Czechoslovak foreign minister, dated Oct. 30, to declare the Habsburgs to have forfeited the throne (Law 47 of 1921). The question of the sovereign's person was postponed till a later date. Relations with Austria were troubled by the fact that the Treaty of Trianon ceded to that Power the western portion of Hungary; but the Austrian occupation was prevented by irregular detachments, consisting mostly of refugees from the States of the Little Entente. The Protocol of Venice (Oct. 12, 1921) finally provided for a plebiscite in the town and district of Sopron (Oedenburg). As this went in Hungary's favour, the districts where it was taken were not ceded to Austria. (*See* BURGENLAND.)

The Bethlen Cabinet.—The consolidation of the internal and foreign situation was due to the cabinet of Count Stephen Bethlen (*q.v.*), who succeeded Teleki on April 14, 1921. Bethlen succeeded in composing a working majority, the "Party of Unity," out of the small agriculturalists, reinforced by intellectuals, large proprietors, and commercial circles. With this party, Bethlen commanded the second National Assembly (June 1922–Nov. 1926). He restored the second chamber by Laws 26 of 1925 and 22 of 1926, abolishing secret ballot for the lower house, except in the towns. In the upper house Bethlen reduced the magnates' representatives to 38, 40 being elected by corporations, 76 by the towns and counties, and 40 nominated by the Government. In the lower house of the new parliament, which met on Jan. 25, 1927, Bethlen's party received 79% of the total mandates. With this powerful majority he liquidated the last counter-revolutionary movements, and excluded a few extreme nationalist deputies from his party. These persons, led by Prince Louis Windischgrätz, were prosecuted for forging French francs for irredentist purposes, and condemned on May 28, 1926, to long terms of imprisonment.

Economic Reconstruction.—The internal political situation consolidated, it was possible to carry through the financial reconstruction of Hungary with the help of the League of Nations. (*See* section *Economy and Finance.*) Even after this, however, the economic situation remained difficult. The State was obliged to maintain many thousands of refugees, housing was still in arrears, industry, cut off from its markets and sources of supply, had to readapt itself. In social legislation, Hungary remodelled her workmen's insurance, prepared old age insurance for all workmen and employees, and founded several hundred scholarships for students entered at foreign universities.

The economic situation could not really improve until the many import and export restrictions, passport difficulties and tariff barriers of Central Europe were abolished. Hungary's relations with her neighbours were also clouded by the question of her minorities within their frontiers; in the case of the optants in Transylvania (*q.v.*) she appealed to the League of Nations. In other respects Hungary, as a member of the League of Nations, had concluded a network of commercial and other treaties, and recovered her place in the European system.

The chief difficulty lay in the establishment of more cordial relations with the States of the "Little Entente," whose primary purpose was the maintenance intact of the provisions of the Treaty of Trianon, while Hungarian public opinion demanded its revision, in view of the attribution by it of various districts with Magyar majorities to Hungary's neighbours, and the sometimes insufficient protection accorded to these minorities. Hungary concluded treaties of friendship with Turkey (Dec. 18, 1923); with the United States (June 24, 1925) and with Italy (April 5, 1927), the last-named being also an arbitration treaty. Further arbitration treaties were concluded with Austria (April 10, 1923) and Switzerland (June 18, 1924). Friendly relations with Italy were cemented by several ministerial visits, the Bethlen Ministry in particular stressing the importance of this relationship.

BIBLIOGRAPHY.—(*a*) Sources: The oldest Hungarian document dates from 1101 (the foundation by St. Stephen of the Abbey of Pannonhalma-Szent Martin). The oldest narrative is the *Gesta Hungarorum* (12th century). The best of the many collections of documents is that issued by the Hungarian Academy of Sciences (114 vols.). More recent documents, from the archives in Budapest and Vienna, are issued by the Hungarian Historical Society. (*b*) Works: Most works on Hungarian history, since the 16th century, are in Magyar, but important works appeared in Latin in the 18th century, *e.g.*, Katona's *Historia critica regum Hungariae* (42 vols., 1779–1810). The *Bibliographia Hungarica,* vols. i.–iii., issued by the Hungarian Institute at the University of Berlin, gives a list of works on Hungary in languages other than Magyar. Among modern works, *see* H. Marczali, *Ungarische Verfassungsgeschichte* (Tübingen, 1910) and *Hungary in the 18th Century* (trans. A. B. Yolland, 1910); A. B. Yolland, *Hungary* (1917); J. Szekfü, *Der Staat Ungarn* (Stuttgart, Berlin, 1918); L. Büday, *Dismembered Hungary* (1922) (statistics on the effects of the Treaty of Trianon); Count Paul Teleki, *The Evolution of Hungary* (Williamstown, 1923, bibl.); A. Domanovsky, *Die Geschichte Ungarns* (Munich, 1923) (latest full account); M. Károlyi, *Fighting the World; the Struggle for Peace* (1924); O. Jászi, *Revolution and Counter-revolution in Hungary* (1924) (these two works put the case for the Socialists and Democrats); F. Eckhart, *Introduction à l'histoire hongroise* (1928); current numbers of the *Ungarische Jahrbücher* (Berlin, quarterly, 1921 *seq.*) and the *Revue des Etudes hongroises et finno-ougriennes* (1923 *seq.*). (J. Sz.)

HUNGER and **THIRST** are highly unpleasant sensations which arise when there is bodily need for food and water. Both hunger and thirst should be sharply distinguished from appetite, a desire for food or drink which past experience has proved to be pleasant. Commonly the requirements of the body are provided by regular meals, tempting the appetite, and only when these fail do hunger and thirst appear. Appetite may be regarded as a primary and hunger and thirst as a secondary defence against the dangers of a serious reduction of the food and water supplies in the body.

Hunger has been described as an ache or uncomfortable pang or gnawing sensation, usually localized in the lower chest or upper abdomen. Associated with this central core of feeling there may be lassitude, drowsiness, faintness, headache, irritability and restlessness, in various degrees and combinations. Two views regarding the nature of hunger have been advocated: (1) that it is a "general sensation," and (2) that it has a local origin.

The idea that hunger is a general sensation is based on the assumption that as the food supplies of the body decrease, nerve cells in the brain are stimulated directly by the impoverished blood, and the sensation results. The body's food supplies may be greatly reduced, however, as in starvation, without the sensation of hunger. And after eating, the hunger pangs cease long before food can be digested and absorbed into the blood stream. Furthermore, the pangs can be temporarily suppressed by swallowing indigestible materials. These facts indicate that the sensation is not due directly to lack of nutriment. Again, hunger pangs are known to be intermittent, lasting between a half-minute and a minute, reappearing after the lapse of approximately another minute, and so forth; there is no evidence that the bodily supplies are intermittently deficient. Finally, the idea that hunger is a general sensation fails to account for the common reference to the stomach region as its place of origin.

The theory that hunger is of local origin has been supported by the discovery that the empty or nearly empty stomach contracts at fairly regular intervals and that after the start of each contraction a hunger pang is experienced. The activity of the empty stomach occurs in cycles. It begins with occasional weak single contractions lasting about 30 seconds; they may fade out or they may become more vigorous and appear at shorter intervals, accompanied by increased tonus of the gastric muscle; the tonus may develop into a cramp-like state. Not only are the single contractions associated with hunger pangs, but the cramp-like state is associated with a continuous ache or gnawing sensation. After such a cycle the stomach relaxes and is inactive for a time; but after a rest the same phenomena are repeated. Examination of the stomach by means of the X-rays has shown that the essential change underlying the hunger pang is a strong contraction of the encircling muscles of the lower third of the stomach. There is evidence of simultaneous contractions of the small intestine, but little attention has been paid to them.

The hunger contractions occur during sleep. They are stopped by chewing and temporarily by swallowing. They cease during intense emotional states such as joy, fear and anger. They are weakened and may be completely abolished by smoking, the effects apparently varying with the "strength" of the tobacco. They may be banished for ten or 15 minutes by pulling a belt tightly about the waist. Very vigorous muscular exercise inhibits the contractions, but after the exercise they may be more intense than before. They persist after the stomach has been disconnected from the central nervous system and are therefore an inherent feature of that organ.

Although hunger pangs are due to strong gastric contractions, these pangs, like other sensations, are modified in their relative intensity by other conditions. Thus, the sensations of hunger may be absent in fever or during prolonged starvation, although the contractions are going on. On the other hand, the sensations may be especially strong if they receive attention.

The conditions for the occurrence of hunger contractions are not yet clearly understood. When the sugar concentration in the circulating blood is reduced about 25%, hunger contractions increase. If the blood-sugar level is raised, they cease. They may be related, therefore, to need for the most generally useful energy-yielding material in the body, viz., glucose.

Thirst.—The sensation of thirst centres about a disagreeable dryness and stickiness of the inner surfaces of the mouth and throat, especially the palate. When thirst is marked, food cannot be chewed and swallowed and even sugar does not dissolve on the tongue.

Conditions which dry the mouth and throat arouse the sensation. Breathing hot dry air, prolonged speaking and singing, repeated chewing of desiccated food, the lessening of salivary secretion by fear and anxiety are all attended by thirst. Also losses of fluid from the body—as in sweating, diarrhoea, haemorrhage and lactation—give rise to the same sensation. Both local and general causes of thirst have been recognized, therefore, and correspondingly it has been explained, like hunger, as a local and as a general sensation.

Thirst is explained as a general sensation by the more concentrated state of the blood after prolonged deprivation of water. Thirst becomes prominent, however, before any change in the blood is demonstrable. Another argument for the general sensation is that if swallowed water is lost through a gastric fistula, it does not satisfy and drinking continues; but if the fistula is closed, a single drink soon assuages the desire for more. This is not a conclusive argument, however, because water retained in the body may moisten the mouth and thereby abolish the local unpleasant dryness.

A theory that thirst has a local origin is based on the biological consideration that it would first be manifest in air-inhabiting animals, exposed to loss of water from the body. Air when breathed moves across a region of the throat likely to be readily dried because lined with flat cells and provided with relatively few glands. A new feature in air-inhabiting animals are the salivary glands. Interestingly enough these glands are either absent or rudimentary in mammalian forms (cetacea) which have returned to an aquatic existence. The presence or absence of salivary glands in large groups of animals, corresponding to exposure or non-exposure of the mouth to desiccating air, indicates that their function is to protect the mouth and throat against drying. This idea is confirmed by the reflex flow of saliva which occurs when the mouth tends to dry. Saliva consists of about 99% water. If the body is not supplied with water the blood is long maintained in an unchanged state by a withdrawal of water from storage in muscles, glands and skin. The salivary glands suffer along with the other structures, but since they need water for their service they are peculiarly affected by the withdrawal. They cannot secrete adequately, therefore the mouth dries, and the unpleasant sensation of dryness and stickiness (thirst) results.

The theory that the salivary glands act as sensitive indicators of bodily need for water because they serve to keep the mouth and throat moist and because they require water to perform that function, receives support from a number of experiments. Atropine, which stops salivary secretion without lessening the water content of the blood, brings on marked thirst. Animals with the ducts of the salivary tied drink almost incessantly. Finally, water lack results in a gradually lessened flow of saliva under equal stimulations, and the drinking of water restores the original flow. Thus the evidence that thirst is a general sensation can be simply explained in terms of the local service of the salivary glands.

It is possible that the sensation of thirst may be stimulated in the course of the nerve paths from mouth and throat to the cerebral cortex. Certainly very slight injuries of the base of the brain below the optic thalamus cause insatiable thirst and the drinking of enormous amounts of water. This is characteristic of the disease diabetes insipidus The relation of such pathological states to physiological thirst is still obscure.

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HUNGERFORD, WALTER HUNGERFORD, BARON (d. 1449), English soldier, belonged to a Wiltshire family. His father, Sir Thomas Hungerford (d. 1398), became speaker of the House of Commons in 1377, through the influence of John of Gaunt, and is the first person formally mentioned in the rolls of parliament as holding the office. Walter Hungerford also served as speaker. He fought at Agincourt and was an envoy at the council of Constance and the congress of Arras. An executor of Henry V.'s will and a member of the council under Henry VI., Hungerford became a baron in 1426, and he was lord treasurer from 1426 to 1431.

HUNGERFORD, a town of Berkshire, England, extending into Wiltshire, 61 m W. by S of London by rail. Pop. (1921) 2,784. It is situated in the valley of the Kennet and lies on the Kennet and Avon canal. It has agricultural trade. John of Gaunt, duke of Lancaster, presented to the citizens manorial rights, including common pasture and fishing. The trout of the Kennet are numerous and carefully preserved. Hungerford is also a favourite hunting centre.

HUNINGUE (HÜNINGEN), a town of France, department of Haut-Rhin (Alsace), on the left bank of the Rhine and a branch of the Rhine-Rhone canal, 3 m. N. of Basle by rail. Pop. (1926), 3,685. The town grew round a fortress at a Rhine crossing. The duke of Lauenburg took it from the Imperialists in 1634 and Louis XIV. of France later bought it. Vauban fortified it (1679–81) and a Rhine bridge was then built. The fortress was dismantled after 1815. The town makes chemicals, molasses, watches and cigars.

HUNNERIC (d. 484), king of the Vandals, was a son of King Gaiseric, and was sent to Italy as a hostage in 435 when his father made a treaty with the emperor Valentinian III. After his return to the Vandal court at Carthage, he married a daughter of Theodoric I., king of the Visigoths; but when this princess was suspected of attempting to poison her father-in-law, she was mutilated and was sent back to Europe. Hunneric became king of the Vandals on his father's death in 477. Like Gaiseric he was an Arian, and his reign is chiefly memorable for his cruel persecution of members of the orthodox Christian Church in his dominions. Hunneric's second wife was Eudocia, a daughter of Valentinian III. and his wife Eudocia. (*See* VANDALS.)

HUNNIS, WILLIAM (d. 1597), English musician and poet, was as early as 1549 in the service of William Herbert, afterwards earl of Pembroke. In 1550 he published *Certayne Psalms . . . in Englishe metre,* and shortly afterwards was made a gentleman of the Chapel Royal. During the reign of Mary he was implicated in plots against the queen, and was imprisoned for some time. In 1566 he was made Master of the children of the Chapel Royal. No complete piece of his is extant, perhaps because of the rule that the plays acted by the children should not have been previously printed. In his later years he purchased land at Barking.

Hunnis's extant works include *Certayne Psalms* (1549), *A Hive full of Hunnye* (1578), *Seven Sobbes of a sorrowful Soule for Sinne* (1583), *Hunnies Recreations* (1588), 16 poems in the *Paradise of Dainty Devices* (1576), and two in *England's Helicon* (1600). *See* Mrs. C. Carmichael Stopes's tract on William Hunnis, reprinted (1892)

from the *Jahrbuch der deutschen Shakespeare Gesellschaft.*

HUNS, a name given to at least four peoples, whose identity remains obscure. (1) The Huns, who invaded the East Roman empire from about A.D. 372 to 453 and were most formidable under the leadership of Attila. (2) The Hungarians or Magyars who crossed the Carpathians into Hungary in A.D. 898 and mingled with the races they found there. (3) The White Huns (Λευκοὶ Οὖννοι or Ephthalites *q.v.*), who troubled the Persian empire from about 420 to 557 and were known to the Byzantines. (4) The Hûnas, who invaded India during the same period. It is most probable that the last two are identical and although it cannot be proved that the Magyars are descended from the horde which sent forth the Huns in the 4th century, it is possible that they were originally Ephthalites. Our present knowledge of the history and distribution of the Huns tends to support this view. In the 1st century A.D. the Chinese drove the Hiung-nu westward, and while one division of the Huns remained in Transoxiana and Afghanistan, another pushed further west and rested near the southern Urals. From this point the Huns invaded Europe, and when their power collapsed, after the death of Attila, many of them may have returned to their original haunts. Possibly the Bulgarians and Khazars were offshoots of the same horde. The Magyars may very well have gradually spread first to the Don and then beyond it, until in the 9th century they entered Hungary. Authorities are not even agreed as to the branch of the Turanians to which the Huns should be referred; the physical characteristics of these nomad armies were very variable and there is no certain ethnic or linguistic identification. Hiung-nu seems not to be a particular but a general term for warlike nomads. The warlike and vigorous temper of the Huns has led many writers to regard them as Turks. The Turks were perhaps not distinguished by name or institutions from other tribes before the 5th century, but the Huns may have been an earlier offshoot of the same stock. Apart from this the Hungarians may have received an infusion of Turkish blood not only from the Osmanlis but from the Kumans and other tribes who settled in the country.

History.—The authentic history of the Huns in Europe practically begins about the year A.D. 372, when under a leader named Balamir (or, according to some mss. Balamber) they began a westward movement from their settlements in the steppes lying to the north of the Caspian. After crushing, or compelling the alliance of various nations unknown to fame (Alpilzuri, Alcidzuri, Himari, Tuncarsi, Boisci), they at length reached the Alani, a powerful nation which had its seat between the Volga and the Don; these also, after a struggle, they defeated and finally enlisted in their service. They then proceeded, in 374, to invade the empire of the Ostrogoths (Greutungi), ruled over by the aged Ermanaric, or Hermanric, who died (perhaps by his own hand) while the critical attack was still impending. Under his son Hunimund a section of his subjects promptly made a humiliating peace; under Withemir (Winithar), however, who succeeded him in the larger part of his dominions, an armed resistance was organized; but it resulted only in repeated defeat, and finally in the death of the king. The representatives of his son Witheric put an end to the conflict by accepting the condition of vassalage. Balamir now directed his victorious arms still farther westward against that portion of the Visigothic nation (or Tervingi) which acknowledged the authority of Athanaric. The latter entrenched himself on the frontier which had separated him from the Ostrogoths, behind the "Greutung-rampart" and the Dniester; but he was surprised by the enemy, who forded the river in the night, fell suddenly upon his camp, and compelled him to abandon his position. Athanaric next attempted to establish himself in the territory between the Pruth and the Danube, and with this object set about heightening the old Roman wall which Trajan had erected in the north-eastern Dacia; before his fortifications, however, were complete, the Huns were again upon him, and without a battle he was forced to retreat to the Danube. The remainder of the Visigoths, under Alavivus and Fritigern, now began to seek, and ultimately were successful in obtaining (376), the permission of the emperor Valens to settle in Thrace; Athanaric meanwhile took refuge in Transylvania, thus abandoning the field without any serious struggle to the irresistible Huns. For more than fifty years the Roman world was undisturbed by any aggressive act on the part of the new invaders, who contented themselves with over-powering various tribes which lived to the north of the Danube. In some instances, in fact, the Huns lent their aid to the Romans against third parties; thus in 404–405 certain Hunnic tribes, under a chief or king named Uldin, assisted Honorius in the struggle with Radagaisus (Ratigar) and his Ostrogoths, and took a prominent part in the decisive battle fought in the neighbourhood of Florence. Once indeed, in 400, they are said to have crossed the Danube and invaded Bulgaria under perhaps the same chief (Uldin), but extensive desertions soon compelled a retreat.

About the year 432 a Hunnic king, Ruas or Rugulas, made himself of such importance that he received from Theodosius II. an annual stipend or tribute of 350 pounds of gold (£14,000), along with the rank of Roman general. Quarrels soon arose, partly out of the circumstance that the Romans had sought to make alliances with certain Danubian tribes which Ruas chose to regard as properly subject to himself, partly also because some of the undoubted subjects of the Hun had found refuge on Roman territory; and Theodosius, in reply to an indignant and insulting message which he had received about this cause of dispute, was preparing to send off a special embassy when tidings arrived that Ruas was dead and that he had been succeeded in his kingdom by Attila and Bleda, the two sons of his brother Mundzuk (433). Shortly afterwards the treaty of Margus (not far from the modern Belgrade) was ratified; this treaty provided for Roman tribute to Attila, the surrender of fugitives, the institution of free markets and regulations as to alliances with other powers. The Romans held to the treaty and during the ensuing eight years the Huns made their extensive conquests in Scythia, Media and Persia.

In 445 Bleda died, and two years afterwards Attila, now sole ruler, undertook one of his most important expeditions against the Eastern empire; on this occasion he pushed southwards as far as Thermopylae, Gallipoli and the walls of Constantinople; peace was cheaply purchased by tripling the yearly tribute (which accordingly now stood at 2,100 pounds of gold, or £84,000 sterling) and by the payment of a heavy indemnity. In 448 again occurred various diplomatic negotiations, and especially the embassy of Maximinus, of which many curious details have been recorded by Priscus his companion. Then followed, in 451, that westward movement across the Rhine which was only arrested at last, with terrible slaughter, on the Catalaunian plains (according to common belief, in the neighbourhood of the modern Châlons, but more probably at a point some 50m. to the south-east, near Mery-sur-Seine). The following year (452) that of the Italian campaign, was marked by such events as the sack of Aquileia, the destruction of the cities of Venetia, and that historical interview with Pope Leo I. which resulted in the return of Attila to Pannonia, where in 453 he died (*see* ATTILA). Almost immediately afterwards the empire he had amassed rather than consolidated fell to pieces. His too numerous sons began to quarrel about their inheritance, while Ardaric, the king of the Gepidae, was placing himself at the head of a general revolt of the dependent nations. The inevitable struggle came to a crisis near the river Netad in Pannonia, in a battle in which 30,000 of the Huns and their confederates, including Ellak, Attila's eldest son, were slain. The nation, thus broken, rapidly dispersed, exactly as the White Huns did after a similar defeat about a hundred years later. One horde settled under Roman protection in Little Scythia (the Dobruja), and others in Dacia Ripensis (on the confines of Serbia and Bulgaria) or on the southern borders of Pannonia. Many, however, appear to have returned to what is now South Russia, and may perhaps have taken part in the ethnical combinations which produced the Bulgarians.

The chief original authorities are Ammianus Marcellinus, Priscus, Jordanes, Procopius, Sidonius Apollinaris and Menander Protector.

See also Gibbon, *Decline and Fall of the Roman Empire;* H. H. Howorth, *History of the Mongols* (1876–88); J. B. Bury, *History of the Later Roman Empire* (1889); J. Hodgkin, *Italy and her Invaders* (1892); E. H. Parker, *A Thousand Years of the Tartars* (1905).
(C. El; A. N. J. W.)

HUNSDON, HENRY CAREY, 1ST BARON (*c.* 1524–1596), English soldier and courtier, was a son of William Carey (d. 1529); his mother was Mary (d. 1543), a sister of Anne Boleyn, and he was consequently cousin to Queen Elizabeth. Member of parliament for Buckingham under Edward VI. and Mary, he was knighted in 1558, was created Baron Hunsdon in 1559, and in 1561 became a privy councillor and a knight of the Garter. In 1568 he became governor of Berwick and warden of the east Marches, and he gained a decisive victory over the northern rebels under Leonard Dacre near Carlisle in February 1570. In 1583 he became lord chamberlain, but he did not relinquish his post at Berwick. Hunsdon was one of the commissioners appointed to try Mary queen of Scots; after Mary's execution he went on a mission to James VI. of Scotland, and when the Spanish Armada was expected he commanded the queen's bodyguard. He died in London, at Somerset House, on July 23, 1596.

HUNSTANTON, seaside resort of Norfolk, England, on the east shore of the Wash, 112 m. N. by E. from London by rail. Pop. (1921) 4,289. The new watering-place is about 1 m. from the old village. The parish church of St. Mary is a Decorated building; Hunstanton Hall is a Tudor building of brick. At Brancaster, 6 m. E., there is a Roman fort which formed part of the defences of the *Litus Saxonicum* (4th cent. A.D.).

HUNT, ALFRED WILLIAM (1830–1896), English painter, son of Andrew Hunt, a landscape painter, was born at Liverpool on Nov. 15, 1830. Most of his pictures are in private ownership; but his "Windsor Castle" is in the Tate gallery, "Working Late" in the Walker art gallery, Liverpool, and others at South Kensington. He died in London on May 3, 1896.

See *Exhibition of Drawings in Water Colour by Alfred William Hunt,* Burlington Fine Arts Club (1897); H. C. Marillier, *The Liverpool School of Painters* (1904).

HUNT, HENRY (1773–1835), English reformer, was born at Upavon, Wilts., on Nov. 6. He was for many years the most prominent among the more extreme English reformers under the oppression of Sidmouth and Castlereagh: indeed, after the defection of Burdett he had a position which was almost that of recognized leader. In person, training and character, he much resembled William Cobbett (*q.v.*). He was tall, florid and bulky; a typical English farmer both in occupation and appearance; he was as pugnacious, as unreasonable, as devoted and as vain as his more famous rival; he was possibly more courageous. But *littera scripta manet:* Cobbett wrote magnificent English which has preserved him a growing fame; Hunt is forgotten because we can no longer hear the voice and eloquence which gave him the name of Orator Hunt. He first adopted radical principles in 1806 and continued his agitation at a persistent series of public meetings and dinners until Aug. 1819 when he presided at the great meeting at St. Peter's fields, Manchester, which was attacked by the yeomanry (*see* PETERLOO). The white hat, which he wore on that occasion and which was stated to have been stove in by a sword cut, became the badge of reform, and for several years to wear a white hat was as symbolical as later it was to wear a red tie. He was sentenced to imprisonment for two and a half years; from his prison he sent out *A peep into a jail,* an exposure of Ilchester gaol which had its share in promoting prison reform. He took a great share in causing the *crescendo* of indignation which eventually overturned the oligarchy in 1832. In 1830 he was himself elected M.P. for Preston, a borough which, by virtue of a Scot-and-lot franchise, was one of the very few with a working class electorate. In Parliament he presented a petition for women's rights, and moved (despite his farming connection) against the Corn Laws. But the Reform Act of 1832, in granting the vote to the middle class and standardizing the franchise, necessarily disfranchised the mass of the electors at Preston. Hunt lost his seat in the election of 1833 and died on Feb. 15, 1835.

See *Memoirs of Henry Hunt Esq.,* by himself (1820–22); R. Huish, *Life of Hunt* (1836). (R. W. P.)

HUNT, HENRY JACKSON (1819–1889), American soldier, was born in Detroit, Mich., on Sept. 14, 1819, and graduated at the U.S. Military Academy in 1839. He served with great gallantry in the Mexican War, became captain in 1852, and major in 1861. His professional attainments were great, and in 1856 he was a member of a board entrusted with the revision of light artillery drill and tactics. He took part in the first battle of Bull Run in 1861, and soon afterwards became chief of artillery in the Washington defences. As a colonel on the staff of General M'Clellan he organized and trained the artillery reserve of the Army of the Potomac. Throughout the Civil War he contributed more than any officer to the effective employment of the artillery arm. With the artillery reserve he rendered the greatest assistance at the battle of Malvern hill, and soon afterwards he became chief of artillery in the Army of the Potomac. On the day after the battle of South Mountain he was made brigadier-general of volunteers. At the Antietam, Fredericksburg and Chancellorsville, he rendered further good service, and at Gettysburg his handling of the artillery was conspicuous. When the U.S. army was reorganized in 1866 he became colonel of artillery and president of the permanent artillery board. In 1883 he retired to become governor of the Soldiers' Home, Washington, D.C. He died on Feb. 11, 1889. He was the author of *Instructions for Field Artillery* (1860).

HUNT, JAMES HENRY LEIGH (1784–1859), English essayist and poet, was born at Southgate, Middlesex. His father had been a lawyer in Philadelphia, and had left the United States because of his loyalist sympathies. The son, who was educated at Christ's Hospital, began writing verse as soon as he left school, and soon became a constant contributor to the newspapers. In 1808 he became editor of the *Examiner,* a clever journal owned by his brother John. The brothers were sent to prison for an attack in the *Examiner* on the prince regent. The offensive phrase was "a fat Adonis of 50." Leigh Hunt's imprisonment had compensations, for it brought Byron, Moore, Brougham and other friends of liberty to see him in prison. Another joint enterprise of the Hunt brothers was a quarterly, the *Reflector.* The essays published as *The Round Table* (2 vols., 1816–17), conjointly with William Hazlitt, appeared in the *Examiner.*

In 1816 Leigh Hunt wrote his *Story of Rimini,* which established his fame as a poet. Though few read it now, the poem is important in the history of English poetry, because in it Hunt went back to the rhythms of Chaucer and Spenser and thus became one of the pioneers of the new romantic school. In 1818 appeared a collection of poems entitled *Foliage,* followed in 1819 by *Hero and Leander,* and *Bacchus and Ariadne.* In the same year he reprinted these two works with *The Story of Rimini* and *The Descent of Liberty* with the title of *Poetical Works,* and started the *Indicator,* in which some of his best work appeared. Both Keats and Shelley belonged to the circle gathered around him at Hampstead, which also included William Hazlitt, Charles Lamb, Bryan Procter, Benjamin Haydon, Cowden Clarke, C. W. Dilke, Walter Coulson, John Hamilton Reynolds and other men of liberal sympathies. After Shelley's departure for Italy Leigh Hunt's financial situation became desperate. Marianne Hunt (*née* Kent), his rather unattractive wife, wrote to Mrs. Shelley, with the result that Leigh Hunt was invited to go out to meet Shelley and Byron at Pisa. Byron provided the Hunts and their family (there were seven children) with a lodging in the Villa Lanfranchi, and Leigh Hunt was to publish a liberal paper. But Byron was annoyed when he learned that Leigh Hunt had no longer a share in the *Examiner,* and the connection proved an unhappy one. Nevertheless, though Byron was not always gracious, he made substantial payments to Hunt, and before he left for Greece made over to John Hunt exceedingly valuable copyrights. The ill-starred *Liberal* existed through four quarterly numbers. The Hunts remained in Italy until 1825. After his return to England Hunt revenged himself for the slights he had received from Byron in the ill-judged *Lord Byron and some of his Contemporaries* (1828), which brought down on him the scorn of Moore.

From that time onwards Leigh Hunt's life was a constant

struggle with sickness and poverty. He edited various papers, and published many admirable volumes of criticism, but was often dependent on Mrs. Shelley's kindness until in 1847 he received a Civil List pension. Hunt was a generous critic, and had a fresh open mind which recognized genius before it was acknowledged elsewhere. He had been one of the first to recognize a great poet in Keats, and he lived to welcome the early poems of Tennyson. He died at Putney on Aug. 28, 1859. His most important later works were two excellent selections (1844 and 1846) from the English poets, *A Book for a Corner* (2 vols., 1849), *Autobiography* (3 vols., 1850), *Table Talk* (1851). His narrative poems, original and translated, many of the shorter of which are minor classics, were collected as *Stories in Verse* (1855). Leigh Hunt excelled especially in narrative poetry, of which "Abou ben Adhem" and "Solomon's Ring" are excellent examples on a small scale.

Leigh Hunt's other works include: *Amyntas, A Tale of the Woods* (1820), translated from Tasso; *The Seer, or Common-Places refreshed* (2 pts., 1840–41); three of the Canterbury Tales in *The Poems of Geoffrey Chaucer, modernized* (1841); *Stories from the Italian Poets* (1846); *Men, Women and Books* (2 vols., 1847); *The Old Court Suburb* (2 vols., 1855; ed. A. Dobson, 1902); selections from Beaumont and Fletcher (1855); and, with S. Adams Lee, *The Book of the Sonnet* (Boston, 1867). His *Poetical Works* (2 vols.), revised by himself and edited by Lee, were printed at Boston, U.S.A., in 1857, and an edition (London and New York) by his son, Thornton Hunt, appeared in 1860. Among volumes of selections are: *Essays* (1887), ed. A. Symons; *Leigh Hunt as Poet and Essayist* (1889), ed. C. Kent; *Essays and Poems* (1891), ed. R. B. Johnson for the "Temple Library"; *Prefaces by Leigh Hunt, Mainly to his Periodicals,* ed. R. Brimley Johnson (1928).

His *Autobiography* was revised by himself shortly before his death, and edited (1859) by his son Thornton Hunt, who also arranged his *Correspondence* (2 vols., 1862). Additional letters were printed by the Cowden Clarkes in their *Recollections of Writers* (1878). The *Autobiography* was edited (2 vols., 1903) with full bibliographical note by R. Ingpen. A bibliography of his works was compiled by Alexander Ireland (*List of the Writings of William Hazlitt and Leigh Hunt,* 1868). There are short lives of Hunt by Cosmo Monkhouse ("Great Writers," 1893) and by R. B. Johnson (1896).

HUNT, RICHARD MORRIS (1828–1895), American architect, was born in Brattleboro (Vt.) on Oct. 31, 1828. He studied in Europe (1843–54), mainly in the École des Beaux Arts at Paris, and in 1854 was appointed inspector of works on the buildings connecting the Tuileries with the Louvre. Under Hector Lefuel he designed the Pavillon de la Bibliothèque, opposite the Palais Royal. In 1855 he returned to New York, and was employed on the extension of the Capitol at Washington. He designed the Lenox library (now torn down) and the *Tribune* buildings in New York; the Theological library, and Marquand chapel at Princeton; the Divinity college and the Scroll and Key building at Yale; the Vanderbilt mausoleum on Staten island, and the Yorktown monument. For the administration building at the World's Columbian exposition at Chicago in 1803 Hunt received the gold medal of the Institute of British Architects. Among the most noteworthy of his domestic buildings were the residences of W. K. Vanderbilt and Henry G. Marquand in New York city; George W. Vanderbilt's country house at Biltmore, and several of the large "cottages" at Newport (R.I.), including "Marble House" and "The Breakers." Hunt was the leader of a school that has established in the United States the manner and the traditions of the Beaux Arts. He took a prominent part in the founding of the American Institute of Architects, and from 1888 was its president. His talent was eminently practical; and he was almost equally successful in the ornate style of the early Renaissance in France, in the picturesque style of his comfortable villas, and the monumental style of the Lenox library. There is a beautiful memorial to Hunt in the wall of Central Park, opposite the site of the old Lenox library building, from designs by Daniel C. French and Bruce Price. He died on July 31, 1895.

HUNT, THOMAS STERRY (1826–1892), American geologist and chemist, was born at Norwich (Conn.), on Sept. 5, 1826. He became interested in natural science, and in 1845 he was elected a member of the Association of American Geologists and Naturalists at Yale (1849). In 1848 he read a paper in Philadelphia *On Acid Springs and Gypsum Deposits of the Onondaga Salt Group.* At Yale he became assistant to Prof. B. Silliman, Jr., and in 1846 was appointed a chemist to the geological survey of Vermont. In 1847 he was appointed to similar duties on the Canadian geological survey at Montreal under Sir William Logan, and this post he held until 1872. In 1859 he was elected F.R.S., and he was one of the original members and president of the Royal Society of Canada. He died in New York city on Feb. 12, 1892.

His publications include *Chemical and Geological Essays* (1875, ed. 2, 1879); *Mineral Physiology and Physiography* (1886); *A New Basis for Chemistry* (1887, ed. 3, 1891); *Systematic Mineralogy* (1891). *See* an obituary notice by Persifor Frazer, *Amer. Geologist* (xi. Jan. 1893), with portrait. A complete bibliography of his work is given in *Bulletin of the Geol. Soc. of America,* vol. 4, p. 379.

HUNT, WILLIAM HENRY (1790–1864), English water-colour painter, was born in London, on March 28, 1790. He was apprenticed about 1805 to John Varley, the landscape-painter, with whom he remained five or six years, exhibiting three oil pictures at the Royal Academy in 1807. He exhibited regularly at the Society of Painters in Water-colour, of which he became a full member in 1827. He died on Feb. 10, 1864. Hunt was one of the creators of the English school of water-colour painting. His subjects, especially those of his later life, are extremely simple; but, by the delicacy, humour and fine power of their treatment, they rank second to works of the highest art only.

HUNT, WILLIAM HOLMAN (1827–1910), English artist, was born in London on April 2, 1827. His father was the manager of a city warehouse. In his thirteenth year Holman Hunt worked in an office, but employed his leisure in reading, drawing and painting. In his 17th year he entered the Royal Academy schools, where he met his lifelong friend John Everett Millais, then a boy of 15. In 1846 Holman Hunt sent to the Royal Academy his first picture, "Hark!", which was followed by "Dr. Rochecliffe performing Divine Service in the Cottage of Joceline Joliffe at Woodstock," in 1847, and "The Flight of Madeline and Porphyrio" (from Keats's *Eve of St. Agnes*) in 1848. In this year he and Millais, with the co-operation of Dante Gabriel Rossetti and others, initiated the Pre-Raphaelite movement. Typical examples of the new creed were furnished in the next year's Academy by Millais's "Isabella" and Holman Hunt's "Rienzi vowing to obtain Justice for the Death of his Young Brother." His "Valentine protecting Sylvia from Proteus" (1851) was praised by Ruskin and gained a prize at Liverpool; it is reckoned as the finest of Holman Hunt's earlier works.

In 1854 he achieved his first great success by the famous picture of "The Light of the World," an allegorical representation of Christ knocking at the door of the human soul. "The Light of the World" was presented by the owner to Keble College. In 1904 Holman Hunt completed a second "Light of the World" which is hung in St. Paul's Cathedral, the execution of which was due to his dissatisfaction with the way in which the Keble picture was shown.

In January 1854 Holman Hunt left England for Syria and Palestine with the desire to revivify on canvas the facts of Scripture history. The first fruit of this idea, which may be said to have dominated the artist's life, was "The Scapegoat," a solitary outcast animal standing alone on the shores of the Dead Sea, with the mountains of Edom in the distance, seen under a gorgeous effect of purple evening light. It was exhibited at the Royal Academy in 1856, together with three Eastern landscapes. His next picture (1860), one of the most elaborate and most successful of his works, was "The Finding of our Saviour in the Temple." Like all his important pictures, it was the work of years. Many causes contributed to the delay in its completion, including a sentence of what was tantamount to excommunication (afterwards revoked) passed on all Jews acting as models. The picture is now in the Birmingham Municipal Art Gallery. Holman Hunt's next great religious picture was "The Shadow of Death." This work was presented to Manchester by Sir William Agnew. After two years' absence Holman Hunt returned to Jerusalem in 1875, where he was engaged upon his great work, "The Triumph of the Innocents," which proved to be the most serious labour of his life. He executed two versions; of these one is in the Liverpool,

the other in the Birmingham Art Gallery. "The Ship," painted on board a P. and O. steamer on the voyage to Palestine in 1875, is now in the Tate gallery. His most important later work is "May-Day, Magdalen Tower."

Holman Hunt remained entirely unaffected by the various movements in the art-world after 1850. His ambition was always "to serve as high priest and expounder of the excellence of the works of the Creator." His *History of Pre-Raphaelitism*, a subject on which he could speak as a first authority, but not without dissent from at least one member of the P.R.B., was published in 1905. On Sept. 7, 1910, he died in London, and he was buried in St. Paul's Cathedral. He was a member of the Order of Merit.

See Archdeacon Farrar and Mrs. Alice Meynell, "William Holman Hunt, his Life and Work" (*Art Annual*) (1893); John Ruskin, *Modern Painters; The Art of England* (lecture) [consult Gordon Crauford's *Ruskin's Notes on the Pictures of Mr. Holman Hunt*, 1886]; Robert de la Sizeranne, *La Peinture anglaise contemporaine* (1895); W. B. Scott, *Autobiographical Notes;* W. M. Rossetti, *Pre-Raphaelite Diaries and Letters;* Percy H. Bate, *The Pre-Raphaelite Painters* (1899); Sir W. Bayliss, *Five Great Painters of the Victorian Era* (1902); H. W. Shrewsbury, *Brokers in Art* (1920). (C. Mon.; X.)

HUNT, WILLIAM MORRIS (1824–1879), American painter, was born at Brattleboro (Vt.), on March 31, 1824. He attended at Harvard, but his real education began when he accompanied his mother and brother to Europe, where he studied with Couture in Paris and then came under the influence of Jean François Millet. The companionship of Millet had a lasting influence on Hunt's character and style, and his work grew in strength, beauty, and seriousness. He was the real introducer of the Barbizon school to America, and he more than any other turned the rising generation of American painters towards Paris. On his return in 1855 he painted some of his most beautiful pictures, all reminiscent of his life in France and of Millet's influence. Such are "The Belated Kid," "Girl at the Fountain," "Hurdy-Gurdy Boy," etc. But the public called for portraits, and it became the fashion to sit to him. Among his best paintings of this kind are those of William M. Evarts, Mrs. Charles Francis Adams, the Rev. James Freeman Clarke, William H. Gardner, Chief Justice Shaw, and Judge Horace Gray. Unfortunately many of his paintings and sketches, together with five large Millets and other art treasures collected by him in Europe, were destroyed in the great Boston fire of 1872. Among his later works American landscapes predominated. They also include the "Bathers" (twice painted) and the allegories for the senate chamber of the State capitol at Albany (N.Y.), now lost by the disintegration of the stone panels on which they were painted. Hunt was drowned at the Isles of Shoals on Sept. 8, 1879. He wrote *Talks about Art* (London, 1878).

HUNTER, JOHN (1728–1793), British physiologist and surgeon, was born on Feb. 13, 1728, at Long Calderwood, in the parish of East Kilbride, Lanarkshire, being the youngest of the ten children of John and Agnes Hunter. His father, who died on Oct. 30, 1741, aged 78, was descended from the old Ayrshire family of Hunter of Hunterston; his mother, *née* Paul, came from Glasgow. Young Hunter worked for some time at cabinet-making, under his brother-in-law, but presently obtained from his brother William (*q.v.*) permission to aid, under Mr. Symonds, in making dissections in his anatomical school, then the most celebrated in London, intending, should he be unsuccessful there, to enter the army. He arrived in London in September 1748, about a fortnight before the beginning of his brother's autumnal course of lectures.

Hard-working, and singularly patient and skilful in dissection, Hunter had by his second winter in London acquired sufficient anatomical knowledge to be entrusted with the charge of his brother's practical class. In the summer months of 1749–1750, at Chelsea Military Hospital, he attended the lectures and operations of William Cheselden, on whose retirement in the following year he became a surgeon's pupil at St. Bartholomew's where Percivall Pott was one of the senior surgeons. In 1754 he became a surgeon's pupil at St. George's Hospital, where he was appointed house-surgeon in 1756. During the period of his connection with Dr. Hunter's school he solved the problem of the descent of the testes in the foetus, traced the ramifications of the nasal and olfactory nerves within the nose, experimentally tested the question whether veins could act as absorbents, studied the formation of pus and the nature of the placental circulation, and with his brother earned the chief merit of practically proving the function and importance of the lymphatics in the animal economy. On June 5, 1755, he entered as a gentleman commoner at St. Mary's Hall, Oxford, but his instincts would not permit him, to use his own expression, "to stuff Latin and Greek at the university."

An attack of inflammation of the lungs in the spring of 1759 having produced symptoms threatening consumption, Hunter obtained in October 1760 the appointment of staff-surgeon in Hodgson and Keppel's expedition to Belleisle. With this he sailed in 1761. In the following year he served with the English forces on the frontier of Portugal. Whilst with the army he acquired the extensive knowledge of gunshot wounds embodied in his important treatise (1794) on that subject. When not engaged in the active duties of his profession, he occupied himself with physiological and other scientific researches. Thus, in 1761, off Belleisle, the conditions of the coagulation of the blood were among the subjects of his inquiries. Later, on land, he continued the study of human anatomy, and arranged his notes and memoranda on inflammation; he also ascertained by experiment that digestion does not take place in snakes and lizards during hibernation, and observed that enforced vigorous movement at that season proves fatal to such animals, the waste so occasioned not being compensated, whence he drew the inference that, in the diminution of the power of a part attendant on mortification, resort to stimulants which increase action without giving real strength is inadvisable. A ms. catalogue by Hunter, probably written soon after his return from Portugal, shows that he had already made a collection of about two hundred specimens of natural and morbid structures.

On arriving in England early in 1763, Hunter, having retired from the army on half-pay, took a house in Golden Square, and began to practise as a surgeon. Most of the metropolitan practice at the time was held by P. Pott, C. Hawkins, Samuel Sharp, Joseph Warner and Robert Adair; and Hunter sought to eke out his at first slender income by teaching practical anatomy and operative surgery to a private class. His leisure was devoted to the study of comparative anatomy, to procure subjects for which he obtained the refusal of animals dying in the Tower menagerie and in various travelling zoological collections. In connection with his rupture of a tendo Achillis, in 1767, he performed on dogs several experiments which, with the illustrations in his museum of the reunion of such structures after division, laid the foundation of the modern practice of cutting through tendons (tenotomy) for the relief of distorted and contracted joints. In the same year he was elected F.R.S.

His first contribution to the *Philosophical Transactions*, with the exception of a supplement to a paper by J. Ellis in the volume for 1766, was an essay (June 18, 1772) on post-mortem digestion of the stomach, written at the request of Sir J. Pringle, in which he explained that phenomenon as a result of the action of the gastric juice. The subjects and dates of his subsequent papers in the *Transactions*, the titles of which give little notion of the richness of their contents, are as follows: The torpedo (1773); air-receptacles in birds, and the Gillaroo trout (1774); the *Gymnotus electricus*, and the production of heat by animals and vegetables (supplemented in 1777), (1775); the recovery of people apparently drowned (1776); the free martin (1779); the communication of smallpox to the foetus in utero, and the occurrence of male plumage in old hen pheasants (1780); the organ of hearing in fishes (1782); the anatomy of a "new marine animal" described by Home (1785); the specific identity of the wolf, jackal and dog (supplemented in 1789), the effect on fertility of extirpation of one ovarium, and the structure and economy of whales (1787); observations on bees (1793); and some remarkable caves in Bayreuth and fossil bones found therein (1794). With these may be included a paper by Home, from materials supplied by Hunter, on certain horny excrescences of the human body.

On Dec. 9, 1768 he was elected a surgeon to St. George's Hospital, and, soon after, a member of the Corporation of Surgeons.

He now began to take house-pupils. Among these were Edward Jenner, who became a friend and correspondent, W. Guy, Dr. P. S. Physick of Philadelphia and Everard Home, his brother-in-law. William Lynn and Sir A. Carlisle, though not inmates of his house, were frequent visitors there. His pupils at St. George's included John Abernethy, Henry Cline, James Earle and Astley Cooper. In 1770 he settled in Jermyn Street, in the house which his brother William had previously occupied; and in July 1771 he married Anne, the eldest daughter of Robert Home, surgeon to Burgoyne's regiment of light horse[1].

From 1772 till his death Hunter resided during autumn at a house built by him at Earl's Court, Brompton, where most of his biological researches were carried on. There he kept for the purpose of study and experiment the fishes, lizards, blackbirds, hedgehogs and other animals sent him from time to time by Jenner; tame pheasants and partridges, at least one eagle, toads, silkworms and many more creatures, obtained from every quarter of the globe. Bees he had under observation in his conservatory for upwards of twenty years; hornets and wasps were also diligently studied by him. On two occasions his life was in risk from his pets—once in wrestling with a young bull, and again when he fearlessly took back to their dens two leopards which had broken loose among his dogs.

Hunter, ever cautious of confounding fact and hypothesis, besought of nature the truth through the medium of experiments and observations. "He had never read Bacon," says G. G. Babington, "but his mode of studying nature was as strictly Baconian as if he had." To Jenner, who had offered a conjectural explanation of a phenomenon, he writes, on the 2nd of August 1775: "I think your solution is just; but why think? why not try the experiment? Repeat all the experiments upon a hedgehog as soon as you receive this, and they will give you the solution." It was his axiom however, "that experiments should not be often repeated which tend merely to establish a principle already known and admitted, but that the next step should be the application of that principle to useful purposes" ("Anim. Oecon.," *Works*, iv. 86). In his toxicological and other researches, in which his experience had led him to believe that the effects of noxious drugs are nearly similar in the brute creation and in man, he had already, in 1780, as he states, "poisoned some thousands of animals."

In 1772 Hunter, in order effectually to gauge the extent of his own knowledge, and also correctly to express his views, which had been repeatedly misstated or ascribed to others, began his lectures on the theory and practice of surgery. Though Pott, indeed had perceived that the only true system of surgery is that which most closely accords with the curative efforts of nature, a rational pathology can hardly be said to have had at this time any existence; and it was generally assumed that a knowledge of anatomy alone was a sufficient foundation for the study of surgery. Hunter, unlike his contemporaries, to most of whom his philosophic habit of thought was a mystery, and whose books contained little else than relations of cases and modes of treatment, sought the reason for each phenomenon that came under his notice. The principles of surgery, he maintained, are not less necessary to be understood than the principles of other sciences; unless, indeed, the surgeon should wish to resemble "the Chinese philosopher whose knowledge consisted only in facts." Too much attention, he remarked, cannot be paid to facts; yet a multitude of facts overcrowd the memory without advantage if they do not lead us to establish principles, by an acquaintance with which we learn the causes of diseases. Hunter's course, which latterly comprised eighty-six lectures, delivered on alternate evenings between the hours of seven and eight, lasted from October to April. Some teachers of his time were content to dismiss the subject of anatomy and surgery in a course of only six weeks' duration. His class was usually small and never exceeded thirty. He was deficient in the gifts of a good extempore speaker, being in this respect a remarkable contrast to his brother William; and he read his lectures, seldom raising his eyes from the manuscript. His manner with his auditory is stated to have been embarrassed and awkward, and his language always unadorned; but that "his expressions for the explaining of his new theories rendered his lectures often unintelligible" is scarcely evident in his pupils' notes still extant. In January 1776 Hunter was appointed surgeon-extraordinary to the king. He began in the same year his Croonian lectures on muscular motion, continued annually, except in 1777, till 1782; they were never published by him, being in his opinion too incomplete. In 1778 appeared the second part of his *Treatise on the Natural History of the Human Teeth*, the first part of which was published in 1771. It was in the waste of the dental alveoli and of the fangs of shedding teeth that in 1754–1755, as he tells us, he received his first hint of the use of the absorbents. Abernethy (*Physiological Lectures*, p. 196) relates that Hunter, being once asked how he could suppose it possible for absorbents to do such things as he attributed to them, replied, "Nay, I know not, unless they possess powers similar to those which a caterpillar exerts when feeding on a leaf."

Hunter in 1780 read before the Royal Society a paper in which he laid claim to have been the first to make out the nature of the utero-placental circulation. His brother William, who had five years previously described the same in his *Anatomy of the Gravid Uterus*, thereupon wrote to the Society attributing to himself this honour. John Hunter in a rejoinder to his brother's letter, dated the 17th of February 1780, reiterated his former statement, viz. that his discovery, on the evening of the day in 1754 that he had made it in a specimen injected by a Dr. Mackenzie, had been communicated by him to Dr. Hunter. Thus arose an estrangement between the two Hunters, which continued until the time of William's last illness, when his brother obtained permission to visit him.

In 1783 Hunter was elected a member of the Royal Society of Medicine and of the Royal Academy of Surgery at Paris, and took part in the formation of "A Society for the Improvement of Medical and Chirurgical Knowledge," for the *Transactions* of which he wrote many papers. In 1783 he purchased the twenty-four years' leasehold of two houses, the one on the east side of Leicester Square, the other in Castle Street with intervening ground. Between the houses he built in 1783–1785, at an expense of above £3,000, a museum for his anatomical and other collections which by 1782 had cost him £10,000. The new edifice consisted of a hall lighted from the top, with a gallery all round, and having beneath it a lecture theatre. In April 1785 Hunter's collections were removed into it.

In May 1785, Hunter sat to Sir Joshua Reynolds for his portrait. He proved a bad sitter, and Reynolds made little satisfactory progress, till one day Hunter, while resting his somewhat upraised head on his left hand, fell into a profound reverie—one of those waking dreams, seemingly, which in his lectures he has so well described, when "the body loses the consciousness of its own existence." The painter then sketched out the admirable portrait which is in the possession of the Royal College of Surgeons. Among the subjects of Hunter's physiological investigation in 1785 was the mode of growth of deer's antlers. By experiment on a buck he found that under "the stimulus of necessity," to use a phrase of the experimenter, the smaller arterial channels are capable of rapid increase in dimensions to perform the offices of the larger[2]. It happened that, in the ensuing December, there lay in one of the wards of St. George's Hospital a patient admitted for popliteal aneurism. Should the surgeon, following the usual and commonly fatal method of treatment, cut down upon the tumour, and, after tying the artery above and below it, evacuate its contents? Or should he adopt

[1] Mrs. Hunter died on Jan. 7, 1821, in Holles Street, Cavendish Square, London, in her seventy-ninth year. The words for Haydn's English canzonets were supplied by her, and were mostly original poems; of these the lines beginning "My mother bids me bind my hair" are, from the beauty of the accompanying music, among the best known. (*See* R. Nares in *Gent. Mag.* xci. pt. 1, p. 89, quoted in Nichols's *Lit. Anec.*, 2nd ser., vii. 638.)

[2] In his *Treatise on the Blood*, p. 288, Hunter observes: "We find it a common principle in the animal machine, that every part increases in some degree according to the action required. Thus we find . . . vessels become larger in proportion to the necessity of supply, as for instance, in the gravid uterus; the external carotids in the stag, also, when his horns are growing, are much larger than at any other time.

the procedure, deemed by Pott generally advisable, of amputating the limb above it?

It was Hunter's aim in his practice, even if he could not dispense with the necessity, at least to diminish the severity of operations, which he considered were an acknowledgment of the imperfection of the art of healing, and compared to "the acts of the armed savage, who attempts to get that by force which a civilized man would get by stratagem." Since, he argued, the experiment with the buck had shown that collateral vessels are capable of continuing the circulation when passage through a main trunk is arrested, why should he not, in the aneurism case, leaving the absorbents to deal with the contents of the tumour, tie the artery in the sound parts, where it is tied in amputation, and preserve the limb? Acting upon this idea, he ligatured his patient's femoral artery in the lower part of its course in the thigh, in the fibrous sheath enclosing the space since known as "Hunter's canal." The leg was found, some hours after the operation, to have acquired a temperature even above the normal. At the end of January 1786, that is, in six weeks' time, the patient was well enough to be able to leave the hospital. Thus Hunter inaugurated an operation which has been the means of preserving to hundreds life with integrity of limb.

Early in 1786 Hunter published his *Treatise on the Venereal Disease,* which, like some of his previous writings, was printed in his own house. Towards the end of the year appeared his *Observations on certain parts of the Animal Oeconomy,* which, besides the more important of his contributions to the *Philosophical Transactions,* contains nine papers on various subjects. In 1786 Hunter became deputy surgeon-general to the army; his appointment as surgeon-general and as inspector-general of hospitals followed in 1790. In 1787 he received the Royal Society's Copley medal, and was also elected a member of the American Philosophical society. On account of the increase in his practice and his impaired health, he now obtained the services of Home as his assistant at St. George's Hospital. The death of Pott in December 1788 secured to him the undisputed title of the first surgeon in England. He resigned to Home, in 1792, the delivery of his surgical lectures, in order to devote himself more fully to the completion of his *Treatise on the Blood, Inflammation and Gun-shot Wounds,* which was published by his executors in 1794. In this, his masterpiece, the application of physiology to practice is especially noticeable. Certain experiments described in the first part, which demonstrate that arterialization of the blood in respiration takes place by a process of diffusion of "pure air" or "vital air" (*i.e.,* oxygen) through membrane, were made as early as the summer of 1755.

Hunter died on Oct. 16, 1793, while attending a board meeting at St. George's Hospital. His remains were interred privately on Oct. 22, 1793, in the vaults of St. Martin's in the Fields. Thence, on March 28, 1859, through the instrumentality of F. T. Buckland, they were removed to Abbot Islip's chapel in Westminster Abbey, to be finally deposited in the grave in the north aisle of the nave, close to the resting-place of Ben Jonson.

CONTRIBUTIONS TO SCIENCE

To attempt to set forth what in Hunter's teaching was new to pathology and systematic surgery, or was rendered so by his mode of treatment, would be well-nigh to present an epitome of all that he wrote on those subjects. "When we make a discovery in pathology," says Adams, writing in 1818, "we only learn what we have overlooked in his writings or forgotten in his lectures." Surgery, which only in 1745 had formally ceased to be associated with "the art and mystery of barbers," he raised to the rank of a scientific profession. His doctrines were, necessarily, not those of his age: while lesser minds around him were still dim with the mists of the ignorance and dogmatism of times past, his lofty intellect was illumined by the dawn of a distant day.

Hunter was of about medium height, strongly built and high-shouldered and short-necked. He had an open countenance, and large features, eyes light-blue or grey, eyebrows prominent, and hair reddish-yellow in youth, later white, and worn curled behind; and he dressed plainly and neatly. He rose at or before six, dissected till nine (his breakfast hour), received patients from half-past nine till twelve, at least during the latter part of his life, and saw his outdoor and hospital patients till about four, when he dined, taking, according to Home, as at other meals in the twenty years preceding his death, no wine. After dinner he slept an hour; he then superintended experiments, read or prepared his lectures, and made, usually by means of an amanuensis, records of the day's dissections. "I never could understand," says W. Clift, "how Mr. Hunter obtained rest: when I left him at midnight, it was with a lamp fresh trimmed for further study, and with the usual appointment to meet him again at six in the morning." H. Leigh Thomas records that, on his first arrival in London, having by desire called on Hunter at five o'clock in the morning, he found him already busily engaged in the dissection of insects.

Rigidly economical of time, Hunter was always at work, and he had always in view some fresh enterprise. To his museum he gave a very large share of his attention, being fearful lest the ordering of it should be incomplete at his death, and knowing of none who could continue his work for him. At the time of his death he had anatomized over 500 different species of animals, some of them repeatedly, and had made numerous dissections of plants. The manuscript works by him, appropriated and destroyed by Home, among which were his eighty-six surgical lectures, all in full, are stated to have been "literally a cartload"; and many pages of his records were written by Clift under his directions "at least half a dozen times over, with corrections and transpositions almost without end."

The Hunterian Collections.—In accordance with the directions given by Hunter in his will, his collection was offered for purchase to the British government. But the prime minister, Pitt, on being asked to consider the matter, exclaimed: "What! buy preparations! Why, I have not money enough to purchase gunpowder." He, however, consented to the bestowal of a portion of the king's bounty for a couple of years on Mrs. Hunter and her two surviving children. In 1796 Lord Auckland urged upon the government the advisability of acquiring the collection, and on June 13, 1799, parliament voted £15,000 for this purpose. Its custodianship, after refusal by the College of Physicians, was unanimously accepted by the Corporation of Surgeons on the terms proposed. These were in brief—that the collection be open four hours in the forenoon, two days every week, for the inspection and consultation of the fellows of the College of Physicians, the members of the Company of Surgeons and persons properly introduced by them, a catalogue of the preparations and an official to explain it being at those times always at hand; that a course of not less than 24 lectures on comparative anatomy and other subjects illustrated by the collection be given every year by some member of the Company; and that the preparations be kept in good preservation at the expense of the Corporation, and be subject to the superintendence of a board of sixteen trustees.

The fulfilment of these conditions was rendered possible by the receipt of fees for examinations and diplomas, under the charter by which, in 1800, the Corporation was constituted the Royal College of Surgeons. In 1806 the collection was placed in temporary quarters in Lincoln's Inn Fields, and the sum of £15,000 was voted by parliament for the erection of a proper and commodious building for its preservation and extension. This was followed by a grant of £12,500 in 1807. The collection was removed in 1812 to the new museum, and opened to visitors in 1813. The greater part of the present edifice was built in 1835, at an expense to the college of about £40,000; and the combined Hunterian and collegiate collections, having been rearranged in what are now termed the western and middle museums, were in 1836 made accessible to the public. The erection of the eastern museum in 1852, on premises in Portugal Street, bought in 1847 for £16,000, cost £25,000, of which parliament granted £15,000; it was opened in 1855.

AUTHORITIES.—*See,* besides the above quoted publications, *An Appeal to the present Parliament . . . on the subject of the late J. Hunter's Museum* (1795); Sir C. Bell, *A Lecture . . . being a Commentary on Mr. J. Hunter's preparations of the Diseases of the Urethra* (1830); The President of the Royal College of Surgeons of England, *Address to the Committee for the Erection of a Statue of Hunter*

(March 29, 1859); Sir R. Owen, "Sketch of Hunter's Scientific Character and Works," in T. Taylor, *Leicester Square* (1874), also in Hunter's *Works*, vol. iv. (ed. J. F. Palmer, 4 vols., 1835–37); and in *Essays and Observations;* the invaluable catalogues of the Hunterian Collection issued by the Royal College of Surgeons (1893); and numerous Hunterian Orations. Notes of his lectures on surgery, edited by J. W. K. Parkinson, appeared in 1833 under the title of *Hunterian Reminiscences*. Hunter's *Observations and Reflections on Geology*, intended to serve as an introduction to the catalogue of his collection of extraneous fossils, was published in 1859 (ed. R. Owen, 2 vols. 1861) and his *Memoranda on Vegetation* in 1860. (F. H. B.; X.)

BIBLIOGRAPHY.—See *Works of John Hunter* (ed. J. F. Palmer, 4 vols., 1835–37); Hunter's *Observations and Reflections on Geology*, intended to serve as an introduction to the catalogue of his collections of fossils, (1859, ed. R. Owen, 2 vols., 1861); *Memoranda on Vegetation* (1860); *Hunterian Reminiscences* (notes of his lectures on surgery, ed. J. W. K. Parkinson, 1833). In J. White, *Journal of a Voyage to New South Wales* (1790) is a paper containing directions for preserving animals printed separately in 1809, besides six zoological descriptions by Hunter; and in A. Russell, *Natural History of Aleppo* (2nd ed. 1794) are remarks of Hunter's on the anatomy of the jerboa and the camel's stomach. *See* also *An Appeal to the Present Parliament on the subject of the late J. Hunter's Museum* (1795); Sir C. Bell, *A Lecture, being a Commentary on Mr. J. Hunter's preparations of the Diseases of the Urethra* (1830); The President of the Royal College of Surgeons of England, *Address to the Committee for the Erection of a Statue of Hunter* (March 29, 1859); Sir R. Owen, "Sketch of Hunter's Scientific Character and Works" in T. Taylor, *Leicester Square* (1874); the catalogues of the Hunterian Collection issued by the Royal College of Surgeons (1893, etc.) and numerous Hunterian Orations; S. Paget, *John Hunter* (with bibliography, 1897); G. C. Peachey, *A Memoir of William and John Hunter* (1924).

HUNTER, SIR ROBERT (1844–1913), English lawyer and philanthropist, was born on Oct. 27, 1844. In 1882 he became solicitor to the General Post Office. He devoted much of his time to safeguarding the rights of the public in regard to open spaces and the preservation of rights of way, and was one of the principal promoters of the Commons Preservation Society founded in 1865. In 1868 he became its hon. solicitor, and successfully conducted suits for preserving Wimbledon and Wandsworth Commons and for recovering a portion, wrongfully enclosed, of Epping Forest. Ashdown Forest, Hampstead Heath, Hindhead and the New Forest were safeguarded by him. He was made K.C.B. in 1911, and died at Haslemere on Nov. 6, 1913.

HUNTER, ROBERT (d. 1734), colonial governor of New York, New Jersey and Jamaica, was the son of James and Margaret (Spalding) Hunter of Hunterston, Ayrshire, Scotland. Forsaking his apprenticeship as an apothecary, Hunter joined the British army and fought at Blenheim (1704) under Marlborough, with whom he seems to have been personally acquainted. In 1707 Hunter was chosen lieutenant-governor of Virginia, but on the way to America he was captured by the French, remaining as their prisoner until exchanged for the bishop of Quebec. Hunter was commissioned as governor of New York and the Jerseys in 1709. Accompanying the new executive to America in 1710 were 3,000 Palatine refugees who were ordered to undertake the production of naval stores. This Hudson river venture proved to be a failure despite the governor's intense interest and expense in the project. Hunter's career in America was characterized by a series of political and religious entanglements, but he was one of the best loved administrators ever selected by England. He played an important rôle both at the New London congress (1711) and at New York in preparing the colonial contingents for the last campaign of Queen Anne's War. In 1719 Hunter returned to England, and for several years was consulted as an authority on colonial affairs by the board of trade. His last commission was the governorship of Jamaica which office he held until his death on March 31, 1734. (R. L. BE.)

HUNTER, ROBERT MERCER TALIAFERRO (1809–1887), American statesman, was born in Essex county, Va., on April 21, 1809. He entered the University of Virginia in his 17th year and was one of its first graduates; he then studied law at the Winchester (Va.) law school, and in 1830 was admitted to the bar. From 1837 to 1843 and from 1845 to 1847 he was a member of the National House of Representatives, being speaker from 1839 to 1841; and from 1847 to 1861 he was in the Senate, where he was chairman of the finance committee (1850–61). He is credited with having brought about a reduction of the quantity of silver in the smaller coins; he was the author of the Tariff Act of 1857 and of the bonded-warehouse system, and was one of the first to advocate civil service reform. In 1853 he declined President Fillmore's offer to make him secretary of State. At the national Democratic convention at Charleston, S.C., in 1860 he was the Virginia delegation's choice as candidate for the presidency of the United States, but was defeated for the nomination by Stephen A. Douglas. Hunter did not regard Lincoln's election as being of itself a sufficient cause for secession, and in Jan. 1861 he proposed an elaborate but impracticable scheme for the adjustment of differences between the North and the South, but when this and several other efforts to the same end had failed he quietly urged his own State to pass the ordinance of secession. In 1861–62 he was secretary of State in the Southern Confederacy; and in 1862–65 was a member of the Confederate senate, in which he was, at times, a caustic critic of the Davis administration. He was one of the commissioners to treat at the Hampton Roads conference in 1865, and after the surrender of General Lee was summoned by President Lincoln to Richmond to confer regarding the restoration of Virginia in the Union. From 1874 to 1880 he was treasurer of Virginia, and from 1885 until his death near Lloyds, Virginia, on July 18, 1887, was collector of the port of Tappahannock, Virginia.

See Martha T. Hunter, *A Memoir of Robert M. T. Hunter* (Washington, 1903) for his private life, and D. R. Anderson, *Robert Mercer Taliaferro Hunter*, in the John P. Branch Historical Papers of Randolph Macon College (vol. ii. No. 2, 1906), for his public career. *See* also "Correspondence of Robt. M. T. Hunter, 1826–1876," ed. by Charles Henry Ambler, *Amer. Hist. Assoc. Ann. Report, 1916*, vol. ii.

HUNTER, WILLIAM (1718–1783), British physiologist and physician, the first great teacher of anatomy in England, was born on May 23, 1718, at East Kilbride, Lanark. He was the seventh child of his parents, and an elder brother of the still more famous John Hunter (*q.v.*). He was educated at Glasgow university, and then studied medicine under William Cullen at Hamilton. He then studied in Edinburgh and at St. George's hospital, London. In 1746 he lectured on operative surgery for a society of naval practitioners and won a great reputation for the fullness and thoroughness of his teaching. Little by little Hunter renounced surgical for obstetric practice, in which he excelled. He was appointed a surgeon-accoucheur at the Middlesex hospital in 1748, and at the British Lying-in hospital in 1749. He built a house, with lecture and dissecting-rooms, in Great Windmill street, whither he removed in 1770. Here was accommodated his collection, comprising anatomical and pathological preparations, ancient coins and medals, minerals, shells and corals. The whole collection, together with his fine library and an endowment of £8,000, by his will became, after the lapse of 20 years, the property of the University of Glasgow, where the collection may still be seen.

Hunter made several contributions to the *Medical Observations and Enquiries* and the *Philosophical Transactions*. In his paper on the structure of cartilages and joints, published in the latter in 1743, he anticipated what M. F. X. Bichat 60 years afterwards wrote concerning the structure and arrangement of the synovial membranes. His *Medical Commentaries* (pt. i., 1762, supplemented 1764) contains, among other like matter, details of his unseemly disputes with the Monros as to who first had successfully performed the injection of the *tubuli testis* (in which, however, both he and they had been forestalled by A. von Haller in 1745), and as to who had discovered the true office of the lymphatics, and also a discussion on the question whether he or Percivall Pott ought to be considered the earlier to have elucidated the nature of *hernia congenita*, which, as a matter of fact, had also been previously explained by Haller. In the *Commentaries* is exhibited Hunter's one weakness—an inordinate love of controversy. In 1762 he was consulted by Queen Charlotte, and in 1764 was made physician-extraordinary to her Majesty. His great work, *The Anatomy of the Gravid Uterus, exhibited in Figures*, was published in 1774. His posthumous works are *Two Introductory Lectures* (1784), and *Anatomical Description of the Human Gravid Uterus* (1794), which was re-edited by Dr. E. Rigby in 1843. Hunter was never married, and was a man of

frugal habits. He was an early riser, and a man of untiring industry. He is described as being in his lectures, which were of two hours' duration, "both simple and profound, minute in demonstration, and yet the reverse of dry and tedious"; and his mode of introducing anecdotal illustrations of his topic was most happy. Lecturing was to him a pleasure, and, notwithstanding his many professional distractions, he regularly continued it, because, as he said, he "conceived that a man may do infinitely more good to the public by teaching his art than by practising it." His great work, *The Anatomy of the Gravid Uterus,* was published in 1774. His posthumous works are *Two Introductory Lectures* (1784), and *Anatomical Description of the Human Gravid Uterus* (1794).

See *Gent. Mag.* liii. pt. 1, p. 364 (1783); S. F. Simmons, *An Account of the Life of W. Hunter* (1783); Adams's and Ottley's Lives of J. Hunter; Sir B. C. Brodie, *Hunterian Oration* (1837); W. Munk, *The Roll of the Royal College of Physicians of London,* ii. 205 (1878).

HUNTER, SIR WILLIAM WILSON (1840–1900), British publicist, son of a Glasgow manufacturer, was born at Glasgow on July 15, 1840. He was educated at Glasgow university, Paris and Bonn, and entered the Indian civil service in 1862. In 1869 the governor-general asked Hunter to submit a scheme for a comprehensive statistical survey of the Indian empire. The early period of his undertaking was devoted to a series of tours which took him into every corner of India. He himself supervised the statistical accounts of Bengal (20 vols., 1875–77) and of Assam (2 vols., 1879). The various statistical accounts, when completed, comprised no fewer than 128 volumes. *The Imperial Gazetteer of India,* condensed from this mass of material, appeared in 9 volumes in 1881 (2nd ed., 14 vols., 1885–87; 3rd ed., 26 vols., including altas, 1908). After his retirement he arranged with the Clarendon Press to publish a series of *Rulers of India,* to which he himself contributed volumes on Dalhousie (1890) and Mayo (1892). He died at Oaken Holt on Feb. 6, 1900.

HUNTING, the pursuit of game and wild animals, for profit or sport; equivalent to "chase" (like "catch," from Lat. *captare,* Fr. *chasse,* Ital. *caccia*). The circumstances which render necessary the habitual pursuit of wild animals, either as a means of subsistence or for self-defence, generally accompany a phase of human progress distinctly inferior to the pastoral and agricultural stages. Resorted to as a recreation, however, the practice of the chase in most cases indicates a considerable degree of civilization, and sometimes ultimately becomes the almost distinctive employment of the classes which are possessed of most leisure and wealth. It is in some of its latter aspects, viz., as a "sport," pursued on fixed rules and principles, that hunting is dealt with here. (*See* also GAME LAWS.)

ENGLISH PRACTICE

Stag Hunting.—At an early period stag hunting was a favourite recreation with English royalty. It seems probable that in the reign of Henry VIII. the royal pack of buckhounds was kennelled at Swinley, where, in the reign of Charles II. (1684), a deer was found that went away to Lord Petre's seat in Essex; only five got to the end of this 70m. run, one being the king's brother, the duke of York. George III. was a great stag hunter, and met the royal pack as often as possible. In *The Chase of the Wild Red Deer,* Collyns says that the earliest record of a pack of staghounds in the Exmoor district is in 1598, when Hugh Pollard, Queen Elizabeth's ranger, kept one at Simonsbath. The succeeding rangers of Exmoor forest kept up the pack until some 200 years ago, the hounds subsequently passing into the possession of Mr. Walter of Stevenstone, an ancestor of the Rolle family. Successive masters continued the sport until 1825, when the fine pack, descended probably from the bloodhound crossed with the old southern hound, was sold in London. In 1827 Sir Arthur Chichester got a pack together again. Stag hunting begins on Aug. 12, and ends on Oct. 8; it begins again about Ladyday, and lasts till May 10. The mode of hunting with the Devon and Somerset hounds is briefly this: the whereabouts of a warrantable stag is communicated to the master by that important functionary the harbourer; a few couple of steady hounds called tufters are then thrown into cover, and, having singled out a warrantable deer, follow him until he is forced to make for the open, when the body of the pack are laid on. Very often a considerable period elapses before the stag breaks, but a run over the wild country fully atones for the delay.

Hare and Otter Hunting.—Hare hunting, which must not be confounded with Coursing (*q.v.*), is an excellent school both for men and for horses. It is cheaper than any other kind, and does not need so large an area of country. Hare hunting requires considerable skill. Beckford even goes so far as to say: "There is more of true hunting with harriers than with any other description of hounds. . . . In the first place, a hare, when found, generally describes a circle in her course which naturally brings her upon her foil, which is the greatest trial for hounds. Secondly, the scent of the hare is weaker than that of any other animal we hunt, and, unlike some, it is always the worse the nearer she is to her end." Hare hunting is essentially a quiet amusement; no hallooing at hounds nor whip-cracking should be permitted; nor should the field make any noise when a hare is found, for, being a timid animal, she might be headed into the hounds' mouths. Capital exercise and much useful knowledge are to be derived by running with a pack of beagles. There are the same difficulties to be contended with as in hunting with the ordinary harrier, and a very few days' running will teach the youthful sportsman that he cannot run at the same pace over sound ground and over a deep ploughed field, up hill and down, or along and across furrows.

Otter hunting, which is less practised now than formerly, begins just as all other hunting is drawing to a close. When the waterside is reached an attempt is made to hit upon the track by which the otter passed to his "couch," which is generally a hole communicating with the river, into which the otter often dives on first hearing the hounds. When the otter "vents," or comes to the surface to breathe, his muzzle only appears above water, and when he is viewed or traced by the mud he stirs up, or by air bubbles, the hounds are laid on. Notwithstanding the strong scent of the otter, he often escapes the hounds, and then a cast has to be made. Otter hunting can claim to have been a royal sport, being mentioned in the reign of King Henry II. Roughly speaking, the season begins in April and extends into October, though, as in foxhunting, the weather has to be taken into consideration. The modern method of hunting otters differs from that employed in bygone days when the spear and net were used, for to-day the work is largely left to the hounds and terriers. There were in 1926 18 packs of otterhounds.

Fox Hunting.—It is only within comparatively recent times that the fox has come to be considered as an animal of the higher chase. William Twici, indeed, who was huntsman-in-chief to Edward II., and who wrote in Norman French a treatise on hunting, mentions the fox as a beast of venery, but obviously as an altogether inferior object of sport. The precise date of the establishment of the first English pack of hounds kept entirely for fox hunting cannot be accurately fixed. In any case, since fox hunting began, the system of the sport has been much changed. In our great-grandfathers' time the hounds met early, and found the fox by the drag, that is, by the line he took to his kennel on his return from a foraging expedition. Hunting the drag was doubtless a great test of nose, but many good runs must have been lost thereby, for the fox must often have heard the hounds upwind, and have moved off before they could get on good terms with him. The woodlands are neither so large nor so numerous as they formerly were, while there are many more gorse covers; therefore, instead of hunting the drag up to it, a much quicker way of getting to work is to find a fox in his kennel; and, the hour of the meeting being later, the fox is not likely to be gorged with food, and so unable to take care of himself at the pace at which the modern foxhound travels.

Cub hunting, carried out on a proper principle, is one of the secrets of a successful season. To the man who cares for hunting, as distinct from riding, September and October are not the least enjoyable months of the whole hunting season. As soon as the young entry have recovered from the operation of "rounding," arrangements for cub hunting begin. The hounds must

have first of all walking, then trotting and fast exercise, so that their feet may be hardened, and all superfluous fat worked off by the last week in August. So far as the hounds are concerned, the object of cub hunting is to teach them their duty; it is a dress rehearsal of the November business. In company with a certain proportion of old hounds, the youngsters learn to stick to the scent of a fox, in spite of the fondness they have acquired for that of a hare when at walk. When cub hunting begins, a start is made at an early hour, and then the system is adopted of tracking the cub by his drag. A certain amount of blood is of course indispensable for hounds, but it should never be forgotten that a fox cub of seven or eight months old, though tolerably cunning, is not very strong; the huntsman should not therefore, be over-eager in bringing to hand every cub he can find.

Modern Developments.—The years immediately preceding the World War were in many ways the golden age of this great English sport. Money was plentiful and it was noticeable that newcomers to the country-side were inclined to favour hunting rather than shooting. Increased facilities for transport enabled people to hunt from towns. Horse-breeding and hound-breeding had been placed on a sound basis, and hunting, generally, had been organized and stabilized under the supreme authority of the Masters of Foxhounds Association. Then came the war. The drain on horses was tremendous; subscription lists dropped to practically nothing; and, worst of all, at the height of the submarine menace, the feeding of hounds became an almost insoluble problem. The expense was enormous and there was a considerable outcry to the effect that hounds should be suppressed altogether as useless animals which consumed useful food. In 1917–18 hunting very nearly ceased altogether, and had it once come to an end it is extremely improbable that it would have been revived. The Association of M.F.H., however, in collaboration with Sir William Burton, tackled the problem. All over the country the number of hounds was reduced, the reduction being effected partly by killing off hounds, but mainly by drafting large numbers out of the country, notably to America, and by breeding fewer.

These drastic measures had their reward. Not only was hunting saved, but it was far easier for the staffs, greatly depleted by the war, to deal efficiently with these reduced packs. Further, half a century of hound shows had given the general breeder a very sound idea at what to aim; so that, in spite of these reductions, not only was the total number of hounds in England in 1925 very nearly up to the pre-war strength, but the quality of English hounds was as high as ever. Not a single well-known hunt ceased to exist.

Post-war Developments.—The end of the war by no means put an end to the difficulties which faced hunting. Judicious reductions, compensated for by breeding on sound lines, settled the hound difficulty. The question of horses largely answered itself by the release of an enormous number of animals from the army. After the war, too, whether as a direct result or not it is impossible to say, there was a decided improvement in the quality of the horses; this has been accentuated by the judgments given at horse shows. Before the war the show animal and the hunter were two distinct types; the animal that won prizes was not always likely to prove of much use across country and vice versa. But after the war the show animal was displaced by the real hunter, who is quite capable of winning a prize in the show ring in the summer and a point-to-point in the spring, the ideal at which to aim. The subscriber difficulty was also automatically solved by the return of the armies and, at any rate immediately after the armistice, there were more people hunting than before the war.

Speaking generally, then, fox-hunting recovered in a surprising way from the direct consequences of the war. But an indirect consequence still had a great and adverse effect on the sport, namely, the change in the social and territorial conditions of rural England. This began before 1914, but was enormously accentuated by the war. In the old days rural England was largely in the hands of the great landowners, who were probably hunting men themselves, or at any rate supporters of hunting, and their tenant farmers, who took their cue from their landlord. Then came the extensive sales of landed property, due to the heavy taxation of the war period and after with its adverse effects on the sport.

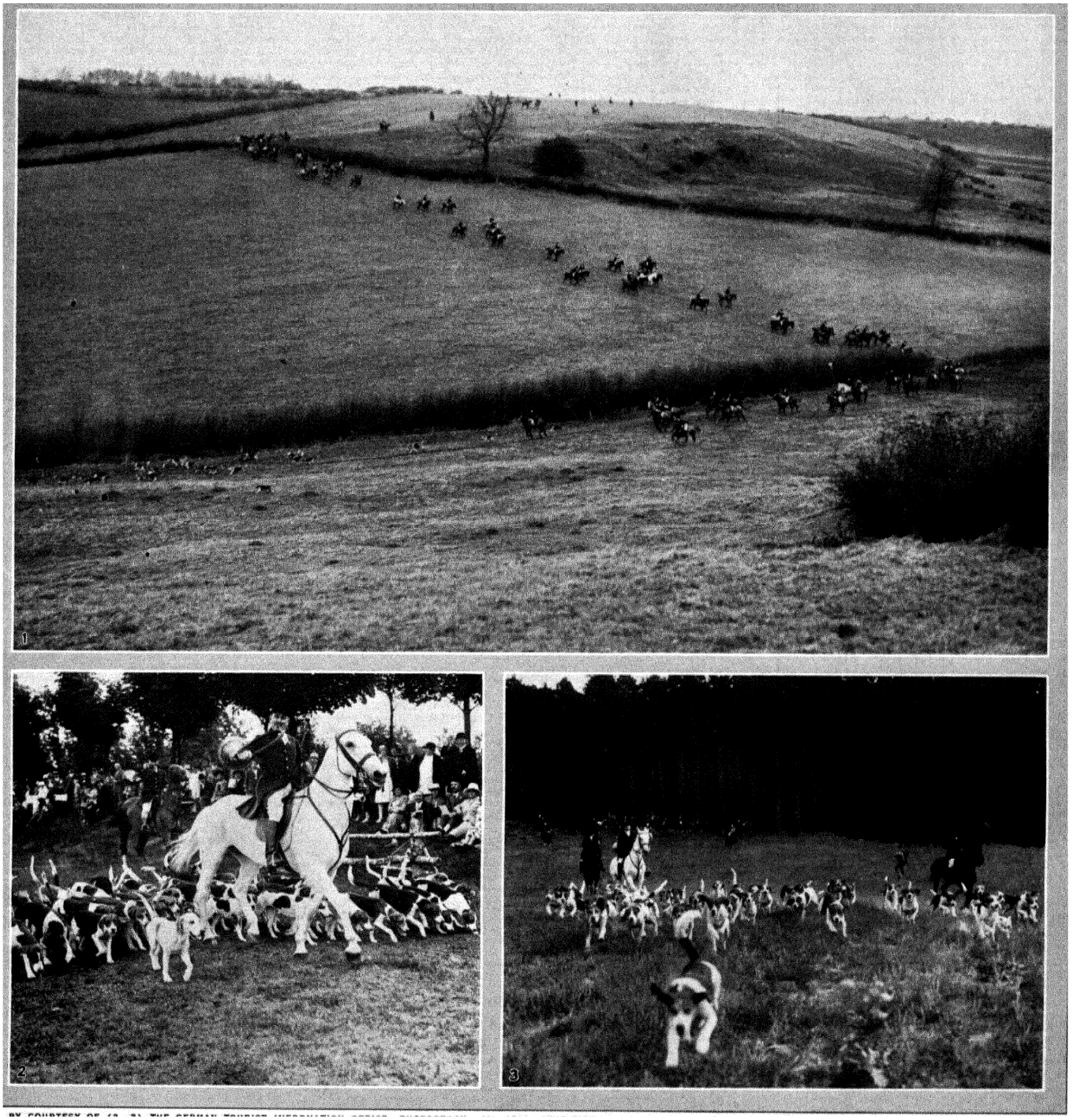
Hunting countries whose borders extend up to the limits of towns are in danger of losing portions of their territory, and in some hunts this has already taken place. The great increase in poultry farms and the advent of the smallholder is not in the interests of hunting, though up to the present matters in general have been amicably arranged by the aid of the poultry fund and tact and good-feeling. The various outbreaks of foot-and-mouth disease affected hunting for the time being, and helped to bring about that depression in agriculture which became so marked in 1927. One of the least of the evils of the failure of so many farmers to make headway owing to the difficulties of the social and political situation has been the fact that far fewer are able to follow hounds than was the case, say, before the war, though the good feeling towards the chase has in no wise diminished. The fact that the farmer, who has in the great majority of cases been a staunch supporter of hunting, has fallen upon evil times has naturally inclined masters to come to his succour as much as possible. Even in fashionable countries followers are requested to avoid doing unnecessary damage, and not to jump fences when hounds are not running, while, in order to assist farmers and to prevent stock straying, all followers of hounds are particularly requested to shut gates and also to instruct their second horsemen to do the same, both when following the hunt and on the way home.

Hunting is still as popular as ever, though the difficulties of carrying on have increased, largely owing to the expenditure, which has doubled and even trebled in places. The fact that large estates in this country have in very many cases been sold and subdivided has naturally affected hunting in various ways. In far too many cases the earth stopping is not done anything like as systematically as it used to be, and this may in the future have serious effects. Another drawback that hunting has to face is that in making roads suitable for motor traffic the slippery nature of the surfaces adopted has rendered riding on roads unusually dangerous.

The increasing use of barbed wire should be noted, though in most countries there is an arrangement to take it down during the hunting season and replace it at the end, or at least to have the obstacle properly marked; but the real trouble is what may be termed the forgotten strand in a hedge, which has been the cause of several serious accidents.

Packs.—When railways were first started in England dismal prophecies were made that the end of hunting would speedily be brought about. Much the same was predicted about the motor-car. But on the whole results have been the reverse. While in some counties the sport has suffered, townsmen who formerly would have been too far from a meet can now secure transport for themselves and their horses in all directions; and as a consequence, meets of certain packs are not advertised because of the number of strangers who would be induced to attend. The sport was never so vigorously pursued as at the beginning of the 20th century, 19 packs of staghounds being kept in England and four in Ireland, over 170 packs of foxhounds in England, ten in Scotland and 23 in Ireland, with packs of harriers and beagles too numerous to be counted. The chase of the wild stag is carried on in the west country by the Devon and Somerset hounds, which hunt three or four days a week from kennels at Exford; by the Quantock; and by a few other local packs.

Packs of foxhounds vary, from large establishments in the "Shires," the meets of which are attended by hundreds of horsemen, some of whom keep large stables of hunters in constant work, to small kennels in the north of England, where the field follow on foot. The "Shires" is a recognized term, but is nevertheless somewhat vague. The three counties included in the expression are Leicestershire, Rutlandshire and Northamptonshire. Several packs which hunt within these limits are not supposed, however, to belong to the "Shires," whereas a district of the Belvoir country is in Lincolnshire, and to hunt with the Belvoir is certainly understood to be hunting in the "Shires." The Shire



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HUNTING IN ENGLAND AND ON THE CONTINENT

1. The Cottesmore hunt. This famous English fox-hunting pack of Rutlandshire is in full cry after picking up the scent, while the followers who have been held up by wire fences are rapidly closing up
2. The start of the hunt at the beginning of the stag-hunting season at Frohnau, near Berlin
3. The Frohnau stag-hunting pack getting away into open country

hounds include the Belvoir, the Cottesmore, the Quorn, the Fernie and the Pytchleys; for besides the Pytchley proper there is a pack distinguished as the Woodland. It is generally considered that the cream of the sport lies there, but with many of the packs which are generally described as "provincial" equally good hunting may be obtained. Round about London a man who is bent on the pursuit of fox or stag may gratify his desire in many directions. The Essex and the Essex Union, the Old Surrey and Burstow and the Surrey Union, the Old Berkeley, the West Kent, the Hertfordshire, the Crawley and Horsham, the Puckeridge are amongst the foxhounds; and as regards staghounds there are the Berks and Bucks, which was substituted for the Royal Buckhounds, within easy reach of the capital.

Modern Horses and Hounds.—Questions are constantly raised as to whether horse and hounds have improved or deteriorated in modern times. It is probable that the introduction of scientific agriculture has brought about an increase of pace. Hounds hunt as well as ever they did, are probably faster on the whole, and in the principal hunts more thoroughbred horses are employed. For pace and endurance no hunter approaches the English thoroughbred; and for a bold man who "means going," a steeplechase horse is often the best animal that could be obtained, for when he has become too slow to win races "between the flags," he can always gallop much faster, and usually lasts much longer, than animals who have not his advantage of blood. The quondam "chaser" is, however, usually apt to be somewhat impetuous at his fences. But it must by no means be supposed that every man who goes out hunting desires to gallop at a great pace and to jump formidable obstacles, or, indeed, any obstacles at all. A large proportion of men who follow hounds are quite content to do so passively through gates and gaps, with a canter along the road whenever one is available. A few of the principal packs hunt five days a week, and sometimes even six, and for such an establishment between 60 and 75 couples of hounds are requisite. A pack which hunts four days a week will be well supplied with anything between 50 and 60 couples—some hunts do with less,—and for two days a week from 20 to 30 will suffice. The young hound begins cub-hunting when he is some 18 months old, and as a rule is found to improve until his third or fourth season, though some last longer than this. Often, however, when a hound is five or six years old he begins to lack speed. Exceptional animals naturally do exceptional things, and a famous hound called Potentate is recorded by the 8th duke of Beaufort to have done notable service in the hunting field for 11 seasons.

Hunt Servants.—Servants necessary for a pack include the huntsman, the duties of whose office a master sometimes fulfils himself; two whippers-in, and often a kennel huntsman, though the 18th Lord Willoughby de Broke (d. 1902), a great authority, laid it down that "the man who hunts the hounds should always feed them." In all but the largest establishments the kennel huntsman is generally called the "feeder." It is his business to look after the pack which is not hunting, to walk them out, to prepare the food for the hunting pack so that it is ready when they return, and in the spring to attend to the wants of the matrons and whelps. A kennel huntsman proper may be described as the man who does duty when the master hunts his own hounds, undertaking all the responsibilities of the huntsman except actually hunting the pack. It may be said that the first duty of a huntsman is to obtain the confidence of his hounds, to understand them and to make himself understood; and the intelligence of hounds is remarkable. If, for example, it is the habit of the huntsman to give a single note on his horn when hounds are drawing a covert, and a double note when a fox is found, the pack speedily understand the significance. The problems of scent are certainly no better comprehended now than they were more than a hundred years ago when Peter Beckford wrote his *Thoughts on Hunting*. The subject of scent is full of mysteries. The great authority already quoted, the 8th duke of Beaufort, noted as a very extraordinary but well known fact for example, "that in nine cases out of ten if a fox is coursed by a dog during a run all scent ceases afterwards, even when you get your hounds to the line of the fox beyond where the dog has been." This is one of many phenomena which have always remained inexplicable. The duties of the whipper-in are to a great extent explained by his title. Whilst the huntsman is drawing the covert the whipper-in is stationed at the spot from which he can best see what is going on, in order to view the fox away; and it is his business to keep the hounds together when they have found and got away after the fox. There are many ways in which a whipper-in who is not intelligent and alert may spoil sport; indeed the duke of Beaufort went so far as to declare that "in his experience, with very few exceptions, nine days out of ten that the whipper-in goes out hunting he does more harm than good." In woodland countries, however, a good whipper-in is really of almost as much importance as the huntsman himself; if he is not alert the hounds are likely to divide, as when running a little wide they are apt to put up a fresh fox. The earth-stopper "stops out" and "puts to"—the first expression signifying blocking, during the night, earths and drains to which foxes resort, the second performing the same duties in the morning so as to prevent the fox from getting to ground when he has been found. In the interests of humanity care should be taken that the earth-stopper always has with him a small terrier, as it is often necessary to "stop-out" permanently; and unless a dog is run through the drain some unfortunate creature in it, a fox, cat or rabbit, may be imprisoned and starved to death. This business is frequently performed by a gamekeeper, a sum being paid him for any litter of cubs or fox found on his beat.

Cost of Hunting.—With regard to the expenses of hunting, it was calculated before the war that a master of hounds should be prepared to spend at the rate of £500 a year for every day in the week that his hounds are supposed to hunt. This is probably rather under than over the mark, and the cost of hunting three days a week, if the thing be really properly done, will most likely be nearer £2,000 than £1,500. The expenses to the individual naturally vary so much that no figures can be given. As long ago as 1826, 27 hunters and hacks were sold for 7,500 guineas, an average of over £290; and when Lord Stamford ceased to hunt the Quorn in 1853, 73 of his horses fetched at auction an average of close on £200. Early in the 19th century, when on the whole horses were much cheaper than they are at present, 700 and 800 guineas are prices recorded as having been occasionally paid for hunters of special repute. A man may see some sport on an animal that cost him £40; others may consider it necessary to keep an expensive establishment at Melton Mowbray or elsewhere in the shires, with a dozen or more 500-guinea hunters and a corresponding staff of servants. Few people realize what enormous sums of money are annually distributed in connection with hunting. At least ten million pounds change hands every season, and numbers of the population in a good hunting season may expect to benefit by the sport. Horses must be fed; the wages of grooms and helpers be paid; saddlery, clothing, shoeing, etc., are items; farmers, innkeepers, railway companies, fly-men and innumerable others benefit more or less directly. (A. E. T. W.; X.)

FOX-HUNTING IN AMERICA

Fox-hunting in America dates from a very early period, though just how early it is difficult to ascertain. We find indefinite statements of early settlers from England who brought hounds, horses and even foxes over with them, but nothing definite until we find that Lord Fairfax, who settled on the Northern Neck in Virginia, in 1739, imported hounds in 1742, and kept up a regular establishment for fox-hunting at his country seat.

In 1766, the Gloucester Fox Hunting Club was organized by a number of gentlemen of Philadelphia, and a pack, which was said to have sprung from imported English blood, was maintained until 1818, when the club disbanded. At the initial meeting, held Dec. 13, 1766, the membership of the club was about 125, among them a great number of well-known historical personages. Capt. Samuel Morris was president, and his negro slave, "Old Natty," served the club as kennel-man and huntsman from 1769 until the Revolution. In 1775 the pack consisted of 14½ couples of hounds, and in 1778, when the kennels were on the Delaware, near Gloucester Point, of

16 couples. It seems probable that these hounds were very similar to those used in England for fox-hunting at that time. If this was the case, it is curious to note the development in the two countries, for the Rose Tree hounds, which now hunt over a neighbouring territory, are of the so-called American type, which is vastly different from the existing English type, and yet both could probably trace back to the same parent stock.

The half-dozen packs which hunt the country about Philadelphia are all prone to claim their origin from this club, and it is certain that it is very easy to trace the gradual development of fox-hunting in and about the Quaker city along these lines. Going further south, we find in that oldest of American sporting journals, *The American Turf Register and Sporting Magazine*, that there were many private packs owned and hunted about Baltimore, and even much farther south, and although there was no organized hunting at that time, these packs were the nucleus from which the southern hunt clubs have sprung.

Almost contemporaneous with the Gloucester Fox Hunting Club was the Brooklyn Hunt, founded 1789. Previously, in 1770, one John Evers maintained and hunted a pack of fox-hounds at Hempstead, Long Island. Hounds, horses and hunt servants were said to have been brought from England, and among the subscribers to the pack was George Washington, Esquire. The Revolutionary War put an end to these pioneer efforts, and as was the case with the hunting about Philadelphia, there was a period of inactivity among the fox-hunters; but we can trace the origin of many of the northern packs directly to the ante-Revolution organization.

Going still further north, to Canada, we find that the Montreal Hunt, founded in 1826, is the oldest organized hunt on the continent which can show a continuous record of sport. Of course, England maintained garrisons in all the principal Canadian cities, and it was natural that these military organizations should bring with them their national sport. Looking through the records of the Montreal Hunt, and also those of its somewhat younger sister, the Toronto Hunt, founded in 1843, we find that both have been largely supported in this way.

Fox-hunting in America is almost contemporary with fox-hunting in England, but the development in England has been much more rapid, and the whole game has been carried out on a much more scientific basis than in the United States and Canada. Conditions in England differ widely from those in America in the following particulars: First, in the climate, which makes a considerable difference in the scenting conditions; second, in the conformation of the country hunted over—it is much easier to stay with hounds in England than in America; third, the nature of the quarry—in England foxes are protected by popular feeling, whereas in America, or at any rate the greater portion of it, the fox is considered vermin and has to shift for himself from the first; and finally, the method of pursuing the sport. The diversity of these conditions, and for that matter, the diversity which exists among the hunting countries in America—which, it must be realized, cover an area comprising nearly the whole of the United States and southern Canada—is so great that it is impossible for any one type of hound to show the best sport under these widely varying conditions. The result has been the development of hounds which differ in type and conformation to a marked degree.

During the last 30 years there has been a tremendous growth of hunting. Organizations have sprung up all over the United States and Canada and particularly in the West, where a great interest is being shown in the sport. The scale on which hunting is carried on in America as compared to England will seem very small, but it must be remembered that hunting in America, while not in its infancy, is at least in its adolescence.

There were in 1928 over 100 packs of hounds in America which are officially "recognized" by the Hunts Committee of the National Steeplechase and Hunt Association, and by the Masters of Foxhounds Association of America; which latter body has jurisdiction over all hunting matters. Each hunt is required to file with the secretary of the Masters of Foxhounds Association of America a map showing the area hunted, and any disputes as to the boundaries between hunts is settled by the executive committee of this association, whose decision is final. This executive committee is composed of the president, vice-president and secretary of the association, ex officio, and also representatives from the middle West, Virginia, Maryland, Pennsylvania, New York and New Jersey, New England and Canada; thus giving a full representation to the entire area. The Hunts Committee, on the other hand, which is composed of delegates from the National Steeplechase and Hunt Association, and also from the areas described, has jurisdiction over all matters pertaining to hunt race meetings, and working in conjunction with the Masters of Foxhounds Association, with whom there is a reciprocal agreement, forms what might be termed a complete tribunal for the government of hunting.

Of the 100 packs mentioned, some 25 are used for drag-hunting. There is in America a very large class of sportsmen—good sportsmen they are, too—who cannot give up two, or even one *whole* day a week to fox-hunting. These men get through their business at two or three in the afternoon, hasten into the country, jump on their horses and want their gallop. With the drag they can get it, and in no other way. The fences at most of the places where drag packs flourish are big and stiff, and certainly they have chosen no child's game as a substitute for the real thing.

But to get back to fox-hunting proper. Starting at the north, in Canada, we find (1928) two hunts, mentioned above, in existence. Working south to New England, we find 23 packs of hounds. New York and New Jersey have 13, among them the Meadow Brook, which is a direct descendant of the Brooklyn Hunt. Pennsylvania, Delaware and Maryland contain 27 packs of recognized hounds, while Virginia and the Carolinas have 26. In the middle West, we find a group, for the most part newly organized, of 17, and these are on the increase steadily. Finally, it will be interesting to note that there is an organized pack of hounds for each arm of the service in the United States army—the Cavalry School Hunt, with kennels at Ft. Riley, Kan.; the Artillery Hunt, with kennels at Ft. Sill, Okla.; and the Infantry School Hunt, at Ft. Benning, Georgia.

Some of these packs are composed of American hounds, hunted in the American way, by American huntsmen; some are half-bred hounds, hunted by both American and English huntsmen; and some are composed of hounds either imported from the best English kennels or bred from stock so imported, and hunted by English hunt servants. Each organization has developed hunting along methods which for the period of years of its existence have seemed to produce the best results.

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HUNTING AND FISHING, PRIMITIVE. Archaeological evidence and observations on the most backward peoples of the present day show an appreciation of animal food, and, in the case of existing hunters, considerable ingenuity in methods of capturing it. The earliest teeth suggest that man was omnivorous, eating flesh as well as vegetable products; primitive hearths contain animal bones intentionally smashed with stones for the extraction of the marrow; and stone weapons have been found embedded in vertebra and skull of Palaeolithic reindeer (Dordogne) and Neolithic ox (Cambridge). The cave paintings of western Europe are presumed to represent the efforts of hunters to obtain success in their hunting by magical means. Primitive man everywhere depended on hunting and fishing for his supply of animal food. Later, hunting is accessory to agriculture, provides variety in the vegetable diet, and survives as sport or recreation; or is required to protect flocks and herds against predatory beasts. Primitive agriculture is often the work of the women while the men are hunters. But where nature is sufficiently lavish in vegetable food, or where land mammals are comparatively few and small, hunting is of secondary importance to fishing, and fishing to horticulture. It is of least importance to purely pastoral people among whom,

except for defence or sport, it is often entirely disregarded, while for many of them all meat save that from their herds is tabu.

At the present day hunting peoples, together with the game on which they depend, are being encroached upon and crowded out by pastoral or agricultural peoples. When hunters can no longer shift their hunting grounds, when game diminishes or disappears, they must find some other food supply or die. As a purely hunting group they cease to exist. They may be actually exterminated, like the Tasmanians, and, to a large extent, the Bushmen of South Africa; they may be artificially protected and preserved, like the Amerinds of North America, and the Australians; they may survive with the help of agriculture, like many central African peoples; or augment their living by trade, like many of the Eskimo groups. But in their original state hunting peoples are now found only in unsettled districts, in areas too barren, remote, unhealthy or otherwise unattractive for settlers. In Africa the equatorial forest region preserves its pygmies and marginal Bantu hunters, the barren semi-desert of the Kalahari its scanty tribes of Bushmen, and sporadic groups of hunting peoples are found in isolated patches such as the Bauchi highlands of Nigeria and elsewhere. In the tundra region of Asia, animals are hunted as much for fur as for food, and the general use of fire-arms raises the hunting above the primitive level; but to the east, the Ainu in northern Yezo and the Kuriles still shoot with small bows and poisoned arrows and maintain themselves by fishing and hunting. In the south of the continent the forested and hilly parts of Ceylon shelter the Vedda, and the jungles of southern India contain tribes such as the Kadir of the Anaimalai hills and the Kurumba of the Nilgiris. Further to the east the isolated Andaman islands, the thick jungle of the Malay peninsula, and neighbouring islands, and parts of the Philippines all contain primitive hunters and collectors, as do the open arid plains of Australia. In North America the Eskimo, a typical hunting and fishing people, fringe the north coast and its islands and the easternmost end of Asia; on the north-west coast the Salish, Nootka, Tshimshian and other tribes, live in one of the best hunting grounds of the world, between the mountains and the sea. The caribou and other deer in the tundra and northern plains, and bison in incredible herds in the heart of the continent (from the upper waters of the Saskatchewan to the Gulf of Mexico) maintained hunting tribes until the coming of the whites. In South America the river basins of the Guianas and the Amazon are still occupied by little-known hunting tribes, usually partly dependent on cassava made from manioc. To the south, from the interior of the Argentine to the Horn is more or less open country where the guanaco (wild llama) was abundant, and, with smaller game and fish, supported nomadic hunters. In this area the Spaniards introduced cattle, which ran wild over the plains, and wild horses, to be trained to follow in pursuit. Some of the Gran Chaco hunters cultivated a little maize but this was unknown to the Patagonians, and in the extreme south the Fuegians, like the Eskimo, depend more on sea produce than on land.

Except in cases of co-operative hunting, as among the Amerinds and in the Congo region, a hunting group is small in numbers. Its first demand is for space. The land must be unoccupied and the game free from disturbance, for a hunting community needs one to ten miles, and in barren areas up to 500 miles, per head of the population. Families are small, children few, and many succumb to the inevitable hardships of the life. The group wanders within a recognized area, camping at convenient spots, but no settled life is possible.

PRIMITIVE INVENTIVENESS

Hunting Methods.—Methods of hunting vary with the nature of the country and of the animal hunted, the ingenuity and inventiveness of the hunters and the materials at their disposal. The Australians have few and plain weapons: their traps and snares are, for the most part, simple and obvious. They depend on their stone or bone-tipped spears, wooden clubs and missile club or boomerang. They stalk both emus and kangaroos, use pituri plant decoctions to stupefy emus at waterholes, and exploit the curiosity of the bird by luring it on to a pitfall in which it is speared. The Bushman of the Kalahari will run an unwounded springbok to a standstill in the hottest part of the day, keeping the animal constantly on the move, preventing it from lying down, until, by reason of the hot sand getting between its hoofs, it sinks exhausted to the ground. The Eskimo pursue sea-birds in their kayaks, following them by the bubbles when they rise, and, by tiring them out, catch them by hand. They also run down fawns in the spring, driving them into deep snow, a method used by the Plains Indians for killing the floundering bison.

Disguise, Traps, Snares, etc.—Patience and cunning of a higher order are seen in the devices by which the hunter conceals his approach and the various nooses, snares, nets, traps, game-pits and decoys, found almost universally among primitive hunters. The Australian covers his head with water-weeds as he swims after water-fowl, or approaches the emu carrying a leafy branch to prevent the bird noticing him. The Bushman scatters a handful of dust over his head to make himself the same colour as the dry grass, or plaits a kind of saddle of grass, sticks some ostrich feathers in it and places it on his shoulders, holding up a long stick with the head curved to look like an ostrich. He imitates the actions of the bird, feeding, running, preening its feathers, and, always moving up wind, contrives to get as near as possible to the flock before discharging his poisoned arrow. Sometimes the imitation is too realistic, and the cock bird, resenting the advances of a rival, attacks the little hunter. The Navaho hunter stalks deer disguised in a deer skin, and the Blackfoot puts on a bison skin when stalking bison. Nooses, snares, traps and pitfalls are very varied and the peculiarities of the animal to be lured are carefully studied, human ingenuity being pitted against animal cunning.

Firing the bush or prairie is a common method of startling game, which can easily be trapped or knocked over in terrified flight. Fire is used by the Zande for elephant hunting. When a herd is discovered a large circle surrounding it is fired simultaneously, and the entrapped animals, crowded together, bewildered by the flames and blinded by the smoke, are unable to defend themselves and not a single beast escapes.

Weapons.—Any stick or stone can be picked up at random to knock over birds and small game, but specially shaped clubs or throwing sticks are common, such as the African knobkerry and the Australian waddy, which have developed into the more specialized trombash of the Upper Nile or the Australian boomerang (*q.v.*). The Australian spear is often only a stick, with its end hardened in the fire, though barbs may be added, or stone heads fixed in with "gum." The knife is a sharpened stone or made of the leg bone of the emu. In Australia, as in Arctic America, the spear is propelled by the spear-thrower to give greater range. Except in Australia bows and arrows are the universal weapons of primitive hunters, varying according to the skill of the maker, the materials at his disposal and the prospective victims. (*See* BOWS AND ARROWS.) The blow-pipe or blow-gun (*q.v.*) is more silent than bow and arrow and, with its poisoned darts, is one of the deadliest weapons in the hands of the primitive hunter.

Poisons.—Poisons are both animal and vegetable, and consist of many ingredients which are mixed with secrecy and magic. The central Australians catch emu by pounding up pituri (*Duboisia Hopwoodii*) leaves with water as a bait; the bird becomes stupefied and is easily speared. In parts of the Amazon region the poison is assaca sap, and all the hunters carry with them little bags of salt, which acts as an antidote. The Macusi of British Guiana make their famous *curare* ("urali") poison from the climbing *Strychnos toxifera*, mixed with other plants, adding black and red ants, and the poison fangs of snakes. The Punan poison in Borneo is the dried juice of the upas tree. The Bushmen of South Africa have a wide range of vegetable poisons, using, as well as *Strychnos, Euphorbia, Digitalis, Strophanthus* and the "Bushman poison bush," *Acocanthera venenata*. They add snake poison glands, poisonous spiders and scorpions, and in particular the little and specially deadly caterpillar called *"ngwa."*

Dogs.—Dogs are used to smell out, track, beat up and chase game, and their remains are found in deposits of Neolithic and earlier ages, though the Australian never trained the native dingo

to help him catch his prey. The hunting dogs of the Lillooet of British Columbia were carefully trained and treated; one good dog was worth a large dressed elk skin. As a rule the treatment of dogs by Indians compares very unfavourably with that of the Eskimo. Among the Eskimo seal-hunting would be scarcely possible without the help of dogs, who smell out the breathing holes under the snow. Dogs help the Labrador Eskimo in hunting the polar bear. Among the Gilyaks of the Amur river the dog is held in high esteem for at death the soul of the hunter passes into his favourite dog, which is fed with choice food and finally sacrificed on his master's grave. The Nagas of Manipur hunt in large numbers while the dogs drive out the game. Custom provides for the dogs (or owners of the dogs) a share of the quarry which is known as the dog's share. The "dog's share" is a recognized part of the spoil in Africa and in Melanesia. Lean, half-starved and savage tempered Bushman dogs accompany their masters: they attack leopard or hyena with courage born of hunger. The little yellow hunting dogs of central Africa are trained as beaters in the Congo. Some 10 or 12 men or boys go out to hunt duiker (antelope) and small game in the Ituri forest, armed with spears and two or three savage little prick-eared long-tailed pit-dogs of a peculiar breed.

Fishing.—Fishing is commonly accessory to hunting and as widely distributed, but more restricted in its range, since purely fishing peoples are found only on the banks of large rivers or lakes or on sea coasts. Here, however, if the fish are abundant, fishers are able to maintain a more settled life than hunters on land, supporting themselves entirely on their catch, for food and trade. They are also less isolated than hunting peoples. Fish are not easily exterminated, and large groups can live in fishing villages, while the water provides a means of intercommunication.

There are whole tribes among whom fish forms the staple food all the year round. The Indians on the banks of the great rivers of north-west America where sturgeon grow to an extraordinary size, could catch and dry enough fish to last from one season to the next, and if not, there is scarcely a month in which some species of "salmon" cannot be caught. The Eskimo are great fishermen and in the winter live mainly on sea or river produce. In the summer the women fish while the men hunt, and dried or frozen fish and seal meat form the winter provisions. At the other extremity of the continent the Fuegians, a sea-shore people, fish from their frail boats made of bark and train their dogs to assist them by plunging into the water and driving the fish. Fishing is important on all the great rivers of Siberia, where people without reindeer are dependent on natural resources. The Gilyaks and Golds of the Amur river live entirely on fish and on the bears which crowd down to join in the fishing, when the salmon "run." Transparent fish skin supplies the windows for the half-underground houses, and, in former days, the clothing was of salmon skin, ornamented with carp skin, a fashion now abandoned, though fish skin shoes are commonly worn in the summer.

Many people are mainly if not entirely dependent on fishing in Africa, living on the banks of the great rivers or on the shores of the great lakes. With the negroes of Melanesia and throughout the islands of the Pacific, fish, dugong and turtle are especially welcome as a change in the ordinary vegetable diet. In some islands anything connected with fishing is too sacred to be touched by women, and all but certain fish are tabu to them. In Samoa the men take their netting with them to the council meeting, and in New Zealand no woman may approach a net-maker. In south-eastern Asia, in the Malay archipelago and on the Chinese coast, are families and groups of families who seldom land on shore and never settle there for any length of time. Their homes are their boats, and fishing is their livelihood, supplemented by trade, or by piracy. The peaceful Mawken of the Mergui archipelago are almost entirely self-supporting, trading their surplus fish, trepang and other sea produce, to the Chinese, in exchange for a little grain or spirit, or cloth; the boat is the house, with convenient notches for the children to clamber in and out, and if obliged by storm to take refuge on land, the deck awning forms the temporary hut.

FISHING METHODS

Primitive fishing methods consist merely in the collecting; the fish are caught by hand, speared or shot with bow and arrow. The Australians catch catfish with their feet, or stirring up the water, hit or spear the fish coming to the surface. The Bushmen spread grass on the surface of a pool, then, wading in, push the grass and fish into the shallows where they are easily caught. Further north, near Stanley pool, as the river shrinks in the dry season, fish are scooped out of pockets in the rocks with gourds, a pint or more at a dip. And when the sukai, the "fish of fishes" (*Onchorynchus*) are crowding up the Fraser river to spawn, "so that it is almost possible to cross the river upon their backs" or the oolichan (*Thaleichthys pacificus*) chokes the river in a plentiful run, the Salish Indians spear them in hundreds or scoop them up in buckets.

Spears, bows and arrows are the principal weapons for fishing as for hunting, to which may be added harpoons for larger fish and sea mammals; nets are fairly general, from the small hand nets, mainly used by women and children in shallow water and at low tide, to enormous seine or drag nets stretching right across reaches of the rivers or shallows of the sea; but the use of hook and line, though found among many primitive fishers, is not universal. The Andamanese, most skilful fishermen, use no hook or line; the central Australians had no hooks before the coming of the white man, and neither nets nor hook and line were known to the Tasmanians. The Bushmen have barbed harpoons for fishing, but rely on baskets instead of nets. In Torres straits the Murray islanders wade into the sea with conical baskets to scoop up the sardine-like shoals of *tup*. In central Australia nets made of rushes, without floats or sinkers, are stretched from tree to tree or stakes, and left there. If a man wants some fish, he swims out and helps himself.

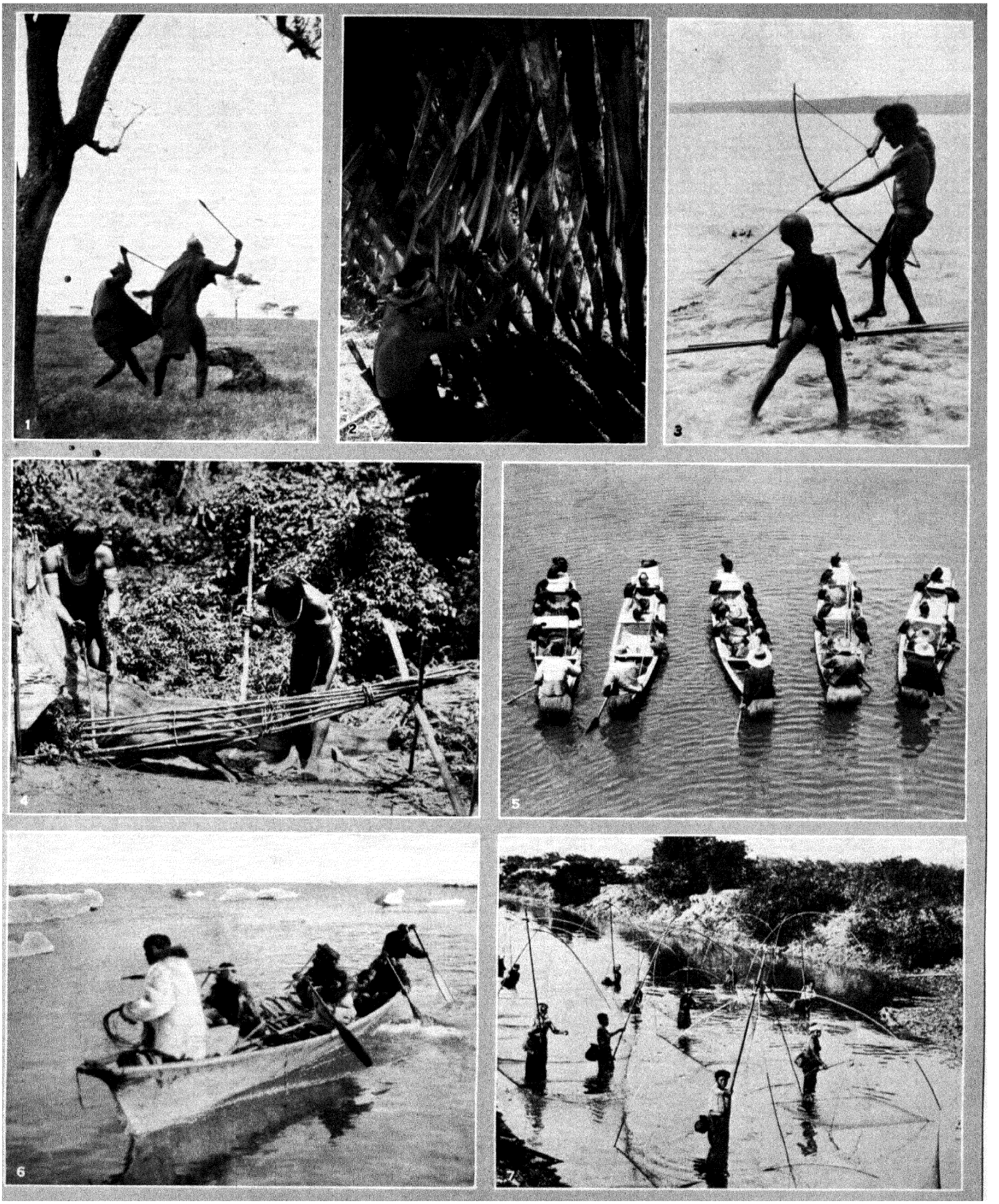
Fire and Poison.—Fire is here man's ally, as in hunting, and fish are everywhere lured to destruction by the light of a torch. Poison is also commonly used. In Africa circles of *Euphorbia* stakes are planted in a river, and the fish become entangled and stupefied; or bruised stems of poisonous plants are thrown in, and the helpless fish float to the surface. The Polynesians mix *Tephrosia piscatoris* or *Barringtonia speciosa* with taro as a poison bait and catch the fish by hand.

Dogs and Sucker-fish.—The dog is occasionally used to drive fish (Fuegians, Ainu, and not unknown in England and Ireland) as otters are trained on the Yangtse; while in Chinese lakes and canals cormorants dive for fish, with a cord round their necks to prevent the catch from being swallowed. In Australia and Torres straits, as in Central America, sucker-fish (*Echeneis naucrates* or *remora*) are used for catching small turtle. The fish is thrown out of the canoe with a line attached to the tail, and, attaches itself to the turtle. The line may then be drawn in, together with the turtle, or it acts as a guide to a man who swims down and gives it a finishing blow.

Kite-fishing.—Kite-fishing is found sporadically from the Malay region to Santa Cruz island in Melanesia.

Property.—The recognition of definite rights over hunting grounds or fishing waters is usually clearly established and poaching vigorously resented by the rightful owners, who are sometimes, however, placated by a share of the spoil. The Eskimo form an exception to this rule, for it is recorded that they have no strict divisions of hunting territory, holding that food belongs to everyone. The rights of the individual or the hunting group over the game killed were sometimes definitely fixed. Usually the man whose arrow first struck the animal, or first struck it in a vital part, had first claim. In the Andaman islands a pig belongs to the man whose arrow first strikes it, but a bachelor must be content to see it distributed by one of the older men, all the best parts going to his seniors, while he and his contemporaries have to be satisfied with the inferior parts.

Magic.—Magic plays a very important part in primitive hunting and fishing, and a man relies for his success as much on supernatural as on natural means, while ill-success is ascribed less to lack of skill and inadequate weapons, than to failure in some preliminary ritual, or to the stronger magic of some rival force. Sir



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HUNTING AND FISHING FOR BIG GAME

1. African natives spearing a hyena
2. Setting up a trap for big game in the Malay Peninsula
3. Papuans of New Guinea hunting fish in the native manner
4. Wiama Indians of northern Brazil trapping the peccary (wild hog)
5. Chinese fishermen of Hang-chow-fu fishing with cormorants; a cord around the bird's neck prevents its swallowing the fish
6. Eskimos harpooning walruses from an "umiak" or skin-boat
7. Siamese fishermen fishing with nets on poles, in a "kiong" or canal

J. G. Frazer in the *Golden Bough* describes the sympathetic magic worked by the Indians of British Columbia, the Australians and the hunters and fishers of the East Indian archipelago, with parallel examples from Cambodia and the Scottish Highlands; and illustrations can be collected from all over the world.

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HUNTING DOG, *Lycaon pictus,* an African wild dog, differing from the rest of the family in having only four toes on each foot, and in its blotched coloration of ochry yellow, black, and white. The species is nearly as large as a mastiff, with long limbs, broad flat head, short muzzle, and large erect ears. These wild dogs hunt in packs, and are found in nearly the whole of Africa south and east of the Sahara. The statement of Gordon Cumming that a pack "could run into the swiftest or overcome the largest and most powerful antelope," is abundantly confirmed, and these dogs do great damage to sheep flocks.



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

WILD HUNTING DOG OF AFRICA (LYCAON PICTUS)

HUNTINGDON, EARLS OF. GEORGE HASTINGS, first earl of Huntingdon[1] (*c.* 1488–1545), was the son and successor of Edward, second Baron Hastings (d. 1500), and the grandson of William, Baron Hastings, who was put to death by Richard III. in 1483. He was created earl of Huntingdon in 1529, and he was one of the royalist leaders during the suppression of the rising known as the Pilgrimage of Grace in 1536. His eldest son FRANCIS, the second earl (*c.* 1514–1561), was a close friend and political ally of John Dudley, duke of Northumberland, sharing the duke's fall and imprisonment after the death of Edward VI. in 1553; but he was quickly released, and was employed on public business by Mary. His brother Edward (*c.* 1520–1572) was one of Mary's most valuable servants; a stout Roman Catholic, he was master of the horse and then lord chamberlain to the queen, and was created Baron Hastings of Loughborough in 1558, this title becoming extinct when he died.

The second earl's eldest son HENRY, the third earl (*c.* 1535–1595), married Northumberland's daughter Catherine. His mother was Catherine Pole (d. 1576), a descendant of George, Duke of Clarence; and, asserting that he was thus entitled to succeed Elizabeth on the English throne, Huntingdon won a certain amount of support, especially from the Protestants and the enemies of Mary, queen of Scots. In 1572 he was appointed president of the council of the north and during the period between the flight of Mary to England in 1568 and the defeat of the Spanish armada, twenty years later, he was frequently employed in the north of England. He was for a short time in 1569 one of the custodians of Mary. Lady Elizabeth Hastings (1682–1739), daughter of Theophilus, the seventh earl, was famous for her charities and her piety. Her beauty drew encomiums from Congreve and from Steele in the pages of the *Tatler,* and her other qualities were praised by William Law. She was a benefactor to Queen's college, Oxford. THEOPHILUS (1696–1746), the ninth earl, was the husband of the famous Selina, countess of Huntingdon (*q.v.*). The earldom became dormant in 1789, and was not revived until 1818.

See H. N. Bell, *The Huntingdon Peerage* (1820).

[1]The title of earl of Huntingdon had previously been held in other families (*see* HUNTINGDONSHIRE). The famous Robin Hood (*q.v.*) is said to have had a claim to the earldom.

HUNTINGDON, DANIEL (1816–1906), American artist, was born in New York on Oct. 14, 1816. In 1835 he studied with S. F. B. Morse, and produced "A Bar-Room Politician" and "A Toper Asleep." Subsequently he painted some landscapes on the Hudson river and in 1839 went to Rome. On his return to America he painted portraits and began the illustration of *The Pilgrim's Progress,* but his eyesight failed and in 1844 he went back to Rome. Returning to New York in 1846 he devoted his time chiefly to portrait-painting, although he had painted many genre, religious and historical subjects. He was president of the National Academy 1862–70, and again 1877–90. He died on April 19, 1906, in New York city.

HUNTINGDON, SELINA HASTINGS, COUNTESS OF (1707–1791), English religious leader and founder of a sect of Calvinistic Methodists, known as the Countess of Huntingdon's Connection, was the daughter of Washington Shirley, 2nd Earl Ferrers. She was born at Stanton Harold, near Ashby-de-la-Zouch, Leicestershire, on Aug. 24, 1707, and in 1727 married Theophilus Hastings, 9th earl of Huntingdon. In 1739 she joined the first Methodist society in Fetter Lane, London. On the death of her husband in 1746 she threw in her lot with Wesley and Whitefield in the work of the great revival. Isaac Watts, Philip Doddridge and A. M. Toplady were among her friends. In 1748 she gave Whitefield a scarf as her chaplain, and he frequently preached in her London house in Park Street to audiences that included Chesterfield, Walpole and Bolingbroke. In her chapel at Bath there was a curtained recess dubbed "Nicodemus's corner," where some of the bishops sat incognito to hear him. Lady Huntingdon spent her ample means in building chapels in different parts of England, *e.g.,* at Brighton (1761), London and Bath (1765), Tunbridge Wells (1769), and appointed ministers to officiate in them, under the impression that as a peeress she had a right to employ as many chaplains as she pleased. In 1768 she converted the old mansion of Trevecca, near Talgarth, in South Wales, into a theological seminary for young ministers for the connection.

Up to 1779 Lady Huntingdon and her chaplains continued members of the Church of England, but in that year the prohibition of her chaplains by the consistorial court from preaching in the Pantheon, a large building in London rented for the purpose by the countess, compelled her, in order to evade the injunction, to take shelter under the Toleration Act. This step placed her legally among dissenters. Till her death in London on June 17, 1791, Lady Huntingdon continued to exercise an active, and even autocratic, superintendence over her chapels and chaplains. She successfully petitioned George III. in regard to the gaiety of Archbishop Cornwallis's establishment, and made a vigorous protest against the anti-Calvinistic minutes of the Wesleyan Conference of 1770, and against relaxing the terms of subscription in 1772. Her 64 chapels and the college were bequeathed to four trustees. In 1792 the college was removed to Cheshunt, Hertfordshire, where it remained till 1905, when it was transferred to Cambridge.

See *The Life of the Countess of Huntingdon* (2 vols., 1844); A. H. New, *The Coronet and the Cross, or Memorials of Selina, Countess of Huntingdon* (1857); Sarah Tyler, *The Countess of Huntingdon and her Circle* (1907).

HUNTINGDON, municipal borough and county town of Huntingdonshire, England, on the left bank of the Ouse, 59 m. N. of London by rail. Pop. (1921) 4,184. Huntingdon (*Huntandun, Huntersdune*) was recovered from the Danes *c.* 919 by Edward the Elder, who raised a castle there, probably on the site of an older fortress. In 1010 the Danes destroyed the town. The castle was among those destroyed by order of Henry II. At the time of the Domesday Survey Huntingdon was divided into four divisions, two containing 116 burgesses and the other two 140. Most of the burgesses belonged to the king. King John in 1205 granted them the liberties and privileges held by other boroughs and increased the farm to £20. The borough was incorporated by Richard III. in 1483, and in 1630 Charles I. granted a new charter, which remained in operation until 1835. The burgesses were represented in parliament by two members from 1295 to 1867, when the number was reduced to one, and in 1885 they ceased to be separately represented. Huntingdon owed its prosperity to its

situation on the Roman Ermine Street, and is the centre of an agricultural district. The market held on Saturday was granted to the burgesses by King John. During the Civil Wars Huntingdon was several times occupied by the Royalists, but was a great Puritan centre. It forms a twin town with Godmanchester.

The town consists principally of one street, about a mile long, in the centre of which is the market-place. The parish church of St. Mary occupies the site of the priory of Augustinian Canons already existing in the 10th century, in which David Bruce, Scottish earl of Huntingdon, was buried. All Saints' church has slight remains of the original Norman church. Some Norman remains of the hospice of St. John the Baptist founded by David, king of Scotland, at the end of the 12th century were incorporated in the buildings of Huntingdon grammar school, once attended by Oliver Cromwell and by Samuel Pepys. Hinchingbrooke House, an Elizabethan mansion chiefly of the 16th century, and the seat of the Cromwell family, occupies the site of a Benedictine nunnery. A racecourse is situated in the bend of the Ouse to the south of the town.

HUNTINGDON, a borough in the central part of Pennsylvania, U.S.A., beautifully situated on the Juniata river, 150m. E. of Pittsburgh; the county seat of Huntingdon county. It is on Federal highway 22, and is served by the Huntingdon and Broad Top Mountain and the Pennsylvania railways. The population was 7,051 in 1920 (95% native white). Coal, iron, fire-clay, limestone and white sand abound in the vicinity, and water power is supplied by the river. The borough has a number of manufacturing industries which make use of the natural resources. It is the seat of the State Industrial Reformatory (opened 1888) and of Juniata college, founded in 1876 by the Church of the Brethren (Dunkers). Huntingdon was laid out in 1767 under the direction of Dr. William Smith, then provost of the college (which became the university) of Pennsylvania, and was named after the countess of Huntingdon, who had contributed liberally to that institution. It was incorporated as a borough in 1796.

HUNTINGDONSHIRE (HUNTS), an east midland county of England, bounded north and west by Northamptonshire, south-west by Bedfordshire and east by Cambridgeshire. Among English counties it is the smallest with the exception of Middlesex and Rutland, having an area of 366 sq. miles. All the stratified rocks are of Jurassic age, except a small area of Lower Greensand north of Potton. The Greensands form low, rounded hills. A narrow strip of Inferior Oolite reaches from Thrapston by Oundle to Wansford near Peterborough. It is represented about Wansford by the Northampton sands and by a slight development of the Lincolnshire limestone. The Great Oolite Series has at the base the Upper Estuarine clays; in the middle, the Great Oolite limestone, which forms the escarpment of Alwalton Lynch; and at the top, the Great Oolite clay. The Cornbrash is exposed along part of the Billing brook, and in a small inlier near Yaxley. Over the remainder of the county the lower rocks are covered by Oxford clay, about 600 ft. thick. All the strata have a general dip towards the south-east.

Much glacial drift clay with stones covers the older rocks; it is a bluish clay, often containing masses of chalk. The Fens on the eastern side of the county are underlain by Oxford clay, which here and there projects through the prevailing newer deposit of silt and loam. There are usually two beds of peat or peaty soil separated by a bed of marine warp. Black loamy alluvium and valley gravels, the most recent deposits, occur in the valleys of the Ouse and Nene. Calcareous tufa is formed by the springs near Alwalton. Oxford clay is dug for brick-making at Fletton, St. Ives, Ramsey and St. Neots. The Bedford Levels occupy about 50,000 ac. in the north-east. The Ouse skirts the borders of the county near St. Neots, and after flowing north to Huntingdon runs eastwards past St. Ives into Cambridgeshire on its way to the Wash. The Kym, from Northamptonshire, joins the Ouse at St. Neots, while the Alconbury brook falls into it at Huntingdon. The Nene forms for 15 m. the north-western border of the county, and quitting it near Peterborough, enters the Wash below Wisbech, in Cambridgeshire. The course of the old River Nene flows eastward midway between Huntingdon and Peterborough, and about 1½ m. N. by E. of Ramsey it is intersected by the Forty Foot, or Vermuyden's Drain, a navigable cut connecting it with the old Bedford river in Cambridgeshire.

Early History.—Prehistoric objects of all ages, except the upper Paleolithic, have been discovered. They were found chiefly along the upper valleys of the Nene and Great Ouse, the borders of the Fens, and other dried up river courses. The reason for this distribution is that the river valleys are composed of gravel while the higher lands are of clay and were therefore forested in early times. Finds of flint in this latter area are sporadic and may date from as late as the Roman period. The later invaders seem to have pierced the county by coming up the rivers from the Wash and to have settled on the first non-Fen land which they found. Finds of British coins suggest that in the century before the Roman Conquest of A.D. 43, Huntingdon formed part of the political organization of the Catuvellauni. Ermine street ran athwart the county and where it crossed the valleys of the Ouse and Nene there were important settlements. In the latter valley during the Roman period pottery making was an important industry.

The Gyrwas, an East Anglian tribe, early in the 6th century worked their way up the Ouse and the Cam as far as Huntingdon. After their conquest of East Anglia in the latter half of the 9th century, Huntingdon became an important seat of the Danes. About 915 Edward the Elder wrested the fen-country from the Danes, repairing and fortifying Huntingdon, and a few years later the district was included in the earldom of East Anglia. Religious foundations were established at Ramsey, and St. Neots by the Benedictines in the 10th century and a cell at St. Ives before the Conquest.

In 1011 Huntingdonshire was again overrun by the Danes and in 1016 was attacked by Canute. A few years later the shire was included in the earldom of Thored (of the Middle Angles), but in 1051 it was detached from Mercia and formed part of the East Anglian earldom of Harold. Shortly before the Conquest, however, it was bestowed on Siward, and became an outlying portion of the earldom of Northumberland passing to David of Scotland. After the separation of the earldom from the crown of Scotland during the Bruce and Balliol disputes, it was conferred in 1336 on William Clinton; in 1377 on Guichard d'Angle; in 1387 on John Holand; in 1471 on Thomas Grey, afterwards marquess of Dorset; and in 1529 on George, Baron Hastings, whose descendants now hold it.

The Norman Conquest was followed by a general confiscation of estates, only four or five thanes retaining lands. In the Domesday survey it is recorded that the abbot of Ramsey held 26 manors while most of the other holdings were divided between the crown and the sheriff, Count Eustace of Boulogne. This shrievalty was united with Cambridgeshire in 1154 and has remained united until the present day, except from 1637 to 1643 when they were independent of each other. The boundaries of the county have scarcely changed since the time of the Domesday Survey, except that parts of the Bedfordshire parishes of Everton, Pertenhall and Keysoe and the Northamptonshire parish of Hargrave were then assessed under this county. There were castles at Huntingdon, Kimbolton and Connington. The second is now a mansion. Other famous mansions are Hinchingbrook House at Huntingdon, the home of the Cromwells and Elston Hall, rebuilt in 1660, which has a collection of rare books of devotion. Huntingdonshire was formerly in the diocese of Lincoln but in 1837 was transferred to Ely. At the end of the 11th century it was constituted an archdeaconry, comprising the deaneries of Huntingdon, St. Ives, Yaxley, St. Neots and Leightonstone, and the divisions remained unchanged until the creation of the deanery of Kimbolton in 1879. During the reign of the conqueror the Benedictines established a nunnery at Hinchingbrook while in 1147 the Cistercian abbey was founded at Sawtry, 7 m. W. of Ramsey. In the same century the Austin canons established priories at Huntingdon and Stonely and towards the end of the 13th century the Austin Friars had a house at Huntingdon. Almost the only remains of these religious houses are ruins at Ramsey and St. Ives. The most interesting churches for Norman architecture are Hartford near

Huntingdon, Old Fletton near Peterborough, Ramsey and Alwalton, a singular combination of Norman and Early English. Early English churches are Kimbolton, Alconbury, Warboys and Somersham, near Ramsey, and Hail Weston near St. Neots. Decorated are Orton Longueville and Yaxley, Perpendicular, St. Neots, Connington near Ramsey and Godmanchester.

In 1174 Henry II. captured and destroyed Huntingdon castle; during the Wars of the Roses the town was captured and sacked by the Lancastrians. The county resisted the illegal taxation of Charles I. and protested against the arrest of the five members. Hinchingbrook, however, was held for the king by Sir Sydney Montagu, and in 1645 Huntingdon was sacked by the Royalist forces. During the reign of Charles I. Little Gidding, a village 9 m. north-west of Huntingdon, was the home of a religious "family" established by Nicholas Ferrar.

Industries.—Huntingdonshire has always been mainly an agricultural county. At the time of the Domesday Survey it had 31 mills, besides fisheries in its meres and rivers. The woollen industry flourished from Norman times, and previous to the draining of its fens in the 17th century, turf-cutting, reed-cutting for thatch and the manufacture of horse-collars from rushes were carried on in Ramsey and district. In the 17th century saltpetre was manufactured. In the 18th century yarn spinning, pillow-lace making and the straw-plait industry flourished in the St. Neots district, where it survives; pillow lace was also manufactured at Godmanchester. In the early 19th century there were two large sacking manufactures at Standground, and brewing and malting were largely carried on. In 1926 the total acreage under crops and grass was 201,964. On the drained pasturage a large number of cattle is fed. The gravel of the Ouse valley is often covered by fine black loam deposited by the overflow of the river, and its meadows form very rich pasture grounds. The milk is used chiefly for the rearing of calves, while cattle, principally shorthorn, are fattened and sold. The village of Stilton had formerly a large market for cheese. The chief breeds of sheep are the Leicester and Lincoln, and pig-breeding is extensively practised. Wheat, barley, oats, potatoes, beans and peas are the chief crops and sugar beet in 1926 occupied over 3,000 acres. 11,485 acres were under clover and rotation grasses. During the last quarter of the 19th century there was a large decrease in the areas of grain crops and of fallow, and an increase in that of permanent pasture. Market-gardening and fruit-farming, however, greatly increased in importance. Willows are largely grown in the fen district. Good drinking water is deficient in many districts, but there are three natural springs, once famous for the healing virtues their waters were thought to possess, namely, at Hail Weston near St. Neots, at Holywell near St. Ives and at Somersham in the same district. Bee-farming is largely practised. The chief manufacture is that of paper and parchment. Madder is obtained, and in nearly every part of the county lime burning is carried on.

Communications and Administration.—The middle of the county is traversed from south to north by the L.N.E.R., which enters it at St. Neots and passing by Huntingdon leaves it at Peterborough. From Huntingdon a branch line goes via St. Ives to Cambridge and from Holme Junction to Ramsey. A branch of the L.M.S.R. runs from Huntingdon to Thrapston (Northamptonshire). From St. Ives L.N.E.R. lines also run north-east to Ely (Cambridgeshire), and north to Wisbech (Cambridgeshire) with a branch line westward from Somersham to Ramsey. The north-western border is served by the L.N.E.R. and the L.M.S.R. between Peterborough and Wansford where they part. The area of the administrative county is 233,985 acres with a population of 54,741. The county contains four hundreds. The municipal boroughs are Godmanchester (pop. 2,035), Huntingdon, the county town (4,184) and St. Ives (2,797). The other urban districts are Old Fletton (5,637), Ramsey (5,135) and St. Neots (4,110). The county is in the south-eastern circuit, and assizes are held at Huntingdon. It has one court of quarter sessions, and is divided into five petty sessional divisions. Huntingdonshire is almost wholly in the diocese of Ely, but a small part is in the diocese of Peterborough. The county returns one member to parliament.

HUNTINGTON, COLLIS POTTER (1821–1900), American railway builder, was born at Harwinton, Conn., on Oct. 22, 1821. At the age of 28, he left a prosperous general merchandise business in which he had been associated with his brother at Oneonta, N.Y., and, with $1,200 capital, set out for the California gold fields. He commenced business in Sacramento, and soon associated himself with Mark Hopkins in a hardware store. Huntington was early an active advocate of an overland railway and in 1861, together with Hopkins, Stanford and the Crocker brothers, he succeeded in getting the Central Pacific R.R. of California incorporated. Huntington was sent east as fiscal agent and was able to secure from the Government not only permission, but grants of land and financial aid to construct a line from the Pacific coast to the point where it would meet the Union Pacific. He sold the bonds, managed the finances and acted as purchasing agent until the line was completed. He then turned his attention to the building of the Southern Pacific, planning and completing the entire line, which at his death comprised 9,600 m. of track, besides 5,000 m. of steamship lines. He next took over the Chesapeake and Ohio, long unprofitable, and by operating it in connection with his Southern Pacific system and extending its eastern terminus from Richmond to the seaboard at Newport News, Va., he made it a paying road. By 1890, however, Huntington had sold his interests east of the Mississippi in order to devote his whole attention to the Southern Pacific. His death occurred on Aug. 13, 1900, at his summer camp in the Adirondack mountains.

HUNTINGTON, ELLSWORTH (1876–), American geographer, was born at Galesburg, Ill., on Sept. 16, 1876, and educated at Beloit (A.B., 1897), Harvard (A.M., 1902) and Yale (Ph.D., 1909). From 1897 to 1901 he was an instructor in Euphrates college, Harput, Turkey, and in 1901 he carried out an exploration of the canyons of the Euphrates river for which he was awarded the Gill memorial of the Royal Geographical Society. In 1903–04 he was a member of Pumhelly's Carnegie Institute expedition to Turkistan and in 1905–06 of R. L. Barrett's expedition to Chinese Turkistan, which explorations found a record in Huntington's books, *Explorations to Turkistan* (1905), and *The Pulse of Asia* (1907), the latter one of his best. At Yale he was instructor of geography, 1907–12, assistant professor 1912–15, and in 1917 was appointed research associate. In 1909 he headed the Yale expedition to Palestine and Asia Minor, and in 1911 published *Palestine and its Transformation.* From 1910 to 1913 he was research associate of the Carnegie Institution of Washington and made climatic investigations in the United States, Mexico and Central America. Huntington's investigations have had to do chiefly with climate and its relation to land forms, geological and historical changes, and to human activities and the distribution of civilizations. He published *The Climatic Factor* (1914), *Civilization and Climate* (1915, rev. ed., 1924) and *Quaternary Climates* (1925). These interests led him to investigate also the causes of climatic variation and of weather changes, resulting in *Climatic Changes,* with S. S. Visher (1922) and *Earth and Sun* (1923). Other important works are: *The Character of Races* (1924); *The Pulse of Progress* (1926); *The Human Habitat* (1927).

HUNTINGTON, FREDERIC DAN (1819–1904), American clergyman, first Protestant Episcopal bishop of central New York, was born in Hadley, Mass., on May 28, 1819. He graduated at Amherst in 1839 and at the Harvard Divinity School in 1842. In 1842–55 he was pastor of the South Congregational Church of Boston, and in 1855–60 was preacher to the university and Plummer professor of Christian Morals at Harvard; he then left the Unitarian Church, with which his father had been connected as a clergyman at Hadley, resigned his professorship and became pastor of the newly established Emmanuel Church of Boston. He had refused the bishopric of Maine when in 1868 he was elected to the diocese of central New York. He was consecrated in April 1869, and thereafter lived in Syracuse. He died in Hadley, Mass., on July 11, 1904.

See *Memoir and Letters of Frederic Dan Huntington* (Boston, 1906), by A. S. Huntington, his daughter.

HUNTINGTON, HENRY EDWARDS (1850–1927), American railway executive and financier, was born at Oneonta, N.Y., on Feb. 27, 1850. He received a common school education, but his success in positions of trust offered him by his uncle, Collis P. Huntington (*q.v.*), railway magnate, early resulted in his promotion to executive posts of importance. He was superintendent of construction in the building of the Chesapeake, Ohio and Southwestern line between Louisville and Memphis; later vice-president and general manager of the Kentucky Central railroad, one of his uncle's acquisitions; and, at the same time, supervisor of construction of the line between Ashland and Covington, Kentucky. He was then made assistant to the president of the entire Southern Pacific System; and in 1900, shortly before his uncle's death, was promoted to first vice-president. This position he continued to hold under Harriman, who succeeded to the presidency. The will of C. P. Huntington made his widow and nephew heirs to the vast Huntington estate. H. E. Huntington began at this time to be interested in the possibilities of electric railway development in the growing cities of California. He acquired control of all the street car lines of Los Angeles and consolidated them into one system, which in time, with the rapid extensions to outlying towns and suburbs, came to be one of the largest interurban systems in the country. He acquired suburban tracts, laid out town sites, beach resorts and city additions, through all of which his street car lines were extended. He began the organization of the Pacific Light and Power Company to supply not only his street car lines, but the city of Los Angeles as well with power and light. Extension to other cities of California resulted in its becoming one of the largest power systems of the United States. His marriage in 1913 with the widow of C. P. Huntington united the Huntington fortune. After 1910 he devoted more and more time to the assembling of a choice art collection and a magnificent library, especially rich in rare editions of early English literature and in Americana. In 1922 the library, together with his mansion which housed it, was deeded to the American public in perpetuity, and a trust fund of $8,000,000 was established, the income to be used for further additions, research and publication. Mr. Huntington died at Philadelphia on May 23, 1927.

HUNTINGTON, SAMUEL (1731–1796), American jurist and public official, was born at Windham, Conn., on July 3, 1731. He received only a common school education, but read widely and in 1753 began to study law. In 1760 he settled at Norwich, Conn., where he achieved rapid and extensive success in his practice. He was elected to the assembly of the Colony from Norwich in 1764 and served until he was appointed associate justice of the supreme court in 1774. The following year he was made a member of the governor's council. Despite these royal appointments he sided with the Colonies in the impending struggle with the mother country, and in 1775 became a member of the Connecticut council of safety. Later in that year he was elected a delegate to the Continental Congress, and as such in 1776 voted for and signed the Declaration of Independence. He was a member of the Congress until 1783, and served from Sept. 1779, to July 1781, as its president, succeeding John Jay in that office. He returned to Connecticut in 1783 to be made chief justice of the supreme court in 1784, lieutenant-governor in 1785 and governor in 1786. The latter office he retained by successive annual re-elections until his death at Norwich on Jan. 5, 1896.

HUNTINGTON, a city of Indiana, U.S.A., on the Little river, 25m. S.W. of Fort Wayne; the county seat of Huntington county. It is on Federal highway 24, and is served by the Erie and the Wabash railways and by inter-urban electric lines. The population was 14,000 in 1920 (97% native white). General farming is carried on in the neighbourhood, and the city has several large grain elevators. There are vast limestone deposits in the vicinity. Several hundred men are employed in the manufacture of lime, and there are large railroad repair shops and numerous other varied manufacturing industries. The aggregate factory output in 1925 was valued at $11,658,163. Huntington college (established 1897) is an institution of the United Brethren church, which also has its publication office here. Huntington was named after Samuel Huntington (1736–96) of Connecticut, a signer of the Declaration of Independence. It was settled about 1829, incorporated as a town in 1848, and chartered as a city in 1873.

HUNTINGTON, a town of Suffolk county, N.Y., U.S.A., on the north shore of Long Island; served by the Long Island railroad. The population in 1925 was 20,955. Along the sound are the villages of Huntington, Cold Spring Harbor, Centerport, and Northport, noted for their fine country estates. At Cold Spring Harbor are biological laboratories of the Carnegie Institution and a State fish hatchery. The principal occupations of the township are market-gardening, oyster fisheries and shipbuilding. The first settlement was made in 1653. From 1662 to 1664 the territory was under the jurisdiction of Connecticut. On the shore near the village of Huntington Nathan Hale was captured by the British on Sept. 21, 1776. Benjamin Thompson (Count Rumford) occupied the village towards the end of the Revolution, and built a British fort. Walt Whitman was born in Huntington, where in 1836 he established the weekly newspaper *The Long Islander* (still published) which he edited for three years.

HUNTINGTON, a city of West Virginia, U.S.A., on the Ohio river, at an altitude of 564ft., just below the mouth of the Guyandotte, near the point at which Ohio, Kentucky and West Virginia meet; the county seat of Cabell county. It is on Federal highways 52 and 60, and is served by the Baltimore and Ohio and the Chesapeake and Ohio railways. The population was 50,177 in 1920 (93% native white) and was estimated locally at 85,000 in 1928. It is a rapidly growing city, with large car shops and other manufacturing industries, surrounded by a region rich in mineral resources. The factory output in 1926 was valued at $48,211,702. Bank clearings in 1927 amounted to $68,727,620, and the assessed valuation of property was $127,452,375. Huntington is the seat of a State hospital for the insane, and of Marshall college, a State teachers' college which traces its history back to an academy established in 1837 and named after Chief Justice Marshall. In Ritter park stands the oldest house of the region, now used as an historical museum. The city was founded in 1871, as the western terminus of the Chesapeake and Ohio railway, and was named after Collis P. Huntington (*q.v.*), the president of the road.

HUNTINGTON PARK, a rapidly growing residential suburb of Los Angeles, Calif., U.S.A., in Los Angeles county. It is served by the Pacific Electric and the Union Pacific railways. The population was 4,513 in 1920 and was estimated locally at 35,000 in 1928.

HUNTINGTOWER AND RUTHVENFIELD, a village of Perthshire, Scotland, on the Almond, 3 m. N.W. of Perth. Huntingtower (originally Ruthven) Castle, was the scene of the Raid of Ruthven, when the Protestants under William, 4th Lord Ruthven kidnapped the boy-king James VI., in 1582. The earl's sons were killed in the Gowrie conspiracy (1600), after which the Scots parliament ordered the barony to be known in future as Huntingtower. A bleaching field was formed in 1774 the water of the neighbourhood being especially suitable for bleachings.

HUNTLY, EARLS AND MARQUESSES OF. This Scottish title, in the Gordon family, dates as to the earldom from 1449, and as to the marquessate (the premier marquessate in Scotland) from 1599. The first earl (d. 1470) was Alexander de Seton, lord of Gordon—a title known before 1408; and his son George (d. 1502), by his marriage with Princess Annabella (afterwards divorced), daughter of James I. of Scotland, had several children, including, besides his successor the 3rd earl (Alexander), a second son Adam (who became earl of Sutherland), a third son William (from whom the mother of the poet Byron was descended) and a daughter Katherine, who first married Perkin Warbeck and afterwards Sir Matthew Cradock (from whom the earls of Pembroke descended). Alexander, the 3rd earl (d. 1524), consolidated the position of his house as supreme in the north; he led the Scottish vanguard at Flodden, and was a supporter of Albany against Angus. His grandson George, 4th earl (1514–62), who in 1548 was granted the earldom of Moray, played a leading part in the troubles of his time in Scotland, and in 1562 revolted against Queen Mary and was killed in fight at Corrichie, near Aberdeen. His son George (d. 1576) was restored to the forfeited earldom in 1565; he became Bothwell's close associate

—he helped Bothwell, who had married his sister, to obtain a divorce from her; and he was a powerful supporter of Mary till he seceded from her cause in 1572.

GEORGE GORDON, 1st marquess of Huntly (1562–1636), son of the 5th earl of Huntly, and of Anne, daughter of James Hamilton, earl of Arran and duke of Chatelherault, was born in 1562, and educated in France as a Roman Catholic. He took part in the plot which led to the execution of Morton in 1581 and in the conspiracy which delivered King James VI. from the Ruthven raiders in 1583. In 1588 he signed the Presbyterian confession of faith, but continued to engage in plots for the Spanish invasion of Scotland. On Nov. 28 he was appointed captain of the guard, and while carrying out his duties at Holyrood his treasonable correspondence was discovered. James, however, pardoned him. In April 1589 he raised a rebellion in the north, but was obliged to submit, and after a short imprisonment in Borthwick Castle was again set at liberty. He next involved himself in a private war with the Grants and the Mackintoshes, who were assisted by the earls of Atholl and Murray; and on Feb. 8, 1592, he set fire to Murray's castle of Donibristle in Fife, and stabbed the earl to death with his own hand. This outrage, which originated the ballad "The Bonnie Earl of Moray," brought down upon Huntly his enemies, who ravaged his lands. In December the "Spanish Blanks", were intercepted (*see* ERROLL, FRANCIS HAY, 9TH EARL OF), two of which bore Huntly's signature, and a charge of treason was again preferred against him. On Nov. 26, he and the other rebel lords were freed from the charge of treason, being ordered at the same time, however, to renounce Romanism or leave the kingdom On their refusal they were attainted. Subsequently Huntly joined Erroll and Bothwell in a conspiracy to imprison the king. Huntly and Erroll gained a victory over the king's troops at Glenlivat, but his castle of Strathbogie was blown up by James, and he left Scotland about March 1595. He returned secretly, submitted to the Kirk and was restored to his estates. In 1599 he was created a marquess and, with Lennox, appointed lieutenant of the north. He was treated with great favour by the king, and was reconciled with Murray and Argyll. Doubts, however, as to the genuineness of his abjuration again troubled the Kirk. On March 19, 1607, he was summoned before the privy council. Huntly thereupon went to England and appealed to James himself. He was excommunicated in 1608, and imprisoned in Stirling Castle till Dec. 10, 1610, when he signed again the confession of faith. He was again imprisoned in 1616. At the accession of Charles I. Huntly lost much of his influence at court. For the private war waged against the Crichtons from 1630 onwards, he was again summoned before the privy council in 1635, and was imprisoned in Edinburgh Castle. He died at Dundee on June 13, 1636, after declaring himself a Roman Catholic.

GEORGE GORDON, 2nd marquess of Huntly (d. 1649), his eldest son by Lady Henrietta, daughter of the duke of Lennox, was brought up in England as a Protestant, and created earl of Enzie by James I. His influence in Scotland was employed by the king to balance that of Argyll in the dealings with the Covenanters. In the civil war he took the king's side, and in 1647 was excepted from the general pardon; in March 1649, he was beheaded by order of the Scots parliament at Edinburgh. The attainder was reversed by parliament in 1661.

HUNTLY, burgh of barony and parish, Aberdeenshire, Scotland. Pop. (1921) 3,752. It lies at the confluence of the rivers Deveron and Bogie, 41 m. N.W. of Aberdeen on the London & North Eastern Railway. It is a market town, a holiday and fishing resort, and the centre of a large agricultural district, its industries including weaving of woollen cloth and hosiery and a distillery. Huntly castle, half a mile north, now in ruins, was once a fortalice of the Comyns. From them it passed in the 14th century to the Gordons, by whom it was rebuilt. It was blown up in 1594, but was restored in 1602, subsequently it gradually fell into disrepair. The Standing Stones of Strathbogie in Market Square have offered a permanent puzzle to antiquaries.

HUNTSMAN, BENJAMIN (1704–1776), English inventor and steel manufacturer, was born in Lincolnshire in 1704. He started business as a clock and toolmaker at Doncaster. He experimented in steel manufacture, and at Handsworth, near Sheffield, at last produced a satisfactory cast steel, purer than any then in use. The Sheffield cutlery manufacturers refused it because it was too hard, but it was largely used in France, and the competition of imported French cutlery made from it forced the English makers to use it. Huntsman had not patented his process, and its secret was discovered by a Sheffield ironfounder, who, according to a popular story, obtained admission to his works in the disguise of a tramp. Benjamin Huntsman died in 1776.

See Smiles, *Industrial Biography* (1879).

HUNTSVILLE, a city of Alabama, U.S.A., 18m. from the northern boundary of the State; the county seat of Madison county. It is on Federal highway 72, and is served by the Nashville, Chattanooga and St. Louis and the Southern railways. The population was 8,018 in 1920 (37% negroes). Huntsville is surrounded by the beautiful scenery of the Cumberland plateau. The public square is on a high bluff (750ft. above sea-level). From its base issues a large spring, which furnishes water for the city and forms a stream once used for floating cargoes of cotton to the Tennessee river, 1om. south. The city has large cotton mills, with an aggregate of 332,776 spindles in 1928, and other manufacturing industries. It is one of the principal nursery centres south of the Ohio, and near by is the largest water-cress farm in the country. At Normal, 3½m. N.E., is the State Agricultural and Mechanical Institute for negroes. Huntsville was founded in 1805 by John Hunt of Virginia, who had fought in the Revolution, and in 1811 it was incorporated by the Territorial Government, the first settlement in Alabama to receive a charter. Among the first residents were some relatives of Alexander Pope, and for a short time (1809–11) the town was called Twickenham in memory of his home. It was the meeting-place of the convention that framed the first State Constitution (1819) and of the first legislature (1820). In 1844 it was chartered as a city. During the Civil War it was in possession of Federal troops from April 11 to Sept. 1862, and from July 1863 to the end of the war.

HUNTSVILLE, a city of eastern Texas, U.S.A., 68m. N. of Houston, on Federal highway 75 and the Missouri Pacific railway; the county seat of Walker county. The population in 1920 was 4,689 (45% negroes), and was estimated locally at 6,000 in 1928. Cotton-growing, stock-raising, general farming and lumbering are the leading occupations of the region. The Sam Houston State Teachers college and the State penitentiary are located at Huntsville. It was the last home of Gen. Houston, and his grave is here. The house in which he lived is preserved as a memorial. The city was settled about 1830 and incorporated in 1845.

HUNYADI, JOHN (JANOS) (*c.* 1387–1456), Hungarian statesman and warrior, was the son of Vojk, a Magyarized Vlach who married Elizabeth Morzsinay. He derived his family name from the small family estate of Hunyad, in Transylvania. The epithet Corvinus, adopted by his son Matthias, was derived from another property, Piatra da Corvo. While a youth, he entered the service of King Sigismund, accompanied him to Frankfort in 1410; took part in the Hussite War in 1420, and in 1437 drove the Turks from Semendria. For these services he received numerous estates and a seat in the royal council. In 1438 King Albert II. made him ban of Szöreny, a most dangerous dignity entailing constant warfare with the Turks. On the death of Albert in 1439, Hunyadi supported the candidature of the young Polish king Wladislaus III. (1440), against the partisans of the Austrian candidate Ladislaus V., took a prominent part in the ensuing civil war and was rewarded by Wladislaus III. with the captaincy of the fortress of Belgrade and the voivodeship of Transylvania, which latter dignity, however, he shared with his rival Mihaly Ujlaki.

The burden of the Turkish War now rested entirely on his shoulders. He won brilliant victories at Semendria (1441), near Hermannstadt (1442) and near the Iron Gates (1442). In 1443 he advanced across the Balkans, captured Niš, defeated three Turkish pashas, and, after taking Sofia, united with king Wladislaus' army and defeated Murad II. at Snaim. When he returned home (Feb. 1444), he had broken the sultan's power in Bosnia, Herzegovina, Serbia, Bulgaria and Albania. The Pope, the despot

of Serbia (George Branković) and the prince of Albania (George Castriota) urged him on his return to resume the war and drive the Turks from Europe. All preparations were made, when Turkish envoys arrived in Hungary to conclude a ten years' truce. The pact was concluded, but broken when news arrived that a Venetian fleet had started to prevent the Sultan (who had retired to Asia Minor) from recrossing into Europe. In July the Hungarian army recrossed the frontier and advanced towards the Euxine coast to join the galleys. Branković, however, privately informed Murad of the advance, and prevented Castriota from joining it. On reaching Varna, the Hungarians found that the Venetian galleys had failed to prevent the transit of the sultan, who now confronted them with fourfold odds, and in Nov. 1444 they were utterly routed, Wladislaus falling on the field and Hunyadi narrowly escaping.

At the diet which met in 1445 a provisional government of five Magyar captain-generals, was formed, Hunyadi receiving Transylvania and the ultra-Theissian counties as his district; but the resulting anarchy became unendurable, and in June 1446 Hunyadi was unanimously elected governor of Hungary in the name of Ladislaus V., with regal powers. His first act as governor was to proceed against the German king Frederick III., who refused to deliver up the young king. After ravaging Styria, Carinthia and Carniola and threatening Vienna, Hunyadi's difficulties elsewhere compelled him to make a truce with Frederick for two years. In 1448 he received a golden chain and the title of prince from Pope Nicholas V., and immediately afterwards resumed the war with the Turks. He lost the two days' battle of Kosovo owing to the treachery of Dan, hospodar of Wallachia, and of his old enemy Branković, who imprisoned him at Semendria; but he was ransomed by the Magyars, and, after composing his differences with his enemies in Hungary, led a punitive expedition against the Serbian prince In 1450 Hunyadi went to Pressburg to negotiate with Frederick the terms of the surrender of Ladislaus V. To refute the accusation made by his enemies that he was aiming at the throne, he resigned all his dignities into the hands of the young king, on his return to Hungary in 1453, whereupon Ladislaus created him count of Bestercze and captain-general of the kingdom.

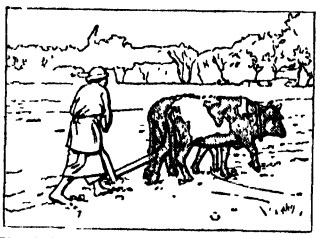
Meanwhile the Turkish danger had again become pressing. In 1455 Hunyadi provisioned and armed the fortress of Belgrade at his own expense, and leaving in it a garrison under his brother-in-law Mihály Szilágyi and his eldest son László, he proceeded to form a relief army and a fleet of 200 corvettes. To the eternal shame of the Magyar nobles, he was left entirely to his own resources. His one ally was the Franciscan friar, Giovanni da Capistrano (*q.v.*), thanks to whose preachings Hunyadi's small mercenary army was reinforced by a host of peasant volunteers. On July 14, 1456 Hunyadi with his flotilla destroyed the Turkish fleet; on the 21st and 22nd he routed the forces investing Belgrade, forcing Mohammed to raise the siege, return to Constantinople, and thus securing the independence of Hungary for another 70 years. On Aug. 11, however, Hunyadi died of plague in his camp.

Hunyadi was one of Christendom's most glorious champions, and also a great statesman. He recognized the insufficiency and the unreliability of the feudal levies, and was one of the first to employ a regular army on a large scale. A man of average education, he owed his influence partly to his natural genius and partly to the transparent integrity and nobility of his character.

See J. Teleki, *The Age of the Hunyadis in Hungary* (Hung.) (Pesth, 1852–57; supplementary volumes by D. Csánki 1895); G. Fejer, *Genus, incunabula et virtus Joannis Corvini de Hunyad* (Buda, 1844); J. de Chassin, *Jean de Hunyad* (Paris, 1859); P. Frankl, *Der Friede von Szegedin und die Geschichte seines Bruches* (Leipzig, 1904); R. N. Bain, "The Siege of Belgrade, 1456" (*Eng. Hist. Rev.*, 1892); A. Bonfini, *Rerum ungaricarum libri xlv., editio septima* (Leipzig, 1771).

HUNYADI, LÁSZLÓ (1433–1457), Hungarian statesman and warrior, was the eldest son of János Hunyadi and Elizabeth Szilágyi. At a very early age he accompanied his father in his campaigns. After the battle of Kosovo (1448) he was left for a time, as a hostage for his father, in the hands of George Branković, despot of Serbia. In 1452 he was a member of the deputation which went to Vienna to receive back the Hungarian king Ladislaus V. In 1453 he was ban of Croatia-Dalmatia. At the diet of Buda (1455) he resigned all his dignities, because of the accusations of Ulrich Cillei and the other enemies of his house, but a reconciliation was ultimately patched up and he was betrothed to Maria, the daughter of the palatine, László Garai. After his father's death in 1456, he was declared by his arch-enemy Cillei (now governor of Hungary with unlimited power), responsible for the debts alleged to be owing by the elder Hunyadi to the state; but he defended himself so ably at the diet of Futak (Oct. 1456) that Cillei feigned a reconciliation; but being persuaded by a bribe to surrender his fortress at Belgrade and to accompany the King to Buda, Hunyadi was arrested there on a charge of compassing Ladislaus's ruin, condemned to death without the observance of any legal formalities, and beheaded on March 16, 1457. (R. N. B.)

HUNZA (also known as KANJUT) and **NAGAR,** two small states on the north-west frontier of Kashmir (*q.v.*) formerly under the administration of the Gilgit agency. The two states, which are divided by a river which runs in a bed 600 ft. wide between cliffs 300 ft. high, are inhabited generally by people of the same stock, speaking the same language, professing the same form of the Mohammedan religion, and ruled by princes sprung from the same family, though frequently at war with each other. Formerly Hunza was the more prominent of the two, because it held possession of the passes leading to the Pamirs, and could plunder the caravans on their way between Turkistan and India. But they are both shut up in a recess of the mountains, and were of no importance until about 1889, when the advance of Russia up to the frontiers of Afghanistan, and the great development of her military sources in Asia, increased the necessity for strengthening the British line of defence. This led to the establishment of the Gilgit agency, the occupation of Chitral, and the Hunza expedition of 1891, which asserted British authority over Hunza and Nagar. The country is inhabited by a Dard race of the Yeshkun caste speaking Burishki. Pop. of Hunza (1921), 12,117; of Nagar (1921), 14,188. (*See* GILGIT.) The Hunza-Nagar Expedition of 1891, under Colonel A. Durand, was due to the defiant attitude of the Hunza and Nagar chiefs towards the British agent at Gilgit. The fort at Nilt was stormed, and after a fortnight's delay the cliffs (1,000 ft. high) beyond it were also carried by assault. The chief of Nagar was reinstated on making his submission, and the half-brother of the raja of Hunza was installed as chief in the place of his brother.



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NATIVE TILLING HIS GROUND WITH OXEN IN THE HUNZA CANYON

HUON OF BORDEAUX, hero of romance. The French *chansonde geste* of Huon de Bordeaux dates from the first half of the 13th century. Huon, son of Seguin of Bordeaux, kills Charlot, the emperor's son, who had laid an ambush for him, without recognizing his assailant. He is condemned by Charlemagne to be hanged, but reprieved on condition that he visits the court of Gaudisse, the amir of Babylon, and brings back a handful of hair from the amir's beard and four of his back teeth, after having slain the greatest of his knights and three times kissed his daughter Esclarmonde. By the help of the fairy dwarf Oberon, Huon succeeds in this errand, in the course of which he meets with further adventures. The Charlot of the story has been identified by A. Longnon (*Romania* viii. 1–11) with Charles l'Enfant, one of the sons of Charles the Bald and Irmintrude. The poem exists in a later version in alexandrines, and, with its continuations, was put into prose in 1454 and printed by Michel le Noir in 1516, since when it has appeared in many forms, notably in a beautifully printed and illustrated adaptation (1898) in modern French by Gaston Paris. The romance had a great vogue in England through the translation (*c.* 1540) of John Bourchier, Lord Berners, as *Huon of Burdeuxe.* The tale was dramatized and produced in Paris by the Confrérie de la Passion in 1557, and in Philip Henslowe's

diary there is a note of a performance of a play, *Hewen of Burdoche,* on Dec. 28, 1593. For the literary fortune of the fairy part of the romance *see* OBERON.

The *Chanson de geste* of Huon de Bordeaux was edited by F. Guessard and C. Grandmaison for the *Anciens poètes de la France* in 1860; Lord Berners's translation was edited for the E.E.T.S. by S. L. Lee in 1883–85. *See* also *Hist. litt. de la France* (vol. xxvi., 1873); L. Gautier, *Les Épopées françaises* (2nd ed. vol. iii. pp. 719–773); A. Graf, *I complementi della Chanson de Huon de Bordeaux* (Halle, 1878); M. Schweigel, "Esclarmonde," etc. in *Ausg. u. Abhandl. . . . der roman. phil.* (Marburg, 1889); C. Voretzsch, *Epische Studien* (vol. i., Halle, 1900).

HUON PINE, botanical name *Dacrydium Franklinii,* the most valuable timber tree of Tasmania, a member of the order Coniferae (*see* GYMNOSPERMS). It is a fine tree of pyramidal outline 80 to 100 ft. high, and 10 to 20 ft. in girth at the base, with slender pendulous much-divided branchlets, densely covered with the minute scale-like sharply-keeled bright green leaves. It occurs in swampy localities from the upper Huon river to Port Davey and Macquarie Harbor, but is less abundant than formerly owing to the demand for its timber, especially for ship- and boat-building. The wood is close-grained and easily worked.

HUPA. This, the most advanced and best known tribe of the Pacific coast division of the Athabascan family of American Indians, lives, to the number of 600, on lower Trinity river in Hoopa valley, north-western California. Their culture, shared by the Yurok and Karok, was characterized by acorn and salmon subsistence, canoes, frame houses of planks bearing individual names; clanless villages, a wealth-aristocracy owning debt slaves, fishing places and oak groves, dentalium shell and woodpecker scalp currency, treasures of albino deer skins, huge obsidian blades, furs, etc.; no political authority but an intricate law of persons and property; wealth displaying, stringently localized dances, without symbolism but attached to the recitation of narrative magical formulas. This is the southernmost efflorescence of the native culture characteristic of the North Pacific coast of North America, though lacking the *potlatch* festivals, secret societies and masks, totem poles and carving art of the northern tribes.

See Goddard in *Univ. Calif. Publ. Am. Arch. Ethn.,* vol. i. (1904); Kroeber, *Bur. Am. Ethn. Bull.* 78 (1925).

HUPEH, a province in the Yang-tze Valley in the heart of China. Pop. over 27 millions. Its core is a great plain traversed by the Yang-tze and its tributary the Han whose beds are slightly raised above its general surface. The Yang-tze is fringed with numerous marginal lakes which serve as reservoirs for its flood-waters and flood-silt. The largest lake is the Tung-ting-hu which, lying on the border of Hupeh with Hunan, has given them both their names—the one north, the other south of the lake. The two constituted a single province until the reign of K'ang Hsi (1662–1722). The most fertile and most populous part of the plain forms a broad band lying close to the course of the Yang-tze and to the lake region around the lower Han. The upper part of the course of the Han through the plain is far less closely occupied. The crops are typical of Middle China whose climate permits the growth of temperate cereals and legumes in winter, and of the sub-tropical rice and cotton in summer. Rice is the largest crop but considerable quantities are imported.

The Hupeh plain is ringed by highland—the Hwai-yang-shan in the north, the Kiu-kung-shan in the south-east, a prolongation of the Kweichow plateau in the south-west and the eastern ranges of the Ta-pa-shan in the west. The highland rim is not continuous, being pierced by the river valleys of the Yang-tze, the Han, and the rivers of Hunan, through all of which the Hupeh basin communicates with the rest of China. Roads to South China pass through Hunan, to North China up the Han and over the Hwai-yang-shan, while the Yang-tze leads to West China and eastwards to the sea. Because of this focal position at the junction of routes from all quarters of China and as the geometrical centre of the country the Hupeh Basin has come to be known as the Central Basin of China. Its focal character is crystallized in the great triple city of Wu-Han, at the confluence of the Han with the Yang-tze, long the commercial centre for all the vast area of interior China drained to the Basin. Wu-Han is becoming one of the premier industrial districts of the country (*see* HANKOW). In the political situation it is a point of great strategic importance, and under the imperial regime the viceroy of Hupeh, with his seat of government at Wuchang, was one of the most powerful officials in the empire.

HUPFELD, HERMANN (1796–1866), German orientalist and biblical commentator, was born on March 31, 1796, at Marburg, and was educated in his native town and in Halle, where in 1824 he became a teacher in the university. In the following year he was appointed professor of theology at Marburg, but 13 years later returned to Halle, where he died on April 24, 1866.

Hupfeld's earliest works in Semitic philology (*Exercitationes Aethiopicae,* 1825, and *De emendanda ratione lexicographiae Semiticae,* 1827), were followed by the first part (1841) of his *Ausführliche Hebräische Grammatik,* and by his *De rei grammaticae apud Judaeos initiis antiquissimisque scriptoribus* (1846). His principal contribution to biblical literature was the *Übersetzung und Auslegung der Psalmen* (1855–61, 3rd ed. 1888). Other writings are *Über Begriff und Methode der sogenannten biblischen Einleitung* (1844); *De primitiva et vera festorum apud Hebraeos ratione* (1851–64); *Die Quellen der Genesis von neuem Untersucht* (1853); *Die heutige theosophische oder mythologische Theologie und Schrifterklärung* (1861).

See E. Riehm, *Hermann Hupfeld* (Halle, 1867); W. Kay, *Crisis Hupfeldiana* (1865); and Herzog-Hauck's *Realencyklopädie* (1900).

HURD, RICHARD (1720–1808), English divine and writer, bishop of Worcester, was born at Congreve, Penkridge, Staffordshire, on Jan. 13, 1720, and educated at Emmanuel college, Cambridge, of which he became a fellow. He was ordained in 1744, and in 1748 he published some *Remarks* on an *Enquiry into the Rejection of Christian Miracles by the Heathens* (1746), by William Weston, a fellow of St. John's college, Cambridge. He prepared editions, which won the praise of Gibbon, of the *Ars poetica* and *Epistola ad Pisones* (1749), and the *Epistola ad Augustum* (1751) of Horace. A compliment in the preface to the edition of 1749 led to a lasting friendship with William Warburton, through whose influence he was appointed one of the preachers at Whitehall in 1750. In 1765 he became preacher at Lincoln's Inn, and in 1767 archdeacon of Gloucester. In 1768 he delivered at Lincoln's Inn the first Warburton lectures, which were published in 1772 as *An Introduction to the Study of the Prophecies concerning the Christian Church.* He became bishop of Lichfield and Coventry in 1774 and two years later tutor to the prince of Wales and the duke of York. In 1781 he was translated to the see of Worcester. He built at Hartlebury Castle a fine library, to which he transferred Pope's and Warburton's books, purchased on the latter's death. In 1783 he declined the primacy.

Hurd's *Letters on Chivalry and Romance* (1762), written in continuation of a dialogue on the age of Queen Elizabeth which was included in his *Moral and Political Dialogues* (1759), had some influence in stimulating the romantic movement; two later dialogues *On the Uses of Foreign Travel* were printed in 1763.

Hurd edited the *Works* of William Warburton, the *Select Works* (1772) of Abraham Cowley, and left materials for an edition of Addison (6 vols., 1811). His own works were published in 8 vols. in 1811. *See* Francis Kilvert, *Memoirs of . . . Richard Hurd* (1860).

HURDES, LAS or JURDES, a region of north-west Spain, south of Salamanca and the Sierra de Peña de Francia and east of the Sierra de Bejar. The Hurdanos are a peculiar people, probably originally a settlement of religious and political refugees; they number about 6,000 and inhabit primitive slate hamlets in the isolated mountainous region of the Sierra de Gata. The principal wealth consists in goats and bees. Much damage is done by boars and wolves. In the high-lying districts the Hurdanos suffer from goitre; along the rivers they are subject to malaria. In 1922 King Alfonso rode through the most difficult parts of Las Hurdes, and since then rapid progress has been made in the improvement of this region, and a good road has been built from La Alberca to the lovely valley of Las Batuecas, which was previously almost inaccessible.

See M. Legendre, *Las Jurdes. Étude de géographie humaine* (Paris, 1927).

HURDLE, a movable fence, formed of a framework of light timber, wattled with smaller pieces of pliable wood, or constructed on the plan of a light five-barred gate, filled in with brushwood. Similar movable frames can be made of iron, wire or other material. A construction of the same type is used in military engineering and fortification as a foundation for a temporary roadway across boggy ground or as a backing for earthworks.

HURDLING, running races over short distances, in which a series of ten flights of hurdles has been set. The standard distances are 120yds., ten flights of 3ft. 6in. hurdles; 220yds., ten flights of 2ft. 6in. hurdles; and 440yds., ten flights of 3ft. hurdles. At the short distance each flight of hurdles is separated from the next by 10yds., with a space of 15yds. from the start to the first flight, and a like distance from the last flight to the finish. At the intermediate distance the hurdles are 20yds. apart and at the long distance 40yds. apart. The Oxford and Cambridge distances are 120yds. high hurdles and 220yds. low hurdles. The distances at the A.A.A. championships are 120yds. and 440yds., and at the Olympic games 110 metres and 400 metres.

In 1927 the official world's records stood as follows:—E. J. Thomson, Dartmouth college, U.S.A., 1920, 120yds. hurdles, 14⅘secs.; 110 metres hurdles, 14⅘secs.; C. R. Brookins, University of Iowa, U.S.A., 1924, 220yds. and 200 metres hurdles, 23 secs.; J. K. Norton, U.S.A., 1920, and Lord Burghley, Great Britain, 1927, 440yds. hurdles, 54⅘secs.; F. M. Taylor, Grinnell college, U.S.A., 1924, 400 metres hurdles, 52⅘secs. At the American national championships 1927, J. Gibson, U.S.A., won the 440yds. low hurdles title in 52⅘secs., a new world's record which will no doubt be accepted by the I.A.A.F. in due course.

In the early days of hurdle racing men merely ran the distance, jumping over each hurdle in turn and landing on both feet, so that there was very nearly a dead stop in the run after each jump. A later school of hurdlers favoured a "sail-over" style, with body upright, front leg tucked up and rear leg trailing. This was quicker, because it called only for a one-foot landing. The next discovery made was that the fastest pace could be achieved at the 120yds. distance by a man taking only three strides to cover the 10yds. distance between hurdles. About 1885 A. C. M. Croome, Oxford university, realized that the athlete who tucked up his front leg and "bucked" high over the hurdle was losing time. From that year a straight-leg, step-over action came into vogue. Forrest Smithson, U.S.A., Olympic victor and world's record holder, 15secs. in 1908, produced a wonderful flexibility of the rear hip, and it only remained for Earl J. Thomson to add the forward lift of the arms, and the high pick-up action of the rear knee, which allows the athlete to land in the best position for the next stride forward after the hurdle has been cleared.

The difference between high and low hurdling lies in the extent to which the body is bent forward in the clearance of the obstacle. A 6ft. man clearing a 3ft. 6in. high hurdle should not allow the crown of his head to rise more than 5ft. 9½in. above the ground, whereas the same man clearing a 2ft. 6in. low hurdle should raise his body an approximate 2½in., so that the crown of his head would pass just under a bar raised 6ft. 2½in. above the ground.

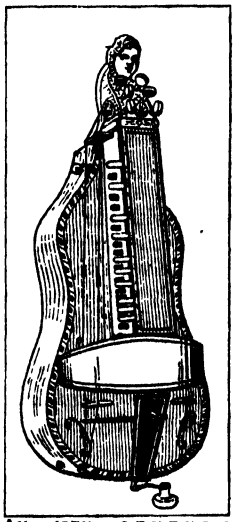
Method of Hurdling.—In clearing the hurdle the athlete's leading leg and *opposite* arm, or both arms, are stretched straight to the front, the other arm being bent at the elbow and tucked in to the side; the rear leg, bent at the knee, is at right angles to the body and the trunk is pressed forward over the thigh of the leg which goes first over the hurdle. As the body is centralized over the hurdle the leading leg is chopped sharply down so that the foot lands close to the fence, the body leans well forward and the rear knee is picked up to the point of the shoulder so that the rear foot can be carried straight through for a full forward stride after the hurdle clearance has been effected.

Under modern rules it is laid down that "A competitor knocking down three or more hurdles, or trailing his leg, or foot, alongside any hurdle shall be disqualified."

See F. A. M. Webster, *Athletics* (1925); Boyd Comstock, *How to Hurdle* (Spaldings 1926). (F. A. M. W.)

HURDY-GURDY, now loosely used as a synonym for any grinding organ, but strictly a mediaeval drone instrument with strings set in vibration by the friction of a wheel, being a development of the *organistrum* (*q.v.*) reduced in size so that it could be conveniently played by one person instead of two.

The hurdy-gurdy originated in France, and during the 13th and 14th centuries was known by the name of *Symphonia* or *Chyfonie,* and in Germany, *Lira* or *Leyer.* Its popularity remained undiminished in France until late in the 18th century, but in Germany it never obtained recognition among serious musicians. The idea embodied in the mechanism stimulated ingenuity, however, the result being such musical curiosities as the *Geigenwerk* or *Geigen-Clavicymbel* of Hans Hayden, of Nuremberg (*c.* 1600), a harpsichord in which the strings, instead of being plucked by quills, were set in vibration by small wheels.



AN 18TH CENTURY FRENCH HURDY-GURDY

HURGRONJE, CHRISTIAAN SNOUCK (1857–), Dutch orientalist, was born at Oosterhaut on Feb. 8, 1857. After completing his studies in theology and oriental languages he went to Arabia, where he stayed for several years, and to other parts of the Near East. The result of these travels was his work *Mekka* (2 vol., 1888–89). He refused a nomination as professor of Arabic at Cambridge university in succession to Robertson Smith and also nominations in Germany and at Leyden, preferring to continue his studies on Islam in the Dutch East Indies (1889–1906), where for some years he was counsellor to the Government in Mohammedan affairs. In 1893–94 he published *De Atjehers,* which was translated into English in 1900. He returned to Holland in 1906, where he accepted the chair of Arabic at the University of Leyden; in 1907 he was nominated counsellor for Indian and Arabian affairs to the Dutch and the Dutch East Indies Government. Among his other works are *Nederland en de Islam* (1911) and *Verspreide Geschriften* (1923 *ff.*).

HURLSTONE, FREDERICK YEATES (1800–69), English painter, was born in London, his father being a proprietor of the *Morning Chronicle.* F. Y. Hurlstone studied under Sir W. Beechey, Sir T. Lawrence and B. R. Haydon, and in 1820 became a student at the Royal Academy, where he soon began to exhibit. In 1831 he was elected to the Society of British Artists, of which in 1835 he became president; it was to their exhibitions that he sent most of his pictures. He died in London on June 10, 1869. His historical paintings and portraits were very numerous.

HURON, a rapidly growing city of eastern South Dakota, U.S.A., on the James river, at an altitude of 1,310ft.; the county seat of Beadle county. It is on Federal highway 14; is served by the Chicago and North Western and the Great Northern railways, and has connection with the Chicago, Milwaukee, St. Paul and Pacific at Wolsey, 15m. W., through regular motor-bus and freight-truck service. There is a municipal airport, one mile north of the heart of the city. The population in 1925 (State census) was 10,204 (about 90% native white) and was estimated locally at 13,000 in 1928. Huron is the shipping point and supply centre for a large territory raising corn, alfalfa, cattle, sheep, hogs and potatoes. It is a division headquarters of the Chicago and North Western railway, which has shops, freight-yards, a roundhouse and offices here. Its packing plants and produce houses use over $23,000,000 worth of live stock, poultry, eggs and cream in a year. Annual shipments include 4,000 carloads of meat products and 1,000 of dairy and poultry produce. The assessed valuation of property in 1927 was $12,328,810. The State fair, held at Huron since 1905, draws an attendance of 135,000. Huron college, a Presbyterian institution opened at Pierre (as Pierre university) in 1883, was moved here in 1898.

The city was founded in 1880 and incorporated in 1883.

HURON. This French epithet, meaning bristle-head or ruffian, was applied to a group of Indians calling themselves Wendat, whence Wyandot. They belonged to the Iroquoian family but were bitter enemies of the Iroquois, who between the visits of Cartier in 1543 and Champlain in 1603 drove part of the Hurons from St. Lawrence river westward into Ontario, where kindred tribes seem to have been already resident. About 1590 four of these tribes, the Bear, Cord, Rock and Deer people, established a confederacy which included also a number of smaller or dependent tribes. The confederacy numbered perhaps 20,000 souls. The Huron received the French as friends and the missionaries made many converts; but the old warfare with the Iroquois went on. In 1648–50 Iroquois invasions completely broke up the confederacy, thousands of Hurons being killed, others taken captive or forced to settle among their conquerors, and the remnants driven west. These fragments drifted back and forth between Michigan, Wisconsin, Ontario, Ohio and Quebec, in alliance or conflict with many tribes, some of them also victims of the Iroquois. There remain about 500 Huron at Lorette in Quebec and 500 Wyandot in Oklahoma; but there is probably considerable Huron blood incorporated among the Iroquois and other tribes. The culture was similar to that of the Iroquois (*q.v.*).

HURON, LAKE, the second largest of the Great Lakes of North America, is about 220 m. in length, 101 m. in width and has a maximum measured depth of about 750 feet. Bordering on it are the State of Michigan and the Province of Ontario, Canada. The area of the water surface of the Lake is 23,010 sq.m. of which 9,110 sq. m. are in the United States. Its entire drainage basin comprises 72,420 sq.m., of which 24,850 sq m. are in United States. The average mean surface of Lakes Huron and Michigan for the 67-year period (1860–1926) was 580·97 ft. above sea-level; 21·25 ft. below the mean surface of Lake Superior and 8·54 ft. above the mean surface of Lake Erie. The level of the lake is subject to annual fluctuation; the greatest difference between the highest and lowest monthly means of any year was 1·94 ft. and the least difference was 0·61 foot. During the 67-year period referred to above, the difference between the highest (583·66) and the lowest (577·36) mean monthly stages was 6·30 feet. In addition to the annual fluctuation there are occasional oscillations of irregular amount and duration. These apparently result from the variations in barometric pressure which may produce changes ranging from a few inches to several feet within a few hours. The level is also affected by winds which have been known to cause a local change of elevation of some 5 ft. in a few hours. Any lowering of the level of the lake, either as a result of natural causes or of diversions, reduces the depths available to navigation and causes loss to shipping, as ships are loaded to the full depth available in the dredged cuts. The average opening and closing dates of its season of navigation are April 12 and Dec. 15, respectively at its upper end, and April 5 and Dec. 23 at its lower end.

Lake Huron receives its water from Lake Superior via St. Marys river and from Lake Michigan via the Straits of Mackinac. It empties its water into Lake Erie via the St. Clair river, Lake St. Clair and Detroit river. In its natural condition the St. Marys river was obstructed by falls and shoals; those, however, at Sault Ste. Marie are now overcome by locks. A channel has been dredged through the river with minimum depth of 21 feet. The Straits of Mackinac have channels sufficiently wide and deep to permit navigation by the largest lake vessels. In their natural condition the St. Clair river, Lake St. Clair and Detroit river were obstructed by shoals, but a through navigable channel not less than 20 ft. deep has been dredged by the United States.

The most important traffic on Lake Huron is the through commerce between Lake Erie and Lakes Superior and Michigan. This traffic consists primarily of shipments of iron ore and grain from Lake Superior ports, grain from Lake Michigan ports and coal from Lake Erie ports upbound. The total freight movement in 1926 was 85,979,087 tons through the St. Marys river and 95,003,604 tons through the Detroit river.

Rockport and Calcite are the only ports in the United States along the west coast of Lake Huron with sufficient depth of water to accommodate the largest vessels for loading and unloading. Both these harbours have been created by and for interests engaged in the limestone trade. In 1926, 1,847,413 tons of limestone were shipped from Rockport, and 9,041,301 tons from Calcite. On the south-western shore of the lake is the artificial harbour of Harbor Beach, Mich., located some 60 m. west of the head of St. Clair river. The improvement at this locality by the United States was to provide a harbour of refuge and consists of a breakwater inside of which there is a sheltered area of about 650 acres Other U.S. harbours on Lake Huron are Bay City, at the head of Saginaw bay, Alpena on the north-west shore of Thunder bay, and Sheboygan near the Straits of Mackinac. The Canadian ports on Georgian bay, Depot Harbor, Port McNicoll, Tiffin, Midland and Collingwood, receive yearly about a million tons of coal from Lake Erie ports, and some 85,000,000 bu. of grain from upper lake ports, most of it coming from Port Arthur and Fort William on Lake Superior. Some of this grain is milled at lake ports, but most of it is transhipped to rail lines and carried to the eastern seaboard for consumption or export.

HURRICANE, an unusually violent wind-storm in the West Indies. The term, corresponding to the highest number (12) on the Beaufort Scale (*q.v.*), is now used to describe similar storms in other regions, except those of the East Indies and the Chinese seas, which are still known as "typhoons." Hurricane is the Carib word *huracan* imported by the Portuguese explorers of the 15th century. The "hurricane deck" of a steamer is an upper deck which protects the one below

HURRY (or URRY), **SIR JOHN** (d. 1650), Scottish soldier of fortune, was born in Aberdeenshire, and saw much service as a young man in Germany. In 1641 he was involved in the plot known as the "Incident" (*see* HAMILTON, JAMES HAMILTON, *1st Duke of*). At the outbreak of the Civil War Hurry joined the army of the earl of Essex, but early in 1643 he deserted to the Royalists, bringing with him information on which Rupert acted at once. Thus was brought about the action of Chalgrove Field, where Hurry again showed conspicuous valour; he was knighted on the same evening. In 1644 he was with Rupert at Marston Moor, where with Lucas he led the victorious left wing of horse. But a little later, thinking the King's cause lost, he again deserted, and eventually was sent with Baillie against Montrose in the Highlands. His detached operations were conducted with great skill, but his attempt to surprise Montrose's camp at Auldearn ended in complete disaster. He once more joined Charles's party, and he was taken prisoner in the campaign of Preston (1648). Sir John Hurry was Montrose's major-general in the last desperate attempt of the Scottish Royalists Taken at Carbisdale, he was beheaded at Edinburgh, May 29, 1650.

HURST, JOHN FLETCHER (1834–1903), American Methodist Episcopal bishop, was born in Salem, Md., on Aug. 17, 1834. He graduated at Dickinson college in 1854, taught for a couple of years, and in 1856 went to Germany to study at Halle. From 1857 to 1866 he was engaged in pastoral work in America, and from 1867 to 1871 he taught in Methodist mission institutes in Germany. In 1871 he became professor of historical theology at Drew Theological seminary, Madison, N.J., of which he was president from 1873 till 1880, when he was made a bishop. He died at Bethesda, Md., on May 4, 1903. Bishop Hurst, by his devotion, recovered the endowment of Drew Theological seminary, lost by the failure in 1876 of Daniel Drew, its founder; and with McClintock and Crooks he improved the quality of Methodist scholarship. The American university (Methodist Episcopal) at Washington (D.C.) for post-graduate work, of which he was chancellor from 1891 till 1902, when he was made chancellor emeritus, was the outcome of his labours. Besides translating and revising many important works he published *A History of Rationalism* (1865, rev. ed., 1901); *Life and Literature in the Fatherland* (1875), brilliant sketches of Germany; *Indika: The country and people of India and Ceylon* (1891); *History of the Christian Church* (1897–1900); and edited the *History of Methodism* (1902–04), co-operative work.

HURSTMONCEAUX (also HERSTMONCEUX), a village in Sussex, England, 9 m. N.E. of Eastbourne. Pop. (1921) 1,495. The village takes its name from Waleran de Monceux, lord of

the manor after the Conquest, but the 15th century castle, for the ruins of which the village is famous, was built in the reign of Henry VI. by Sir Roger de Fiennes. Towers flank the corners, and there is a beautiful turreted entrance gate, but only the foundations of most of the buildings ranged round the inner courts are to be traced. The church of All Saints is Early English. Much material from the castle was used in the erection of Hurstmonceaux Place, a mansion of the 18th century.

HUSAIN IBN ALI (*c.* 1854–), Amir of Mecca from 1908 to 1916 and king of Hejaz from 1916 to 1924, was the second son of Muhammad Ibn'Aun of the 'Abadila clan of Ashraf. He was brought up in Bedouin surroundings, but spent a great part of his life at Constantinople. Reputed to harbour Anglophil tendencies, he was deeply versed in the byways of Ottoman politics and his best trait was a profound knowledge of the desert, for which he always maintained a genuine affection. At the beginning of his Amirate he won golden opinions by his sagacity and modesty and set himself vigorously to forward Turkish interests in Arabia. In 1910 he subdued a rebellion in 'Asir and subsequently invaded Qasim without result, but in 1913 he began to show his true colours by opposing the extension of the Hejaz railway to Mecca.

When the World War broke out he entered into negotiations with the British, which culminated in the Arab revolt in June 1916. In October he proclaimed himself "King of the Arab Countries" though he was formally recognized only as king of Hejaz. At the Versailles Peace Conference (1919) he was represented by his third son, Faisal, but refused to ratify the treaty as a protest against the mandatory *régimes* imposed on Syria, Palestine and 'Iraq. Subsequently his domestic policy was marked by ever increasing avarice and reaction, while he sowed the seeds of future trouble by deliberately courting the enmity of Ibn Saud. In March 1924, while on a visit to Transjordan, he proclaimed himself Caliph, but war with Ibn Saud was already imminent, and the Wahhabi attack on Zaif in September found him unprepared. On Oct. 5 he abdicated and proceeded to 'Aqaba, whence in July 1925 he was conveyed by a British warship to Cyprus, where he took up his residence.

By his first marriage Husain had three sons: 'Ali; 'Abdullah, Amir of Transjordan, and Faisal. The first of these, 'Ali Ibn Husain, who was born about 1880, took no conspicuous part in affairs during his father's Amirate. After the World War he became Amir of Medina and in that capacity did much useful work in connection with the reconstruction of the Hejaz railway. In 1924 he was pressed to accept the Amirate of Transjordan but declined in favour of returning to Medina. He succeeded his father as second king of Hejaz on Oct. 3, 1924, but abdicated on Dec. 10 of the following year (*see* HEJAZ) and returned to Baghdad to live as the guest of his brother Faisal.

HUSBAND, the "head of a household," now chiefly used in the sense of a man legally joined by marriage to a woman, his "wife"; the legal relations between them are treated below under HUSBAND AND WIFE.

HUSBAND AND WIFE (*see* ROMAN LAW). For the methods in which the relation of husband and wife may be constituted and dissolved *see* MARRIAGE and DIVORCE. The present article deals only with the effect of marriage on the legal position of the spouses. The person chiefly affected by the contract is the wife, who under most early systems of law became subject in consequence of the marriage to some kind of disability. The most favourable system scarcely left her as free as an unmarried woman and the most unfavourable subjected her absolutely to the authority of her husband. In modern times the effect of marriage on property is perhaps the most important of the consequences arising from the relationship, and on this point the laws of different States show wide diversity of principles.

English Law.—The contract of marriage, which is by law regarded as a civil contract only, is in its essence a consent on the part of a man and woman to cohabit with each other and with each other only. This contract differs from all other civil contracts in that it is indissoluble at the will of the parties. The English common law relating to marriage is indigenous to the country, the rules relating alike to the ceremony itself and to the legal results of the ceremony being entirely insular in their origin and deducible from no foreign source. There is, however, considerable analogy between the later development of the civil law of Rome and the modern law of England—in that both, starting from an extreme theory of the possessory right of the husband over the person and property of the wife, have subsequently tended towards practical equality between the sexes. The original concept in English law was an absolute merger of the personality of husband and wife by virtue of the marriage ceremony—*unica persona. quia caro una et sanguis unus.* Bacon states in his Abridgement "from the time of the intermarriage, the law looks upon the husband and wife but as one person; and therefore allows of but one will between them, which is placed in the husband." Hence a man could not grant or give anything to his wife, because she was himself, and if there were any compacts between them before marriage they were dissolved by the union of persons. A husband, moreover, during his lifetime, had an absolute power of disposing of the personal property and chattels real (leasehold interests) of the wife, no act of hers being of any force to affect or transfer that which by the intermarriage she had assigned to him. The husband could not, however, dispose of the wife's chattels real by will and if she survived him her rights in her leasehold property revived. In the wife's freeholds the husband's ownership was not absolute, he having no power to dispose of them without her consent, although as master and governor of the family he was entitled to receive the profits during the life of his wife.

Courts of equity, however, in process of time considerably modified the stringency of the common law by the introduction of the doctrine of *separate estate, i.e.*, property settled to the wife for her separate use. In such case a married woman was entitled to deal with her property as if she were a *feme sole.* Connected with the doctrine of separate use was the equitable contrivance of *restraint on anticipation,* with which later legislation has not interfered, whereby property might be so settled to the separate use of a married woman that she could not, during coverture, alienate it or anticipate the income. In yet another way the court of chancery interfered to protect the interests of married women. When a husband applied to the court to get possession of his wife's *choses in action* (*i.e.*, a legal right not in possession), he was required to make provision for her and her children out of the fund sought to be recovered. This provision was called the wife's *equity to a settlement.* Two other interests of minor importance also existed. The wife's *pin-money,* which was a provision for the purchase by her of clothes and ornaments suitable to her husband's position, and the *paraphernalia, i.e.,* jewels and other ornaments purchased by a husband for the adornment of his wife, but not actually given to her so as to pass the property. These might be reclaimed by the husband in his lifetime, but he could not dispose of them by testamentary disposition unless equivalent benefits were conferred on the wife by his will—in which case she had to elect between the will and the paraphernalia. If her husband died solvent she might also claim the paraphernalia on his decease even though bequeathed by him to a third party.

The corresponding interests of the wife in the property of the husband were much less satisfactory. Besides a general right to maintenance at her husband's expense she had at common law a right to *dower* in her husband's lands and, if he died intestate, to a third of his personal estate. Both of these rights were abolished by the Administration of Estates Act, 1925, which substitutes therefor the provisions following. If an intestate leaves surviving a husband or wife (with or without issue) the survivor takes the personal chattels of the deceased absolutely with a sum of £1,000 from the residuary estate, and in addition (should the intestate leave no issue) a life interest in the residuary estate. If the intestate leaves issue, then a life estate of one-half of the residuary estate goes to the surviving spouse, and the other half on statutory trusts for the issue of the intestate. The act further provides for the ultimate distribution of the residuary estate. Under the older law the regulation of the respective rights of husband, wife and children by marriage settlements tended largely to obviate the hardships and injustices imposed upon women by the common law.

A necessary sequence to the theory of the unity of person in the marriage relation was that neither husband nor wife could give evidence against the other in any legal proceeding whether civil or criminal. Survivals of this old law still exist in the fact that the combination of husband and wife, without a third party, for an unlawful purpose does not constitute an indictable misdemeanour so as to support a charge of conspiracy; and (apart from treason and murder) it is still a good defence for a wife to prove that the crime with which she is charged was committed in the presence of and under the coercion of her husband (15 and 16 G.5, c. 86 s. 47). A third survival of the old law is to be found in the fact that a husband continues liable for the pure torts of his wife, *i.e.*, for any tort not directly connected with a contract (*Edwards* v. *Porter*, 1925, A.C. 1).

The fundamental changes introduced by the Married Women's Property Act, 1882, 1893, 1907, have enormously improved the position of a woman unprotected by settlements practically placing her in the position of a *feme sole*. The chief provisions of the Act of 1882 are shortly, that a married woman is capable of acquiring, holding and disposing of by will or otherwise, any real and personal property, in the same manner as if she were a single woman, without the intervention of any trustee. The property of a woman married after the commencement of the act, whether belonging to her at the time of marriage or acquired after marriage, is held by her as a *feme sole*. The same rule applies in the case of property acquired after the beginning of the act by a woman married before the act. After marriage a woman remains liable for antenuptial debts and liabilities, and as between her and her husband, in the absence of contract to the contrary, her separate property is deemed primarily liable, the husband being liable only to the extent of property acquired from or through his wife. The act also contains provisions as to stock, investment, insurance, criminal proceedings and other matters. Its effect was to render obsolete the law as to what created a separate use on a reduction into possession of *choses* in action, as to equity to a settlement, as to fraud on the husband's marital rights, and as to the inability of one of two married persons to give a gift to the other.

The Married Women's Property Act of 1893 provides specifically that every contract thereinafter entered into by a married woman, otherwise than as an agent, should be deemed to be a contract entered into by her with respect to and be binding upon her separate property, whether she was or was not in fact possessed of or entitled to any separate property at the time when she entered into such contract, that it should bind all separate property which she might at that time or thereafter be possessed of or entitled to, and that it should be enforceable by process of law against all property which she might thereafter, while discovert, be possessed of or entitled to. The Act of 1907 provides that a settlement or agreement for a settlement whether before or after marriage, respecting the property of the woman, shall not be valid unless executed by her if she was of full age or confirmed by her after she attained full age. The Act of 1908 provides that married women possessing separate property shall be liable for the maintenance of their parents. The Guardianship of Infants Act, 1925, gives the mother of an infant equal right with the father to apply to a court for guardianship of a child. The Act of 1926 provides for the legitimation of children (*q.v.*) by the subsequent marriage of their parents. The Law of Property Act, 1925, enables a married woman, without her husband, to dispose of or join in disposing of real or personal property held by her solely or jointly as trustee or personal representative in like manner as if she were a *feme sole*. It further enables her to disclaim any estate or interest in land without the concurrence of her husband and to acquire as well from her husband as from any other person any interest in real or personal property, and to hold the same either solely or jointly with third parties as a trustee or personal representative as if she were a *feme sole*.

Law of Scotland.—The law of Scotland differs less from English law than the use of a very different terminology would lead us to suppose. The phrase *communio bonorum* has been employed to express the interest which the spouses have in the *movable* property of both, but its use has been severely censured as essentially inaccurate and misleading. It has been contended that there was no real community of goods, and no partnership of *societas* between the spouses. The wife's movable property, with certain exceptions, and subject to special agreements, became as absolutely the property of the husband as it did in English law. The notion of a *communio* was, however, favoured by the peculiar rights of the wife and children on the dissolution of the marriage. Previous to the Intestate Movable Succession (Scotland) Act, 1855, the law stood as follows. The fund formed by the movable property of both spouses may be dealt with by the husband as he pleases during life; it is increased by his acquisitions and diminished by his debts. The respective shares contributed by husband and wife return on the dissolution of the marriage to them or their representatives within a year and a day, and without a living child. Otherwise the division is into two or three shares, according as children are existing or not at the dissolution of the marriage. On the death of the husband, his children take one-third (called *legitim*), the widow takes one-third (*jus relictae*), and the remaining one-third (the *dead part*) goes according to his will or to his next of kin. If there be no children, the *jus relictae* and the dead's part are each one-half. If the wife die before the husband, her representatives, whether children or not, are creditors for the value of her share. The statute above mentioned, however, enacts that "where a wife shall predecease her husband, the next of kin, executors or other representatives of such wife, whether testate or intestate, shall have no right to any share of the goods in communion; nor shall any legacy or bequest or testamentary disposition thereof by such wife, affect or attach to the said goods or any portion thereof." It also abolishes the rule by which the shares revert if the marriage does not subsist for a year and a day. Several later acts apply to Scotland some of the principles of the English Married Women's Property Acts. These are the Married Women's Property (Scotland) Act of 1877, which protects the earnings, etc., of wives, and limits the husband's liability for antenuptial debts of the wife; the Married Women's Policies of Assurance (Scotland) Act, 1880, which enables a woman to contract for a policy of assurance for her separate use; and the Married Women's Property (Scotland) Act, 1881, which abolished the *jus mariti*.

A wife's *heritable property* does not pass to the husband on marriage, but he acquires a right to the administration and profits. His courtesy, as in English law, is also recognized. On the other hand, a widow has a *terce* or life-rent of a third part of the husband's heritable estate, unless she has accepted a conventional provision.

Continental Law.—On the continent of Europe and especially among the Latin nations (after age-long vicissitudes of varying custom and procedure possibly derived from an infiltration of Teutonic law and principle into the civil code) the main ideas of Roman jurisprudence became established as the bases of the law governing the marriage relation. The leading feature in modern Continental marriage law is the community of goods between husband and wife. Of this system it is said "the community is not regarded in French law as a legal entity except for the purposes of taking an account. It is somewhat like a private partnership." It generally extends to all property of the husband and wife and to the income or other proceeds derived therefrom. It extends also to all immovable property of the husband and wife acquired during the marriage. The property thus acquired is liable to the debts of the spouses existing at the time of the marriage, to the debts contracted by the husband during the community or by the wife during the community, with the husband's consent, and to debts contracted for the maintenance of the family. When the community is dissolved an account is taken to ascertain what each partner owes to the partnership and what the partnership owes them, and after ascertainment the partnership property, if any, is divided equally between husband and wife. Certain modifications of this general principle have, however, been introduced in French legislation by a series of enactments dating from 1881 which somewhat assimilates the Gallic law to that of England in matters relating to personal savings or profits derived by a married woman from her individual exertions. More recently, a law dated July

13, 1907, has accorded to a married woman an absolute right to deal as she pleases with salary or business profits earned by her or with any property she may have purchased therewith; whilst a further enactment of 1924 protects (subject to certain safeguards against fraud) the goods and property of a married woman from seizure by her husband's creditors, whether such property was owned by her before marriage, has since been inherited by her, or has been acquired by her personal exertions. Should she, however, squander her separate estate her husband may apply to the court to restrict her freedom of disposal.

In Denmark, Finland, Iceland, Norway and Sweden the legal effects resulting from the contract of marriage are practically identical, the result of the adoption by these countries of the Marriage Act of 1925 and the Inheritance Act of 1926 being to confer on husband and wife legal equality during lifetime and equal rights of inheritance upon the death of either of the parties. In these countries the principle of community of property between husband and wife is preserved concurrently with right to the possession of separate estate. The communal property can only be encumbered or disposed of with the joint consent of the spouses, but the separate estate may be disposed of by either without reference to the other. Separate estate may consist of antenuptial property, not brought into the community upon the marriage, or such earnings of either spouse as are not required for the family maintenance. In case of desertion, bankruptcy or mismanagement of the joint estate by husband or wife the law permits of an equitable resettlement by the court. In Germany by the civil code which came into operation in 1900 (art. 1367) it is provided that the wife's wages or earnings shall form part of her *Vorbehaltsgut* or separate estate, which a previous article (1365) placed outside her husband's control. In Italy a law of July 17, 1919, abolished the last contractual incapacity of married women. Henceforth the husband has no legal right either to veto or control the acts of his wife or to interfere with her separate estate. In 1906 Switzerland enacted a statute conferring on married women contractual emancipation. (W. W. P.)

THE UNITED STATES

In each of the 48 States of the United States the status of husbands and wives is different. This makes it impossible to generalize except along broad lines. Practically every known variety of marital relationship has existed, ranging all the way from complete dominion of the male to something approaching equality of interests. Nowhere, however, is the wife the dominant party. The U.S. laws range from the early English common-law notion (to paraphrase Blackstone) that husband and wife are one, and *that one* is the husband, and the early Continental civil-law notion (embodied in the community property doctrines of Spain and France) that the community "is a partnership which begins only at its end" (Justice Oliver Wendell Holmes), down to the most modern theories as to what constitutes a working arrangement between the parties. The years since about 1850 have seen great changes, the trend now being definitely in the direction of expanding the wife's rights and powers, both as to property and person.

The marital status is, in essence, lifelong monogamy. Under the Mormons polygamy flourished for a time but it was eventually outlawed. While marriage is called a contract, it is nevertheless one that, once made, cannot be unmade by the parties. The State must be called in to revoke the contract, and even the State will refuse to act except for special reasons. Husband and wife agree to cohabit, they pledge mutual fidelity so long as they live. Divorce (*q.v.*), practically the only way to bring marriage to an end short of death, is generally granted only where one of the parties has been unfaithful or has in some way made living together dangerous or impossible. Some States refuse to revoke the contract for any cause short of infidelity. One State, South Carolina, refuses to do so at all. No State will do so merely because the parties want it done.

Personal Rights.—The marital contract effects other changes almost as startling. In the field of personal rights women have not advanced as far as they may think from the days when the English wife was simply one of her husband's "chattels," when he was romantically supposed to be privileged to beat her "with a stick no bigger than the wedding ring," and to dictate where she should live and what she should do. The husband is everywhere to-day the head of the household and he alone chooses the family domicile. This is true even in the community property States in which the wife in other respects enjoys great personal freedom. In Virginia the wife must observe "the Pauline injunction to remain subject to her husband," and this might be matched by equally poetic legislative language in other States. In most States the husband cannot be sued for damages for beating his wife, although he can be proceeded against criminally for it. He cannot be sued in most States for negligence, libel, slander, false imprisonment or assaults of any kind upon his wife. There is equality between the sexes here, for neither can a wife be sued by her husband in such circumstances.

The marital relationship itself is to a large extent a law unto itself. Husband and wife agree to intercourse, exclusive and unlimited. It is therefore impossible in most States for the husband to commit the crime of rape upon his wife, even if suffering from venereal disease, as the wife's consent is presumed. All she can do is run away or get a legal separation or divorce (on the ground of cruelty, perhaps). Just as the wife cannot easily control intercourse, so it is in many places difficult for her to control childbirth. Many States forbid the dissemination of contraceptive information, except in case of disease. And abortion, except in case of danger to life, is also generally held criminal.

So far as names are concerned, the husband's name is commonly assumed by the wife, but there is no legal obligation to do so. This is entirely a matter of custom, not of law. A few sporadic administrative rulings to the contrary are found here and there in connection with passports, pay-checks, etc., but they are wrong in principle.

While there is in general no liability for personal torts as between husband and wife, torts as between husband or wife and a third person are a different matter. Formerly the husband was liable for his wife's torts; she on the contrary was never liable for his. This rule no longer prevails to any extent. The husband is generally liable for his wife's tort, if at all, only where committed in his presence or, more commonly, by his order. Formerly the husband alone could sue for his wife's injuries; she on the contrary could never sue for his. This rule has been abrogated somewhat. Now in most States the wife can sue for her own injuries. But the husband also can sue for loss of his wife's society (known as "consortium"), her services and wages, and medical expenses paid by him. The wife on the contrary cannot sue for loss of his "consortium" or support, where it is the husband who was injured.

A wife is liable for the crimes which she commits. There is sometimes a rebuttable presumption of innocence, however, if the crime be committed in the presence or under the order or coercion of her husband, and if the crime itself be minor in its nature. Husband and wife formerly could not be witnesses for or against one another. This has been largely done away with, except for the privilege not to reveal confidential communications.

Marriage affects the citizenship of women as it does not affect that of men. At one time a wife's nationality automatically followed that of her husband. Now she keeps her own nationality upon marriage and, if a foreigner married to an American, must be naturalized in order to become an American herself. She needs only one year of residence, however, whereas a man in a similar case needs five.

Property Rights.—It is in the field of property that the greatest changes have taken place. At common law the husband upon marriage took practically all his wife's personal property and all the income from her land. The creation by courts of equity of a separate equitable estate for her beyond the reach of her husband only partially mitigated the hardship. This condition lasted until well into the last century. The first Married Women's Property Acts were passed in 1848, and from that time on the change was rapid. In most States married women can now own property of any sort just as though they were single. The degree of control

which they exercise over it varies in different States. In some states they have full control; in others the husband must join in the transfer, sometimes of personalty, sometimes only of realty; in others, he or the court may constitute her a "free trader." When it comes to her power to contract, there is equal variety. In no State are husband and wife permitted to contract to dissolve the marital relation, that being a matter which, once consummated, the State alone can dissolve. In many States she has complete freedom to contract with third persons, but not with her husband. In others, she can contract to employ him to work for her, but cannot contract to be employed to work for him. In still others she can enter into contracts with third persons only after she has been declared a "free trader" by the courts or her husband. Her power to contract also varies in subject-matter. In some States she can form a partnership, borrow or lend money, act as surety or guarantor, appoint agents, etc.; in others she can do one or more of these things but not all.

When it comes to services and earnings, the same diversity exists. Formerly her earnings belonged to her husband and she was by the same token bound to render services to him without pay. Now most States permit her to keep her earnings when working for third persons outside her home. If, however, she work for a third person inside the home, her earnings generally belong to her husband, unless he make her a present of them by "emancipating" her. If she work for her husband outside the home, some States declare her entitled to wages, others not. If she work for her husband inside the home, no State in the union will let her have wages for it.

Correlative with the wife's services to her husband is the husband's support of her. This is an enforceable duty, whereas the wife's duty of service is not. Formerly the husband did not owe any such duty, even though he took all her property on marriage. The rule was early established, however, that if he refused to supply her with "necessaries" (food, clothing, shelter and medical expenses, varying in quality according to his rank and wealth), she could order them for herself and charge them up to him. At present the husband's obligation of support is in most states well defined, the failure to support his wife furnishing ground for divorce in some States, for separation in others. The obligation lasts only during his lifetime. A few States have written a more modern viewpoint into their statute books by declaring support to be a mutual obligation. As generally interpreted, however, this does not prescribe any financial contribution from the wife, but only such assistance as she would naturally render in taking care of the house, children, etc., while upon the husband falls the financial burden. Some few States specifically require the wife to support her husband where she has property and he is infirm and without any means of support. Elsewhere when he comes to such a pass she need not lift a finger to help him.

Closely bound up with property rights while living is the matter of these same rights after death. Both husband and wife are nowadays competent to make wills. Formerly a wife was not. Frequently a woman's will is revoked by her subsequent marriage, or else marriage followed by the birth of issue; a man's will, by marriage and birth of issue. In some States a subsequent marriage or birth of issue only revokes the will *pro tanto*.

In some few States dower and curtesy still exist. In most of those States the wife may completely disinherit her husband, since curtesy only attaches to such of the wife's realty as she does not dispose of during her lifetime or will away at death. Not so the husband. He cannot by will as a rule deprive her of her dower, which attaches to all the realty which he owned during his lifetime and in which she had not released her claim to dower. In most States, however, neither dower nor curtesy any longer exists. Instead there have been substituted a great variety of rights, for the most part assuring to the survivor some portion, even if a small one, of the deceased spouse's estate.

Where there is no will, the personal estate is generally divided up between the survivor and the children, or the survivor and the nearer relatives if there be no children. In some States the husband gets all on his wife's death, whereas she on his death must share with children or other relatives. In some States there is strict equality. The realty as a rule goes to the heirs, with dower or curtesy or some form of life-interest only to the surviving spouse. In some States realty and personalty are treated alike and the surviving spouse shares in the corpus, not merely in the income. The inheritance laws of the different States show such marked diversity that it is almost impossible to generalize. But the trend is toward giving a larger share to the wife, as distinguished from more distant relatives, making total disinheritance impossible, and establishing equality as between the sexes.

Divorce is the other method besides death of bringing marriage to an end. It is unlike death, however, in that the husband's obligation of support, generally termed alimony, survives it. Where the husband obtains the divorce the wife generally forfeits her right to it. Alimony may be paid in a lump sum or in instalments and, if the latter, may be raised or lowered in amount from time to time, depending on the husband's changing economic circumstances. It continues sometimes even after the wife has married again. It is, however, extinguished at the husband's death, or at hers. Judges are coming more and more to take into consideration the wife's property and earning capacity, if any, and to fit the size of the alimony accordingly.

Community Property.—The theory of joint ownership of property acquired after marriage is undergoing an interesting development in the eight community property States. These States derive from the civil law. The theory of ownership varies from that of legal title in the husband, with or without an equitable interest in the wife, to so-called corporate or partnership title. The husband is everywhere in practical control, although the limitations on his power of disposal are many. At death or dissolution of the marriage the property is as a rule divided equally.

Children.—The relationship of father and mother to their children has undergone a profound change since the middle of the 19th century. Formerly the children's father was their natural guardian, had custody of their persons and property, was entitled to their services and earnings, and, on his death, could will them away to someone other than their mother. There are still a few States where fathers may will away their children. But for the most part, mothers are now recognized as joint guardians of the persons of their children and as alone entitled to their custody on the death of the father. In the majority of States the father is still entitled to his children's earnings and services, in exchange for which he must support them. Upon his death the mother becomes charged with their support and is in turn entitled to their earnings. In some States these rights and duties have been made the mutual obligation of both parents.

The above brief description paints a chaotic picture, perhaps, but one which reveals a growing interest in the subject and ceaseless experimentation. The United States has been going through a period of change, a period of the growth of a critical awareness of this as the most important of its institutions. Each State has experimented for itself according to its own ideas on the subject, citizenship alone being a Federal matter. Because of the resulting chaos many have advocated unification, either by Federal law or uniform State legislation. Whether the latter method is practicable or not, the former would require amendment of the Constitution and a reversal of the prevailing theory of Federal government. It is not likely to succeed. The States will probably continue to experiment; and the next 50 years should see a crystallization into a more set mould of the happier results of all this experimenting. (D. Kn.)

HUŞI, the capital of the department of Falciu, Rumania; on a branch of the Jassy-Galatz railway, 9 m. W. of the river Pruth and the Russian frontier. Pop. (1928) 17,000, about one-fourth being Jews. Huşi is an episcopal see. The cathedral was built in 1491 by Stephen the Great of Moldavia. Huşi is said to have been founded in the 15th century by a colony of Hussites, from whom its name is derived. The treaty of the Pruth between Russia and Turkey was signed here in 1711.

HUSKISSON, WILLIAM (1770–1830), English statesman and financier, was descended from an old Staffordshire family of moderate fortune, and was born at Birch Moreton, Worcestershire, on March 11, 1770. He went to Paris at 14 to the care of

his uncle, Dr. Gem, physician to the British embassy in Paris, and witnessed the French revolution. In Jan. 1793 he was employed by Dundas in the carrying out of the Aliens Act; and in 1795 he was appointed under-secretary for war. Huskisson sat in parliament for Morpeth (1796–1802), Liskeard (1804–07), Harwich (1807–12), Chichester (1812–23), and Liverpool (1823–30). He was secretary to the Treasury under Pitt (1804–05), and Portland (1807–09). He took a prominent part in the corn-law debates of 1814 and 1815; and in 1819 he presented a memorandum to Lord Liverpool advocating a large reduction in the unfunded debt, and explaining a method for the resumption of cash payments, which was embodied in the act passed the same year. In 1821 he was a member of the committee appointed to inquire into the causes of the agricultural distress then prevailing, and the proposed relaxation of the corn laws embodied in the report was understood to have been chiefly due to his strenuous advocacy. In 1823 he was appointed president of the board of trade and treasurer of the navy, and shortly afterwards he received a seat in the cabinet. In the same year he was returned for Liverpool as successor to Canning, and as the only man who could reconcile the Tory merchants to a free trade policy. Among the more important legislative changes with which he was principally connected were a reform of the Navigation Acts, admitting other nations to a full equality and reciprocity of shipping duties; the repeal of the labour laws; the introduction of a new sinking fund; the reduction of the duties on manufactures and on the importation of foreign goods; and the repeal of the quarantine duties. In accordance with his suggestion Canning in 1827 introduced a measure on the corn laws proposing the adoption of a sliding scale to regulate the amount of duty. A misapprehension between Huskisson and the duke of Wellington led to the duke proposing an amendment, the success of which caused the abandonment of the measure by the government. After the death of Canning in the same year Huskisson accepted the secretaryship of the colonies under Lord Goderich, an office which he continued to hold in the new cabinet formed by the duke of Wellington in the following year. After succeeding with great difficulty in inducing the cabinet to agree to a compromise on the corn laws, Huskisson finally resigned office in May 1829 on account of a difference with his colleagues in regard to the disfranchisement of East Retford. On Sept. 15, 1830, he was accidentally killed by a locomotive engine while present at the opening of the Liverpool and Manchester railway.

See the *Life of Huskisson,* by J. Wright (1831).

HUSS, HENRY HOLDEN (1862–), American musician, was born in Newark, N.J., on June 21, 1862, of Bohemian ancestry. He was reared in a musical atmosphere, and in 1882 graduated from the Royal Conservatoire at Munich. Besides playing the piano and composing, Huss has been prominent in New York as a teacher of the piano, particularly as a teacher of teachers, and his *Condensed Technics,* published in 1904, is used widely. His works include a piano concerto, a violin concerto and a violin sonata. He has also written a number of songs.

HUSS or **HUS, JOHN** (*c.* 1373–1415), Bohemian reformer, was born of peasant parents at Hussinecz, near the Bavarian frontier. He was educated at the University of Prague where he began to lecture in 1398. He was made dean of the philosophical faculty in Oct. 1401, and was rector (Oct. 1402–April 1403) of the university. His appointment in 1402 as rector of the Bethlehem chapel, which had been erected in 1391 by some zealous citizens of Prague to provide good popular preaching in the Bohemian tongue, greatly influenced his religious life, and led him to an appreciation of the philosophical and theological writings of Wycliffe, whose *Trialogus* he had translated into Czech in 1403.

In 1405, while still unconscious of any opposition to Catholicism, Huss published his *De Omni Sanguine Christi Glorificato,* in which he declaimed against forged miracles and ecclesiastical greed, and urged Christians to desist from looking for sensible signs of Christ's presence, but rather to seek Him in His enduring word. More than once, also, Huss was appointed to be synod preacher, and in this capacity he delivered at the provincial councils of Bohemia many admonitions. In 1408, however, the clergy laid before the archbishop a formal complaint against the strong expressions used by Huss with regard to clerical abuses. He was deprived of his appointment as synodal preacher, and forbidden the exercise of priestly functions. Simultaneously with these proceedings, negotiations had been going on for the removal of the long-continued papal schism. King Wenceslaus of Bohemia had requested that the clergy and the university observe a strict neutrality towards both popes. But the clergy remained supporters of Gregory XII., and of the university; only the Bohemian "nation" under Huss avowed neutrality. There followed an expression of nationalist feeling, with the result that a royal edict (Jan. 18, 1409) was issued, by which the Bohemian "nation" received three votes, while only one was allotted to the Bavarians, Saxons and Poles combined; whereupon all the foreigners, to the number of several thousands, immediately withdrew from Prague.

His Teaching.—It was a dangerous triumph for Huss; for his popularity at court and in the general community had been secured only at the price of clerical antipathy. Among the first results of the changed order of things were on the one hand the election of Huss (Oct. 1409) to be again rector of the university, but on the other hand the appointment by the archbishop of an inquisitor to inquire into charges of heretical teaching and inflammatory preaching brought against him. He had spoken disrespectfully of the church, it was said, had even hinted that Antichrist might be found to be in Rome, had fomented in his preaching the quarrel between Bohemians and Germans, and had, notwithstanding all that had passed, continued to speak of Wycliffe as both a pious man and an orthodox teacher. The direct result of this investigation is not known, but it is probably connected with the promulgation by Pope Alexander V., in 1409, of a bull which ordered the abjuration of all Wycliffite heresies and the surrender of all his books, while at the same time—a measure specially levelled at the pulpit of Bethlehem chapel—all preaching was prohibited except in localities by long usage set apart for that use. The archbishop publicly burned some 200 volumes of the writings of Wycliffe, and excommunicated Huss and certain of his friends, who had in the meantime protested and appealed to the new pope (John XXIII.). Again the populace rose on behalf of their hero, who continued to preach in the Bethlehem chapel, and in the university began publicly to defend the so-called heretical treatises of Wycliffe, while from king and queen, nobles and burghers, a petition was sent to Rome praying that the condemnation and prohibition in the bull of Alexander V. might be quashed. In March 1411 the ban was anew pronounced upon Huss, and ultimately the whole city was laid under interdict; yet he went on preaching.

The struggle entered on a new phase with the proclamation of the papal bulls by which a religious war was decreed against the excommunicated King Ladislaus of Naples, and indulgence was promised to all who should take part in it. By his bold opposition to this procedure against Ladislaus, and still more by his doctrine that indulgence could never be sold without simony, and could not be lawfully granted except by genuine contrition and repentance, Huss at last isolated himself, not only from the archiepiscopal party but also from the theological faculty of the university. The excommunication against Huss was renewed, and the interdict again laid on all places which should give him shelter. In December Huss had to yield to the King's wish by temporarily withdrawing from Prague to Kozihradek, and to Krakowitz. There he carried on a copious correspondence, and composed the *De Ecclesia,* which subsequently furnished most of the material for the charges against him. This work was largely based on the doctrines of Wycliffe.

Trial and Death.—In 1413 his presence was requested at the council of Constance, and, having arrived there on Nov. 3, he received the famous imperial "safe conduct," the promise of which had been one of his inducements to quit the comparative security he had enjoyed in Bohemia. This safe conduct stated that, whatever judgment might be passed on him, Huss should be allowed to return freely to Bohemia. This by no means provided for his immunity from punishment. If faith to him had not been broken he would have been sent back to Bohemia to be punished

by his sovereign, the king of Bohemia. The treachery of King Sigismund is undeniable and was indeed admitted by the king himself. The safe conduct was probably indeed given by him to entice Huss to Constance. On Dec. 4, the pope appointed a commission of three bishops to investigate the case against the heretic, and to procure witnesses; but the flight of pope John XXIII. in the following March furnished a pretext for the removal of Huss from the Dominican convent to a more secure place of confinement under the charge of the bishop of Constance at Gottlieben on the Rhine. On May 4, the temper of the council was revealed in its unanimous condemnation of Wycliffe, especially of the so-called "forty-five articles" as erroneous, heretical, revolutionary. On June 5, when the case of Huss came up for hearing, he was unable to make his defence by reason of the violent outcries. The sitting of June 7 at which King Sigismund was present, was better disciplined. Propositions extracted from the *De Ecclesia* were brought up, and the relations between Wycliffe and Huss were discussed. The accused repudiated the charge of having abandoned the doctrine of transubstantiation, while expressing admiration for Wycliffe. On June 8, he declared that among the propositions he could abjure was that relating to transubstantiation; among those he felt constrained to maintain was that which denied that Peter was the head of the church. The council finally demanded that Huss should declare that he had erred in all the articles cited against him; secondly, that he should promise on oath neither to hold nor teach them in the future; thirdly, that he should publicly recant them. He declined, and sentence of death was pronounced on July 6, in the presence of Sigismund and a full sitting of the council. Once again he attempted to remonstrate, but in vain, and finally he betook himself to silent prayer. He was handed over to the secular arm, and on the same day the fire was kindled, and his voice as it audibly prayed in the words of the "Kyrie Eleison" was soon stifled in the smoke. When the flames had done their office, the ashes that were left and even the soil on which they lay were carefully removed and thrown into the Rhine.

Not many words are needed to convey a tolerably adequate estimate of the character and work of the "pale thin man in mean attire," who in sickness and poverty thus completed the forty-sixth year of a busy life at the stake. The value of Huss as a scholar was formerly underrated. The publication of his *Super IV. Sententiarum* has proved that he was a man of real learning. Yet his principal glory will always be founded on his spiritual teaching. It is not easy to formulate precisely the beliefs for which he died, and certainly some of them, *e.g.*, that regarding the church, were such as many Protestants would regard as unguarded and difficult to harmonize with the maintenance of external church order. By propagating the reformatory doctrines of Wycliffe, Huss may be said to have handed on to Luther the torch which kindled the Reformation. His popularity in his own country was due both to his oratorical powers and to his pastoral activity.

The works of Huss were published at Nuremberg in 1558 (reprinted with new matter at Frankfort in 1715); by K. J. Erben at Prague (1865–68), and by W. Flojšhaus at Prague (1904 fol.) In 1869 F. Palacky edited *Documenta J. Hus vitam, doctrinam, causam in Constantiensi concilio*. Among separate publications may be mentioned the *Letters* translated into Eng. by H. B. Workman (1904). *See* G. von Lechler's *Wiclif und die Vorgeschichte der Reformation*, trans. P. Lorimer (1878); H. Finke, *Acta concilii Constantiensis* (1896); J. A. von Helfert, *Studien über Hus und Hieronymus* (1853), J. Loserth, *Hus und Wiclif* (1884, 2nd ed. 1925, Eng. trs. 1884); G. von Lechler, *Johannes Hus* (1889); Count Lützow, *The Life and Times of John Hus* (1909, 2nd ed. 1921); W. N. Schwarze, *John Huss* (1915); D. S. Schaff, *John Huss* (1915); P. Bracciolini, *Todesgeschichte des Johannes Huss* (Constance, 1926) and K. Kašpar, *Hus und die Früchte seiner Wirksamkeit* (Warnsdorf, 1926).

HUSSAR, originally the name of a soldier belonging to a corps of light horse raised by Matthias Corvinus, king of Hungary, in 1458, to fight against the Turks. The hussar was the typical Hungarian cavalry soldier, and, in the absence of good light cavalry in the regular armies of central and western Europe, the name and character of the hussars gradually spread into Prussia, France, etc. Frederick the Great sent Maj. H. J. von Zieten to study the work of this type of cavalry in the Austrian service, and Zieten so far improved on the Austrian model that he defeated his old teacher, Gen. Baranyai, in an encounter between the Prussian and Austrian hussars at Rothschloss in 1741. The typical uniform of the Hungarian hussar was followed, with modifications, in other European armies. It consisted of a busby or a high cylindrical cloth cap, jacket with heavy braiding and a dolman or pelisse, a loose coat worn hanging from the left shoulder. The hussar regiments of the British army were converted from light dragoons at the following dates: 7th (1805), 10th and 15th (1806), 18th (1807, and again on revival after disbandment, 1858), 8th (1822), 11th (1840), 20th (late 2nd Bengal European Cavalry) (1860), 13th, 14th and 19th (late 1st Bengal European Cavalry) (1861). The 21st Lancers were hussars from 1862 to 1897. In 1922, on the reduction of the cavalry, the 13th and 18th, the 15th and 19th were amalgamated as the 13th/18th Hussars and 15th/19th Hussars. In 1928 the 11th were converted into an armoured car regiment, retaining their title.

HUSSITES, the name given to the followers of John Huss (1369–1415), the Bohemian reformer. They were at first often called Wycliffites, as the theological theories of Huss were largely founded on the teachings of Wycliffe. Huss indeed laid more stress on Church reform than on theological controversy. On such matters he always writes as a disciple of Wycliffe. The Hussite movement may be said to have sprung from three main sources. Bohemia was long but very loosely connected with the Church of Rome. The connection became closer at the time when the papacy was discredited by the great schism. The rapacity of its representatives in Bohemia, and the immorality of the clergy caused general indignation. The Hussite movement was also a democratic one, an uprising of the peasantry against the landowners at a period when a third of the soil belonged to the clergy. Finally, national enthusiasm for the Slavic race contributed largely to its importance. The towns were mainly German; and since by the regulations of the University of Prague Germans also held almost all the more important ecclesiastical offices—a condition of things greatly resented by the natives of Bohemia, which at this period had reached a high degree of intellectual development. (*See* BOHEMIA.)

Utraquism.—The Hussite movement assumed a revolutionary character as soon as the news of the death of Huss reached Prague. The knights and nobles of Bohemia and Moravia, who were in favour of Church reform, sent to the council at Constance (Sept. 2, 1415) a protest which condemned the execution of Huss in the strongest language. The uncompromising attitude of Sigismund, king of the Romans, caused trouble in various parts of Bohemia, and many Romanist priests were driven from their parishes. Almost from the first the Hussites were divided into two principal sections. Shortly before his death Huss had accepted a doctrine preached during his absence by his adherents at Prague, namely, that of "utraquism," *i.e.*, the obligation of the faithful to receive communion in both kinds. This doctrine became the watchword of the moderate Hussites, known as the Utraquists, while the more advanced Hussites known as the Taborites from the name of their stronghold, recognized only two sacraments, Baptism and Communion, and rejected most of the ceremonial of the Roman Church.

Anti-Hussite Movements.—Under the influence of his brother Sigismund, King Wenzel endeavoured to stem the Hussite movement. A certain number of Hussites left Prague. They held meetings in various parts of Bohemia, particularly at Usti, near the spot where the town of Tabor was founded soon afterwards. At these meetings Sigismund was violently denounced, and the people everywhere prepared for war. The troubles at Prague continued, and on July 30, 1419, when a Hussite procession marched through the streets, stones were thrown at the Hussites from the windows of the town hall of the "new town." The people, headed by John Žižka (1376–1424), threw the burgomaster and several town councillors from the windows and they were immediately killed by the crowd. On hearing this news King Wenzel was seized with an apoplectic fit and died a few days afterwards. The death of the king resulted in renewed troubles in Prague and in almost all parts of Bohemia. Many Romanists,

most of them Germans, were expelled from the Bohemian cities. In Prague, in Nov. 1419, severe fighting took place between the Hussites and the mercenaries whom Queen Sophia (widow of Wenzel) had hurriedly collected. After a considerable part of the city had been destroyed a truce was concluded on Nov. 13. The nobles, who, though favourable to the Hussite cause, yet supported Sophia, promised to act as mediators with Sigismund; while the citizens of Prague consented to restore to the royal forces the castle of Vyšehrad, which had fallen into their hands. Žižka, who disapproved of this compromise, left Prague and retired to Plzeň (Pilsen), then into southern Bohemia, and after defeating the Romanists at Sudoměř—the first pitched battle of the Hussite wars—he arrived at Usti, one of the earliest meeting-places of the Hussites. Not considering its situation sufficiently strong, he moved to the neighbouring new settlement of the Hussites, to which the biblical name of Tabor was given. The ecclesiastical organization of Tabor had a somewhat puritanic character, and the Government was established on a thoroughly democratic basis. Four captains of the people were elected, one of whom was Žižka; and a strictly military discipline was instituted.

The Articles of Prague.—On March 17, 1420, Martin V. proclaimed a crusade "for the destruction of the Wycliffites, Hussites and all other heretics in Bohemia." A vast army of crusaders arrived before Prague on June 30 (*see* ŽIŽKA, JOHN). Negotiations took place for a settlement of the religious differences. The united Hussites formulated their demands in a statement known as the "Articles of Prague." This document, the most important of the Hussite period, runs thus:

"I. The word of God shall be preached and made known in the kingdom of Bohemia freely and in an orderly manner by the priests of the Lord. . . .

"II. The sacrament of the most Holy Eucharist shall be freely administered in the two kinds, that is bread and wine, to all the faithful in Christ who are not precluded by mortal sin—according to the word and disposition of Our Saviour.

"III. The secular power over riches and worldly goods which the clergy possesses in contradiction to Christ's precept, to the prejudice of its office and to the detriment of the secular arm, shall be taken and withdrawn from it, and the clergy itself shall be brought back to the evangelical rule and an apostolic life such as that which Christ and his apostles led. . . .

"IV. All mortal sins, and in particular all public and other disorders, which are contrary to God's law, shall in every rank of life be duly and judiciously prohibited and destroyed by those whose office it is."

These articles, which contain the essence of the Hussite doctrine, were rejected by Sigismund. Hostilities therefore continued, and nearly all Bohemia fell into the hands of the Hussites. Internal troubles prevented them from availing themselves completely of their victory. At Prague a demagogue, the priest John of Želivo, for a time obtained almost unlimited authority over the lower classes of the townsmen; and at Tabor a communistic movement (that of the so-called Adamites) was sternly suppressed by Žižka. Sigismund only arrived in Bohemia at the end of 1421. He took possession of the town of Kutna Hora (Kuttenberg), but was decisively defeated by Žižka at Německy Brod (Deutschbrod) on Jan. 6, 1422. Bohemia was now again for a time free from foreign intervention, but internal discord again broke out caused partly by theological strife, partly by the ambition of agitators. There were troubles at Tabor itself, where a more advanced party opposed Žižka's authority. Bohemia obtained a temporary respite when, in 1422, Prince Sigismund Korybutovič of Poland became for a short time ruler of the country. His authority was recognized by the Utraquist nobles, the citizens of Prague, and the more moderate Taborites, including ŽIŽKA. Korybutovič, however, remained but a short time in Bohemia; after his departure civil war broke out, the Taborites opposing in arms the more moderate Utraquists, whose principal stronghold was Prague. On April 27, 1423, Žižka now again leading, the Taborites defeated at Horic the Utraquist army under Čenek of Wartemberg; shortly afterwards an armistice was concluded at Konopoišt.

Further Anti-Hussite Attacks.—Papal influence had meanwhile succeeded in calling forth a new crusade against Bohemia, but it resulted in complete failure. In spite of the endeavours of their rulers, the Slavs of Poland and Lithuania did not wish to attack the kindred Bohemians; the Germans were prevented by internal discord from taking joint action against the Hussites; and the king of Denmark, who had landed in Germany with a large force, soon returned to his own country. Free for a time from foreign aggression, the Hussites invaded Moravia, where a large part of the population favoured their creed; but, again paralyzed by dissensions, soon returned to Bohemia. The city of Königgrätz (Králové Hradec), which had been under Utraquist rule, espoused the doctrine of Tabor, and called Žižka to its aid. After several military successes gained by Žižka (*q.v.*) in 1423 and 1424, a treaty of peace between the Hussites was concluded on Sept. 13, 1424 at Liben, now part of Prague.

In 1426 the Hussites were again attacked by foreign enemies. In June their forces, led by Prokop the Great—who took the command of the Taborites shortly after Žižka's death in Oct. 1424—and Sigismund Korybutovič, who had returned to Bohemia, signally defeated the Germans at Aussig (Usti nad Labem). After this great victory, and another at Tachau in 1427, the Hussites repeatedly invaded Germany.

The almost uninterrupted victories of the Hussites now rendered vain all hope of subduing them by force of arms. Moreover, the conspicuously democratic character of the Hussite movement caused the German princes, who were afraid that such views might extend to their own countries, to desire peace. Many Hussites, particularly the Utraquist clergy, were also in favour of peace. Negotiations for this purpose were to take place at the council which had been summoned to meet at Basel on March 3, 1431. The Roman see reluctantly consented to the presence of heretics at this council, but indignantly rejected the suggestion of the Hussites that members of the Greek Church and representatives of all Christian creeds should also be present. Before definitely giving its consent to peace negotiations, the Roman Church determined on making a last effort to reduce the Hussites to subjection. On Aug. 1, 1431, a large army of crusaders, under Frederick, margrave of Brandenburg, crossed the Bohemian frontier; but on the arrival of the Hussite army under Prokop the crusaders immediately took to flight, almost without offering resistance.

Settlement of Disputes.—On Oct. 15, the members of the council, who had already assembled at Basel, issued a formal invitation to the Hussites to take part in its deliberations. Prolonged negotiations ensued; but finally a Hussite embassy arrived at Basel on Jan. 4, 1433. It was found impossible to arrive at an agreement. Negotiations were not, however, broken off; and a change in the political situation of Bohemia finally resulted in a settlement. In 1434 war again broke out between the Utraquists and the Taborites. On May 30 the Taborite army, led by Prokop the Great and Prokop the Less, who both fell in the battle, was totally defeated and almost annihilated at Lipan. The moderate party thus obtained the upper hand; and it formulated its demands in a document known as the *Compactata*, which incorporated the principles laid down in the Articles of Prague.

On July 5, 1436, the compacts were formally accepted at Iglau, in Moravia, by King Sigismund, by the Hussite delegates, and by the representatives of the Roman Church. The Utraquist creed, frequently varying in its details, continued to be that of the established Church of Bohemia till all non-Roman religious services were prohibited shortly after the battle of the White Mountain in 1620. The Taborite party never recovered from its defeat at Lipan, and after the town of Tabor had been captured by George of Poděbrad in 1452 Utraquist religious worship was established there. The Bohemian brethren, whose intellectual originator was Peter Chelčicky, to a certain extent continued the Taborite traditions, and in the 15th and 16th centuries included most of the strongest opponents of Rome in Bohemia. After the beginning of the German Reformation many Utraquists

adopted to a large extent the doctrines of Luther and Calvin; and in 1567 obtained the repeal of the compacts, which no longer seemed sufficiently far-reaching.

See F. Palacky, *Geschichte von Böhmen* (1836–67); L. Krummel, *Geschichte der böhmischen Reformation* (Gotha, 1866) and *Utraquisten und Taboriten* (Gotha, 1871); E. Denis, *Huss et la guerre des Hussites* (1878); Count Lützow, *Bohemia; an Historical Sketch* (1896); H. Toman, *Husitské Valečtnictvi* (Prague, 1898). (Lz.)

HUSTING, the "thing," *i.e.*, assembly, of the household of a king, earl or chief (O.Norw. *hústhing*). In England the word is chiefly noteworthy as denoting an important court in the City of London which for many purposes superseded the more ancient assembly of the citizens known as the "folkmoot." Its appearance is a striking proof of the strong Scandinavian influence which affected London in the 11th century. The ordinary use of "hustings" at the present day for the platform from which a candidate speaks at a parliamentary or other election, or more widely for a political candidate's election campaign, is derived from the application of the word, first to the platform in the Guildhall on which the London court was held, and next to that from which the public nomination of candidates for a parliamentary election was formerly made, and from which the candidate addressed the electors. The Ballot Act of 1872 did away with this public declaration of the nomination.

HUSUM, a town in the Prussian province of Schleswig-Holstein, in a fertile district 2½ m. inland from the North sea, on the canalized Husumer Au, which forms its harbour and roadstead, 99 m. N.W. from Hamburg. Pop. (1925) 9,962. Husum is first mentioned in 1252, and its church was built in 1431. Wisby rights were granted it in 1582, and in 1603 it received municipal privileges from the duke of Holstein. It suffered greatly from inundations in 1634 and 1717. It has communication with the North Frisian islands, and is a port for the cattle trade with England. Cattle markets are held weekly, and in them, as also in cereals, a lively export trade is done. There are also extensive oyster fisheries, the property of the state, the yield during the season being very considerable. Husum is the birthplace of Theodor Storm (1817–88), the poet, to whom a monument has been erected here.

HUTCHESON, FRANCIS (1694–1746), English philosopher, was born on Aug. 8, 1694, at Drumalig in Co. Down, the son of a Presbyterian minister. From 1710 to 1716, he studied philosophy, classics and theology at Glasgow university, and then opened a private academy in Dublin where he made many friends among the clergy of the Established Church. While in Dublin, Hutcheson published the four essays upon which his reputation rests, namely, the *Inquiry concerning Beauty, Order, Harmony and Design*, the *Inquiry concerning Moral Good and Evil*, in 1725, the *Essay on the Nature and Conduct of the Passions and Affections* and *Illustrations upon the Moral Sense*, in 1728. In 1729, he returned to Glasgow as professor of moral philosophy. In spite of being accused in 1738 before the Glasgow presbytery for holding that the standard of moral goodness was the promotion of the happiness of others and that we could have a knowledge of good and evil without and prior to a knowledge of God, Hutcheson enjoyed a well-deserved popularity. He died at Glasgow in 1746.

Although Hutcheson dealt with metaphysics, logic and ethics, his importance is due almost entirely to his ethical writings. Opposing Hobbes and Bernard de Mandeville, he closely followed the 3rd earl of Shaftesbury, especially as regards the analogy between beauty and virtue, the functions assigned to the moral sense, the position that the benevolent feelings form an original and irreducible part of our nature, and the unhesitating adoption of the principle that the test of virtuous action is its tendency to promote the general welfare. According to Hutcheson, man has a variety of senses, internal as well as external, reflex as well as direct, the definition of a sense being "any determination of our minds to receive ideas independently on our will, and to have perceptions of pleasure and pain" (*Essay on the Nature and Conduct of the Passions*, §1). Without exhaustively enumerating these "senses," he specifies, besides the five external senses (1) consciousness, by which each man has a perception of his own mind; (2) the sense of beauty; (3) a public sense, or *sensus communis*, "a determination to be pleased with the happiness of others and to be uneasy at their misery"; (4) the moral sense, or "moral sense of beauty in actions and affections, by which we perceive virtue or vice, in ourselves or others"; (5) a sense of honour or praise and blame; (6) a sense of the ridiculous. Of these "senses" the "moral sense" is the most important. It is implanted in man, and pronounces immediately on the character of actions and affections, approving those which are virtuous, and disapproving those which are vicious, because the Author of Nature "has made virtue a lovely form to excite our pursuit of it, and has given us strong affections to be the springs of each virtuous action." Hutcheson's use of the term "moral sense" and his failure to couple it invariably with the term "moral judgment" tends to obscure the part played by deliberation.

But though Hutcheson usually describes the moral faculty as acting instinctively and immediately, he does not, like Butler, confound the moral faculty with the moral standard. The criterion of right action is for him, as for Shaftesbury, its tendency to promote the general welfare of mankind. He thus anticipates the utilitarianism of Bentham even in the use of the phrase "the greatest happiness for the greatest number" (*Inquiry concerning Moral Good and Evil*, § 3). But since intuition has no possible connection with an empirical calculation of results, Hutcheson in adopting such a criterion practically denies his fundamental assumption. His most distinctive ethical doctrine is the "benevolent theory" of morals by which he opposes Hobbes. He not only maintains that benevolence is the direct source of many of our actions, but that it is the only source of those actions of which, on reflection, we approve. Actions which flow from self-love only are morally indifferent, though in so far as a man may justly regard himself as a part of the rational system, and may thus "be, in part, an object of his own benevolence," the "personal virtues" may be regarded as fitting objects of moral approbation. Hutcheson inconsistently declares that while self-love merits neither approbation nor condemnation, the satisfaction of the dictates of self-love is one of the very conditions of the preservation of society. In the *Synopsis metaphysicae*, he holds that will is determined by motives in conjunction with our character and habit of mind, and that the only true liberty is the liberty of acting as we will, not the liberty of willing as we will.

The prominence given by Hume and Adam Smith to the analysis of moral action and moral approbation, with the attempt to discriminate the respective provinces of the reason and the emotions in these processes, is undoubtedly due to the influence of Hutcheson. To a study of Shaftesbury and Hutcheson we might probably attribute the unequivocal adoption of the utilitarian standard by Hume, and, if this be the case, Hutcheson is linked through Hume with Priestley, Paley and Bentham.

Mental Philosophy.—Hutcheson's less important contributions in the sphere of mental philosophy and logic are interesting mainly as a link between Locke and the Scottish school. With Locke he rejects the doctrine of innate ideas (*see*, for instance, *Inquiry concerning Moral Good and Evil*, 1 *ad fin.*, and § 4; and compare *Synopsis Metaphysicae*, pars i. cap. 2); but he modifies Locke's doctrine and anticipates Reid when he states that the ideas of extension, figure, motion and rest "are more properly ideas accompanying the sensations of sight and touch than the sensations of either of these senses"; that the idea of self accompanies every thought, and that the ideas of number, duration and existence accompany every other idea whatsoever (see *Essay on the Nature and Conduct of the Passions*, art. 1; *Syn. Metaph.* pars i. cap. 1, pars ii. cap. 1; Hamilton on *Reid*, p. 124, note). Like Locke, Hutcheson also depreciates the importance of the so-called laws of thought, distinguishes between the primary and secondary qualities of bodies, asserts that we cannot know the inmost essences of things though they excite various ideas in us, and assumes that external things are known only through the medium of ideas (*Syn. Metaph.* pars i. cap. 1). He accounts for our assurance of the reality of externals by referring it to a natural instinct (*Syn. Metaph.* pars i. cap 1). Of the correspondence between our ideas of the primary qualities of things

and the things themselves God alone is the cause, having effected it through a law of nature.

Hutcheson diverges from Locke in his account of the idea of personal identity, which he appears to have regarded as made known to us directly by consciousness. Generally, he speaks as if we had a direct consciousness of mind as distinct from body (*see*, for instance, *Syn. Metaph.* pars ii. cap. 3), though, in the posthumous *Moral Philosophy*, he expressly states that we know mind as we know body "by qualities immediately perceived though the substance of both be unknown" (bk. i. ch. 1). Other points in which he supplemented or departed from Locke are:—the distinction between perception proper and sensation proper, which is not explicitly worked out, the imperfection of the ordinary division of the external senses into five, the limitation of consciousness to a special mental faculty (severely criticized in Hamilton's *Lectures on Metaphysics*, 12), and the disposition to refer on disputed questions of philosophy not so much to formal arguments as to the testimony of consciousness and our natural instincts. The last point suggests the "common-sense philosophy" of Reid.

The short *Compendium of Logic* contains a large proportion of psychological matter. The author distinguishes between the mental result and its verbal expression (idea—term; judgment—proposition), constantly employs the word "idea," and defines logical truth as "convenientia signorum cum rebus significatis" thus implicitly repudiating a merely formal view of logic.

Hutcheson is one of the earliest modern writers on aesthetics. He maintains that the special sense by which we perceive beauty, harmony and proportion, is a *reflex* sense, pre-supposing sight and hearing. Beauty is also perceived in universal truths, in the operations of general causes and in moral principles and actions. Thus, the analogy between beauty and virtue, a favourite topic with Shaftesbury, is prominent in Hutcheson also.

Hutcheson's writings naturally gave rise to much controversy. He found opponents in John Balguy (1686–1748), author of two tracts on "The Foundation of Moral Goodness," and John Taylor (1694–1761) of Norwich, author of *An Examination of the Scheme of Morality advanced by Dr. Hutcheson* and the essays appear to have suggested Butler's *Dissertation on the Nature of Virtue*, and Richard Price's *Treatise of Moral Good and Evil* (1757). (*See* ETHICS.)

BIBLIOGRAPHY.—Besides the above named works, Hutcheson's chief writings are: *Philosophiae moralis institutio compendiario, ethices et jurisprudentiae naturalis elementa continens, lib. iii.* (Glasgow, 1742); *Metaphysicae synopsis ontologiam et pneumatologiam complectens* (Glasgow, 1742), *A System of Moral Philosophy*, 2 vols. (1755) containing a life by Dr. William Leechman (d. 1785), a treatise on *Logic* (1756).

See Adam Smith, *Theory of Moral Sentiments* pt. 7; Mackintosh, *Progress of Ethical Philosophy;* Cousin, *Cours d'histoire de la philosophie morale du XVIIIe siècle;* Whewell, *Lectures on the Hist. of Moral Philosophy in England;* A. Bain, *Mental and Moral Science;* Sir L. Stephen's *Hist. of English Thought in the 18th Cent.;* Martineau, *Types of Ethical Theory* (1902); W. R. Scott, *Francis Hutcheson* (1900); Albee, *Hist. of English Utilitarianism* (1902); T. Fowler, *Shaftesbury and Hutcheson* (1882); J. McCosh, *Scottish Philosophy* (New York, 1874).

HUTCHINSON, ANNE (*c.* 1600–1643), American religious enthusiast, was born in Lincolnshire, England, the daughter of a clergyman, Francis Marbury, and according to tradition, a cousin of John Dryden. She married William Hutchinson, and in 1634 emigrated to Boston, Massachusetts. Although her orthodoxy was suspected and for a time she was not admitted to the church, she soon organized meetings among the Boston women, among whom her exceptional ability and her services as a nurse had given her great influence. At these meetings, which were soon attended even by some of the ministers and magistrates, she discussed and commented upon recent sermons and gave expression to her own theological views. She asserted that she, John Cotton and her brother-in-law, the Rev. John Wheelwright, were under a "covenant of grace," that they had a special inspiration, a "peculiar indwelling of the Holy Ghost," whereas the other ministers of the colony were under a "covenant of works." Anne Hutchinson, according to Winthrop a woman "of a ready wit and bold spirit," was, in fact, voicing a protest against the legalism of the Massachusetts Puritans, and was also striking at the authority of the clergy in an intensely theocratic community. As a result the entire colony was divided into factions. Mrs. Hutchinson was supported by Governor Vane, Cotton, Wheelwright and the great majority of the Boston church; opposed to her were Deputy Governor John Winthrop, the Rev. John Wilson of the Boston church and all of the country magistrates and churches. The strength of the parties was tested at the general court of election of May 1637, when Winthrop defeated Vane for the governorship. Cotton recanted, Vane returned to England in disgust, Wheelwright was tried and banished. Mrs. Hutchinson was tried by the general court chiefly for "traducing the ministers," and was sentenced to banishment; later she was tried before the Boston church and formally excommunicated. With William Coddington and others she established a settlement on the island of Aquidneck (now Rhode Island) in 1638. Four years later, after the death of her husband, she settled on Long Island sound near what is now New Rochelle, N.Y., and was killed by the Indians in Aug. 1643, an event regarded in Massachusetts as a manifestation of divine providence. Anne Hutchinson and her followers were called "Antinomians," rather as a term of reproach than with any reference to her doctrinal theories; and the controversy in which she was involved is known as the "Antinomian controversy."

See C. F. Adams, *Three Episodes of Massachusetts History* (1892) and the life by G. E. Ellis in Jared Sparks, *Library of American Biography*, 2nd ser., vol. 6 (1845).

HUTCHINSON, JOHN (1615–1664), Puritan soldier, son of Sir Thomas Hutchinson of Owthorpe, Nottinghamshire, and of Margaret, daughter of Sir John Byron of Newstead, was baptized on Sept. 18, 1615. On the outbreak of the Great Rebellion he took the side of the parliament, and was made in 1643 governor of Nottingham Castle, which he defended till the triumph of the parliamentary cause. He was M.P. for Nottinghamshire in March 1646, took the side of the Independents, opposed the offers of the king at Newport, and signed the death-warrant. Though a member at first of the council of state, he disapproved of Cromwell's policy, and took no further part in politics during the lifetime of the protector. He resumed his seat in the recalled Long Parliament in May 1659, and followed Monk in opposing Lambert, believing that Monk intended to maintain the commonwealth. He was returned to the Convention Parliament for Nottingham but expelled on June 9, 1660. In October 1663, however, he was arrested upon suspicion of being concerned in the Yorkshire plot, imprisoned in the Tower of London, and in Sandown Castle, Kent. He died on Sept. 11, 1664. His career draws its chief interest from the *Life* by his wife, Lucy, daughter of Sir Allen Apsley, written after the death of her husband but not published till 1806 (since often reprinted), which is a masterpiece of its kind.

See the edition of Lucy Hutchinson's *Memoirs of the Life of Colonel Hutchinson* by C. H. Firth (1885); Brit. Mus. *Add. MSS.* 25,901 (a fragment of the *Life*), also *Add. MSS.* 19, 333, 36,247 f. 51; *Notes and Queries*, 7, ser. iii. 25, viii. 422; *Monk's Contemporaries*, by Guizot.

HUTCHINSON, JOHN (1674–1737), English theological writer, was born at Spennithorne, Yorkshire, in 1674. He served as steward in several families of position, latterly in that of the duke of Somerset, who ultimately obtained for him the post of riding purveyor to the master of the horse, a sinecure worth about £200. He taught that the Bible contained the elements not only of true religion but also of all rational philosophy. He held that the Hebrew must be read without points, and his interpretation rested largely on fanciful symbolism. His followers were called Hutchinsonians.

His *Works* were edited by Robert Spearman and Julius Bate (1748, 12 vols.). A *Supplement*, with *Life* by Spearman prefixed, appeared in 1765.

HUTCHINSON, SIR JONATHAN (1828–1913), English surgeon and pathologist, was born on July 23, 1828, at Selby, Yorkshire, his parents belonging to the Society of Friends. He entered St. Bartholomew's hospital, and rapidly gained reputation as a skilful operator and a scientific enquirer. He was professor of surgery and pathology at the College of Surgeons from 1877 to 1882. In 1889 he was president of the Royal College of Surgeons

and was at different times president of various other professional organizations. His lectures on neuro-pathogenesis, gout, leprosy, diseases of the tongue, etc., were full of original observation; but his principal work was connected with the study of syphilis, on which he put forward the view that it was a specific fever. He was the founder of the London Polyclinic or Post-graduate School of Medicine and the promoter of the New Sydenham Society for the publication of translations of important foreign medical treatises at a moderate cost. Both in his native town of Selby and at Haslemere, Surrey, he started (about 1890) educational museums for popular instruction in natural history. He published several volumes on his own subjects, and was editor of the quarterly *Archives of Surgery*. His book, *Leprosy and Fisheating* (1906) exposed many popular errors, though his conclusion regarding a definite connection between this disease and the eating of salted fish has not been generally accepted.

He received a knighthood in 1908, and died at Haslemere, Surrey, on June 26, 1913.

HUTCHINSON, THOMAS (1711–1780), the last royal governor of the province of Massachusetts, son of a wealthy merchant of Boston, Mass., was born there on Sept. 9, 1711. He graduated at Harvard in 1727 and for several years thereafter devoted himself to business. In 1737 he began his public career as a member of the Boston board of selectmen, and a few weeks later he was elected to the general court of Massachusetts Bay, of which he was a member until 1740 and again from 1742–49, serving as speaker in 1747, 1748 and 1749. He consistently contended for a sound financial system, and vigorously opposed the operations of the "Land Bank" and the issue of pernicious bills of credit. His first trip to England was in 1740 when he represented his Colony in a boundary dispute with New Hampshire. He was a member of the Massachusetts council from 1749–56, was chief justice of the superior court of the province from 1761–69, was lieutenant governor from 1758–71, acting as governor in the latter two years, and from 1771–74 was governor. In 1754 he was a delegate from Massachusetts to the Albany convention, and, with Franklin, was a member of the committee appointed to draw up a plan of union. Though he recognized the legality of the Stamp Act of 1765, he considered the measure inexpedient and impolitic and urged its repeal, but his attitude was misunderstood; he was considered by many to have instigated the passage of the act, and in Aug. 1765 a mob sacked his Boston residence and destroyed many valuable manuscripts and documents. He was acting governor at the time of the "Boston Massacre" in 1770, and it was his orders that removed the British troops from the town. Throughout the pre-revolutionary disturbances in Massachusetts he was the representative of the British ministry, and though he disapproved of some of the ministerial measures he felt impelled to enforce them and necessarily incurred the hostility of the Whig or patriot element. In 1774, upon the appointment of Gen. Thomas Gage as military governor, he went to England, and acted as an adviser to George III. and the British ministry on American affairs, uniformly counselling moderation. He died at Brompton, now part of London, on June 3, 1780.

He wrote *A Brief Statement of the Claim of the Colonies* (1764); a *Collection of Original Papers relative to the History of Massachusetts Bay* (1769), reprinted as *The Hutchinson Papers* by the Prince Society in 1865; and a judicious, accurate and very valuable *History of the Province of Massachusetts Bay* (vol. i., 1764, vol. ii., 1767, and vol. iii., 1828). His *Diary and Letters, with an Account of his Administration*, was published at Boston in 1884–86.

See J. K. Hosmer's *Life of Thomas Hutchinson* (Boston, 1896), and a biographical chapter in John Fiske's *Essays Historical and Literary* (1902). For an estimate of Hutchinson as an historian, *see* M. C. Tyler's *Literary History of the American Revolution* (1897).

HUTCHINSON, a city of Kansas, U.S.A., on the Arkansas river, 6om. N.W. of Wichita, at an altitude of 1,553ft.; the county seat of Reno county. It is on a Federal highway and is served by the Missouri Pacific, the Rock Island and the Santa Fe railways. The population in 1925 (State census) was 25,970 (92% native white). Hutchinson is the fourth city of the State in size. It ships great quantities of grain (7,000,000bu. in 1927), flour, poultry, dairy products, live stock and lumber. Under the city and its environs are thick beds of salt, from which an average of 15,000 barrels of salt a day is produced. There are large packing plants and grain elevators, creameries, flour mills, a soda ash plant, a bag factory and a strawboard factory. The factory output in 1927 was valued at $17,000,000. Hutchinson was founded in 1871 and incorporated in 1872. The State industrial reformatory is situated here.

HUTTEN, PHILIPP VON (*c.* 1511–1546), German knight, a relative of Ulrich von Hutten, joined the band of adventurers which under Georg Hohermuth, or George of Spires, sailed to Venezuela, or Venosala as Hutten calls it, with the object of conquering and exploiting this land in the interests of the Augsburg family of Welser. The party landed at Coro in February 1535 and Hutten accompanied Hohermuth on his toilsome expedition into the interior in search of treasure. After the death of Hohermuth in December 1540 he became captain-general of Venezuela. Soon after this event he vanished into the interior, returning after five years of wandering to find that a Spaniard, Juan de Caravazil, or Caravajil, had been appointed governor in his absence. With his travelling companion, Bartholomew Welser the younger, he was seized by Caravazil in April 1546 and the two were afterwards put to death.

Hutten left some letters, and also a narrative of the earlier part of his adventures, this *Zeitung aus India Junkher Philipps von Hutten* being published in 1785.

HUTTEN, ULRICH VON (1488–1523), German humanist and soldier, was born on April 21, 1488, at the castle of Steckelberg, near Fulda, in Hesse. His life may be divided into four parts:—his youth and cloister-life (1488–1504); his wanderings in pursuit of knowledge (1504–1515); his strife with Ulrich of Württemberg (1515–1519); and his connection with the Reformation (1519–1523). He was the eldest son of a poor but not undistinguished knightly family.

Wanderings.—As he was mean of stature and sickly his father sent him to the Benedictine house at Fulda; the thirst for learning there seized on him, and in 1505 he fled from the monastic life. He went first to Cologne, next to Erfurt, and then to Frankfort-on-Oder on the opening in 1506 of the new university of that town. For a time he was in Leipzig, and in 1508 we find him a shipwrecked beggar on the Pomeranian coast. In 1509 the university of Greifswald welcomed him, but the sensitive ill-regulated youth, who took the liberties of genius, wearied his burgher patrons. He left Greifswald and was robbed of clothes and books, his only baggage, by the servants of his late friends; in the dead of winter, half starved, frozen, penniless, he reached Rostock.

Here under the protection of the Humanists he wrote against his Greifswald patrons, thus beginning the long list of his satires and fierce attacks on personal or public foes. From Rostock he wandered on to Wittenberg and Leipzig, to Vienna and on to Pavia, where he spent the year 1511 and part of 1512. In the siege of Pavia (1512) by papal troops and Swiss, he was plundered by both sides, and escaped, sick and penniless, to Bologna; on his recovery he took service as a private soldier in the emperor's army.

In 1514 he was again in Germany, under the patronage of the elector of Mainz, Archbishop Albert of Brandenburg. But the murder in 1515 of his relative Hans von Hutten by Ulrich, duke of Württemberg, changed the whole course of his life; satire, chief refuge of the weak, became Hutten's weapon; with one hand he took his part in the famous *Epistolae obscurorum virorum*, and with the other launched scathing letters, eloquent Ciceronian orations, or biting satires against the duke. The emperor took Hutten under his protection and gave him a laureate crown in 1517. The poet, who had meanwhile revisited Italy, again attached himself to the electoral court at Mainz. In 1518 his friend Pirckheimer urged him to abandon the court and dedicate himself to letters, but he insisted on his mission as a knight of the empire.

The Knightly Satirist.—In 1519 he issued in one volume his five attacks on Duke Ulrich, and then took part in the private war against him; in this affair he became intimate with Franz von Sickingen, the champion of the knightly order (Ritterstand). Hutten now espoused the Lutheran cause, but he was at the same time mixed up in the attempt of the "Ritterstand" to assert itself

as the militia of the empire against the independence of the German princes. Soon after this time he discovered at Fulda a copy of the manifesto of the emperor Henry IV. against Hildebrand, and published it with comments as an attack on the papal claims over Germany. He hoped thereby to interest the new emperor Charles V., and the higher orders in the empire, in behalf of German liberties; but the appeal failed. Luther had succeeded by speaking to cities and common folk in homely phrase, because he touched heart and conscience; Hutten tried to touch the more cultivated sympathies and dormant patriotism of princes and bishops, nobles and knights. And so he at once gained an undying name in the republic of letters and ruined his own career. He showed that the artificial verse-making of the Humanists could be connected with the new outburst of genuine German poetry. The Minnesinger was gone; the new national singer, a Luther or a Hans Sachs, was heralded by the stirring lines of Hutten's pen. These have in them a splendid natural swing and ring, strong and patriotic.

The attack on the papacy, and Luther's vast and sudden popularity, frightened Elector Albert, who dismissed Hutten from his court. Hoping for imperial favour, he betook himself to Charles V., but was rebuffed. He now attached himself more closely to Franz von Sickingen He fled to Basel, where Erasmus refused to see him, both for fear of his loathsome diseases, and also because the beggared knight was sure to borrow money from him. A paper war consequently broke out between the two Humanists, which embittered Hutten's last days, and stained the memory of Erasmus. From Basel Ulrich went to Mülhausen; and then to Zurich. There Zwingli helped him with money, and found him a refuge on the little isle of Ufnau on the Zurich lake. There the frail and worn-out poet, writing swift satire to the end, died on Aug. 29, 1523 at the age of thirty-five. He left behind him some debts due to compassionate friends; he did not even own a single book, and all his goods amounted to the clothes on his back, a bundle of letters, and that valiant pen which had fought so many a sharp battle, and had won for the poor knight-errant a sure place in the annals of literature.

Ulrich von Hutten is one of those men of genius at whom propriety is shocked, and whom the mean-spirited avoid. Yet through his short and buffeted life he was befriended, with wonderful charity and patience, by the chief leaders of the Humanist movement. For, in spite of his irritable vanity, his immoral life and habits, his odious diseases, his painful restlessness, Hutten had much in him that strong men could admire, for he passionately loved truth for its own sake. His patriotism is beyond dispute, though the cause with which he associated himself was particularist and doomed to failure. There was no salvation for Germany in the Ritterstand. It is as humanist and poet, and for his frank and noble nature that his claims to honour lie. A swarm of writings issued from his pen; at first the smooth elegance of his Latin prose and verse seemed strangely to miss his real character; he was the Cicero and Ovid of Germany before he became its Lucian.

His chief works were his *Ars versificandi* (1511); the *Nemo* (1518); a work on the *Morbus Gallicus* (1519); the volume of Steckelberg complaints against Duke Ulrich (including his four *Ciceronian Orations*, his *Letters* and the *Phalarismus*) also in 1519; the *Vadismus* (1520); and the controversy with Erasmus at the end of his life. Besides these were many admirable poems in Latin and German. He was one of the most distinguished contributors to, though not the originator of the *Epistolae obscurorum virorum*, that famous satire on the theologians of Cologne with which the friends of Reuchlin defended him. In 1909 the Latin text of the *Epistolae* with an English translation was published by F. G. Stokes. D. F. Strauss concludes that he had no share in the first part, but that his hand is clearly visible in the second part, which he attributes in the main to him. To him is due the more serious and severe tone of that bitter portion of the satire. *See* W. Brecht, *Die Verfasser der Epistolae obscurorum virorum* (1904).

BIBLIOGRAPHY.—For a complete catalogue of the writings of Hutten, *see* E. Böcking's *Index Bibliographicus Huttenianus* (1858). Böcking is also the editor of the complete edition of Hutten's works (7 vols., 1859–62). A selection of Hutten's German writings, edited by G. Balke, appeared in 1891. The best biography (though it is also somewhat of a political pamphlet) is that of D. F. Strauss (*Ulrich von Hutten*, 1857; new ed. by O. Clemen, 1914; English translation by G. Sturge, 1874), with which may be compared the P. Kalkoff's *Ulrich von Hutten und die Reformation* (1920) and Huttens, *Vaganten zeit und Untergang* (1925), in which a less favourable view of Hutten's political and religious activity is taken.

HUTTER, LEONHARD (1563–1616), German Lutheran theologian, born at Nellingen, near Ulm, began to lecture at Jena in 1594, and in 1596 became professor of theology at Wittenberg, where he died on Oct. 23, 1616. Hutter was a champion of Lutheran orthodoxy, as set down in the confessions and embodied in his own *Compendium locorum theologicorum* (1610; reprinted 1863). He was called "Luther redonatus."

In reply to Rudolf Hospinian's *Concordia discors* (1607), he wrote *Concordia concors* (1614), defending the formula of Concord, which he regarded as inspired. His *Irenicum vere christianum* is directed against David Pareus (1548–1622), of Heidelberg, who had pleaded for a reconciliation of Lutheranism and Calvinism; his *Calvinista aulopoliticus* (1610) was written against the "damnable Calvinism" which was becoming prevalent in Holstein and Brandenburg. Another work, based on the formula of Concord, was entitled *Loci communes theologici*. Karl von Hase used his name as the symbol of orthodoxy in his *Hutterus redivivus* (1827).

HUTTON, ARTHUR WOLLASTON, (1848–1912), English divine and author, was born at Spridlington, Lincs., on Sept. 5, 1848. A scholar of Exeter College, Oxford, he took orders in the Church of England in 1872, but under Newman's influence became a Roman Catholic, and from 1876–83 was a member of the Edgbaston Oratorian community. Later he renounced Roman Catholicism, and became known as an agnostic and free-thinker. For some years he was librarian at the National Liberal Club in London. In 1898 he was readmitted to the Church of England, and from 1903 until his death was rector of Bow church, London. He died at Blackheath, on March 25, 1912. He wrote a *Life of Manning* (1892).

HUTTON, JAMES (1726–1797), Scottish geologist, was born in Edinburgh on June 3, 1726. He qualified as a doctor of medicine, studying in Edinburgh and Paris, but turned to practical agriculture, in which he made many improvements. In 1768 he retired, and from then until his death (March 26, 1797) he lived in Edinburgh, devoting himself to scientific pursuits.

At that time geology in any proper sense of the term did not exist. Mineralogy, however, had made considerable progress. But Hutton had conceived larger ideas than were entertained by the mineralogists of his day. He desired to trace back the origin of the various minerals and rocks, and thus to arrive at some clear understanding of the history of the earth. For many years he continued to study the subject. At last, in the spring of the year 1785, he communicated his views to the recently established Royal Society of Edinburgh in a paper entitled *Theory of the Earth, or an Investigation of the Laws Observable in the Composition, Dissolution and Restoration of Land upon the Globe.* In this work the doctrine is expounded that geology is not cosmogony, but must confine itself to the study of the materials of the earth; that everywhere evidence may be seen that the present rocks of the earth's surface have been in great part formed out of the waste of older rocks; that these materials having been laid down under the sea were there consolidated under great pressure, and were subsequently disrupted and upheaved by the expansive power of subterranean heat; that during these convulsions veins and masses of molten rock were injected into the rents of the dislocated strata; that every portion of the upraised land, as soon as exposed to the atmosphere, is subject to decay; and that this decay must tend to advance until the whole of the land has been worn away and laid down on the sea-floor, whence future upheavals will once more raise the consolidated sediments into new land. In some of these broad and bold generalizations Hutton was anticipated by the Italian geologists; but to him belongs the credit of having first perceived their mutual relations, and combined them in a luminous coherent theory based upon observation.

It was not merely the earth to which Hutton directed his attention. He had long studied the changes of the atmosphere. The same volume in which his *Theory of the Earth* appeared contained also a *Theory of Rain*, which was read to the Royal Society of Edinburgh in 1784. He contended that the amount of moisture which the air can retain in solution increases with augmentation of temperature, and, therefore, that on the mixture of two masses of air of different temperatures a portion of the moisture must be condensed and appear in visible form. He investigated the available data regarding rainfall and climate in different regions of the globe, and came to the conclusion that the rainfall is everywhere regulated by the humidity of the air on the one hand, and the causes which promote mixtures of different aerial currents in the higher atmosphere on the other.

His other works include: *Dissertations on different Subjects in Natural Philosophy* (1792), in which he discussed the nature of matter, fluidity, cohesion, light, heat and electricity, and *An Investigation of the Principles of Knowledge, and of the Progress of Reason—from Sense to Science and Philosophy*. His closing years were devoted to the extension and republication of his *Theory of the Earth*, of which two volumes appeared in 1795. A portion of the ms. of a third volume, which had been given to the Geological Society of London by Leonard Horner, was edited by A. Geikie in 1899.

Five years after Hutton's death John Playfair published a volume, *Illustrations of the Huttonian Theory of the Earth*, in which he gave an admirable summary of Hutton's theory, with numerous additional illustrations and arguments.

See also his *Biographical Account of James Hutton* (1797), publ. in *Transactions of the Royal Society of Edinburgh*, vol. v. (1805).

(A. Geı.; X.)

HUTTON, RICHARD HOLT (1826–1897), English writer and theologian, son of Joseph Hutton, Unitarian minister at Leeds, was born at Leeds on June 2, 1826. From 1855 to 1895 Hutton and Bagehot were joint-editors of the *National Review*, a new monthly, and conducted it for ten years. In 1861 Hutton became joint-editor and part proprietor of the *Spectator*, then a well-known Liberal weekly. Hutton's own articles became and remained up to the last one of the best-known features of serious and thoughtful English journalism. He was an original member of the Metaphysical Society (1869), an anti-vivisectionist, and a member of the royal commission (1875) on that subject. Hutton died on Sept. 9, 1897. Selections from his *Spectator* articles were published in 1899 under the title of *Aspects of Religious and Scientific Thought*.

HUXLEY, THOMAS HENRY (1825–1895), English biologist, was born on May 4, 1825 at Ealing, the son of a schoolmaster. Of education in the formal sense he received none. "I had two years of a pandemonium of a school (between eight and ten), and after that neither help nor sympathy in any intellectual direction till I reached manhood" (*Life*, ii. 145). When his father moved to Coventry about 1835, young Huxley was left to his own devices. His great desire to be a mechanical engineer, ended in his devotion to "the mechanical engineering of living machines." His curiosity in this direction was nearly fatal; a *post-mortem* he was taken to between 13 and 14 was followed by an illness which seems to have been the starting-point of the ill-health which pursued him all through life. At 15 he devoured Sir William Hamilton's *Logic*, and thus acquired a taste for metaphysics. At 17 he came under the influence of Thomas Carlyle's writings. Fifty years later he wrote: "To make things clear and get rid of cant and shows of all sorts. This was the lesson I learnt from Carlyle's books when I was a boy, and it has stuck by me all my life" (*Life*, ii. 268). At 17 Huxley, with his elder brother James, commenced regular medical studies at Charing Cross hospital, and on graduating in 1845 he published his first scientific paper, demonstrating the existence of a hitherto unrecognized layer in the inner sheath of hairs, a layer since known as "Huxley's layer."

Huxley passed the necessary examination, and at the same time obtained the qualification of the Royal College of Surgeons. He was "entered on the books of Nelson's old ship, the 'Victory,' for duty at Haslar Hospital." Its chief, Sir John Richardson, who was a well-known Arctic explorer and naturalist, recognized Huxley's ability, and procured for him the post of surgeon to H.M.S. "Rattlesnake," about to start for surveying work in Torres strait. By the time the ship was ordered home after the lamented death of her captain at Sydney, to be paid off at Chatham in November 1850, Huxley had made a profound study of the surface-life of the tropical seas. He sent home "communication after communication to the Linnean society," then a somewhat somnolent body, "with the same result as that obtained by Noah when he sent the raven out of the ark" (*Essays*, i. 13). However, his important paper, *On the Anatomy and the Affinities of the Family of Medusae*, was printed by the Royal Society in the *Philosophical Transactions* in 1849. Huxley united, with the Medusae, the Hydroid and Sertularian polyps, to form a class which he subsequently named Hydrozoa. He found that all the members of the class consisted of two membranes enclosing a central cavity or stomach, and wisely compared the two layers with those which appear in the germ of the higher animals. The consequences which have flowed from this prophetic generalization of the *ectoderm* and *endoderm* are familiar to every student of evolution. After returning to England in 1850 Huxley was elected F.R.S. in 1851, and in the following year received the Royal medal when 26 and was elected to the council. With absolutely no aid from any one he had placed himself in the front rank of English scientific men. He secured the friendship of Sir J. D. Hooker and John Tyndall, who remained his lifelong friends. The Admiralty retained him as a nominal assistant-surgeon, in order that he might work up the observations he had made during the voyage of the "Rattlesnake." He was thus enabled to produce various important memoirs, especially those on certain Ascidians, in which he solved the problem of *Appendicularia*—an organism whose place in the animal kingdom Johannes Müller had found himself wholly unable to assign—and on the morphology of the cephalous Mollusca.

Richard Owen, then the leading comparative anatomist in Great Britain, was a disciple of Cuvier, and adopted largely from him the deductive explanation of anatomical fact from idealistic conceptions. He superadded the evolutionary theories of Oken, which were equally idealistic, but were altogether repugnant to Cuvier. Huxley would have none of either. Imbued with the methods of von Baer and Johannes Müller, his methods were purely inductive. He would not hazard any statement beyond what the facts revealed. He retained, however, as has been done by his successors, the use of archetypes, though they no longer represented fundamental "ideas" but generalizations of the essential points of structure common to the individual of each class. He had not wholly freed himself, however, from archetypal trammels. "The doctrine that every natural group is organized after a definite archetype . . seems to me as important for zoology as the doctrine of definite proportions for chemistry," and further: "There is no progression from a lower to a higher type, but merely a more or less complete evolution of one type" (*Phil. Trans.*). As Chalmers Mitchell points out, this statement is of great historical interest. Huxley definitely uses the word "evolution," and admits its existence *within* the great groups. He had not rid himself, however, of the notion that the archetype was a property permanently inherent in the group. Herbert Spencer, whose acquaintance he made in 1852, was unable to convert him to evolution in its widest sense (*Life*, i. 168). About the same time, in his first interview with Darwin, he expressed his belief "in the sharpness of the lines of demarcation between natural groups," and was received with a humorous smile (*Life*, i. 169).

After three years' nominal employment Huxley was ordered on active service. He resigned, as he was determined to continue his scientific work. In July 1854 Huxley became lecturer at the School of Mines and naturalist to the Geological Survey in 1855, the year of his marriage with Miss H. A. Heathorn. His most important published work at this period was the Croonian Lecture of 1858 on "The Theory of the Vertebrate Skull," in which he completely demolished by his inductive method, the idealistic, if in some degree evolutionary, views of its origin held by Richard Owen. This finally disposed of the "archetype," and may be said to have liberated the English anatomical school from the deduc-

tive method.

In 1859 *The Origin of Species* was published. This was a momentous event in the history of science, and not least for Huxley, who found in Darwin what he had failed to find in Lamarck and in Charles Lyell, namely, an intelligible hypothesis good enough as a working basis for evolution. The rigorous proof which Huxley demanded was the production of species sterile to one another by selective breeding (*Life*, i. 193). He warned Darwin: "I will stop at no point as long as clear reasoning will carry me further" (*Life*, i. 172). Owen, who was at first favourably disposed to Darwin's theory, could not break with orthodoxy, and in his Rede Lecture asserted that man was clearly marked off from other animals by the anatomical structure of his brain. This was inconsistent with known facts, and was effectually refuted by Huxley in various papers and lectures, summed up in 1863 in *Man's Place in Nature*. This "monkey damnification" of mankind was too much even for the "veracity" of Carlyle, who is said to have never forgiven it. Meanwhile Huxley had been drawn into palaeontological research. Numerous memoirs on fossil fishes established many far-reaching morphological facts. The study of fossil reptiles led to his demonstrating, in the course of lectures on birds, delivered at the College of Surgeons in 1867, the fundamental affinity of the two groups which he united under the title of Sauropsida. An incidental result of the same course was his proposed rearrangement of the zoological regions into which P. L. Sclater had divided the world in 1857. Huxley anticipated, to a large extent, the results at which botanists have since arrived; he proposed as primary divisions, Arctogaea—to include the land areas of the northern hemisphere—and Notogaea for the remainder. Successive waves of life originated in and spread from the northern area, the survivors of the more ancient types finding successively a refuge in the south. In 1892 he wrote: "The doctrine of evolution is no speculation, but a generalization of certain facts . . . classed by biologists under the heads of Embryology and of Palaeontology" (*Essays*, v. 42). Earlier in 1881 he had asserted even more emphatically that if the hypothesis of evolution "had not existed, the palaeontologist would have had to invent it" (*Essays*, iv. 44).

From 1870 onwards Huxley was more and more drawn away from scientific research by the claims of public duty. From 1862 to 1884 he served on no less than ten Royal Commissions; from 1871 to 1880 he was a secretary of the Royal Society, and from 1881 to 1885 president; and from 1870 to 1872 he served as a member of the newly constituted London School board. He resigned the latter position in 1872, but in the brief period during which he acted, probably more than any man, he left his mark on the foundations of national elementary education. He made war on the scholastic methods which wearied the mind in merely taxing the memory; the children were to be prepared to take their place worthily in the community. Physical training was the basis; domestic economy, at any rate for girls, was insisted upon, and for all some development of the aesthetic sense by means of drawing and singing. Reading, writing and arithmetic were the indispensable tools for acquiring knowledge, and intellectual discipline was to be gained through the rudiments of physical science. He insisted on the teaching of the Bible partly as a great literary heritage, partly because he was "seriously perplexed to know by what practical measures the religious feeling, which is the essential basis of conduct, was to be kept up, in the present utterly chaotic state of opinion in these matters, without its use" (*Essays*, iii. 397), and, again, because it was "the most democratic book in the world." In 1872 the School of Mines was moved to South Kensington, and Huxley had, for the first time after 18 years, those appliances for teaching beyond the lecture room, which to the lasting injury of the interests of biological science in Great Britain had been withheld from him by the shortsightedness of government. Huxley had only been able to bring his influence to bear upon his pupils by oral teaching, and had had no opportunity by personal intercourse in the laboratory of forming a school. He was now able to organize a system of instruction for classes of elementary teachers in the general principles of biology, which indirectly affected the teaching of the subject throughout the country. In 1892 he accepted a Privy Councillorship. The physical failure to meet the strain of his scientific and public duties made rest imperative, and he took a long holiday in Egypt in 1873. He still continued to occupy himself with vertebrate morphology, but prevented by growing ill health from stooping over the microscope, and driven by attacks on Darwin and himself, he found an outlet for his energies in public addresses and more or less controversial writings. His health completely broke down in 1885. In 1890 he removed from London to Eastbourne, where after a painful illness he died on June 29, 1895.

The latter years of Huxley's life were mainly occupied with contributions to periodical literature on subjects connected with philosophy and theology. The only approach to certainty which he admitted lay in the order of nature. "If there is anything in the world which I do firmly believe in, it is the universal validity of the law of causation, but that universality cannot be proved by any amount of experience" (*Essays*, ix. 121). The assertion that "There is only one method by which intellectual truth can be reached, whether the subject-matter of investigation belongs to the world of physics or to the world of consciousness" (*Essays*, ix. 126) laid him open to the charge of materialism, which he vigorously repelled. "Legitimate materialism, that is, the extension of the conceptions and of the methods of physical science to the highest as well as to the lowest phenomena of vitality, is neither more nor less than a sort of shorthand idealism" (*Essays*, i. 194). While "the substance of matter is a metaphysical unknown quality of the existence of which there is no proof . . the non-existence of a substance of mind is equally arguable; . the result . is the reduction of the All to co-existences and sequences of phenomena beneath and beyond which there is nothing cognoscible" (*Essays*, ix. 66) As regards miracles, he wrote: "nobody can presume to say what the order of nature must be"; this "knocks the bottom out of all *a priori* objections either to ordinary 'miracles' or to the efficacy of prayer" (*Essays*, v 133). In 1860 he asserted: "Science seems to me to teach in the highest and strongest manner the great truth which is embodied in the Christian conception of entire surrender to the will of God" (*Life*, i. 219). In 1885 he formulated "the perfect ideal of religion" in a passage which has become famous: "In the 8th century B.C. in the heart of a world of idolatrous polytheists, the Hebrew prophets put forth a conception of religion which appears to be as wonderful an inspiration of genius as the art of Pheidias or the science of Aristotle. 'And what doth the Lord require of thee, but to do justly, and to love mercy, and to walk humbly with thy God' " (*Essays*, iv. 161). Two years later he was writing: "That there is no evidence of the existence of such a being as the God of the theologians is true enough" (*Life*, ii. 162); he never really advanced beyond the recognition of "the passionless impersonality of the unknown and unknowable, which science shows everywhere underlying the thin veil of phenomena" (*Life*, i. 239), though he insisted that "atheism is on purely philosophical grounds untenable" (*Life*, ii. 162). In other respects his personal creed was a kind of scientific Calvinism. From 1880 onwards Huxley was occupied in a campaign against orthodox beliefs. He threw Christianity overboard bodily on the grounds that "the exact nature of the teachings and the convictions of Jesus is extremely uncertain" (*Essays*, v. 348). His final analysis of what "since the second century, has assumed to itself the title of Orthodox Christianity" is a "varying compound of some of the best and some of the worst elements of Paganism and Judaism, moulded in practice by the innate character of certain people of the Western world" (*Essays*, v. 142). He did not omit, however, to do justice to "the bright side of Christianity," and was deeply impressed with the life of Catherine of Siena. He compared the moral with the aesthetic sense, which he repeatedly declares to be intuitive and in the Romanes Lecture for 1894, defined "law and morals" to be "restraints upon the struggle for existence between men in society." Apparently he thought that the moral sense in its origin was intuitional and in its development utilitarian. "The cosmic process has no sort of relation to moral ends" (*Essays*, ix. p. 83); "of moral purpose I see

no trace in nature. That is an article of exclusive human manufacture" (*Life*, ii. 268). The cosmic process gives rise to what is evil in man's moral life, and in the long run will get the best of the contest, and "resume its sway" when evolution enters on its downward course (*Essays*, ix. p. 45).

As has been said, Huxley never accepted without qualification the Darwinian principle. He thought "transmutation may take place without transition" (*Life*, i. 173) and thereby anticipated the findings of modern research. He recognized the "struggle for existence" but not the gradual adjustment of the organism to its environment which is implied in "natural selection." In highly civilized societies he thought that the former was at an end (*Essays*, ix. 36) and had been replaced by the "struggle for enjoyment" (*l c* p. 40).

See *Life and Letters of T. H. Huxley*, by his son Leonard Huxley (2 vols., 1900; 2nd ed. 3 vols. 1903); *Scientific Memoirs of T. H. Huxley* (5 vols., 1898-1903); *Collected Essays* by T. H. Huxley (9 vols., 1898); P. Chalmers Mitchell, *Thomas Henry Huxley, a Sketch of his Life and Work* (1900); E. Clodd, *T. H. Huxley* (1902); and J. R. Ainsworth Davis, *T. H. Huxley* (1907).

HUY, a town of Belgium (Lat *Hoium*, and Flem. *Hoei*), on the two banks of the Meuse, at the point where it is joined by the Hoyoux. Pop. (1925) 14,393. It is 19 m east of Namur and a trifle less west of Liége. Huy certainly dates from the 9th century. Its citadel crowns a grey rock between which and the Meuse is the fine collegiate church of Notre Dame (14th cent. with 13th cent. gateway). The citadel is now partly a military depot and partly a prison. The ruins are still shown of the abbey of Neufmoustier founded by Peter the Hermit on his return from the first crusade. He was buried there in 1115. Neufmoustier was one of ten abbeys in this town alone dependent on the bishopric of Liége. Huy is surrounded by vineyards, and the bridge which crosses the Meuse at this point connects the fertile Hesbaye north of the river with the rocky Condroz south of it.

HUYGENS, CHRISTIAAN (1629–1695), Dutch mathematician, astronomer and physicist, was born at The Hague on April 14, 1629. From his father Constantijn Huygens, he received the rudiments of his education, which was continued at Leyden. In 1651 he published an essay in which he attacked the unsound methods of Gregory of St. Vincent in his method of quadratures. This was followed by other papers on mathematical subjects.

In 1655, Huygens, working with his brother Constantijn on the improvement of the telescope, hit upon a new method of grinding and polishing lenses. The immediate results of the clearer definition obtained were the detection of a satellite to Saturn (the sixth in order of distance from its primary), and the resolution into their true form of the abnormal appendages to that planet. Huygens was also in 1656 the first effective observer of the Orion nebula; he delineated the bright region still known by his name, and detected the multiple character of its nuclear star. His application of the pendulum to regulate the movement of clocks sprang from his experience of the need for an exact measure of time in observing the heavens. The invention dates from 1656; on June 16, 1657, Huygens presented his first "pendulum-clock" to the States-General; and the *Horologium*, containing a description of the requisite mechanism, was published in 1658.

His reputation now became cosmopolitan. In 1663 he was elected a fellow of the Royal Society, and delivered before that body in Jan. 1669 a clear and concise statement of the laws governing the collision of elastic bodies. Although these conclusions were arrived at independently, they were in great measure anticipated by the communications on the same subject of John Wallis and Christopher Wren, made respectively in Nov. and Dec. 1668.

Huygens had before this time fixed his abode in France. In 1665 Colbert made to him on behalf of Louis XIV. an offer too tempting to be refused, and from 1666 to 1681 his residence at the Bibliothèque du Roi was only interrupted by two short visits to his native country. His *magnum opus* dates from this period. The *Horologium oscillatorium* (1673) contained many original discoveries. This work contains the first successful attempt to deal with the dynamics of a system. The determination of the true relation between the length of a pendulum and the time of its oscillation; the invention of the theory of evolutes; the discovery, hence ensuing, that the cycloid is its own evolute, and is tautochronous; the ingenious although practically inoperative idea of correcting the "circular error" of the pendulum by applying cycloidal cheeks to clocks—were all contained in this remarkable treatise. The theorems on centrifugal force in circular motion with which it concluded helped Newton to formulate his law of gravitation.

In 1681 he returned to Holland; perhaps because of the treatment of his co-religionists in France. He now spent six years on the production of lenses of enormous focal distance, which, mounted on high poles, and connected with the eye-piece by means of a cord, formed what were called "aerial telescopes." Three of his object-glasses, of respectively 123, 180 and 210 ft. focal length, are in the possession of the Royal Society. He also succeeded in constructing an almost perfectly achromatic eye-piece, still known by his name. But his researches in physical optics constitute his chief title-deed to immortality. He developed the wave theory of light which had already been adopted by Hooke in 1665; he assumed that all the points of a wave-front originate secondary waves, the aggregate effect of which is to reconstitute the primary disturbance at the subsequent stages of its advance, thus accomplishing its propagation; so that each primary wave-front is the envelope of an indefinite number of secondary undulations. This resolution of the original wave is the well-known "Principle of Huygens," and by its means he was enabled to prove the fundamental laws of optics, and to assign the correct construction for the direction of the extraordinary ray in uniaxial crystals. These investigations, together with his experiments on polarization, are recorded in his *Traité de la lumière*, published at Leyden in 1690, but composed in 1678. In the appended treatise *Sur la Cause de la pesanteur*, he rejected gravitation as a universal quality of matter, although admitting the Newtonian theory of the planetary revolutions. From his views on centrifugal force he deduced the oblate figure of the earth, estimating its compression, however, at little more than one-half its actual amount.

Huygens never married. He died at The Hague on June 8, 1695, bequeathing his manuscripts to the University of Leyden.

In addition to the works already mentioned, his *Cosmotheoros*—a speculation concerning the inhabitants of the planets—was printed posthumously at The Hague in 1698, and appeared almost simultaneously in an English translation. A volume entitled *Opera posthuma* (Leyden, 1703) contained his "Dioptrica," in which he calculated the magnifying power of a telescope, together with the shorter essays *De vitris figurandis*, *De corona et parhelio*, etc. An early tract *De ratiociniis in ludo aleae*, printed in 1657 with Schooten's *Exercitationes mathematicae*, is notable as one of the first formal treatises on the theory of probabilities; nor should his investigations of the properties of the cissoid, logarithmic and catenary curves be left unnoticed. His invention of the spiral watch-spring was explained in the *Journal des savants* (Feb. 25, 1675). An edition of his works was published by G. J.'s Gravesande, in four quarto volumes entitled *Opera varia* (Leyden, 1724) and *Opera reliqua* (Amsterdam, 1728). His scientific correspondence was edited by P. J. Uylenbroek from manuscripts preserved at Leyden. A complete edition of his works and correspondence was published by the *Société Hollandaise des Sciences* (1888–1905, 10 vols.). *See* Boscha, *Christian Huygens* (1895).

HUYGENS, SIR CONSTANTIJN (1596–1687), Dutch poet and diplomatist, was born at The Hague on Sept. 4, 1596. His father, Christiaan Huygens, was secretary to the State council. Constantijn received a liberal education, became a master of Latin verse, a great gymnast, a good musician and an accomplished artist. After a year's further study at Leyden, he went, in 1618, to London with the English ambassador Dudley Carleton; he remained in London for some months, and then went to Oxford, where he studied for some time in the Bodleian library, and to Woodstock, Windsor and Cambridge; he was introduced at the English court, and played the lute before James I. An intimacy sprang up between the young Dutch poet and John Donne, for whose genius Huygens preserved through life an unbounded admiration. He returned to Holland in company with the English contingent of the synod of Dort, and in 1619 he received a diplomatic mission at Venice; on his return he nearly lost his life in scaling the topmost spire of Strasbourg cathedral. In 1621

he published his *Batava Tempe,* and in the same year he proceeded again to London, as secretary to the ambassador, Wijngaerdan, but returned in three months. During his third diplomatic visit (1621–23) his volume of satires, *'t Costelick Mal,* dedicated to Jacob Cats, appeared at The Hague. In the autumn of 1622 he was knighted by James I. In 1625 he was appointed private secretary to the stadholder, and in 1630 a member of the privy council. In 1634 he is supposed to have completed his long-talked-of version of the poems of Donne, fragments of which exist. In 1637 his wife, Susanna van Baerle, died. Their married life is celebrated in the didactic poem, *Dagwerck. Hofwijck* (1653) describes the splendid house and garden which Huygens built for himself at The Hague. In 1647 he wrote his poem *Oogentroost,* to gratify his blind friend Lucretia van Trollo. Huygens wrote only one play, *Trijntje Cornelis Klacht,* which deals with the adventures of the wife of a ship's captain at Zaandam. In 1658 he rearranged his poems, and issued them with many additions, under the title of *Corn Flowers.* He proposed to the Government that the present highway from The Hague to the sea at Scheveningen should be constructed, and during his absence on a diplomatic mission to the French court in 1666 the road was made as a compliment to the venerable statesman, who expressed his gratitude in a descriptive poem entitled *Zeestract.* Huygens edited his poems for the last time in 1672, and died in his 91st year, on March 28, 1687. He was buried, with the pomp of a national funeral, in the church of St. Jacob, on April 4. His second son, Christiaan, the eminent astronomer, is noticed separately.

Constantijn Huygens is the most brilliant figure in Dutch literary history. Other statesmen surpassed him in political influence, and at least two other poets surpassed him in the value and originality of their writings. But his figure was more dignified and splendid, his talents were more varied, and his general accomplishments more remarkable than those of any other person of his age, the greatest age in the history of the Netherlands. Huygens is the *grand seigneur* of the republic, the type of aristocratic oligarchy, the jewel and ornament of Dutch liberty. As a poet Huygens shows a finer sense of form than any other early Dutch writer; the language, in his hands, becomes as flexible as Italian. His epistles and lighter pieces, in particular, display his metrical ease and facility to perfection.

See the complete edition by T. A. Worp of his works (9 vols., 1892–99), and of his correspondence (6 vols., 1913–17); also G. Kalff, *Constantin Huygens* (1900). (E. G.; X.)

HUYSMANS, the name of three Flemish painters, who matriculated in the Antwerp gild in the 17th century.

JACOB, born at Antwerp in 1633 and apprenticed to Frans Wouters in 1650, came to England towards the close of the reign of Charles II., and competed with Lely as a fashionable portrait painter. Among the portraits executed by him are those of Queen Catherine of Braganza, and of Izaak Walton, now in the National Portrait Gallery. He died in London in 1696.

JAN BAPTIST HUYSMANS, born at Antwerp in 1654, matriculated in 1676–77, and died there in 1716. There are several of his paintings in the museums of Antwerp, Brussels and Munich, representing southern landscapes with figures and cattle.

His elder brother, CORNELIUS HUYSMANS, was born at Antwerp in 1648, and educated by Gaspar de Wit and Jacob van Artois. Cornelius is the only master of the name of Huysmans whose talent was largely acknowledged. He received lessons from two artists, one of whom was familiar with the Roman art of the Poussins, whilst the other inherited the scenic style of the school of Rubens. He combined the two in a rich, highly coloured style, seldom attempting anything but woodside views with fancy backgrounds, half Italian, half Flemish. He first practised at Malines, where he married in 1682. From 1706 to 1717 he lived at Antwerp, and then returned to Malines, where he died on June 1,1727. According to Walpole, he also visited England. Though most of his pictures were composed for cabinets rather than for churches, he sometimes emulated van Artois in the production of large sacred pieces, and for many years his "Christ on the Road to Emmaus" adorned the choir of Notre Dame of Malines. The national galleries of London and Edinburgh each contain one example of his skill.

HUYSMANS, CAMILLE (1871–), Belgian statesman, was born at Bilsen in Belgian Limbourg on May 26, 1871. After graduating in Germanic philology at Liége, he became a professor, first at the College Libéral at Ypres, and then at the Université Nouvelle, Brussels. He wrote in the *Peuple* and other Socialist papers, and, after the World War, started the Flemish *Volksgazet* in Antwerp. He entered the Chamber in 1910, first as deputy for Brussels and then for Antwerp, where he became an alderman of public instruction. From 1905 till 1922 he was secretary of the Socialist International Bureau, and while in Holland in 1917 endeavoured to organize the Stockholm International Socialist Congress. After the War he became the chief organizer of the Socialist Party in Antwerp. In June 1925 he became minister of science and arts. His chief works are: *Limburgsch Jaarboek* (1891–95); *Toponymische Studie* (in conjunction with J. Cuvelier, 1897); *Stockholm* (1919); *De Coster's Stephanie* (1926); *Don Juan,* a Flemish dramatic work of the 18th century (1928); *The Works of De Swaen* (4 vol., 1928); and numerous Socialist reports and brochures.

HUYSMANS, JORIS KARL (1848–1907), French novelist, was born in Paris on Feb. 5, 1848. He belonged to a family of artists of Dutch extraction; he entered the ministry of the interior, and was pensioned after thirty years' service. He thus led a thoroughly bourgeois existence in striking enough contrast to the character of his novels. His earliest venture in literature, *Le Drageoir à épices* (1874), contained stories and short prose poems showing the influence of Baudelaire.. *Marthe* (1876), the life of a courtesan, was published in Brussels, and Huysmans contributed a story, "Sac au dos," to *Les Soirées de Médan,* the collection of stories of the Franco-German war published by Zola. He then wrote a series of novels of everyday life, including *Les Sœurs Vatard* (1879), *En Ménage* (1881), and *À vau-l'eau* (1882), in which he outdid Zola in minute and uncompromising realism. Of these the most important is *En Ménage,* which describes the complete disillusion of two friends, Adrien and Cyprien, the one by means of marriage, the other by a vulgar liaison: "The book," says Lalou, "ooses with misanthropy, with hatred of a society incurably common, ugly and stupid." But there is more in Huysmans's work than the presentment in realistic detail of the more disagreeable side of life. He was, in fact, influenced more directly by Flaubert and the brothers de Goncourt than by Zola.

In *L' Art moderne* (1883) Huysmans gave a careful study of impressionism and in *Certains* (1889) a series of studies of contemporary artists. He went on to glorify art at the expense of nature, and the real importance of his work is to be found in his later works, in which the excesses of the aesthetic revolt find a serious and quite humourless exponent. *À Rebours* (1884), the history of the morbid tastes of a decadent aristocrat, des Esseintes, provides a caricature of literary and artistic symbolism which nevertheless contained much of the real beliefs of the aesthetes. In *Là-Bas* Huysmans's most characteristic hero, Durtal, makes his appearance. Durtal is occupied in writing the life of Gilles de Rais; the insight he gains into Satanism is supplemented by modern Parisian students of the black art; but already there are signs of a leaning to religion in the sympathetic figures of the religious bell-ringer of Saint Sulpice and his wife. *En Route* (1895) relates the conversion of Durtal to mysticism and catholicism in his retreat to La Trappe.

In *La Cathédrale* (1898), Huysmans gives a symbolist interpretation of the architecture of the cathedral of Chartres which is a magnificent evocation of the spirit of the place. The life of *Sainte Lydwine de Schiedam* (1901), an exposition of the value of suffering, gives further proof of his conversion; and *L'Oblat* (1903) describes Durtal's retreat to the Val des Saints, where he is attached as an oblate to a Benedictine monastery. Huysmans was nominated by Edmond de Goncourt as a member of the Académie des Goncourt. He died as a devout Catholic, after a long illness of cancer in the palate on May 13, 1907. Before his death he destroyed his unpublished mss. His last book was *Les*

Foules de Lourdes (1906).

See Arthur Symons, *Studies in two Literatures* (1897) and *The Symbolist Movement in Literature* (1899); Jean Lionnet in *L'Évolution des idées* (1903); Eugène Gilbert in *France et Belgique* (1905); J. Sargeret in *Les Grands convertis* (1906).

HUYSUM, JAN VAN (1682–1749), Dutch painter, was born at Amsterdam on April 15, 1682, and died in his native city on Feb. 8, 1749. He was the son and pupil of Justus van Huysum, who is said to have been expeditious in decorating doorways, screens and vases. His pictures of flowers and fruit, in oil and water colours, were finished in every detail and highly prized during his lifetime. He also painted landscapes with Arcadian scenery. His work may be seen in most of the European galleries.

HVAR, an island in the Adriatic Sea (Ital. *Lesina*), forming part of Dalmatia, Yugoslavia. Pop. (1921) 3,568. It is 43 m. long and from 2 m. to 5 m. broad. The warm and equable climate lends itself to the successful growth of grapes, olives, figs, dates and the locust bean. Other industries of the islanders are the making of rosemary essence and liqueurs, bee-keeping, boat-building, fishing and marble quarrying. There are many villages but Hvar (*Lesina*) the capital, and Stari Grad (*Cittavecchia*) are the chief towns and seaports. The former possesses, among other beautiful Venetian buildings, the finest Loggia in Dalmatia, and has also an arsenal and an observatory. It is a Roman Catholic bishopric, and near by there is a Franciscan monastery, which was burned by the Turks in 1471 but rebuilt in 1571. Stari Grad is one of the busiest ports in the Dalmatian islands, and still possesses "Cyclopean" walls, possibly raised by the primitive "Illyrians" whose stone cists and bronze instruments have been found near the capital. The island is memorable as the home of two Slav poets, Lucić, a writer of exquisite lyrics, and the more famous Hektorovic (1487–1572), a democratic noble, some centuries ahead of his time, who devoted his genius to the writing of national songs. About 390 B.C., a Greek colony from Paros built a city on the site of the present Hvar and called it Paros or Pharos. In 229 B.C. Demetrius, the lieutenant of the Illyrian Queen Teuta, betrayed the island to the Romans, but as he proved false to them also, they razed his capital in 219 B.C. Neos Pharos, now Stari Grad, took its place and flourished till the 7th century, when the Slavs, fleeing from the Avars, settled upon the island. Throughout the Middle Ages, and on to the present day, it has remained purely Slavonic. The island became a bishopric in 1145 and received a charter from Venice in 1331; was sacked by the Genoese in 1354 and 1358; ceded to Hungary in the same year; held by Dubrovnik (*Ragusa*) from 1413 to 1416, and incorporated in the Venetian dominions in 1420. During the 16th century Hvar had a considerable maritime trade and though sacked and partly burned by the Turks in 1571, it remained the chief arsenal of Venice in these waters until 1776. In 1797 it passed to Austria, was held by the French from 1805 till 1813, when it was surrendered to Austria, remaining in the possession of that country until the close of the World War. In 1918 it was forcibly occupied by the Italians, until it was formally annexed to Yugoslavia.

HWAI SENG, Chinese monk, travelled with Sung-Yun to India in 518–521 to collect books.

HWANG-HO, the most northerly of China's great rivers, approximately 2,500 m. in length. The name, literally the "Yellow River," is due to the loess (*hwang tu* or "yellow earth") which it carries in suspension and which it derives from the deposits stretching across the middle part of its basin. The Hwang-ho flows through a region having a much lower rainfall than the Yang-tze basin and its discharge is in consequence very much smaller. It pursues a very composite course. It rises in a marshy trough just west of the Tsaring-nor within the parallel ranges of the Kuen-Lun whose central and northern ranges it eventually cuts across before entering on the Ordos, an extension of the Gobi desert. The northern limit of the Ordos is defined by the mountain arc of the Ala-shan, Khara-narin-ula and Ta-tsing-shan, and the Hwang-ho, keeping on the inner side of this arc, occupies a much more open valley than in its upper course. Then the river which was heading eastwards for the "grill of Peking" (*see* CHINA) deserts this mature valley to turn abruptly southwards and in a very rapid and obviously immature course rushes through a long trench cut into the very border of the loess-filled basin of North Shensi. At the south end of this north-south course, it receives first the Fen-ho on its left bank and then the Wei-ho on its right bank, which together gather up the drainage of a string of fertile loess-basins in south Shansi and central Shensi. Their combined waters then flow due east, as though the Wei-ho were the master-stream, through the Tungkwan gorge, where the river is restricted by the approach of the ridges of south Shansi towards the Tsin-ling, and enter on the funnel-shaped valley which leads across Honan to the north China plain. The Tungkwan gorge forms the historic gateway into the north China plain from the Wei-ho valley and beyond from Kansu and the Tarim basin. About Kaifeng the valley gives way to the plain and here the character of the river changes also. With the neighbourhood of Kaifeng as a pivot, the Hwang-ho, after breaking its dykes during flood, has several times shifted bodily the whole of its lower course through the plain. For over five centuries before 1852 the Yellow river entered the Yellow sea well to the south of the Shantung uplands, but since 1852 its mouth has lain to the north of them, involving a change of over 250 miles.

The most irregular feature in this long course of the Hwang-ho is the entrenched torrent along the Shansi-Shensi border in the very middle of its course and between two mature valley stretches, that across the Ordos and that through Honan. This disposition suggests that the torrent stretch has comparatively recently joined two formerly independent drainage systems. In its course across the Ordos the Hwang-ho is heading for the ridge and trough country of the "grill of Peking." The troughs are broad enough to take the river and an enormous deltaic fan to the north-west of Peking, too big to be produced by any existing stream of the neighbourhood, may represent its outfall. In its valley course through Honan the Hwang-ho simply continues the line of the broad Wei-ho valley and these together, though broken by the Tungkwan gorge, may represent a second formerly independent river. The head-streams of the Wei-ho valley lie near to the point where the upper Hwang-ho emerges from the Kuen-Lun ranges. The upper Hwang-ho may be related therefore to either the Ordos or the Wei-ho system. If the "grill of Peking" were tilted, up in the north and down in the south, which the decreasing elevation of its ridges to the south would indicate has actually taken place, then the Ordos river would be compelled to turn southwards until it could escape to the east. This it could not do until it came across the great Ta-hwa fault along which the grill system is broken against the Tsin-ling. By this means it would encounter the southernmost of the once independent rivers, that flow along the northern foot of the Tsin-ling ranges.

In its torrential stretches the current is too swift and in its course through the plain the channel is too wide and shallow for the Hwang-ho to be of much use for navigation. The Ordos loop is navigable from Chungwei to Hokow save during low water in winter and flood in summer, but the region through which it flows is unproductive. Further down, there is some local traffic along the trench between Hokow and Tungkwan, but it is nearly all downstream because of the swift current. In its lower course only the last 25 miles are really suitable for navigation.

The economic significance of the Hwang-ho is not as an artery of commerce but as the source of many of the floods which from time to time devastate the north China plain and which have earned it the names of "China's Sorrow," "The Ungovernable," "The Scourge of the Sons of Han." The plain has only a very gentle slope towards the sea and is to some degree the deltaic accumulation of the Hwang-ho, the Hwai-ho and the Chihli rivers. In its course over it the channel of the Hwang-ho becomes exceedingly broad and shallow. With the agricultural reclamation of the plain this broad channel has become confined by dyke construction and the river silt formerly spread over a wide area has become concentrated on the river bed itself so that the river is now flowing on the top of the plain as much as within it. The river surface of the Hwang-ho is at low water 15 feet above the general level of the plain, at high water as much as 30 feet. It

is estimated that it is raising its bed, mainly when the current is slackening after the summer floods, at the rate of one foot in every hundred years, but this represents only about 1% of the total amount of silt brought down within such a period. In this lower course the dykes are sufficiently far apart for the river to have considerable swing, which not only lengthens the river course but also facilitates the breaching of the dykes by an aggressive meander. The International Famine Relief Commission propose to control the river by straightening its channel which would increase the current and thereby the scour of the river-bed and would prevent the breaching of dykes by meandering. By this means it is hoped not only to prevent flood but also to add to the land reclaimed for agriculture.

HWICCE, one of the kingdoms of Anglo-Saxon Britain, coinciding generally with the mediaeval diocese of Worcester, the early bishops of which bore the title "Episcopus Hwicciorum." It would therefore include Worcestershire, Gloucestershire except the Forest of Dean, the southern half of Warwickshire, and the neighbourhood of Bath. The name Hwicce survives in Wychwood Forest in Oxfordshire. This district, or at all events the southern portion, was according to the *Anglo-Saxon Chronicle, s.a.* 577, originally conquered by the West Saxons under Ceawlin. In later times, however, the kingdom of the Hwicce appears to have been always subject to Mercian supremacy, and possibly it was separated from Wessex in the time of Edwin. The first kings of whom we read were two brothers, Eanhere and Eanfrith, probably contemporaries of Wulfhere. They were followed by Osric, a contemporary of Aethelred, and by Oshere. Oshere's three sons Aethelheard, Aethelweard and Aethelric succeeded him, the two last reigning in 706. At the beginning of Offa's reign we again find the kingdom ruled by three brothers, named Eanbert, Uhtred and Aldred, the two latter of whom lived until *c.* 780. After them the title of king seems to have been given up. Their successor Aethelmund, who was killed in a campaign against Wessex in 802, is described only as an earl. The district remained in possession of the rulers of Mercia until the fall of that kingdom. Together with the rest of English Mercia it submitted to King Alfred *c.* 877–883 under Earl Aethelred, who possibly himself belonged to the Hwicce. No list of kings has been preserved, and we do not know whether the dynasty was connected with that of Wessex or Mercia.

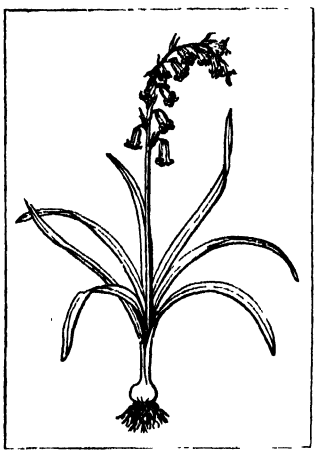
See Bede, *Historia Eccles.* iv. 23 (ed. Plummer, 1896); Birch, *Cartularium Saxonicum*, 43, 51, 76, 85, 116, 117, 122, 163, 187, 232, 233, 238 (1885–89). (F. G. M. B.)

HYACINTH, also called JACINTH, one of the most popular of spring garden flowers (family Liliaceae). It was in cultivation prior to 1597, at which date it is mentioned by Gerard. Rea in 1665 mentions several single and double varieties as being then in English gardens, and Justice in 1754 describes upwards of fifty single-flowered varieties, and nearly one hundred double-flowered ones, as a selection of the best from the catalogues of two then celebrated Dutch growers. One of the Dutch sorts, called La Reine de Femmes, a single white, is said to have produced from thirty-four to thirty-eight flowers in a spike, and on its first appearance to have sold for 50 guilders a bulb; while one called Overwinnaar, or Conqueror, a double blue, sold at first for 100 guilders, Gloria Mundi for 500 guilders, and Koning Saloman for 600 guilders. Several sorts are at that date mentioned as blooming well in water-glasses. Justice relates that he himself raised several very valuable double-flowered kinds from seeds, which many of the sorts he describes are noted for producing freely.

The original of the cultivated hyacinth, *Hyacinthus orientalis*, a native of Greece and Asia Minor, is by comparison an insignificant plant, bearing on a spike only a few small, narrow-lobed, washy blue flowers, resembling in form those of our common bluebell. So great has been the improvement effected by the florists, and chiefly by the Dutch, that the modern hyacinth would scarcely be recognized as the descendant of the type above referred to, the spikes being long and dense, composed of a large number of flowers; the spikes produced by strong bulbs not unfrequently measure 6 to 9 in. in length and from 7 to 9 in. in circumference, with the flowers closely set from bottom to top. Of late years much improvement has been effected in the size of the individual flowers and the breadth of their recurving lobes, as well as in securing increased brilliancy and depth of colour.

The peculiarities of the soil and climate of Holland are so very favourable to their production that Dutch florists have made a specialty of the growth of those and other bulbous-rooted flowers. Hundreds of acres are devoted to the growth of hyacinths in the vicinity of Haarlem.

In the spring flower garden few plants make a more effective display than the hyacinth. Dotted in clumps in the flower borders, and arranged in masses of well-contrasted colours in beds in the flower garden, there are no flowers which impart during their season—March and April—a gayer tone to the parterre. The bulbs are rarely grown a second time, either for indoor or outdoor culture, though with care they might be utilized for the latter purpose; and hence the enormous numbers which are procured each recurring year from Holland.



THE WILD HYACINTH OR BLUEBELL (SCILLA NUTANS)

The first hyacinths were single-flowered, but towards the close of the 17th century double-flowered ones began to appear, and till a recent period these bulbs were the most esteemed At the present time, however, the single-flowered sorts are in the ascendant, as they produce more regular and symmetrical spikes of blossom, the flowers being closely set and more or less horizontal in direction, while most of the double sorts have the bells distant and dependent, so that the spike is loose and by comparison ineffective. For pot culture, and for growth in water-glasses especially, the single flowered sorts are greatly to be preferred. Few if any of the original kinds are now in cultivation, a succession of new and improved varieties having been raised, the demand for which is regulated in some respects by fashion.

HYACINTH or **JACINTH,** in mineralogy, a variety of zircon (*q.v.*) of yellowish red colour, used as a gem-stone. The *hyacinthus* of ancient writers must have been our sapphire, or blue corundum, while the hyacinth of modern mineralogists may have been the stone known as *lyncurium* (λυγκούριον). The Hebrew word *leshem*, translated ligure in the A.V. (Exod. xxviii. 19), from the λιγύριον of the Septuagint, appears in the R.V. as jacinth, but with a marginal alternative of amber; both may be reddish yellow, but their indentification is doubtful. Most of the gems known in trade as hyacinth are only garnets, generally the deep orange-brown hessonite or cinnamon-stone; and the stones known as Compostella hyacinths are simply ferruginous quartz from Santiago de Compostella, Spain. Hyacinth is not a common mineral. It occurs, with other zircons, in the gem-gravels of Ceylon, and very fine stones have been found as pebbles at Mudgee, New South Wales. Crystals of zircon, with all the typical characters of hyacinth, occur at Expailly in Central France, but they are not large enough for cutting. (L. J. S.)

HYACINTHUS, in Greek legend, a young man (parentage variously given) of Amyclae in Laconia (Gr. Ὑάκινθος). According to the general story, which is probably late and composite, his great beauty attracted the love of Apollo, who killed him accidentally when teaching him to throw the *discus* (quoit); others say that Zephyrus (or Boreas) out of jealousy deflected the quoit so that it hit Hyacinthus on the head and killed him. According to the representation on the throne of Apollo at Amyclae (Pausanias) he was translated into Heaven with his virgin sister Polyboea. Out of his blood there grew the flower called *hyacinthos* (perhaps fritillary; not our hyacinth), the petals of which were marked with the mournful exclamation AI, AI, "alas." It was also said to have sprung from the blood of Ajax son of Telamon.

The death of Hyacinthus was celebrated at Amyclae by the second most important of Spartan festivals, the Hyacinthia, which took place in the Spartan month Hecatombeus. What month this was is not certain. Arguing from Xenophon (*Hell.* iv. 5) we get May; assuming that the Spartan Hecatombeus is the Attic Hecatombaion, we get July; or again it may be the Attic Scirophorion, June. At all events the Hyacinthia was an early summer festival. It lasted three days, and the rites gradually passed from mourning for Hyacinthus to rejoicings in the majesty of Apollo. (*See* Farnell, *Cults of the Greek States,* iv. 266 *et seq.*). This festival is clearly connected with vegetation, and marks the passage from the youthful verdure of spring to the dry heat of summer and the ripening of the corn.

There can be little doubt that Hyacinthus is a pre-Hellenic god. His name is not Greek, and has the characteristic pre-Hellenic suffix *-νθ; cf.* Κόρινθος. The precise relation which he bears to Apollo is obscure. The supposed "tomb of Hyacinthus," which forms the base of the monument of Apollo at Amyclae, described by Pausanias, may be taken as evidence of his subordination to the greater god. Into the "tomb" at Amyclae were put offerings for the hero, before gifts were made to the god. This and the taboo on cereals during the first part of the Amyclean festival suggest a chthonian vegetation deity whose death is mourned like that of Adonis (*q.v.*). Frazer suggests that he may have been regarded as spending the winter months in the underworld, and returning to earth in the spring when the "hyacinth" blooms. With the growth of the hyacinth from his blood should be compared the oriental stories of flowers springing from the blood of Attis (*q.v.*), and from that of Adonis (*q.v.*).

See L. R. Farnell, *Cults of the Greek States,* vol. iv. pp. 125 *et seq.*, 264 *et seq.* (1907); J. G. Frazer, *Golden Bough* (3rd ed.) v. 313; S. Wide, *Lakonische Kulte,* p. 290; Roscher's *Lexikon s.v.* "Hyakinthos" (Greve).

HYADES, "the rainy ones," a group of five stars in the head of the constellation Taurus. In mythology they were maidens (their number and parentage vary in different accounts) who nursed the infant Dionysus, and as a reward were translated to heaven and placed among the stars (Hyginus, *Poët. astron.* ii. 21). According to another version they were sisters, whose brother Hyas was killed while hunting (Ovid, *Fasti,* v. 165; Hyginus, *Fab.* 192). They lamented him so bitterly that Zeus, out of compassion, changed them into stars—five into the Hyades, the remainder into the Pleiades. Their name is derived from the fact that the rainy season commenced when they rose at the same time as the sun (May 7–21). The Romans derived the name from *Hys* (ὗς, pig), and translated it by *Suculae* (Cicero, *De nat. deor.*, ii. 43).

HYATT, ALPHEUS (1838–1902), American zoologist and palaeontologist, was born at Washington, D.C., on April 5, 1838. From 1858 to 1862 he studied at Harvard, under Louis Agassiz, and in 1863 he served as a volunteer in the Civil War, attaining the rank of captain. In 1867 he was appointed curator of the Essex Institute at Salem, Mass., and in 1870 became professor of zoology and palaeontology at the Massachusetts Institute of Technology (resigned 1888), and custodian of the Boston Society of Natural History (curator in 1881). In 1886 he was appointed assistant for palaeontology in the Cambridge museum of comparative anatomy, and in 1889 was attached to the United States Geological Survey as palaeontologist. Hyatt rose to foremost rank among American investigators in the field of invertebrate palaeontology. He was the chief founder of the American Society of Naturalists, of which he acted as first president in 1883, and he also took a leading part in establishing the marine biological laboratories at Annisquam and Woods Hole, Mass. He died at Cambridge, on Jan. 15, 1902.

His works include *Observations on Polyzoa* (1866); *Fossil Cephalopods of the Museum of Comparative Zoology* (1867); *Revision of North American Porifera* (1875–1877); *Genera of Fossil Cephalopoda* (1883); *Larval Theory of the Origin of Cellular Tissue* (1884); *Genesis of the Arietidae* (1889); and *Phylogeny of an acquired characteristic* (1894). He wrote the section on Cephalopoda in Karl von Zittel's *Paläontologie* (1900), and his valuable study on the fossil pond snails of Steinheim ("The Genesis of the Tertiary Species of Planorbis at Steinheim") appeared in the *Memoirs* of the Boston Natural History Society in 1880. He was a founder and editor of the *American Naturalist.*

See W. K. Brooks, "Biographical Memoirs of Alpheus Hyatt," *Nat. Acad. of Sciences Biog. Mem.*, vol. vi., pp. 311–325 (1909); R. T. Jackson, "Alpheus Hyatt and His Principles of Research," *Amer. Naturalist,* vol. xlvii., pp. 195–205 (Lancester, Pa., 1913).

HYATT, ANNA VAUGHN (1876–), American sculptor, was born at Cambridge, Mass., March 10, 1876. She studied art in Boston and in New York city, with H. A. MacNeil and Gutzon Borglum. Her equestrian statue, "Jeanne d'Arc," was selected for Riverside Park, New York city, in 1915. This work, a "Saint Joan of Arc" in the Cathedral of St. John the Divine, New York city, and a "Diana" have been her chief figure compositions. She was awarded the Rodin gold medal in 1917, and the Saltus medals in 1920 and 1922. In 1923 she married Archer Milton Huntington.

See F. N. Price, "Anna Hyatt Huntington," *Internat. Studio,* vol. lxxix., pp. 319–323 (1924); Pauline C. Bouvé, "The Two Foremost Women Sculptors in America: Anna Vaughn Hyatt and Malvina Hoffman," *Art and Archaeology,* vol. xxvi., pp. 74–82 (1928).

HYBLA, the name of several cities in Sicily. The best known historically is Hybla Major, near modern Melilli, where numerous Sicel tombs have been found, about 4 m. S.W. of Megara Hyblaea (*q.v.*). It was this Hybla that was famous for its honey. Orsi (*Römische Mitteilungen,* 1909, 84) identifies Hybla Major with Paternò; the view here given is that of Ziegler (Pauly-Wissowa, *Realencyklopädie, s.v.*). Another Hybla, known as Hybla Minor or Geleatis, is represented by the modern Paternò, with its conspicuous mediaeval castle. Various remains have been found, especially tombs of the Sicel period; and there are also Roman remains, two arches of a bridge, remains of baths, cisterns, etc.

HYBRIDISM. This term has its origin in a Greek word meaning an insult or outrage: a hybrid or mongrel used to be regarded as an outrage on nature—being the offspring of wide crosses, *e.g.*, the mating of individuals belonging to different species; a mongrel, the offspring of the crossing of different varieties within a species. But since Mendel worked and wrote hybridity has come to possess a very definite meaning. Any individual that is heterozygous for one or more of the hereditary characters it displays is in respect of that character or those characters a hybrid, for hybridity is but another name for heterozygosis. (*See* HEREDITY.) The degree of hybridity exhibited by the offspring is determined by the extent to which the hereditary constitutions of the two parents differ one from another.

Many species are mutually sterile in matings. Many interspecific hybrids are remarkable in that among them one sex is absent, rare or infecund. Many hybrids are manifestly better equipped in their general characterizations in relation to some particular task or destiny than are the parental pure-bred forms.

The mating of individuals differing markedly one from the other in their characterizations, *e.g.*, belonging to different species, is commonly impossible or unproductive. Two species are normally debarred from producing fertile offspring by any of the following means:—Differences in breeding season or breeding place; psychological repugnance of one from, or failure to be stimulated by, the other's recognition marks, scents, peculiarities in courtship behaviour, or mechanical stimuli; mechanical disharmony of the copulatory apparatus; disharmonies in fertilization and development.

Differences in Breeding Season.—These, limiting interbreeding between allied species, are illustrated in the records of Lo Bianco (1909) relating to the period of sexual maturity of Mollusca and Crustacea in the Gulf of Naples.

	Mollusca	Crustacea
Number of pairs of species of the same genus	37	52
Breeding seasons coincide in the same genus	6	7
Breeding seasons differ in the same genus	7	12
Breeding seasons overlap in the same genus	23	33
Breeding seasons doubtful in the same genus	1	0

Differences in Breeding Place.—These are well illustrated by the case of parasites. The same host species may be occupied by several parasite species but the total range of each parasite, as far as it is known, differs. Another illustration is provided by the observations of Johansen on the distribution of animals in Rander's Fjord in relation to salinity.

No. of marine species	Restricted to salinity of
16	20–24 p-m
9	15–24 p-m
4	12–24 p-m
0	8–24 p-m
3	6–24 p-m
3	5–24 p-m
1	1–24 p-m

Psychological Barriers.—It is uncertain whether unwillingness to mate with an individual of another species is a widespread phenomenon. The records of hybridization in captivity make it evident that sexual intercourse is by no means uncommon. Pairing inclination is not a fair index of morphological affinity nor is disinclination to mate necessarily an index of mutual sterility as can be shown by artificial fertilization. Repugnance has been recorded in mammals (the guinea-pig, Detlefsen 1914); in birds (Columba, Staples Brown); in Pulmonate Gastropoda (*Cepea*, Diver); and in insects (Morrison 1924); but these instances are by no means so numerous as are records of complaisance. The extent to which any particular kind of behaviour as a means of sexual excitation is definitely repugnant to individuals of a different species is most difficult to ascertain. Doubtless the rôle of special scent glands, special markings and mechanical stimuli as means of isolation is important in certain groups. In Lepidoptera the scent glands act as a bar to coitus (Petersen, 1904). The olfactory stimuli are important in Drosophila (Sturtevant, 1921). There are specific differences in the flash emitted by fireflies (McDermott, 1917), which renders interspecific matings unlikely.

Mechanical Disability.—Complete mechanical disability obtains in those cases in which one form liberates its gametes into a fluid medium, having no differentiated external reproductive organs whilst the other practises, and is equipped for, internal fertilization. In cases in which, in both forms, internal fertilization is normal, disharmonies in the methods of sexual intercourse, in the shape and size of the intromittent organ and the vagina, in the construction of special devices for the conveyance of the spermatozoa, can lead to mutual sterility.

Even though the gametes are brought together, fertilization may still be impossible and consequent development may remain imperfect or incomplete. Sterility may then be due to inability on the part of the sperm to penetrate the ovum, failure of cleavage at various stages on the part of the fertilized ovum (Newman, 1915), cessation of, or disharmony in, development of the embryo (Bonnier, 1924), low vitality of the hybrid form (Harrison, 1920), disharmony in the development of the reproductive organs of an otherwise normal hybrid (Goodspeed, 1917), or aberrations in the chromosomal distributive mechanism.

The classical experiments of Godlewski and Loeb on artificial fertilization have shown that in certain instances of failure on the part of the sperm to penetrate the egg fertilization can be induced by rendering the surrounding medium more alkaline.

In many hybrids gametogenesis—the production of functional ova and sperms—is incomplete and imperfect. This may be due to actual disorganization of the nuclear mechanism, taking the form of abnormal synapsis (Smith and Thomas, 1914); failure on the part of the chromosomes to conjugate (Harrison and Doncaster, 1914) (Federlay, 1914); polyploidy (Gates, 1921). The fertility or otherwise of hybrids would seem to be determined by the presence or absence of a balance between the chromosomes, and not by their actual number.

Hybrid Vigour.—The cause of the beneficial result of the meeting of differently constituted germplasms, of the marked general vigour of hybrids, or *heterosis* as it is technically called, has been extensively studied. It has been suggested that this heterosis is due either to a physiological stimulus, the effect of which is revealed in an increase in cell division, or else to the pooling of appropriate hereditary factors contributed to the offspring of the two parents. East and Jones (1921) have produced a mass of evidence which supports this latter interpretation. Heterosis is well exemplified in the common mule, which though sterile, is hardier, stronger and larger than either parent. In general, first-generation hybrids are an improvement on either parent, but usually the increased vigor is shown at its best only in the first generation after the cross.

Hybrid vigour can be produced by the mating of unlike strains within a species. This is often taken advantage of commercially. Pig-breeders, for instance, by mating pigs of distinct breeds, obtain animals which mature more rapidly than either parent stock.

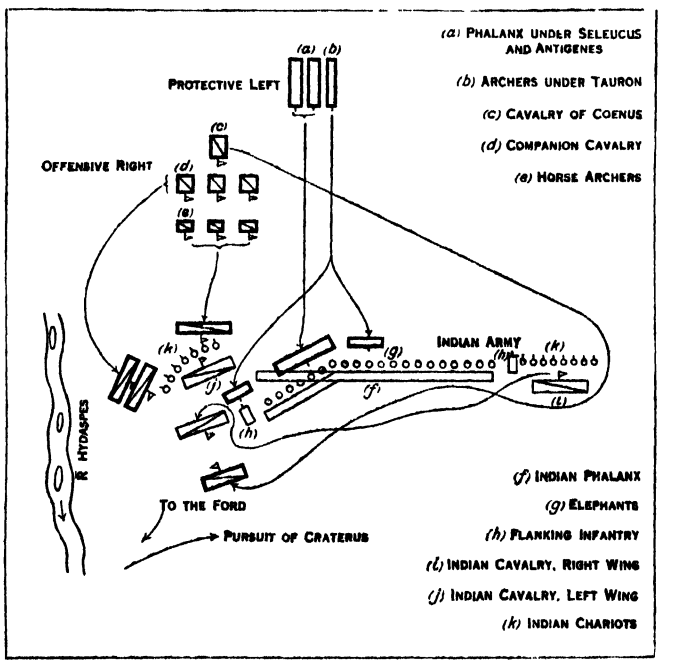
BIBLIOGRAPHY.—The subject is thoroughly discussed and a full bibliography is given in *The Species Problem* by G. C. Robson, Oliver & Boyd (1928). *See* also C. Darwin, *Origin of Species* (1859); East and Jones, *Inbreeding and Outbreeding* (1919). (F. A. E. C.)

HYDANTOIN crystallizes from water in colourless needles, and melts at 208–220° C. It is constitutionally glycolyl urea, or the ureide of glycollic acid, $CO<^{NH\cdot CH_2}_{NH\cdot CO}$, and is obtained by heating allantoin or alloxan with hydriodic acid, by heating bromo-acetylurea with alcoholic ammonia or by the action of urea on dihydroxytartaric acid. When hydrolysed with baryta water, hydantoin yields hydantoic (glycoluric) acid,

$$H_2N\cdot CO\cdot NH\cdot CH_2\cdot CO_2H,$$

colourless prisms, m.p. 153–156°, which are readily soluble in hot water.

HYDASPES, BATTLE OF THE (326 B.C.). The battle of the Hydaspes (Jhelum) is the most interesting of the four great battles fought by Alexander, since he was not only faced by a well-organized enemy protected by a river in flood but by a force of war elephants against which his decisive arm—heavy cavalry—



THE BATTLE OF THE HYDASPES, 326 B.C., BETWEEN PORUS AND ALEXANDER
Alexander executed his favourite manoeuvre of attacking with the right wing (d), first employing horse archers and then charging with the cavalry

was useless. Porus, his adversary, occupied the left bank of the river; he was a man of courage and sense, the most efficient general Alexander ever met. According to Diodorus, his army consisted of 50,000 infantry, 3,000 cavalry, about 1,000 chariots and 130 elephants.

Alexander was encamped near modern Jalapur, the left bank of the river being picketed by the Indians. As he was not able to force a crossing, he divided his army into many parts and laid in a great store of corn in order to make Porus believe that he did not intend to cross until the winter had set in. In any case he

could not cross in face of Porus, since the elephants drawn up on the far bank "by their aspect and trumpeting" would have caused his horse to take panic; he therefore resolved to steal a crossing under the cover of the following stratagem. He sent parties of cavalry up and down the river to make every kind of noise, Porus marching along the opposite bank where the clamour was heard After a time, nothing taking place, Porus "perceiving that his fear had been groundless" kept his position in his camp. Having thus stupefied his adversary, Alexander determined to make a night march and cross the river at a bend some 18 miles north of modern Jhelum. He left Craterus in camp with the bulk of the army, instructing him not to attempt to force a passage unless Porus moved away; then, at the head of 5,000 horse and some 9,000 foot, he set out northwards to the point of crossing where skin-rafts and pontoons had been secreted. The river was successfully crossed, and, once the army was marshalled, Alexander advanced at the head of the cavalry ordering the infantry to follow on at a slow pace in regular formation. His object undoubtedly was to fix his enemy before he could deploy or retire.

Preliminary Engagement.—Porus, still seeing a large force in Alexander's camp, on hearing that a crossing of the river had been effected by the enemy, sent forward his son at the head of 2,000 cavalry and 120 chariots to delay them. On seeing this force approach, Alexander at first thought that it was Porus himself, and sent out his horse archers to reconnoitre. Learning, however, that it was but a detachment, he charged home killing Porus's son and 400 of his men. Apprised of this defeat, Porus was in doubt what to do. Craterus was now attempting to cross the river, and Alexander was advancing on him at top speed. Leaving some elephants and a small force to watch the ford, he moved off the clayey ground, and deployed his elephants into line at intervals of about 100 feet. Behind these he drew up his infantry in phalangial order. On the flanks he posted forces of cavalry, infantry and his chariots.

Seeing the Indians drawn up in order of battle, Alexander halted his cavalry so that his infantry might come up, and then, after resting them, he determined to advance against the enemy's left wing, and so avoid the elephants. His plan was as follows: The horse archers were to move against the enemy's left to throw his cavalry into confusion. Under cover of this fire the Companion cavalry were to move against this same wing, and attack the Indian cavalry "while still in a state of disorder." By moving the bulk of his cavalry against the enemy's left wing he foresaw that Porus would probably withdraw his right wing cavalry to support his left wing, and so uncover his right wing. To take advantage of this probability he ordered Coenus and a force of horse, directly he saw Porus move his right wing cavalry, to gallop round the enemy's right wing and charge it *in rear*. The phalanx and the archers were ordered not to engage "until they observed the enemy's cavalry and phalanx of infantry thrown into disorder by the cavalry under his command."

The Battle.—To understand the battle as described by Arrian it must be presumed that Porus wheeled back the left of his army to meet the approaching attack, and that he drew his elephants more and more from his right towards his left. With his right wing cavalry he did exactly what Alexander had foreseen, whereupon Coenus galloped round the rear of the Indian infantry, and, as Arrian says, "threw the ranks as well as the decisions of the Indians into confusion." To counter this charge Porus wheeled round his cavalry to meet it, whereupon Alexander, seeing his opportunity, charged home at the head of his Companions and drove the enemy back onto their elephants "as to a friendly wall for refuge." The elephants thrown into confusion were nevertheless urged forward by their mahouts, whereupon the phalanx, covered by the archers, charged down on them, but itself became disorganized. The Indian cavalry, seeing this, wheeled round to charge, but Alexander had once again reorganized his cavalry, and charging the Indian cavalry, cut them down in great numbers. One by one the mahouts were killed, and "when the beasts were tired out . . . they began to retire slowly, facing the foe like ships backing water, merely uttering a shrill piping sound." Alexander now surrounded the whole of the enemy's line with his cavalry, and, giving the signal to the infantry to link shields, he charged his disorganized foe, and won the battle after eight hours fierce contest. The pursuit was at once taken up by Craterus. According to Diodorus the Indian losses were 12,000 and Alexander's 980.

Tactics.—The first point which strikes the student is the preparatory moral attack made by Alexander on Porus by a series of feints which blind him by tiring out his vigilance. Directly this has been accomplished, he sets out at the head of a small force; he did not require a large one, because the whole idea of his attack was based on surprise. For surprise to prove successful, it was essential that Porus should not notice any serious reduction in the numbers opposed to him; consequently, when he learnt of Alexander's advance, he did not realize what was happening. In brief, it was because Craterus was so strong that the surprise of the smaller force was so complete. Alexander's main problem was, seeing that he could not attack the Indian front, which of its two flanks should he select. His army was so small that he must maintain touch with Craterus, and if he could turn Porus's left flank he would facilitate the crossing of the river by Craterus. He decided to concentrate against the enemy's left flank, and to assist this concentration he detached Coenus, for by this economical distribution of force he added vastly to his main blow which was delivered under cover of demoralization due to surprise. Secured on his right flank by the river and his main army which threatened the Indian rear, he protected the left of his cavalry by the phalanx, and prepared his assault by the fire of his horse archers. Then in oblique order he converged on the enemy's left. As the enemy cavalry was scattered the phalanx approached and with it he delivered a left-hand punch under cover of which he withdrew his cavalry—his right-hand punch. No sooner was this done, than he withdrew his phalanx, and charged home with his cavalry. Then with his phalanx (his left) he knocked his antagonist out.

BIBLIOGRAPHY.—*See under* GRANICUS, BATTLE OF THE.

(J. F. C. F.)

HYDATID, a name for a bladderworm (*q.v.*). (*See* also TAPEWORMS, PLATYHELMINTHES.)

HYDE, the name of an English family distinguished in the 17th century. Robert Hyde of Norbury, Cheshire, had several sons, of whom the third was Lawrence Hyde of Gussage St. Michael, Dorsetshire. Lawrence's son Henry was father of Edward Hyde, earl of Clarendon (*q.v.*), whose second son by his second wife was Lawrence, earl of Rochester (*q.v.*); another son was Sir Lawrence Hyde, attorney-general to Anne of Denmark, James I.'s consort; and a third son was Sir Nicholas Hyde (d. 1631), chief justice of England. Sir Nicholas entered parliament in 1601 and soon became prominent as an opponent of the court, though he does not appear to have distinguished himself in the law. Before long, however, he deserted the popular party, and in 1626 he was employed by the duke of Buckingham in his defence to impeachment by the Commons; and in the following year he was appointed chief justice of the king's bench. In 1629 Hyde was one of the judges who condemned Eliot, Holles and Valentine for conspiracy in parliament to resist the king's orders; refusing to admit their plea that they could not be called upon to answer out of parliament for acts done in parliament. He died in August 1631.

Robert (1595–1665), son of Lawrence, the attorney-general to Anne of Denmark, became recorder of Salisbury and represented that borough in the Long Parliament, in which he professed royalist principles, voting against the attainder of Strafford. He gave refuge to Charles II. on his flight from Worcester in 1651, and on the Restoration he was knighted and made a judge of the common pleas. He died in 1665.

See Anthony à Wood, *Athenae oxonienses* (1813–20); Lord Clarendon, *The Life of Edward, Earl of Clarendon* (3 vols., Oxford, 1827); Edward Foss, *The Judges of England* (1848–64); Samuel Pepys, *Diary and Correspondence*, edited by Lord Braybrooke (4 vols., 1854).

HYDE, DOUGLAS (1860–), Irish scholar and writer, was born at Frenchpark, Co. Roscommon, 1860, and was educated at Trinity College, Dublin. In 1891 he acted as interim professor of modern languages at the University of New Brunswick, Canada.

He formed in 1893 the Gaelic League, for the preservation and extension of the Irish language, and was president of that body until 1915. In 1899 his production, before a vice-regal committee on education, of letters from leading Celtic scholars throughout Europe saved the Irish language on the intermediate board which regulated the curricula for Irish schools. During 1905 he toured America and raised £11,000 for the Gaelic League. On his return he was appointed a member of a royal commission on Irish university education. Dr. Hyde was made professor of Modern Irish at University College, Dublin, in 1909. He was co-opted by the Free State Senate in 1922, but failed to secure re-election in 1925. In the latter year he became editor of *Lia Fáil*. The movement created by him initiated an enthusiasm for the native language, which finally resulted in the teaching of the language being made compulsory in Irish schools.

Among Dr. Hyde's more important works are *A Literary History of Ireland* (1899); collections and translations of the *Love Songs of Connacht* (1893); *Raftery's Irish Songs* (1904); *The Religious Songs of Connacht* (1906). He also wrote several short plays in Irish.

HYDE, THOMAS (1636–1703), English orientalist, was born at Billingsley, near Bridgnorth, in Shropshire, on June 29, 1636. At King's college, Cambridge, he studied oriental languages under Wheelock, and after only one year of residence, was invited to London to assist Brian Walton in his edition of the *Polyglot Bible*. Besides correcting the Arabic, Persic and Syriac texts for that work, Hyde transcribed into Persic characters the Persian translation of the Pentateuch, which had been printed in Hebrew letters at Constantinople in 1546. To this work Hyde appended the Latin version which accompanies it in the *Polyglot*. After holding various preferments, he was at length appointed, in 1691, Laudian professor of Arabic; and in 1697, on the deprivation of Roger Altham, regius professor of Hebrew and a canon of Christ Church. Under Charles II., James II. and William III. Hyde discharged the duties of Eastern interpreter to the court. He died at Oxford on Feb. 18, 1703. In his chief work, *Historia religionis veterum Persarum* (1700), he made the first attempt to correct from oriental sources the errors of the Greek and Roman historians who had described the religion of the ancient Persians.

With the exception of the *Historia religionis*, which was republished by Hunt and Costard in 1760, the writings of Hyde, including some unpublished mss., were collected and printed by Dr. Gregory Sharpe in 1767 under the title *Syntagma dissertationum quas olim . . . Thomas Hyde separatim edidit*, with a life of the author. Hyde also published a catalogue of the Bodleian library in 1674.

HYDE, market town, municipal borough, Stalybridge and Hyde parliamentary division, Cheshire, England, 7½ m. E. of Manchester, by the L.N.E. railway. Pop. (1921), 33,424. It is connected with Manchester by an electric tramway system. Standing on the river Tame, it has cotton and weaving factories, spinning mills, print-works, iron foundries and machine works; it also manufactures hats and margarine. There are extensive coal mines in the vicinity. Hyde is wholly of modern growth, though it contains a few ancient houses, such as Newton Hall. The old family of Hyde held possession of the manor as early as the reign of John. The borough was incorporated in 1881.

HYDE DE NEUVILLE, JEAN GUILLAUME, Baron (1776–1857), French politician, was born at La Charité-sur-Loire (Nièvre), on Jan. 24, 1776, of an English family which had emigrated with the Stuarts after the rebellion of 1745. From 1793 he was an active agent of the exiled Bourbon princes; he took part in the Royalist rising in Berry in 1796, and after the *coup d'état* of the 18th Brumaire (Nov. 9, 1799), tried to persuade Bonaparte to recall the Bourbons. After an accusation of complicity in the infernal machine conspiracy (1800–1), subsequently retracted, Hyde de Neuville went to the United States, returning after the Restoration. His mission from Louis XVIII. to induce the British Government to transfer Napoleon to a safer place of exile than Elba was cut short by the emperor's return to France in March 1815. Under the Restoration he was ambassador at Washington, and at Lisbon, where his action at the time of the *coup d'état* of Dom Miguel (April 30, 1824), was disapproved in Paris. Hyde de Neuville was recalled. He then opposed the policy of Villele's cabinet in the Chamber and in 1828 became minister of marine in Martignac's moderate administration. During the Polignac ministry (1829–1830) he was again in opposition, being a firm upholder of the charter; but after the revolution of July 1830 he entered an all but solitary protest against the exclusion of the legitimate line of the Bourbons from the throne, and resigned his seat. He died in Paris on May 28, 1857.

His *Mémoires et souvenirs* (3 vols., 1888), compiled from his notes by his nieces, the vicomtesse de Bardonnet and the baronne Laurenceau, are of great interest for the Revolution and the Restoration. An English edition translated and abridged by F. Jackson was published (2 vols.) in 1913.

HYDERABAD, SIR MIR OSMAN ALI KHAN, Nizam of (1886–), was born on April 6, 1886, and succeeded his father, Sir Mir Mahbub Ali Khan, at his death on Aug. 29, 1911. Soon after accession he abandoned the traditional system of governing through a Diwan, and for five years was his own prime minister. In 1919 he constituted an executive council with a president and eight other members, each in charge of one or more departments. During the World War he was an ardent supporter of the British cause. He was promoted hon. lieutenant-general in the British army, and in 1918 King George V. conferred upon him the new and special title of Exalted Highness.

HYDERABAD, the principal native state of India in extent, population and political importance; area, 82,698 sq.m.; pop. (1921) 12,471,770. The state occupies a large portion of the eastern plateau of the Deccan. It is bounded north and north-east by Berar, south and south-east by Madras, and west by Bombay. Two tracts may be distinguished from one another geologically and ethnically, and are locally known from the languages spoken as Telingana and Marathwara. In some parts it is mountainous, wooded and picturesque, in others flat and undulating. The open country includes rich and fertile plains, much good land not yet brought under cultivation, and numerous sterile tracts. The territory is well watered, with many rivers, tanks and artificial pieces of water, especially in Telingana. The principal rivers are the Godavari (*q.v.*), with its tributaries, the Dudna, Manjira and Pranhita; the Wardha, with its tributary the Penganga; and the Kistna, with its tributary the Tungabhadra. The climate is in general good; and as there are no arid bare deserts, hot winds are little felt.

The revenue of the state is largely derived from the land, and the development of irrigation and railways has caused considerable expansion. (Revenue [est. 1927–28] 768 lakhs of rupees; expenditure 724 lakhs.) Over half the population are dependent on agriculture. The soil is generally fertile, though in some parts it consists of *chilka*, a red and gritty mould little fitted for purposes of agriculture. The principal crops are millets of various kinds, rice, wheat, oil-seeds, cotton, tobacco and fruits and garden produce. Lac, gums and oils are found, and hides, raw and tanned, are of commercial importance. The principal exports are cotton, oil-seeds, grain, timber, country-clothes and hides; the imports are salt, timber, European piece-goods, sugar, cattle, metals, oil and yarn. Mineral wealth consists of coal, copper, iron, diamonds and gold, but its development has not been very successful. The only coal mine now worked is the large one at Singareni, with an out-turn of 700,000 tons in 1925. The total exports in 1924–25 amounted to 1,578 lakhs; imports 2,165 lakhs.

The Bombay-Madras line (Great Indian Peninsular) runs through the south-west of the state, and the Nizam's railway runs from Wadi junction on this line through Hyderabad to Bezwada on the Madras and Southern Mahratta line. The Hyderabad-Godavari railway traverses rich cotton country, and cotton presses have been erected along the line. There are also cotton weaving mills and flour mills. After periods of considerable difficulty, the financial situation of the state is now good. The currency is based on the *hali sikka*, which contains approximately the same weight of silver as the British rupee. A new coin was minted in 1904, and the supply regulated. The current coin, called osmania sicca, exchanges at about 116 to 100 rupees. The state suffered acutely from famine during 1900.

The nizam of Hyderabad is the principal Mohammedan ruler in India. The family was founded by Asaf Jah, a distinguished Turkoman soldier of the emperor Aurangzeb, who in 1713 was

appointed subadar of the Deccan, but eventually threw off the control of the Delhi court. His death in 1748 was followed by internecine struggle among his descendants, in which British and French took part. At one time the French nominee, Salabat Jang, established himself with the help of Bussy. But when the British had secured their predominance throughout southern India, Nizam Ali took his place. He confirmed the grant of the Northern Circars in 1766, and joined in the two wars against Tippoo Sultan in 1792 and 1799. The additions of territory which he acquired by these wars were afterwards (1800) ceded to the British, as payment for the subsidiary force which he had undertaken to maintain. By a later treaty in 1853, the districts known as Berar were "assigned" to defray the cost of the Hyderabad contingent. In 1857 when the Mutiny broke out, the Nizam remained loyal to the British. An attack on the residency was repulsed, and the Hyderabad contingent displayed their loyalty in the field against the rebels. In 1902 by a treaty made by Lord Curzon, Berar was leased in perpetuity to the British government, and the Hyderabad contingent was merged in the Indian army. The present Nizam, His Exalted Highness Sir Osman Ali Khan, Bahadar Fateh Jung, G.C.S.I., G.B.E., faithful ally of the British government, was born in 1886 and succeeded in 1911. He is entitled to a salute of 21 guns. For many years the Hyderabad finances were unhealthy. But in 1902, on the revision of the Berar agreement, the nizam received 25 lakhs (£167,000) a year for the rent of Berar, thus substituting a fixed for a fluctuating source of income, and a British financial adviser was appointed for the purpose of reorganizing the resources of the state. The executive council, with 7 ordinary and one extraordinary members under a president, was set up in 1919. A resident, representing the government of India, has his headquarters at Hyderabad.

HYDERABAD, capital of the State of Hyderabad on the right bank of the Musi, a tributary of the river Kistna, with Golconda to the west, and the British cantonment of Secunderabad 5½ m. to the north-east. It is the fourth largest city in India; pop. (1921) 404,187, including suburbs and cantonment. It was founded in 1589 by Mohammed Kuli, fifth of the Kutb Shahi kings. The Char Minar or Four Minarets (1591), which rise from arches facing the cardinal points, stand in the centre of the city, with four roads radiating from their base. The Ashur Khana (1594), a ceremonial building, the hospital, the Gosha Mahal palace and the Mecca mosque, a sombre building designed after a mosque at Mecca, surrounding a paved quadrangle 360 ft. square, were the other principal buildings of the Kutb Shahi period, though the mosque was only completed in the time of Aurangzeb. The city proper is surrounded by a stone wall with thirteen gates, completed in the time of the first nizam, who made Hyderabad his capital. The suburbs, of which the most important is Chadarghat, extend over a large additional area. There are several fine palaces built by various nizams, and the British residency is an imposing building in a large park on the left bank of the Musi, north-east of the city. The bazaars around it, and under its jurisdiction, are extremely picturesque. Four bridges crossed the Musi, the most notable of which was the Purana Pul, of 23 arches, built in 1593. In 1908, however, the river, swollen by torrential rain (15 in. fell in 36 hours), rose in flood to a height of 12 ft. above the bridges and swept them away. Enormous damage was done, and thousands of lives were lost. The principal educational establishments are the Nizam college (affiliated to Madras University) and the Osmania University with medical, normal, industrial and Sanskrit schools, and a number of schools for Europeans and Eurasians. Hyderabad is an important centre of general trade, and there is a cotton mill in its vicinity. The city is supplied with water from two large lakes retained by great dams.

HYDERABAD or HAIDARABAD, a city and district of British India, in the Sind province of Bombay. The city stands on a hill about 3 m. from the left bank of the Indus; pop. (1921) 81,838. Upon the site of the present fort is supposed to have stood the ancient town of Nirun, which in the 8th century submitted to Mohammed bin Kasim. In 1768 the present city was founded by Ghulam Shah Kalhora; and it remained the capital of Sind until 1843. After the battle of Meeanee (Miani), it was surrendered to the British, and the capital transferred to Karachi. The city is built on the most northerly hills of the Ganga range, a site of great natural strength. In the fort, which covers an area of 36 acres, is the arsenal of the province, transferred thither from Karachi in 1861, and the palaces of the ex-mirs of Sind. An excellent water supply is derived from the Indus. In addition to manufactures of silk, gold and silver embroidery, lacquered ware and pottery, there are factories for ginning cotton. There are four high schools, training colleges for masters and mistresses, a medical school, an agricultural school for village officials, and a technical school.

The DISTRICT OF HYDERABAD has an area of 4,417 sq.m.; pop. (1921) 573,450. It consists of a vast alluvial plain, on the left bank of the Indus, 216 m. long and 48 broad. A limestone range called the Ganga and the pleasant frequency of garden lands break the monotonous landscape. The principal crops are millets, rice, oil-seeds, cotton and wheat, which are dependent on irrigation, mostly from government canals. There is a special manufacture at Hala of glazed pottery and striped cotton cloth. Three railways traverse the district: (1) one of the main lines of the North-Western system, following the Indus valley and crossing the river near Hyderabad; (2) a broad-gauge branch running south to Badin, which will ultimately be extended to Bombay; and (3) a metre-gauge line from Hyderabad city into Rajputana. (*See* also INDIAN DESERT.)

HYDER ALI or **HAIDAR 'ALI** (*c.* 1722–1782), Indian ruler and commander. This Mohammedan soldier-adventurer, who, followed by his son Tippoo, became the most formidable Asiatic rival the British ever encountered in India, was the great-grandson of a *fakir* or wandering ascetic of Islam, who came from the Punjab to Gulburga in the Deccan, and the second son of a *naik* or chief constable at Budikota, near Kolar in Mysore. An elder brother rose to command a brigade in the Mysore army, while Hyder acquired a useful familiarity with the tactics of the French under Dupleix. He is said to have induced his brother to employ a Parsee to purchase artillery and small arms from the Bombay government, and to enroll some 30 sailors of different European nations as gunners, and is thus credited with having been "the first Indian who formed a corps of sepoys armed with fire-locks and bayonets, and who had a train of artillery served by Europeans."

After the siege of Devanhalli (1749) Hyder received an independent command in Mysore; within the next 12 years his energy and ability had made him master of minister and raja alike. In everything but in name he was ruler of the kingdom. In 1763 the conquest of Kanara gave him the treasures of Bednor, which he resolved to make the most splendid capital in India, under his own name, thenceforth changed from Hyder Naik into Hyder Ali Khan Bahadur; and in 1765 he retrieved previous defeat by the Mahrattas by destroying the Nairs or military caste of the Malabar coast, and the conquest of Calicut.

Hyder Ali now occupied the serious attention of the Madras government, which in 1766 agreed with the nizam to furnish him with troops to be used against the common foe. But a secret arrangement was come to between the two Indian powers, the result of which was that Colonel Smith's small force was met with a united army of 80,000 men and 100 guns. British dash and sepoy fidelity, however, prevailed, first in the battle of Chengam (Sept. 3, 1767), and again still more remarkably in that of Tiruvannamalai (Trinomalai). On the loss of his recently made fleet and forts on the western coast, Hyder Ali offered peace overtures; on their rejection, bringing all his resources and strategy into play, he forced Colonel Smith to raise the siege of Bangalore, and brought his army within five m. of Madras. The result was the treaty of April 1769, providing for the mutual restitution of all conquests, and for mutual aid and alliance in defensive war; it was followed by a commercial treaty in 1770 with the authorities of Bombay. Under these arrangements Hyder Ali, when defeated by the Mahrattas in 1772, claimed British assistance, but in vain; this breach of faith aroused a desire for vengeance.

His time came when in 1778 the British, on the declaration of

war with France, resolved to drive the French out of India. The capture of Mahé on the Malabar coast in 1779, followed by the annexation of lands belonging to a dependent of his own, gave him a pretext. Again master of all that the Mahrattas had taken from him, and with empire extended to the Kistna, he descended through the passes of the Ghats amid burning villages, reaching Conjeeveram, only 45 m. from Madras, unopposed. Not till the smoke was seen from St. Thomas's Mount, where Sir Hector Munro commanded 5,200 troops, was any movement made; then, however, the British general sought to join a smaller body under Colonel Baillie recalled from Guntur. The incapacity of the officers resulted in the destruction of Baillie's force of 2,800 (Sept. 10, 1780). Warren Hastings sent from Bengal Sir Eyre Coote, who, though repulsed at Chidambaram, defeated Hyder thrice successively in the battles of Porto Novo, Pollilur and Sholingarh, while Tippoo was forced to raise the siege of Wandiwash, and Vellore was provisioned. On the arrival of Lord Macartney as governor of Madras, the British fleet captured Negapatam, and forced Hyder Ali to confess that he could never ruin a power which had command of the sea. He had sent his son Tippoo to the west coast, to seek the assistance of the French fleet, when his death took place at Chittur in Dec. 1782.

See L. B. Bowring, *Haidar Ali and Tipu Sultan,* "Rulers of India" series (1893). For the personal character and administration of Hyder Ali *see* the *History of Hyder Naik,* written by Mir Hussein Ali Khan Kirmani (translated from the Persian by Colonel Miles, and published by the Oriental Translation Fund), and the curious work written by M. Le Maître de La Tour, commandant of his artillery (*Histoire d'Hayder-Ali Khan,* Paris, 1783). For the whole life and times *see* Wilks, *Historical Sketches of the South of India* (1810–17); Aitchison's *Treaties,* vol. v. (2nd ed., 1876); and Pearson, *Memoirs of Schwartz* (1834).

HYDNOCARPUS, a genus of the botanical family Flacourtiaceae. There are 25 species found in Indo-Malaya. From species of this genus is obtained hydnocarpus oil, which in recent years has proved of value in the treatment of leprosy.

HYDRA, an island of Greece (anc. *Hydrea*), lying about 4 m. off the south-east coast of Argolis and forming with the neighbouring island of Dokos (Dhoko) the Bay of Hydra. The greatest length from south-west to north-east is about 11 m., and the area is about 21 sq.m.; a rocky and treeless ridge with hardly a patch or two of arable soil. Hence the epigram of Antonios Kriezes to the queen of Greece: "The island produces prickly pears in abundance, splendid sea captains and excellent prime ministers." The highest point, Mount Ere, so called (according to Miaoules) from the Albanian word for wind, is 1,958 ft. high. The next is known as the Prophet Elias, from the large convent on its summit. Here the patriot Theodorus Kolokotrones was imprisoned, and a pine tree is still called after him. In former times the island was richly wooded as its Turkish name *Tchamliza,* the place of pines, shows. It was once well-watered (hence the designation Hydrea), but is now wholly dependent on the rain supply, and sometimes water must be brought from the mainland. This change may be due in part to earthquakes, which are frequent; that of 1769 continued for six days. Hydra, the chief town, pop. (1917) 5,700, near the middle of the northern coast, on a very irregular site, has white and handsome houses, and its streets though narrow are clean. There are three other ports on the north coast—Mandraki, Molo, Panagia, but none sufficiently sheltered. Almost all the population of the island is collected in the town, which has a bishop, a local court, numerous churches and a high school. Cotton and silk weaving, tanning and shipbuilding are carried on, and there is a fairly active trade.

Hydra was of no importance in ancient times. In 1580 it was the refuge of Albanians from Kokkinyas in Troezenia; and other emigrants followed in 1590, 1628, 1635, 1640, etc. At the close of the 17th century the Hydriotes took part in the reviving commerce of the Peloponnesus. About 1716 they began to build *sakturia* (of from 10 to 15 tons' burden), and to visit the islands of the Aegean; not long after they introduced the *latinadika* (40–50 tons), and sailed as far as Alexandria, Constantinople, Trieste and Venice; eventually to France and even America. From the grain trade of south Russia they derived great wealth. In 1813 there were about 22,000 people in the island, and of these 10,000 were seafarers. At the time of the outbreak of the war of Greek independence the total population was 28,190, of whom 16,460 were natives and the rest foreigners. One of their chief families, the Konduriotti, was worth £2,000,000. Into the national struggle the Hydriotes flung themselves with rare enthusiasm and devotion, and the final deliverance of Greece was mainly due to their fleets.

See Pouqueville, *Voy. de la Grèce,* vol. vi.; Antonios Miaoules, Ὑπόμνημα περὶ τῆς νήσου Ὕδρας (Munich, 1834); Id. Συνοπτικὴ ἱστορία τῶν ναυμαχιῶν διὰ τῶν πλοίων τῶν τρίων νήσων, Ὕδρας, Πέτσων καὶ Ψαρῶν (Nauplia, 1833); Id. Ἱστορία τῆς νήσου Ὕδρας (Athens, 1874); G. D. Kriezes, Ἱστορία τῆς νήσου Ὕδρας (Patras, 1860).

HYDRA, in Greek legend, the offspring of Typhon and Echidna, a gigantic monster with nine heads (the number is variously given), the centre one being immortal. Its haunt was the marshes of Lerna by Argos. The destruction of this hydra was one of the twelve "labours" of Heracles, which he accomplished with the assistance of Iolaus. Finding that as soon as one head was cut off two grew in its place, they burned out the roots with firebrands, and at last severed the immortal head from the body, and buried it under a rock. The arrows dipped by Heracles in the poisonous blood or gall inflicted fatal wounds.

See Preller-Robert II. 444.

HYDRACRYLIC ACID is a syrupy liquid, which on distillation is resolved into water and acrylic acid, $CH_2{:}CH{\cdot}CO_2H$. It is β-hydroxypropionic acid, $CH_2OH{\cdot}CH_2{\cdot}CO_2H$, and is prepared by acting with silver oxide and water on β-iodopropionic acid, or from ethylene by the addition of hypochlorous acid, the addition product being then treated with potassium cyanide and hydrolysed by an acid. Hydracrylic aldehyde, $CH_2OH{\cdot}CH_2{\cdot}CHO$, is obtained as a colourless oil by heating acrolein with water.

HYDRANGEA, a popular flower (family Saxifragaceae), the plant to which the name is most commonly applied being *Hydrangea Hortensia,* a low deciduous shrub, producing rather large oval strongly-veined leaves in opposite pairs along the stem. It is terminated by a massive globular corymbose head of flowers, which remain a long period in an ornamental condition. The normal colour of the flowers, the majority of which have neither stamens nor pistil, is pink; but by the influence of sundry agents in the soil, such as alum or iron, they become changed to blue; there are numerous varieties.

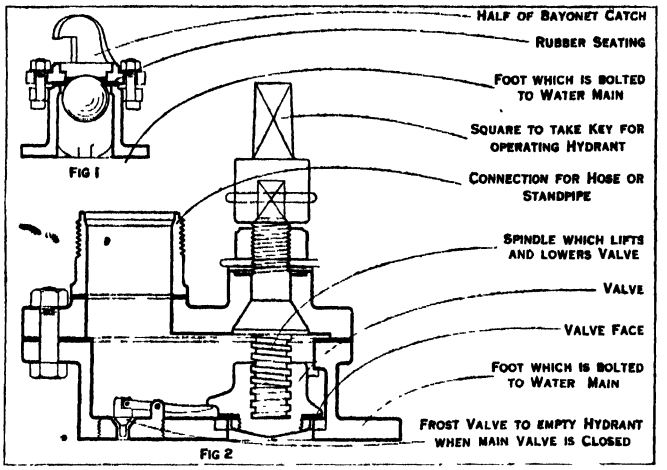
There are upwards of 25 species, found chiefly in Japan, in the mountains of India, and in North America, and many of them are familiar in gardens. *H. Hortensia* (a species long known in cultivation in China and Japan) is the most useful for decoration, as the head of flowers lasts long in a fresh state, and by the aid of forcing can be had for a considerable period for the ornamentation of the greenhouse and conservatory. Their natural flowering season is towards the end of the summer, but they may be had earlier by means of forcing. *H. japonica* is another fine conservatory plant, with foliage and habit much resembling the last named, but this has flat corymbs of flowers, the central ones small and perfect, and the outer ones only enlarged and neuter. This also produces pink or blue flowers under the influence of different soils.

HYDRANT, a form of valve by which water is drawn from a supply in a main either underground or in a building. The earliest hydrant was a simple wood plug driven into a socket at the top of a main.

There are three main types of valves, the ball, the spindle, and the sluice-valve. The first is of simple construction, and opens instantly when the spindle of the standpipe is screwed down to press the ball off the seat. The example shown has a bayonet joint for the connection of the standpipe, and the ball presses up against a rubber seating by the pressure in the main until the hydrant is in use. The spindle type has a leather-faced flat valve forced down on a seating by the screw at the lower end of the spindle. The spindle is kept water-tight, as the figure shows, by the coned collar and the nut and cross-pin. The purpose of the frost-valve, also shown in the drawing, is to clear the interior of the hydrant of water by the tipping of the little lever when the valve is shut down. Both of these hydrants are of ground type; many are connected to vertical pipes, as in theatres and other buildings, and the arrangement is very compact, to leave the least possible projection

from the pipe. The sluice-valve hydrant gives a full clear run through the pipe, the shut-off being by a wedge valve which crosses the bore.

Some hydrants have one pipe connection, or a standpipe permanently in place, in cases where its presence is not objectionable. Multiple outlets are arranged in many fire hydrants. The connection of the hose or standpipe is made by a screw coupling, a



BY COURTESY OF MERRYWEATHER & SONS

FIG 1.—BALL HYDRANT. FIG. 2.—SCREW-DOWN HYDRANT, SHOWING PARTS

bayonet catch, or an instantaneous coupling. (*See* STANDPIPE.) (F. H.)

HYDRASTINE, an alkaloid (*see* ALKALOIDS), found with berberine (*q.v.*) in the rootstocks of golden seal (*Hydrastis canadensis*), isolated by Perrins in 1862. It crystallizes, from alcohol, in colourless, rhombic prisms, which melt at 132° C, is soluble in chloroform or benzene, less so in alcohol, and almost insoluble in water. A solution of hydrastine, $C_{21}H_{21}O_6N$, in dry alcohol is laevorotatory, and in 50% alcohol dextro-rotatory. The salts are unstable in water and difficult to crystallize. A nitrohydrastine has been synthesized (Hope and Robinson, 1912), though not the alkaloid itself. The hydrolytic product, hydrastinine, is an important drug, being used as an internal styptic, and numerous processes have been devised for its synthesis.

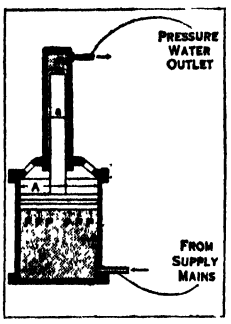
HYDRATE, in chemistry, a liquid or solid compound containing more or less combined water. Frequently the crystalline character of a solid hydrate depends on this water which is present as water of crystallization. Common examples of hydrates are supplied by the well known sodium compounds:—Glauber's salt (*q.v.*), which is decahydrated sodium sulphate, $Na_2SO_4,10H_2O$; washing soda, which is decahydrated sodium carbonate, $Na_2CO_3,10H_2O$; and borax, which is sodium pyroborate, $Na_2B_4O_7$, with five or ten molecules of water. Blue vitriol, $CuSO_4,5H_2O$, the pentahydrated copper sulphate, is another common example. The alums owe their characteristic crystalline form partly to the presence of combined water; for example, potash alum, $KAl(SO_4)_2,12H_2O$, crystallizes in well defined octahedra, which crumble into powder on removing the water. Acids and bases also form hydrates. $Ba(OH)_2,8H_2O$, hydrated barium hydroxide is a well crystallized substance. Sulphuric acid and hydrochloric acid combine with water to form hydrates, and since certain of these are stable only at comparatively low temperatures they are termed cryohydrates. A remarkably stable solid hydrate is chloral hydrate, $CCl_3{\cdot}CH(OH)_2$, produced by adding water to liquid chloral (*q.v.*). In this substance the added water has probably become hydroxide of constitution, so that this hydrate may be regarded as a connecting link between the loosely knit hydrates and the true hydroxides (*q.v.*).

(G. T. M.)

HYDRAULIC LIME: *see* CEMENT.

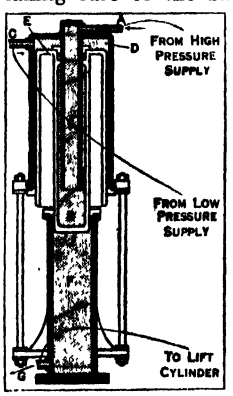
HYDRAULIC MACHINERY, the name given to certain types of machines which utilize water pressure for motive power. Under high pressure, water forms a very convenient medium for operating slow-moving machinery of the piston type in which large forces are involved and where easy and precise regulation is required. Where the main pressure supply is of less intensity than is required to work the hydraulic machinery an intensifier is used. In its simplest form this consists of a ram of area a, carrying a piston of larger area A (fig. 1). Water from the pressure mains, at pressure p, is admitted behind the piston and compresses the water in the ram cylinder to an increased pressure P. If w is the weight of the ram and piston and F is the frictional resistance of the packings: $P = p\frac{A}{a} - \frac{w+F}{a}$ lb.

Lifts and Hoists.—Probably in the aggregate more power is used by lifts and hoists than by any other class of hydraulic machinery, and for such work as this, hydraulic transmission is particularly suitable. Several types of lift are in use, these consisting of modifications of the simple direct-acting or of the suspended type. The former consists of a hydraulic cylinder sunk vertically in the ground, of length slightly greater than the maximum travel of the lift and fitted with a ram which carries the lift cage at its upper end. Pressure water is admitted below the ram and thus raises the cage. Since the weight of the ram and cage forms a large proportion of the whole load to be lifted, this must be balanced for efficient working, while since the volume of water displaced by the ram diminishes as the lift rises, the effective weight of the ram, which is its own weight less that of the displaced water, increases. Various devices have been adopted to overcome this difficulty. One common in high-class work consists of a balance cylinder, one type of which is shown in fig. 2. Here pressure water is admitted to the interior of the hollow ram B. The cylinder D is in communication with an auxiliary low pressure supply through the pipe C, and a downward pressure on the annulus at E is thus produced, which, together with the weight of this ram, produces a pressure in the cylinder F sufficiently great to balance any required proportion of the weight of the lift ram and cage. The total pressure transmitted to the water in the cylinder F is then the sum of the weight of the ram B and of the pressures on the annulus E and on the ram B, the former taking care of the balancing and the latter lifting the load. A suitable area of lift ram being assigned, the external diameter of B is calculated so as to give the required intensity of pressure in the cylinder F. The lift cylinder is supplied from F through the pipe G. On the downstroke of the lift, the ram B rises, the balance water is returned to its own supply tank and the only water rejected is that originally filling the high-pressure ram B. As the balance ram falls, the pressure on the annulus E increases, due to the increasing head to which it is subjected, and this to a certain extent counterbalances the difference in the effective weight of the lift ram.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 1.—HYDRAULIC INTENSIFIER



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 2.—BALANCE CYLINDER FOR HYDRAULIC LIFT

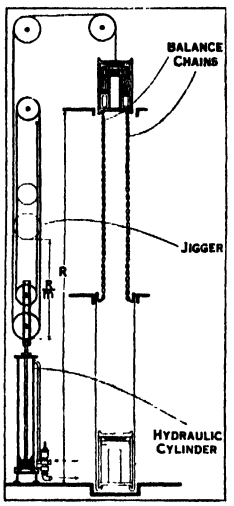
The suspension type of lift is operated from a hydraulic ram having a comparatively short stroke. The requisite travel in the wire rope by which the cage is suspended, is obtained by using a rope and pulley multiplying gear, termed a jigger. The weight of the cage may be balanced by hanging weights, the varying immersion of the ram in this case being unimportant. In the balanced lift shown in fig. 2 two wire ropes are employed for lifting and two for carrying weights which partly counterbalance the cage. As the cage of such a lift rises, a portion of the weight of the suspending rope is transferred to the plunger side of the supporting pulley, and the effective weight transferred to the plunger consequently varies throughout the whole of its stroke. Fig. 3 shows a method of

compensating for this variation. Here a double balance-chain is suspended from the cage as shown, so that if R be the travel of the cage, the length of each chain is $R \div 2$. Let m be the multiplying factor for the jigger; W the weight of the unbalanced portion of the cage; w the weight of the suspending cable per foot run; w' the weight of each balance chain per foot run.

Then with cage at bottom, the pull on plunger $= m\{W + wR\}$

Then with cage at top, the pull on plunger $= m\{W + w'R\} - wR$.

And for these to be equal, $w' = w(1 + \frac{1}{m})$. For very heavy lifting, such as is necessary in canal lifts, etc., where loads up to 1,000 tons may be carried on a single ram, the direct-acting lift is the only suitable type.



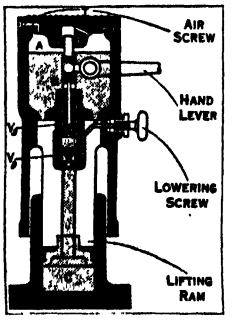
FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 3.—HYDRAULIC LIFT OF SUSPENSION TYPE WITH CHAIN COMPENSATION FOR VARIATION IN WEIGHT OF HOISTING ROPE

Hydraulic Cranes, Jacks, Etc.—Where high-pressure water is available it provides a most convenient means of operating power cranes, and in its safety, adaptability to suit varying conditions, and steadiness of operation, offers some advantages over its chief rival, electricity. Such cranes are usually operated by hydraulic jiggers, the various operations of lifting, racking and slewing often being performed by separate rams and cylinders, each regulated by its own separate valve. Where the load to be lifted may vary within wide limits, some device usually is adopted to economize water at light loads. In small cranes, for loads up to about two tons, a differential or telescopic ram may be used, the smaller working inside the larger, which itself works in the pressure cylinder. For light loads the larger is held stationary by locking gear, the smaller ram then doing the lifting. For heavy loads the two rams work together as one.

Jib luffing cranes are used for dockside work. The jib has an extended end to which are attached the counterbalance weights and tie rods. The lower ends of the tie rods are attached to a travelling crosshead actuated by the rams of the luffing cylinders and also carry a compensating pulley. The lifting rope or chain passes over this pulley, with the result that when the jib is luffed inwards the hoisting rope is paid out to compensate for the rise at the point of the jib. By adjusting suitably the stroke of the luffing ram and the inclination of the rods the level of the lifting hook may be maintained constant for all radial positions of the weight.

The hydraulic jack is used extensively for raising heavy weights for short distances. In principle it consists of a Bramah press on a small scale, and one type of its construction is illustrated in fig. 4. Here the reciprocation of a hand lever pumps water from the cistern A, through the hollow plunger B, past the suction and delivery valves V_s *and* V_D into the space C below the lifting ram and raises the latter. Screws are provided for supplying the cistern A with water and for allowing of the inlet of air, while a lowering screw permits of the escape of pressure water from the space below the lifting ram into the supply cistern when it is desired to lower the load. The lifting ram is usually packed by means of a cup leather, and the pump plunger by means of a single leather ring.

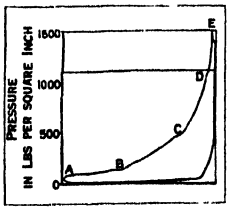


FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 4.—HYDRAULIC LIFTING JACK

Reference has already been made to the Bramah press. Its modifications, as applied to such work as cotton baling, boiler plate flanging and heavy forging are too numerous for detailed mention. In the production of heavy forgings from large steel ingots it is essential that every part of the ingot should be worked equally if the resultant forging is to be homogeneous in structure. Where a steam hammer is used the energy of the blow is largely absorbed in producing distortion of the outer layers, while the interior is practically unaffected. This disadvantage is overcome by the use of the hydraulic forging press with its slow and powerful compression, and this is gradually supplanting the steam hammer for the production of very heavy forgings.

The hydraulic riveter provides another good illustration of the adaptability of the hydraulic machine to workshop processes. Here the problem is to get a fairly large pressure of the rivet during the first portion of the ram stroke, so as to form the rivet head and to clinch the plates, and a final larger pressure of the nature of an impact to cause the rivet to expand and fill its hole fully. The extent to which this is attained in the riveter will be evident from fig. 5, which represents a typical pressure diagram taken from the cylinder of such a machine, supplied from an accumulator under a pressure of 1,100lb. per sq.in. Here AB represents the idle part of the stroke during which the ram is being brought up to its work, BC the setting up of the rivet and the formation of the head, CD the clinching of the rivet and the closing of the plates, while the sudden stoppage of the heavy accumulator ram is responsible for a further rise in pressure DE above the accumulator pressure, which is depended upon to fill up the rivet hole. In fig. 6 a section of the cylinder and valves of a riveter of the hinged type is shown. Here the hydraulic ram acts on one end of an arm pivoted near the centre at A, and carrying the riveting head at the other end. Water is admitted to or discharged from the ram cylinder by the arrangement of valves shown. Thus a quarter-turn of the regulating lever raises the valve V_s and puts the cylinder into communication with the pressure supply. On the completion of the working stroke a half-turn in the opposite direction closes the valve V_s and opens valve V_D, putting the cylinder into communication with the discharge passages. The main ram is drawn back on its idle stroke by means of a special drawback ram which is always exposed to supply pressure. The method of packing the rams and the general construction are indicated in the figure.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 5.—DIAGRAM SHOWING PRESSURES IN CYLINDER OF HYDRAULIC RIVETER ON WORKING STROKE

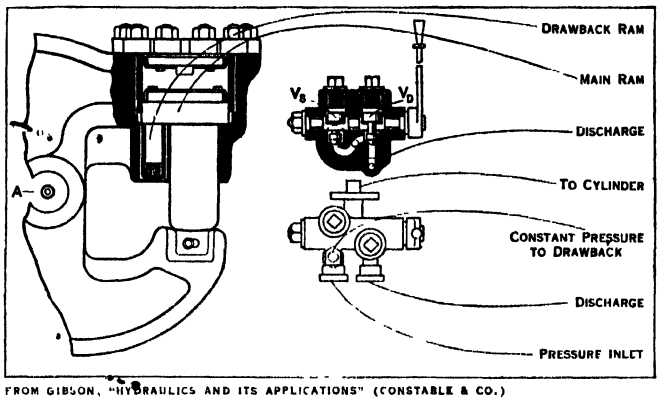
Hydraulic Lock-gate Machinery.—In many modern docks the lock gates or caissons are operated by hydraulic machinery. In the Royal Edward Dock at Avonmouth, for example, each leaf of the entrance lock gates is operated by a direct-acting hydraulic cylinder with piston and rod, the stroke being 12ft. 9in. The sluice gates, 54in. diam., in connection with these caissons are also operated by direct-acting hydraulic rams working under a pressure of 750lb. per sq.in.

The Johnson Valve.—A type of valve which is being used to an increasing degree in large hydro-electric power installations is illustrated in fig. 7. A hollow central cylinder mounted in the centre of an enlargement in the pipe line and attached to the wall by radial ribs, carries a hollow differential plunger capable of axial movement in the cylinder. The projecting portion of this plunger forms the valve. The two chambers A and B can be put into communication either with the high pressure supply or with the atmosphere through small pipes with appropriate regulating valves. To close the main valve, pressure water is admitted to the chamber A, and B is allowed to discharge freely. The valve is then forced over to the right until it comes into contact with its seat. To open the valve the operation is reversed. When open, the water flows through the annular space between the valve and the pipe wall. This gives a waterway with no sudden changes of section or direction. Valves of this type are in use up to 18ft. in diameter.

Hydraulic Engine; Hydraulic Capstans.—Where a supply of high pressure water is available and where rotary motion at a moderate speed is desired, the reciprocating piston engine has certain advantages for small powers, particularly where it is able to work at or near full load and where the speed variation may be excessive, as occurs, for example, in the working of a capstan.

As usually fitted to a capstan three single acting cylinders fitted with trunk pistons are fixed radially to an external casing, the three connecting rods working on a single crank pin. Each cylinder is fitted with a single inlet and outlet port, the opening of this to supply and exhaust being regulated by a rotary valve. This rotates along with the crank shaft and carries passages connecting with the pressure supply and the exhaust which are presented in turn before the port of each cylinder. The water-supply is regulated by means of a treadle which operates the admission valve.

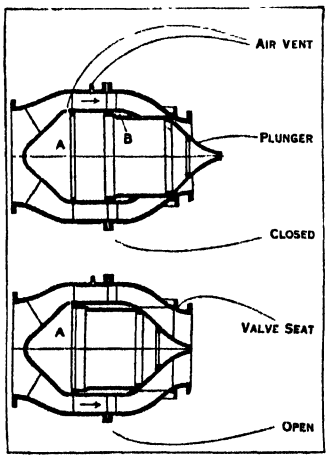
Hydraulic Transmission Gear.—Several schemes for transmitting the torque developed at the crankshaft of a motor-car



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG 6.—DIAGRAMMATIC SKETCH SHOWING CYLINDER AND VALVES OF HYDRAULIC RIVETER OF THE HINGED TYPE

engine to the driving wheels by hydraulic means are now on the market. By the use of such a device shocks due to changing gear are avoided, while the ratio of the speeds of the driving and driven shafts may be regulated with a much greater degree of flexibility than is possible with a mechanical drive. All these devices are broadly the same in principle. The engine drives a series of pumps mounted radially around the central shaft, and these deliver the operating fluid, usually oil, under pressure to a series of fixed radial cylinders whose pistons are connected to the transmission shaft. The radius of the crank on to which these pistons drive can be varied, and since, at a given engine speed, the volume of fluid delivered by the pumps is constant, the ratio of the number of revolutions of the engine shaft and of the transmission shaft is in direct proportion to the capacity of the pumps and of the driving cylinders with the crank radius in use at the moment. A number of gears of this type is described in the *Proceedings* (1921) of the Inst. Mechanical Engineers (p. 843).

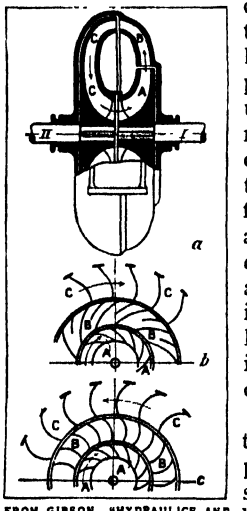


FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 7.—THE JOHNSON VALVE FOR LARGE PIPE LINE

The Föttinger hydraulic transmitter is a combination of centrifugal pump and turbine forming a reduction gear through which the torque from a high-speed steam turbine can be transmitted to a slow-speed steamship propeller. The principle of the device is illustrated in fig. 8 *a*, *b* and *c*. The hydraulic impeller *A* mounted on the driving or primary shaft delivers water into the guide ring *B*, where it is deflected into the turbine wheel *C* mounted on the driven shaft. The water leaving *C* again enters the impeller *A*, either directly or after passing through a small guide wheel, so that it circulates again and again through the system. Fig. 8 *b* and *c* show diagrammatically the blading as arranged respectively for driving in the same and opposite direction to the primary shaft. In practice a continual circulation of cold water is maintained through the transmitter by an auxiliary centrifugal pump. The efficiency is about 90 per cent.

Hydraulic Recoil Brake and Buffer Stop.—The necessity for some braking apparatus by which the kinetic energy of a heavy body, such as a moving train, or of a gun during recoil, might quickly and safely be absorbed without the tendency to rebound accompanying the use of spring buffers led to the invention of the hydraulic brake. In its simplest form this consists of a cylinder fitted with piston and rod and filled with some liquid, usually oil, water or glycerine. The two ends of the cylinder are connected, either by one or more small passages formed by holes in the body of the piston itself or by a by-pass pipe fitted with a spring-loaded valve or with a throttling valve by which the area may be adjusted. In its simplest form the brake is used extensively as a dashpot for damping the vibrations of governing mechanisms, etc. When used as a buffer stop, the body whose kinetic energy is to be absorbed forces in the piston rod and produces a flow of liquid from one side of the piston to the other at high velocity through the connecting orifices. The energy of the body is thus partly transformed into kinetic energy of the liquid, which is dissipated in eddy formation and partly expended in overcoming the frictional resistances of the connecting passages, together with the mechanical friction of the brake. The whole of the energy is thus transformed ultimately into heat. Since the energy absorbed by the brake is equal to the mean resistance of the brake multiplied by the length of its stroke, it is evident that the pressure in the brake cylinder will have its least maximum value when this pressure, and therefore the resistance, is uniform throughout the stroke and when in consequence the pressure-displacement diagram forms a rectangle. The brake is therefore preferably designed so as to give as nearly as possible uniform resistance; and since the resistance varies as the square of the velocity of the liquid through the connecting orifices, while the velocity of the moving body and therefore of the piston, varies from a maximum at the instant of impact to zero at the end of the stroke, it is necessary either to make the connecting passages of diminishing area towards the end of the stroke, so that the velocity of efflux may remain constant, or to discharge from one side of the piston to the other through a spring-loaded valve set to open at the required pressure. The former method is commonly used. The area of the connecting passage may be varied by forming it as a circular orifice through the piston and allowing this to work over a taper circular spindle fixed longitudinally in the cylinder, the available passage area varying with the diameter of the spindle. In an alternative arrangement, two rectangular slots are cut in the piston body and work over two longitudinal strips which are fixed to the interior cylinder walls and vary in radial depth from end to end.



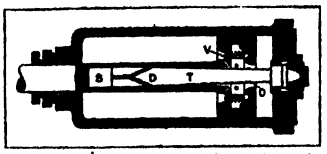
FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 8.—DIAGRAMMATIC ARRANGEMENT OF FÖTTINGER TRANSMITTER
A. Hydraulic Impeller
B. Ring of guide vanes
C. Turbine wheel

A similar device is used for absorbing the energy of recoil of large guns. The principle of one such recoil cylinder is shown in fig. 9. The liquid, escaping from left to right through the valve *V*, as the plunger is forced from right to left by the recoiling gun barrel, passes through the annular passage *O*, whose area depends on the position of the piston relative to the central taper spindle *T*. The piston is returned by springs, whose action is buffered near the end of the stroke by the resistance to the flow of liquid from the space *S* through the holes at *D*. As a liquid for use in recoil cylinders, castor oil or rangoon oil is good and keeps the leathers in condition. A mixture of four parts of glycerine to one of water is also good, as is a mixture of methylated spirits 66%, water 31%, mineral oil 3%, with 25 grains of carbonate of soda per gallon.

Hydraulic Dynamometer.—This, a device for measuring and absorbing the energy developed by a prime mover at a rotating shaft, was invented by William Froude and modified by Professor

Osborne Reynolds. It consists of a rotating disk mounted on the power shaft and carrying on its outer faces a series of narrow pockets. These are semicircular in section, their plane is inclined at 45° to the axis of the shaft and they face forwards in the direction of motion. An outer casing mounted on ball-bearings surrounds the rotator. This casing carries a double set of pockets similar to those on the disk, in the same planes but facing in the opposite direction. Water is admitted to the casing and entering the pockets in the disk is thrown outwards and forwards by centrifugal force into the pockets in the casing. These guide it backwards and return it into the pockets in the disk and so on. In this way a series of vortices is formed and the resistance to the change of momentum which takes place at each reversal of direction of the streams of water produces a braking effect on the disk and a tendency to rotation of the outer casing of the same amount. This is counteracted and measured by means of weights suspended from a horizontal lever attached to the casing. The resistance of the dynamometer can be regulated by varying the amount of water in the casing. In one modern form of the Froude dynamometer the casing is always full of water and the resistance is regulated by a sliding sluice plate fitted between the fixed and rotating pockets which cuts more or less of their periphery out of action. (For bibliography *see* HYDRAULICS.) (A. H. G.)



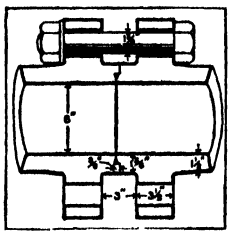
FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 9.—HYDRAULIC RECOIL CYLINDER

HYDRAULIC MOTORS. Now that the old overshot or undershot water-wheel is obsolete, there remain only two main types of hydraulic motor, namely, turbines (*see* TURBINE: *Water*) and reciprocating engines of the piston type (*see* HYDRAULIC MACHINERY).

HYDRAULIC POWER TRANSMISSION. In many instances the use of water under considerable pressure as a medium for the transmission of energy offers advantages over other methods of power transmission, and this is particularly the case where the power is required to operate machinery in which the action is either (*a*) comparatively slow, but in which a considerable force is required, and particularly where the motion requires to be regulated with great precision; or (*b*) very intermittent, a large force being required at intervals and for a comparatively short time. It is thus well adapted for the operation of presses, flanging and riveting machinery, lifts, hoists, cranes, capstans and testing machines.

In many large towns, of which London, Manchester and Glasgow are examples, customers are supplied from a central pumping station through a system of hydraulic mains. The pressure adopted varies from 700 to 1,600 lb. per square inch, being 750 lb. per square inch in the City of London, and 1,120 lb. per square inch at Manchester and Glasgow. In the older installations the pressure water was obtained from reciprocating pumps driven by steam engines, but in the most recent extensions, multi-stage high lift centrifugal pumps are used. The pumps feed accumulators, which in turn feed the supply mains. These are usually of cast iron. Flanged spigot and faucet joints are used with $\frac{3}{8}$ inch gutta-percha packing rings as shown in fig. 1, which illustrates a joint as used for a 6 inch pipe. Owing to the very high pressures used, even a small leakage is serious, and to guard against such a leakage from the mains or valves, a daily record of the minimum flow during the time the demand is at its lowest (between 11 P.M. and 4 A.M.) is kept by means of an automatic electrical recorder. Should this show an abnormal increase in the output for several consecutive nights, a detailed examination of the mains is made.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 1.—SECTION OF JOINT FOR HIGH PRESSURE (1,120 LB. PER SQ. IN.) PIPE LINE

In the London installation the water is taken from the river or from wells, and as it is essential that all deposit should be removed before use, it is allowed to stand for some time in storage tanks. The greater part of the solid matter thus becomes deposited. The water on its way to the pumps is then passed through the surface condensers of the engines to a series of filters, in which it is passed first through a layer of broken sponge, and afterwards through a bed of charcoal.

Transmission Losses.—The transmission losses are due to fluid friction in the pipe line. With water at a given pressure, the energy transmitted varies directly as the volume flowing per second, so that since the loss due to friction increases as the square of the velocity, the proportional effect of this diminishes as the working pressure increases, and for high efficiency of transmission the working pressure must be high.

It may readily be shown that the friction loss is equal to

$$\frac{0{\cdot}635\ flH^3}{p^3d^5}\ \text{horsepower}$$

where H is the horsepower entering the pipe; l is the length and d the diameter of the pipe in feet; p is the pressure at the pipe inlet in lb. per sq. in ; and f is a coefficient of friction whose value, for a new cast iron pipe, is approximately ·006. It follows that the efficiency of transmission equals

$$1 - \frac{0{\cdot}635\ flH^2}{p^3d^5}$$

and that this efficiency increases as p and d are increased An increase in p however involves an increase in the thickness of the pipe walls and in the difficulty of preventing leakage at the joints, so that in practice it has not been found advisable to use pressures much greater than 1,500 lb. per square inch.

The point at which it ceases to pay to increase the diameter of the pipe line for a given horsepower, depends on the relative cost of the pipe line, including excavation, jointing and laying, and of the power production per horsepower. In general a size of pipe which allows of a pressure drop of about 10 lb. per square inch per mile is found to give most economical results in practice. With this drop and with a pumping pressure of 1,120 lb. per sq.in. the following are the efficiencies of transmission:

Length in miles .	1	2	5	10	20
Efficiency . .	·991	·982	·955	·911	·821

It will be seen that for distances not exceeding 10 miles the efficiency is high. In modern practice the largest pipes are about 6 inches diameter, the pipe lines being duplicated for large powers. Such a pipe will transmit about 140 h.p. with a drop of pressure of 10 lb. per sq.in. per mile. The velocity of flow usually ranges from 2·5 to 4·0 ft. per second.

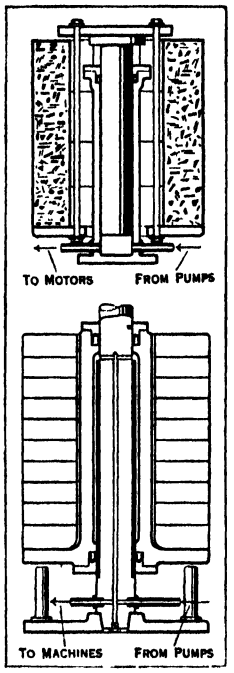
It may be shown that the maximum amount of power is transmitted through a given pipe line when the velocity of flow is such as to make the outlet pressure equal to two-thirds of the pressure at inlet, in which case the efficiency of transmission is only 66·6%. Under these conditions a 6 inch pipe line 1 mile long, having a supply pressure of 1,120 lb. per sq.in., would deliver energy at the rate of 570 h.p., the velocity of flow being 14·8 ft. per sec.

Accumulators.—Since the delivery from a reciprocating pump is not uniform and since it is necessary to have some reserve of energy to meet a sudden or abnormal demand, some means of storing pressure energy is a necessary adjunct to the hydraulic power station. With the high pressures in common use an elevated gravity storage tank is impracticable and the accumulator, devised by Sir W. G. Armstrong, takes its place. This is fitted between the pumps and the pressure main. The accumulator consists of a vertical cylinder fitted with a weighted ram, whose weight is adjusted so as to give the required pressure in the mains. In its most common form the ram (fig. 2) carries a platform which is loaded with some heavy material, usually pig iron or iron slag. If the output from the pumps exceeds the demand, the ram rises, and on reaching the upper limit of its travel moves a stop which, by suitable link connections, causes steam to be shut off from the pumping engine.

The energy-storage capacity is equal to the potential energy of the lifted ram and weight, and, if L is the length of its travel in feet, and W its weight in lb., is given by LW foot lb., or by pAL foot lb., where p is the working pressure in lb. per square inch and A is the cross sectional area of the ram in square inches. Thus if the diameter of the ram is 18 in. and if p=1,120 lb. per sq.in. and L=20 ft., the storage capacity is 5,700,000 ft.lb. or 2·9 h.p. hours. Such an accumulator could not give out energy in excess of the rate at which energy is being supplied to it by the pumps, at a greater rate than 2·9 h.p. for 1 hour; 17·4 h.p. for 10 minutes; or 174 h.p. for 1 minute.

From this example it is evident that the storage capacity of such an accumulator is not large and that its main function is not so much to store energy in the sense that an electric accumulator stores it, as to permit of momentary fluctuations in the rates of supply and demand, or in other words to act as a flywheel does in the case of a steam or gas engine. It also serves to regulate the delivery pressure. Its efficiency is high, up to 98 per cent of the energy expended in charging being returned during delivery.

Where the hydraulic power is to be used for operating such machines as riveters or presses, a small accumulator is often installed at the consumer's end of the pipe line. A modification of the simple type, known as the differential accumulator is shown in fig. 3. This consists of a fixed ram of area A, surrounded over the lower portion of its length by a closely fitting bush of area a. This bush terminates below the inlet and outlet holes. The ram passes through both ends of the storage cylinder, through glands of area (A+a) and A, so that the effective cylinder area exposed to upward pressure is a.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIGS. 2 AND 3.—ACCUMULATOR FOR HYDRAULIC PUMPING STATION (ABOVE); TWEDDELL'S DIFFERENTIAL ACCUMULATOR (BELOW)

Thus pa=W, and by making the bush of small thickness, a very large pressure may be maintained by a comparatively small weight.

Wave Transmission of Energy in a Pipe Line.—In the system of power transmission so far considered the energy is conveyed by a flow of high pressure water through the pipe from the pumps to the motor, and when this water has been passed through the motor it is discharged to waste. In the system of wave transmission of energy the fluid, which may be water or oil, is contained in a closed system consisting of the pump, the pipe line and the motor cylinder. If one end of a closed pipe line full of water be coupled to a reciprocating pump, the to and fro motion of the plunger will cause waves of alternate compression and rarefaction to be propagated through the fluid. The inward motion of the plunger is resisted by the inertia of the fluid, and those layers in contact with the plunger are compressed and absorb resilient energy. This state of pressure and of energy is propagated along the pipe as a pressure wave, with a velocity equal to that of sound in the fluid which, in the case of water, is about 4,700 ft. per sec. If at the remote end of the pipe a reciprocating motor of similar dimensions be fitted, this will be actuated by the changes of pressure, and if its motion is allowed to synchronise with that of the pump, will absorb the energy given to the fluid column by the latter, with the exception of that proportion wasted in friction in the pipe. Since the action is essentially due to elastic deformations of the fluid the volume displaced by the plunger per stroke can only be relatively small, and to enable even moderate powers to be transmitted the speed of the motor must be large. In practice it generally ranges from about 1,500 to 3,000 rev. per minute. The energy transmitted is proportional to the maximum pressure in the pipe line, and consequently high working pressures are adopted, usually between 1,000 and 1,500 lb. per sq. inch. In practice a three-phase system is usually employed as giving more uniform torque and ease of starting. A three-cylinder generator having cranks at 120° gives vibrations to the fluid in three pipes which supply the cylinders of a three-cylinder motor having the same crank angles. The mean pressure within the system is maintained by a pump which returns any fluid leaking past the plungers.

The system, which was devised by G. Constantinesco, has been applied to the operation of rock drills, etc. It has the merit of safety and flexibility, but has not yet been adopted sufficiently extensively for an opinion to be expressed as to its possibilities. Little information is available as to its efficiency under normal operating conditions.

BIBLIOGRAPHY.—Blaine, *Hydraulic Machinery* (1927); Marks, *Hydraulic Power Engineering* (1905); G. Constantinesco, *The Theory of Wave Transmission* (1922); A. H. Gibson, *Hydraulics & its Applications* (1923); F. C. Lea, *Hydraulics* (1922); and *Mechanical Properties of Fluids* (1924). (A. H. G.)

HYDRAULICS, that branch of engineering science which deals with the practical application of the laws of hydrodynamics.

The chief physical properties of a fluid which affect its motion are its density, viscosity and compressibility. For all practical purposes the density of fresh water may be taken as 62·4 lb. per cu.ft. The viscosity varies appreciably with temperature. The coefficient of viscosity μ is given by $\mu=\frac{f_s y}{v}$ where f_s is the resistance per unit area offered to the motion of a flat plate immersed in the fluid at a very small distance y from a parallel surface, and moving in the direction of its own length with velocity v.

Water is so slightly compressible that for all calculations involving steady motion it may be taken as incompressible. The compressibility becomes an important factor however where sudden changes of motion take place in a confined column, as when the valve at the end of a pipe line is suddenly opened or closed. The value of the modulus of compressibility K may be taken as approximately 310,000 lb. per sq in.

Transmissibility of Pressure in an Enclosed Mass of Fluid.—If a closed vessel provided with a piston be filled with water, and if such a force be applied to this piston as will produce a pressure intensity of p lb. per sq.in. on its face, the pressure intensity at every point of the surface of the vessel will be increased by the same amount.

This property is taken advantage of in many hydraulic machines, notably in Bramah's hydraulic press, and in machines of a like type. In the hydraulic press water is forced by means of a small pump, whose plunger has an area a, into the cylinder of the press whose area is A. Neglecting friction, a force P, applied to the plunger of the force pump, will then produce a pressure intensity of $P \div a$ in the pump and press cylinder, and hence a force $Q=PA \div a$ on the press plunger.

MOTION OF FLUIDS

The motion of a fluid may be of two kinds, viz., stream line and turbulent. In stream line motion the filaments move in definite paths and the resistance to flow is due purely to the shear of adjacent layers and is directly proportional to the viscosity and to the velocity. In turbulent motion the water moves in an eddying mass and the motion at a given point varies in an irregular manner from instant to instant. The resistance is only to a slight degree dependent on the viscosity and is proportional to the nth power of the velocity where n is approximately equal to 2.

At very low velocities, the motion is usually streamline, but as the velocity is increased the motion breaks down and becomes turbulent. For any particular case there is some particular velocity at which the change over from one type of motion to the other takes place, and this is known as the "critical velocity."

Several conditions combine to determine whether the motion of a fluid shall be streamline or turbulent. Osborne Reynolds, who first investigated the two manners of motion, came to the conclusion that the conditions tending to the maintenance of

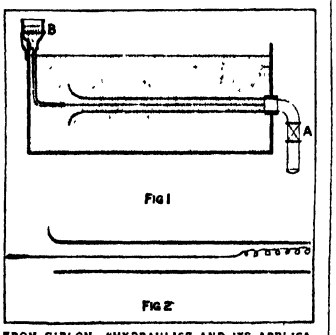
streamline motion are: (1) an increase in the viscosity of the fluid; (2) converging solid boundaries; (3) free (exposed to air) surfaces; (4) curvature of the path with the greatest velocity at the outside of the curve; (5) a reduced density of the fluid. The reverse of these conditions tends to produce turbulence.

The effect of solid boundaries in causing turbulence appears to be due rather to their tangential than to their lateral stiffness. One remarkable instance of this is shown by the effect of a film of oil on the surface of water exposed to the wind. The oil film exerts a very small but appreciable tangential constraint, with the result that the motion of the water below the film tends to become unstable. This results in the formation of eddies below the surface, and the energy, which is otherwise imparted by the action of the wind to form and maintain stable wave motion, is now absorbed in the institution of eddy motion, with the well-known effect as to the stilling of the waves.

Where two streams of fluid are moving with different velocities the common surface of separation is in a very unstable condition. Generally speaking, wherever the velocity of flow is increasing and the pressure diminishing, as where lines of flow are converging, there is an overwhelming tendency to stability of flow. In a tube with converging boundaries this effect is sufficiently great to overcome the tendency to turbulent motion to which all solid boundaries, of whatever form, give rise, and the motion in such tubes is stable for very high velocities. On the other hand, the tendency to eddy formation is very great wherever the lines of flow are diverging and the velocity is diminishing in the direction of flow.

Critical Velocity.—The nature of the two modes of fluid motion was first demonstrated by Osborne Reynolds (Phil. Trans. Roy. Soc., 1883) in a series of experiments on parallel glass tubes of various diameters. These were fitted with bell-mouthed entrances and were immersed horizontally in a tank of water having glass sides (fig. 1). The water in the tank having become quite still the outlet valve A was opened, allowing water to flow slowly through the tube. A little aniline dye solution was introduced at the entrance to the tube through a fine tube supplied from the vessel B.

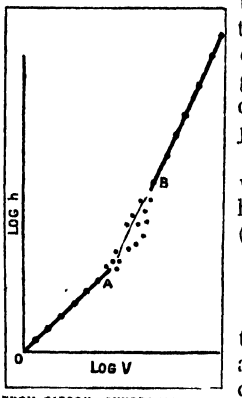
At low velocities this fluid is drawn out into a single colour band extending through the length of the tube. This appears to be motionless unless a slight movement of oscillation is given to the water in the supply tank when the colour band sways from side to side, but without losing its definition. As the velocity of flow is gradually increased, by opening the outlet valve, the colour band becomes more attenuated, still retaining its definition, until at a certain velocity eddies begin to be formed, at first intermittently, near the outlet end of the tube (fig. 2). As the velocity is still further increased the point of eddy initiation approaches the mouthpiece, and finally the motion becomes sinuous throughout. The apparent lesser tendency to eddy formation near the inlet end of the tube is due to the stabilizing influence of the convergent mouthpiece. The velocity at which eddy formation is first noted in such experiments is termed the "higher critical velocity." There is also a "lower critical velocity," at which the eddies in originally turbulent flow die out, and this is, strictly speaking, the true critical velocity. It has a much more definite value than the higher critical velocity, which is extremely sensitive to any disturbance, either of the fluid before entering the tube, or at the entrance. Over the range of velocities between the two critical values, the fluid, if moving with streamline flow, is in an essentially unstable state, and the slightest disturbance may cause it to break down into turbulent motion.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIGS. 1 AND 2.—REYNOLDS' CRITICAL VELOCITY COLOUR BAND EXPERIMENTS

The determination of the lower critical velocity is not possible by the colour band method, and Reynolds took advantage of the fact that the law of resistance changes at the critical velocity, to determine the values by measuring the loss of head accompanying different velocities of flow in pipes of different diameters. On plotting a curve showing velocities and losses of head, it is found that up to a certain velocity the points lie on a straight line passing through the origin of co-ordinates. Following this there is a range of velocities over which the plotted points are very irregular, indicating general instability, while for still greater velocities the points lie on a smooth curve, indicating that the loss of head is possibly proportional to v^n.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 3.—GRAPH OF LOG HEAD AND LOG VELOCITY IN FLOW THROUGH A PIPE LINE AT VELOCITIES ABOVE AND BELOW THE CRITICAL

To test this, and if so to determine the value of n, the logarithms of the loss of head h and of the velocity were plotted (fig. 3). Then if

$$h = kv^n,$$
$$\log h = \log k + n \log v,$$

the equation to a straight line inclined at an angle of $\tan^{-1} n$ to the axis of $\log v$, and cutting off an intercept $\log k$ on the axis of $\log h$. On doing this it is found that with motion initially unsteady the plotted points lie on a straight line up to a certain point A, the value of n for this portion of the range being unity. At A, which marks the lower critical velocity, the law suddenly changes and h increases rapidly. There is, however, no definite relationship between h and v until the point B is reached. Above this point the relationship again becomes definite, and within the limits of experimental error, over a fairly large range of velocities, the plotted points lie on a straight line whose inclination varies with the roughness of the pipe walls. The values of n determined in this way by Reynolds are:

Material of pipe	n
Lead	1·79
Varnished	1·82
Glass	1·79
New cast iron	1·88
Old cast iron	2·0

those for cast iron being deduced from experiments by Darcy.

Between A and B the value of n is greater than between B and C, and the increased resistance accompanying a given change in velocity is greater even than when the motion is entirely turbulent. This is due to the fact that within this range of velocities eddies are being initiated in the tube, and the loss of head is due not only to the maintenance of a more or less uniform eddy regime, but also to the energy absorbed in the initiation of eddy motion.

As a result of his experiments, Reynolds concluded that the critical velocity v_k is inversely proportional to the diameter d of the pipe, and is given by the formula

$$v_k = \frac{1}{b} \cdot \frac{P}{d}$$

where b is a numerical constant, and where P is proportional to the viscosity divided by the density, or μ/ρ. If the unit of length is the foot, b equals 25·8 for the lower critical velocity, and 4·06 for the higher critical velocity; while if t = temperature in degrees Centigrade,

$$P = \frac{1}{1 + \cdot 03368t + \cdot 000221t^2}$$

More recent experiments show that by taking the greatest care to eliminate all disturbance at entry to the tube, values of the higher critical velocity considerably greater than (up to 3·66 times as great as) those given by the above formula may be obtained. The probability is, in fact, that there is no definite higher critical

velocity, but that this always increases with decreasing disturbances.

A general expression for the lower critical velocity in a parallel pipe, applicable to any fluid and any system of units, is

$$v_k = \frac{2000\mu}{dP}$$

Thus for water at 0°C, $\mu/\rho = 1.92 \times 10^{-5}$ in foot-pound second units, so that

$$v_k = \frac{\cdot 0384}{d} \text{ ft./sec., where } d \text{ is in feet.}$$

Bernoulli's Theorem.—Water in motion possesses energy in virtue of its velocity, its pressure and its elevation. Thus water in motion with velocity v f.s. has kinetic energy $v^2 \div 2g$ ft.lb. per pound. Its pressure energy is $p \div w$ ft.lb. per pound where p is its pressure in pounds per square foot, and w its weight per cubic foot, and its potential energy is z ft lb. per pound where z is its height in feet above datum level Each of these expressions is equivalent to a height or head in feet. Thus $v^2 \div 2g$ is the height through which a body falling freely would attain a velocity v, while $p \div w$ is height of a column of water which would produce the pressure p at its base. $p \div w$ is therefore called the pressure head.

The total energy per lb. is equal to

$$\frac{p}{w} + \frac{v^2}{2g} + z \text{ ft.lb.}$$

If water flows from a point (1) to a point (2), and if there is no loss of energy between these points, the relationship

$$\frac{p_1}{w} + \frac{v_1^2}{2g} + z_1 = \frac{p_2}{w} + \frac{v_2^2}{2g} + z_2 = \text{constant}$$

holds. This is known as Bernoulli's theorem. If, due to wall friction or eddy formation, there is a loss of energy of h_f feet between (1) and (2) the equation becomes

$$\frac{p_1}{w} + \frac{v_1^2}{2g} + z_1 = \frac{p_2}{w} + \frac{v_2^2}{2g} + z_2 + h_f.$$

In hydraulic problems, pressures are always measured from atmospheric pressure as datum For example the water in a parallel jet discharging under atmospheric pressure is taken as having no pressure energy

Flow in a Pipe with Converging Boundaries.—Let A and a be the areas at the entrance to and at the throat of the pipe, and let its axis be horizontal. Then neglecting losses between A and a:—

$$\frac{p_A}{w} + \frac{v_A^2}{2g} = \frac{p_a}{w} + \frac{v_a^2}{2g}$$

Also $$v_a a = v_A A.$$

$$\therefore \quad \frac{p_A - p_a}{w} = \frac{v_A^2}{2g}\left\{\left(\frac{A}{a}\right)^2 - 1\right\}$$

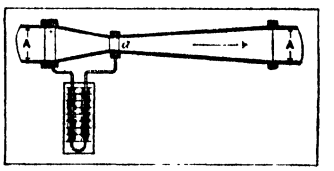
or
$$Q = v_A A = A \sqrt{\left[\frac{2gh}{\left(\frac{A}{a}\right)^2 - 1}\right]} \text{ c.f.s.} \qquad (1)$$

where h is the difference of pressure at A and a measured in feet of water.

The *Venturi meter* (fig. 4) consists essentially of such a converging pipe, which is extended beyond the throat to its original diameter. The meter is usually constructed with an upstream cone having an angle of convergence of about 20°, connected to a downstream cone whose angle of divergence is about 5° 30′, by easy curves. One annular chamber surrounds the entrance to the meter, and a second surrounds the throat, the mean pressures in the pipe at these sections being transmitted to the chambers through a series of small holes in the wall of the pipe. The chambers are connected to the two limbs of a differential pressure gauge which records their difference of pressure h in feet of water. For this purpose a **U**-tube containing mercury may be used as in fig. 4. In this case if the connecting pipes are full of water it may readily be shown that the difference of pressure in feet of water is equal to 12·59 times the difference of level of the tops of the mercury columns. By using an inverted **U**-tube, with compressed air supplied to the highest portion of the tube, the difference of pressure may be directly recorded in feet of water. Actually, owing to frictional losses the discharge is slightly less than is indicated by formula (1), and is given by

$$Q = C.A \sqrt{\left[\frac{2gh}{\left(\frac{A}{a}\right)^2 - 1}\right]} \text{ c.f.s.}$$

where C varies from about ·96 to ·99, increasing slightly with the size of meter. The ratio $A:a$ is usually between 4:1 and 9:1, depending on the range of discharges to be measured.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 4.—VENTURI METER

Change of Pressure Along a Radius in Curvilinear Motion.—If water be moving in a curved path the pressure along the radius of curvature varies. This change in pressure may be determined by considering the equilibrium of an elementary column of fluid of sectional area δa, having its axis radial, and its two ends in regions where the pressures are p and $(p + \delta p)$ respectively. The centrifugal force on the column is balanced by the difference of pressure on the two ends and we have, for equilibrium,

$$w \cdot \delta a \cdot \delta r \cdot \frac{v^2}{gr} = \frac{\delta p}{\delta r} \cdot \delta r \cdot \delta a$$

$$\frac{w v^2}{gr} = \frac{\delta p}{dr}$$

Vortex Motion—Pressure in a Rotating Liquid.—If a mass of liquid has a rotary motion about some axis, it is termed a Vortex. Such a vortex may be either of two types—forced or free.

An example of the first is seen when a vessel containing water is rotated for a sufficient time for the water to adopt the motion of the vessel. The second is seen when water flows freely through a hole in the bottom of a vessel. Here, the water moves spirally towards the centre with streamline motion, so that, neglecting viscosity, its energy per unit mass is everywhere the same. This is termed a "free spiral vortex."

Forced Vortex Motion with Uniform Angular Velocity.—Since the angular velocity ω is constant, we have at any radius r, $v = \omega r$. The increase in pressure radially is given by

$$\frac{dp}{dr} = \frac{w}{g} \frac{\omega^2 r^2}{r} = \frac{w}{g} \omega^2 r.$$

Integrating between the limits r_1 and r_2 we have

$$\frac{p_1 - p_2}{w} = \frac{\omega^2}{2g}(r_1^2 - r_2^2).$$

If $p = p_0$ where $r = 0$,

$$\frac{p - p_0}{w} = \frac{\omega^2}{2g} \cdot r^2$$

or, putting $\frac{p}{w} = h$ (fig. 5a)

$$h - h_0 = \frac{\omega^2}{2g} \cdot r^2$$

which is the equation to a parabola.

Since the pressure at any point in the fluid is that equivalent to the column of water supported at the point, it follows that

all surfaces of equal pressure, including the free surface of the vortex, form paraboloids of revolution having the axis of rotation as their common axis.

Free Cylindrical Vortex Motion.—Here, since we have streamline motion, the equation $\frac{p}{\omega}+\frac{v^2}{2g}+z=$ constant, holds, so that in any horizontal plane $\frac{p}{\omega}+\frac{v^2}{2g}=$ constant. Differentiating,

$$\frac{1}{w}\frac{dp}{dr}+\frac{v}{g}\cdot\frac{dv}{dr}=0.$$

Introducing the condition for rise in pressure across a stream tube, viz., $\frac{dp}{dr}=\frac{wv^2}{gr}$, this becomes

$$\frac{v^2}{gr}+\frac{vdv}{gdr}=0$$

$$\therefore \frac{dv}{dr}+\frac{v}{r}=0, \text{ or } \frac{d(vr)}{dr}=0$$

$$\therefore vr=\text{constant}=B$$

$$\therefore v=\frac{B}{r}.$$

Then if p_1, v_1, r_1, are the attributes of a point in the same horizontal plane as p, v, r,

$$\frac{p-p_1}{w}=\frac{v_1^2}{2g}\left(1-\frac{r_1^2}{r^2}\right).$$

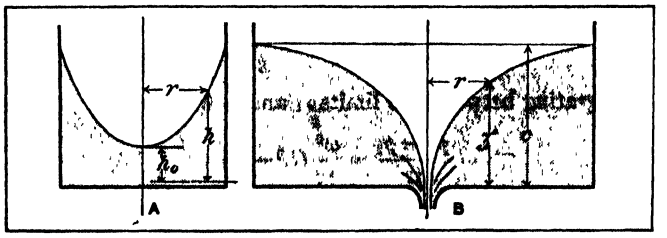
Putting $\frac{p}{w}$ constant in Bernoulli's equation, we get the equation to the curve of equal pressure, that is $\frac{v^2}{2g}+z=$ constant $=C$, and substituting for v in terms of r in this we have

$$\frac{B^2}{2gr^2}+z=C$$

$$\therefore C-z=\frac{B^2}{2gr^2}$$

the equation to a curve of the nature $yx^2=A$, which is asymptotic to the axis of rotation and to the horizontal through $z=C$ (fig. 5b).

Since the velocity varies inversely as the radius, and since this velocity cannot be infinite at the axis where $r=o$, an air column is essential at the centre of a free vortex. When this air column



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG 5.—(A) FORCED VORTEX. (B) FREE VORTEX

cannot be maintained, we get a combination of a forced vortex—at and near the axis—and a free vortex at points further removed.

FLOW FROM ORIFICES

If an opening be made in the side or base of a tank containing a fluid, convergent flow is set up from all sides towards the orifice. Owing to the inertia of the fluid the outer filaments of the issuing jet maintain their convergence for some little distance beyond the plane of the orifice. Up to this point the section of the jet gradually diminishes. The section at which the jet first becomes parallel is termed the *"vena contracta"* and with a sharp-edged orifice is at a distance from the orifice equal to about 0·5 times the diameter. Up to this point the pressures inside the jet are greater than atmospheric owing to the centrifugal forces accompanying its curvature. At the *vena contracta* however the pressure is atmospheric throughout the jet.

Considering a particle in the jet (suffix o) as having at one time been in the surface of the tank (suffix 1), we have

$$\frac{p_1}{w}+\frac{v_1^2}{2g}+z_1=\frac{p_0}{w}+\frac{v_0^2}{2g}+z_0.$$

But $p_1=p_0=o$ both being atmospheric (datum) pressures, and $v_1=o$ if the area of the tank is large compared with that of the orifice,

$$\therefore v_0=\sqrt{2g}\ (z_1-z_0)=\sqrt{2gh}$$

where h is the difference of level between *vena contracta* and the free surface in the tank

Allowance for the small loss of energy up to the point of discharge is made by writing

$$v_0=C_v\sqrt{2gh}$$

where C_v, the coefficient of velocity, usually has a value of about ·975.

If a and a_c are the areas of the orifice and of the *vena contracta*, the ratio $a_c\div a$ is termed the "coefficient of contraction," C_c, and the discharge is given by $C_cC_va\sqrt{2gh}=Ca\sqrt{2gh}$, where C is termed the "coefficient of discharge."

The values of C_c and of C vary with the type of orifice, with its situation, and to a small degree with its size. For a small sharp edged circular orifice remote from the sides of the tank, C is approximately 0·62. Its extreme values are about 0·52 and 0·99. The former is obtained with a sharp-edged re-entrant mouthpiece and the latter with a bell-mouthed orifice.

Submerged Orifices.—When an orifice, such as a sluice gate connecting two locks, is drowned, the effective head to be used in computing the discharge is the difference between the levels of the water surfaces on the two sides of the orifice. The coefficient of discharge is sensibly the same as that of the same orifice when discharging freely into air.

Velocity of Approach.—If the surface area of the vessel is not so large as to enable the velocity of approach to be neglected, we have

$$\frac{v^2}{2g}=\frac{v_1^2}{2g}+(z_1-z)$$

$$=\frac{v_1^2}{2g}+h.$$

The effective head producing efflux is now equal to the static head h plus the head equivalent to the kinetic energy of approach.

Flow over Weirs and Notches.—A weir may be looked upon as a large orifice whose upper edge extends to the surface of the water. If we assume that the velocity of efflux at a point distant x below the free surface is proportional to $\sqrt{2gx}$, the discharge over such a weir is given by

$$Q=KbH^{\frac{3}{2}} \text{ c.ft. per second,}$$

where b is the length of the weir in feet; H is the head over the crest, measured to the level of still water above the weir; and K is an experimental coefficient, which varies with the type of weir and conditions of discharge.

In the case of a rectangular weir having a thin sharp edged crest and a vertical upstream face, the two most useful formulae are those of Francis and Bazin. In the Francis formula $K=3{\cdot}33$, while b is replaced by $b-0{\cdot}1nH$, where n is the number of end contractions. A weir with no end contractions is said to be "suppressed." In the Bazin formula,

$$K=\left(3{\cdot}25+\frac{{\cdot}0789}{H}\right)$$

for a suppressed weir. These values of K apply where the area of the approach channel is so relatively large that the effect of the velocity of approach may be neglected. If, as is usually the

case in a suppressed weir, the velocity of approach is appreciable, the formulae become:

Francis, $Q=3{\cdot}33(b-0{\cdot}1nH)\{(H+h)^{\frac{3}{2}}-h^{\frac{3}{2}}\}$ c.f.s.

Bazin, $Q=\left\{1+{\cdot}55\left(\frac{H}{P+H}\right)^2\right\}\left\{3{\cdot}25+\frac{{\cdot}0789}{H}\right\}bH^{\frac{1}{2}}$ c.f.s.

where, in the Francis formula, $h = v^2 \div 2g$, v being the mean velocity in the approach channel, while in the Bazin formula P is the height of the weir crest above the bed of the channel.

The above formulae apply only to a weir having free access of air to the under side of the falling sheet or nappe. If the nappe clings to the crest or front face of the weir, or if free access of air is prevented, the discharge is increased.

Triangular Weirs.—If the weir is thin-crested and sharp edged, and if θ be the angle between its two sides,

$$Q = 4{\cdot}28c \tan\frac{\theta}{2} \cdot H^{\frac{5}{2}} \text{ c.f.s.}$$

where c depends slightly on θ and H is measured in feet.

If $\theta = 90°$, $c = {\cdot}593$, and $Q = 2{\cdot}536\ H^{\frac{5}{2}}$ c.f.s.

If $\tan\frac{\theta}{2} = 2$, $c = {\cdot}618$, and $Q = 5{\cdot}29\ H^{\frac{5}{2}}$ c.f.s.

Cippoletti Weir.—If the sides of a weir having two end contractions be inclined outwards at an angle θ with the vertical (fig. 6) the value of K in the formula $Q = KbH^{\frac{3}{2}}$ is sensibly independent of the head if θ is such that the side slope is 1 horizontal to 4 vertical. Such a weir is called a Cippoletti weir. The discharge is given by

$$Q = 3{\cdot}37\ bH^{\frac{3}{2}} \text{ c.f.s.}$$

if the velocity of flow in the approach channel is negligible, and by

$$Q = 3{\cdot}37b\{(H+h)^{\frac{3}{2}}-(h)^{\frac{3}{2}}\} \text{ c.f.s.}$$

as in the Francis formula, when the velocity of approach is taken into account.

Broad-crested Weirs.—Experiments indicate that if the width of the crest of a sharp edged weir is less than about $\cdot 33H$, the nappe will spring clear of the crest. Weirs with wider crests, in which the nappe adheres to the crest, are termed broad-crested weirs. Expressing the discharge over such a weir as

$$Q = K'bH^{\frac{3}{2}},$$

values of K' have been determined experimentally for a large number of weir sections, and are given in any standard work on Hydraulics.

Precautions To Be Adopted in Weir Gaugings.—The standard sharp edged weir having a free discharge, or, for small quantities, the right-angled triangular notch, are the only types for which the coefficients have been determined with sufficient accuracy to admit of use for measurement of flow without previous calibration.

For accurate measurement the following are essentials:—

1. Sharp edged weir sill, fixed so as to be incapable of vibration, having its face vertical and perpendicular to the direction of the stream, and, if rectangular, having its sill horizontal.
2. Clear discharge into air, with no adherence of the vein to the weir face.
3. Weir long in proportion to its depth, *i.e.*, $b > 3H$.
4. H small in comparison with the depth of the approach channel, and sectional area of vein (bH) not greater than one-sixth that of this channel.
5. Suitable channel of approach. This should be as long and of as uniform section as possible so as to allow of the motion becoming steady before reaching the weir. The length should, if possible, exceed $30H$, this ratio being increased where the length of weir is largely in excess of $3H$.
6. Accurate determination of the head H. For accurate work the surface-level should not be taken in the stream itself, but in a stilling-box or pit from 18 in. to 2 ft. square communicating with the stream through a pipe of about 1 in. diameter. The zero of the gauge should be accurately adjusted to the level of the weir crest. For accurate work, where individual readings are to be taken, a hook gauge, provided with a vernier for reading to the nearest ·001 ft., and with screw adjustment, is best.

Fluid Friction.—When fluid flows over a stationary surface a resistance to motion is experienced. At velocities so low as to give stream line flow this resistance is

(1) directly proportional to the velocity of the fluid.
(2) directly proportional to the viscosity, μ.
(3) independent of the density, ρ
(4) independent of the roughness of the surface.

At higher velocities at which the motion is sinuous or turbulent, the resistance is

(1) proportional to v^n where n usually lies between 1·8 and 2·0.
(2) varies as μ^{n-2}, and is therefore independent of the viscosity when $n = 2$.
(3) varies as ρ^{n-1} and therefore varies directly as the density when $n = 2$.
(4) increases with the roughness of the surface.

In the great majority of cases of practical importance, the motion is sinuous, and the frictional resistance may be written as

$$R = fSv^n$$

where S is the wetted area in sq. feet, v is the velocity in ft. per sec., and f is a roughness coefficient whose value varies from about ·002 for a smooth surface to about ·004 for such a surface as that of a cast iron pipe after being in use for some years.

Disk Friction.—The resistance to the rotation of a disk in water is an example of fluid friction. It may be shown that this resistance is equal to

$$\frac{4\pi f\omega^n}{n+3} r^{n+3} \text{ foot lb.}$$

where r is the radius of the disk in feet and ω is its angular velocity. This resistance is of importance in the design of centrifugal pumps and turbines. In some high speed centrifugal pumps the energy expended in this way amounts to as much as 15% of the total energy given to the shaft.

PIPE FRICTION

One very important effect of fluid friction is experienced in the resistance to the flow of water through a pipe line. This resistance can only be overcome by a drop in pressure in the direction of motion, and reasoning upon analogy to the resistance to motion over a plane surface it might be inferred that with turbulent motion the total resistance would equal fSv^n.

Putting A = sectional area of pipe in sq.ft.
P = length of perimeter of pipe
$p_1 - p_2$ = drop in pressure in lb. per sq.ft. over a length l ft.

this becomes $$(p_1-p_2)A = f'\mathrm{P}lv^n$$

or $$p_1 - p_2 = f'\frac{\mathrm{P}}{A} lv^n.$$

Here A ÷ P = area/perimeter is termed the "hydraulic mean radius" and is commonly denoted by "m" so that

$$p_1 - p_2 = \frac{f'lv^n}{m}.$$

For a circular pipe $m = \pi r^2 \div 2\pi r = d \div 4$. The earlier experimenters, assuming the loss to be proportional to the kinetic energy, wrote this

$$h = \frac{flv^2}{2gm} \text{ ft.,}$$

or, in the form adopted by Chezy,

$$v = C\sqrt{(mi)} = C\sqrt{[m(h/l)]}$$

where C and f are coefficients whose values depend on the roughness of the pipe. These formulae, with the appropriate values

of f or of C for the particular pipe diameter and velocity are generally used in calculations. More recent investigations indicate that the coefficient also depends on the pipe diameter and on the velocity of flow, and that the index n is less than 2·0 except in a rough pipe, and tend to show that an exponential formula,

$$h = \frac{flv^n}{d^x} \text{ ft.}$$

more nearly agrees with experimental results. Values of f, n, and x have been determined by many observers, and the following table gives a few typical values:

Surface	f	x	n
New uncoated cast iron	·00034	1·17	1·95
„ asphalted „ „	·00044	1·45	1·89
„ „ riveted pipes	·00030	1·37	1·90
Neat cement pipes	·00024	1·31	2·00

Owing to the very convenient form of the Chezy equation, $v = C\sqrt{mi}$), it is often an advantage to have at hand values of C corresponding to various diameters and velocities of flow. Such approximate values are given in the following tables:

Material	Velocity f.s.	Diameter inches 6	12	18	24	30	48	60	72
New cast-iron	2	100	107	111	115	120	124		
	4	104	111	115	119	124	128		
	6	106	113	117	121	126	130		
	8	107	114	118	122	127	131		
Clean asphalted pipes; smoothly finished concrete pipes and cement-lined tunnels	2		103	108	113	120	126	131	135
	4		108	113	118	126	132	137	141
	6		112	117	122	131	1 7	142	145
	8		115	120	125	134	141	146	149
	10		117	122	127	136	143	148	151
New single riveted steel or wrought-iron pipes	2		97	103	108	114	110	123	126
	4		103	109	114	120	125	129	132
	6		107	113	118	125	129	134	137
	8		109	115	121	128	133	138	141
	10		111	117	123	129	135	140	143

A new wood-stave pipe has values about 5% lower than a clean asphalted pipe.

After a period of use the incrustation of a pipe line diminishes its discharge. The rate and type of incrustation depends on the class of water and on the material of the pipe walls. To allow for this diminution, the pipe should be designed to give an initial discharge in excess of the requirements. The excess percentage discharge for different types of pipe should be approximately as follows:—

Type of pipe	Uncoated cast iron	Asphalted cast iron	Asphalted riveted wrought-iron or steel pipes	Wood stave	Cement
Discharge for which designed, in terms of desired discharge Q	1·55Q	1·45Q	1·33Q	1·08Q	1·06Q

Flow Through Pipes Coupled Up in Parallel.—If a series of pipes of diameters d_1, d_2, etc., discharge in parallel between the same two points, so that the available head h is the same in each case, adopting the relationship.

$$h = \frac{klv^n}{d^x},$$

the total flow Q, which equals $\frac{\pi}{4}(v_1d_1^2+v_2d_2^2+\text{etc.})$ c.f.s., becomes

$$Q = \frac{\pi}{4}\left(\frac{h}{k}\right)^{1/n}\left\{\frac{d_1^{2+(x/n)}}{l_1^{\frac{1}{n}}} + \frac{d_2^{2+(x/n)}}{l_2^{\frac{1}{n}}} + \text{etc.}\right\}$$
$$= \frac{\pi}{4}\left(\frac{h}{k}\right)^{1/n}\Sigma\left(\frac{d^{2+(x/n)}}{l^{\frac{1}{n}}}\right) \text{ c.f.s.}$$

E.g., taking, as for a cast-iron pipe, $n = 1·953$, $x = 1·172$,

$$Q = \frac{\pi}{4}\left(\frac{h}{k}\right)^{·512}\Sigma\left(\frac{d^{2·60}}{l^{·512}}\right).$$

Thus two small pipes of diameter d, will give the same discharge as a single large pipe D, of the same length, if

$$2d^{2·60} = D^{2·60},$$

i.e., if
$$D = d \times 2^{\frac{1}{2·60}}$$
$$= 1·31d,$$

or one pipe 13·1 in. in diameter would give the same discharge as two 10 in. pipes.

Long Pipe Line, Terminating in a Nozzle.—Let A be the area, D the diameter, and V the velocity of flow in the pipe line, and let a, d and v refer to the nozzle. Thus if h be the available head, and if the Chezy formula be adopted, we have, in a long pipe line:

$$h = \frac{4V^2l}{C^2D} + \frac{v^2}{2g}$$
$$= \frac{v^2}{2g}\left\{\frac{8gld^4}{C^2D^5} + 1\right\}, \text{ since } VA = va.$$
$$\therefore v = \sqrt{\left(\frac{2gh}{1+\frac{8gl}{C^2}\frac{d^4}{D^5}}\right)} \text{ ft. per second.}$$

In general, the coefficient of velocity, C_v, of a well-designed nozzle is about ·985, and the velocity will be reduced in this ratio.

Since the energy discharged at the nozzle per second

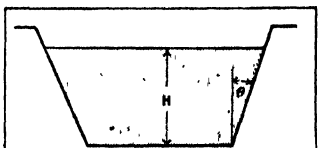
$$= \frac{wav^3}{2g} \text{ ft.lb.},$$

the horse-power delivered at the nozzle is

$$\frac{waC_v^3}{2g\times 550}\left\{\frac{2gh}{1+\frac{8gl}{C^2}\frac{d^4}{D^5}}\right\}^{\frac{3}{2}}$$

Water Hammer.—If, owing to the gradual closure of a valve at the lower end of a pipe line, the velocity of the water column is gradually reduced, the retardation being α ft. per second, this is accompanied by a rise in pressure at the valve of magnitude $\frac{wl\alpha}{g}$ lb. per square foot, or of $\frac{l\alpha}{g}$ ft. of water.

If however the valve closure is sudden, the elasticity of the water is involved. Each layer in turn is brought to rest, its kinetic energy is converted into strain energy, and the disturbance is propagated back to the open end of the pipe with the velocity of sound waves through the medium. Under these conditions, the phenomenon is known as water hammer, and the rise in pressure p at the valve is obtained from the relationship



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 6.—CIPPOLETTI WEIR

$$\frac{v^2}{2g} = \frac{p^2}{2Kw},$$

$$\text{or } p = v\sqrt{\frac{Kw}{g}} \text{ lb. square foot.}$$

Here K is the modulus of compressibility of the water, which has a mean value of $43·2\times10^6$ lb. per square foot. Adopting this value, $p = 63·7v$ lb. per square inch, a value which shows that

excessively high pressures may be obtained with comparatively low velocities of flow where this action is set up. In a non-rigid pipe line some energy is expended in stretching the pipe walls, and the hammer pressure is reduced. Taking this into account, K', the effective value of K, is given by

$$\frac{1}{K'} = \frac{1}{K} \frac{r}{2tE}\left(5 - \frac{4}{\sigma}\right)$$

where r is the radius and t the thickness of the pipe, and for steel pipes $E = 43{\cdot}2 \times 10^8$ lb. per square foot and $\sigma = 3{\cdot}6$.

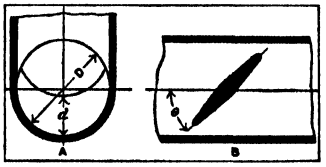
It may be shown that pressures as great as those corresponding to instantaneous closure are attained if the time of valve closure does not exceed $2l \div V_p$ sec. Here V_p, the velocity of propagation of pressure waves along the pipe line, is given by $V_p = \sqrt{\frac{Kg}{w}}$, and is approximately 4,700 ft. per second for a rigid pipe line, but may be as low as 3,000 ft. per second for a large thin-walled pipe line. If the time of closure is greater than $4l \div V_p$ sec., the formula $p = \frac{wl\alpha}{g}$ lb. per square foot is applicable.

Variation of Velocity over the Cross Section of a Pipe.—The velocity of flow at a cross section of a pipe increases from the walls to the centre. With stream line flow the curve of velocities is a parabola and the velocity at the walls is zero. With turbulent flow the curve of velocities is much flatter near the centre of the pipe. Experiment indicates that even when the flow as a whole is turbulent there is a very thin boundary layer in which the motion is non-turbulent, and that the velocity at the wall itself is zero.

Losses at Valves and Bends in a Pipe Line.—In addition to the losses due to wall friction in a pipe line, there are usually losses due to the presence of valves or bends which upset the normal lines of flow through the pipe. The loss of head due to a partially open valve or sluice is particularly serious, and is largely due to the expansion of the stream section on passing the constriction. The loss also depends largely on the design, so that values deduced from tests on any one type of valve cannot be taken as applying to another type. The following values have been determined experimentally from valves of the types shown in fig. (7 a and b). Here the loss equals $Fv^2 \div 2g$ ft., where v is the velocity in the pipe in ft. per sec.

Type of valve	Values of $d \div D$								
	·2	·3	·4	·5	·6	·7	·8	·9	
Circular sluice gate (fig. 7a), 2″ diam.	·30	11	4·2	2·1	·9	·35	·22	·07	Values of F
Circular sluice gate (fig. 7a), 24″ diam.	36	11	3·0	1·6	1·0	.	..	..	
	Values of θ								
	5°	10°	20°	30°	40°	50°	60°	70°	
Butterfly valve (fig. 7b)	·24	·52	1·54	3·9	10·8	32·6	118	750	Value of F

Losses at Bends.—The loss due to a right-angled bend depends on the radius of curvature R of the bend. The best radius in practice is from 2·5 to 5·0 times the pipe diameter. For such bends the loss is given sufficiently nearly by $\cdot 3v^2 \div 2g$ ft. Where the bend is carried round an angle θ less than 90°, the loss is very nearly proportional to θ^2.



FROM GIBSON, "HYDRO-ELECTRIC ENGINEERING" (BLACKIE & SON)

FIG. 7.—(A) SLUICE VALVE. (B) BUTTERFLY VALVE

Loss Due to Enlargement of Section.—When a pipe line has its cross-sectional area suddenly increased from A_1 to A_2 sq.ft., so that the velocity is reduced from v_1 to v_2 f.s., violent eddy formation is set up and the consequent loss of head is given very closely by the expression

$$\frac{(v_1 - v_2)^2}{2g} \text{ ft.}$$

This loss may be reduced within limits by tapering the pipe gradually between sections (1) and (2), and so reducing the velocity gradually. In this case the loss of head is $k(v_1 - v_2)^2 \div 2g$, where k has the following mean values.

	θ°	2°	5°	10°	15°	20°	30°	40°
Circular pipe . . .	K	·20	·13	·18	·27	·43	·75	·91
Rectangular pipe with one pair of sides parallel .	K		·31	·18	·29	·48	·90	1·10

These losses include the skin friction in the pipe. This accounts for the value of F increasing as the angle of divergence θ of the sides is diminished below a definite value, about 6° in a circular pipe, and 11° in a rectangular passage, owing to the increasing length of pipe between points (1) and (2).

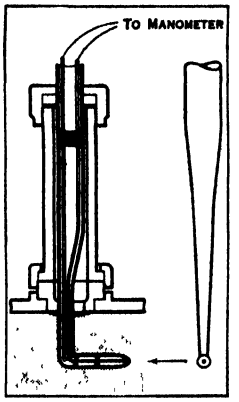
Flow in Pipe Lines—Hydraulic Gradient.—In designing a pipe line, the problem which usually presents itself is that of determining the minimum size of pipe which, with a given loss of head, will discharge a given volume of water per second The available head is absorbed in giving the kinetic energy of flow in the pipe ($v^2 \div 2g$), and overcoming the pipe line losses which are due:

1. to eddy formation at the entrances to the pipe;
2. to bends, valves, changes of sections, etc.;
3. to wall friction.

The loss due to eddy formation at the entrance is small. With a bell mouthpiece it is about $\cdot 05v^2 \div 2g$ ft. With a pipe opening flush with the side of the reservoir it is about $\cdot 47v^2 \div 2g$ ft., and, with a pipe projecting into the reservoir, about $v^2 \div 2g$ ft.

When a submerged open-ended pipe line connects two reservoirs, the velocity of flow in the pipe will adjust itself until the difference of level, h, between their free surfaces is equal to the total head absorbed in these various sources of loss.

If a horizontal be drawn through the upper free water surface and if a series of ordinates be drawn vertically downwards from this to represent on the vertical scale of the drawing the total loss of pressure head from the pipe entrance to the particular point considered, the ends of such ordinates, being joined, give a curve called the hydraulic gradient for the pipe. If a series of open stand pipes were erected on the pipe line, the free surfaces in these pipes would lie on the gradient line, and the pressure in the pipe is represented, at each point, by its distance below this line. If the pipe is above the gradient line at any point, as is the case in a syphon, the pressure will be less than atmospheric. In order to prevent difficulties arising from liberation and accumulation of air at such points, and from admission of air at leaky joints, the greatest height above the gradient line should not in any case exceed 20 ft.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 8.—PITOT TUBE

Measurement of the Flow in Pipes.—The measurement of the flow in a pipe line may be obtained in several ways. Of these the use of the Venturi meter, the Pitot tube, and in very large pipes the current meter, are the most common. The Pitot tube (fig. 8) consists of a bent tube terminating in a small orifice pointing upstream, which is surrounded by a second tube whose direction is parallel to that of flow. A series of small holes in the wall of the outer tube admit water, at the mean pressure in their vicinity, to its interior, which is connected to one leg of a manometer. The other leg is connected to the central tube carrying the impact orifice. If v is the velocity of flow immediately upstream from this orifice, the pressure inside the orifice, where the velocity is zero, is equal to the sum of the statical pressure at the point, plus $kv^2/2g$ ft. of water, where k is a constant whose value approximates closely to unity in a well-designed tube. It follows that the difference of level of the fluid in the two legs of the manometer equals $kv^2/2g$ feet.

For measurements of the flow in pipes the instrument is

inserted into the pipe through a gland in the pipe wall. It should be used if possible at a section remote from any bend or source of disturbance. For approximate work the velocity of the central filament may be measured. This when multiplied by a coefficient which varies from ·79 in small pipes to ·86 in large pipes gives the mean velocity. Alternatively the velocity may be measured at the radius of mean velocity, which varies from about ·7a in small pipes to ·75a in large pipes, where a is the radius of the pipe. These values, however, only apply to a straight stretch of the pipe, and if it is necessary to make measurements near a bend, and in any case for accurate results the pipe should be traversed along two diameters at right angles, and the velocities measured at a series of radii. If δr is the width of an elementary annulus containing one series of such measurements whose mean value is v, the discharge is then given by

$$Q = \int_0^a 2\pi r v \delta r.$$

FLOW IN OPEN CHANNELS

As in the case of pipe flow, the earlier experimenters assumed the loss of head during steady flow in an open channel to be proportional to the square of the velocity, and adopted one or other modification of the Chezy formula

$$v = C\sqrt{(mi)},$$

where m is the hydraulic mean depth (=cross-sectional area $[A]$÷wetted perimeter $[P]$), and i is the gradient of the channel.

The best-known of these formulae are due to Ganguillet and Kutter, and to Bazin.

Ganguillet and Kutter put

$$C = \frac{41{\cdot}66 + \frac{1{\cdot}811}{n} + \frac{{\cdot}00281}{i}}{1 + \left(41\ 66 + \frac{{\cdot}00281}{i}\right)\frac{n}{\sqrt{m}}}$$

and Bazin put

$$C = \frac{157{\cdot}6}{1 + \frac{\nu}{\sqrt{m}}}$$

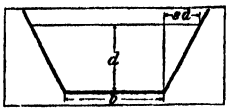
The values of ν and n in these formulae depend on the roughness of the surface. For straight channels the following values are applicable:

	Character of surface	Bazin's ν	Kutter's n
A	Smooth cement or planed timber	·109	·009–·010
B	Unplaned timber, slightly tuberculated iron, ashlar and well-laid brickwork . . .	·290	·012–·013
C	Rubble masonry and brickwork in an inferior condition; fine well-rammed gravel . .	·833	·017
D	Rubble in inferior condition; canals with earthen beds in perfect condition . . .	..	·020
E	Canals with earthen beds in good condition	1·54	·0225

Bazin's formula appears on the whole to be the more reliable for artificial channels and conduits, and the corresponding values of C in Chezy's formula for the different surfaces and hydraulic mean depths are given in the following table:

Surface	Values of c computed from Bazin's formula				
	$m = ·5$	$m = 1·0$	$m = 2·0$	$m = 5·0$	$m = 10$
A . .	137	142	146	150	152
B . .	112	122	131	140	145
C . .	72	86	100	115	125
D .	61	74	88	104	115
E . .	50	62	76	93	106

Best Form of Channel.—Since in a channel of given sectional area A, the hydraulic mean depth $A \div P$ varies with the form of the section, while the resistance to flow increases as $A \div P$ diminishes, it becomes important to determine what form of channel will give the maximum value of $A \div P$ for a given value of A, since this will give the maximum discharge for a given slope. Further, as the sectional area of this channel is a minimum, the cost of construction is a minimum, and since in general the perimeter P increases with the area, the cost of lining the channel is also a minimum.



FROM GIBSON, "HYDRO-ELECTRIC ENGINEERING" (BLACKIE & SON)

FIG. 9.—TRAPEZOIDAL CHANNEL

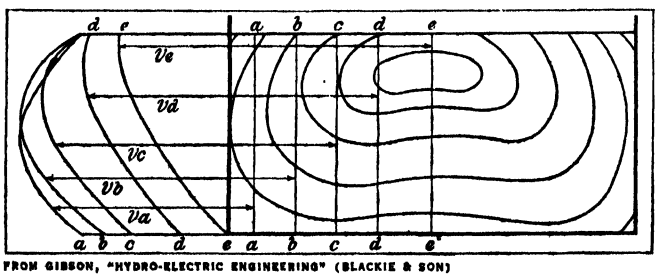
Theoretically the best form of channel is the semicircular section, and for steel and wooden flumes this section is often adopted. For earthen channels the trapezoidal section (fig. 9) with sides sloping at S horizontal to 1 vertical is common, and, for rock channels, the rectangular section. It may be shown that the most economical proportions for such sections are obtained when a circle, with its centre in the water surface, touches the sides and bottom. In a rectangular canal this means that the depth should be one-half the width. In a trapezoidal channel the condition to be satisfied is

$$(1+S^2)d^2 = \left(\frac{b}{2} + Sd^2\right)^2,$$

where b is the bottom breadth and d the depth.

Such a channel has a hydraulic mean radius equal to $d \div 2$. Of the trapezoidal sections, that having side slopes of ·5 to 1 is the most efficient. The section to be adopted, however, depends also on other considerations. The minimum permissible side slope depends on the character of the soil and varies from 0 to 1 in rock to 1·5 to 1 in ordinary loamy soil, and 2 to 1 in loose sandy soil. In loose soil a concrete lining enables side slopes of 1 to 1 to be used, and, by preventing erosion of the banks, enables higher velocities of flow to be adapted, while the increased smoothness of the channel enables these velocities to be attained without any greater loss of head. In such a case a concrete-lined channel may be cheaper than one which is unlined.

Velocity of Flow in Open Channels.—The permissible velocity of flow depends on the tendency to erosion of the sides and bed. Experiment shows that the safe velocity increases with the depth. For medium depths in light soil a mean velocity of from 1·2 to 1·8 f.s. is safe, while in firm loamy soil the safe velocity is from 3·0 to 3·5 f.s. On firm well-rammed gravel this may be increased to between 5 and 7 f.s. In a concrete-lined channel faced with cement, the maximum safe velocity with water which carries solid material in suspension is about 9 f.s. A higher velocity wears and roughens the bottom until this roughness reduces the velocity sufficiently to prevent further erosion. With a brick or dry-laid heavy rubble channel the velocity should not exceed 15 f.s. Any higher velocity necessitates



FROM GIBSON, "HYDRO-ELECTRIC ENGINEERING" (BLACKIE & SON)

FIG. 10.—CONTOURS OF EQUAL VELOCITY IN AN OPEN CHANNEL

a carefully-laid facing of heavy masonry with cemented joints.

Distribution of Velocity in an Open Channel.—The distribution of velocity in a straight channel depends somewhat upon the mean velocity. The maximum velocity is found near the centre and in general below the surface, even with a down-stream wind. Its depth varies from ·1h to ·4h, where h is the depth of the stream. The curves of fig. 10 show typical contours of equal velocity, and the distribution of velocity in a series of verticals in a rectangular channel. The curves of fig. 11 show the variations of velocity in a vertical plane. The effect of an

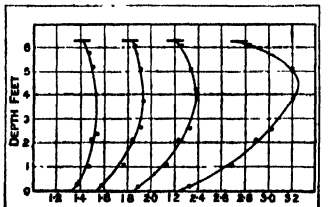
increase in mean velocity in raising the filament of maximum velocity is well shown by these curves. It is found that the depth of the point of mean velocity in any vertical is sensibly independent of the direction of the wind. It varies from about $\cdot 55h$ to $\cdot 70h$, depending on the depth and roughness of the channel as indicated below.

Condition of bed	Gravel and small boulders				Small gravel and sand				Wood or cement			
Depth, feet	0–2	2–4	4–6	6–10	0–2	2–4	4–6	6–10	0–2	2–4	4–6	6–10
Depth of point of mean velocity in terms of h	·54	·58	·62	·66	·57	·60	·65	·69	·61	·65	·68	·70

Generally speaking, the velocity at six-tenths depth in any vertical gives the mean velocity in that vertical within 5% except in abnormal cases, while the mean of the velocities at one-fifth and four-fifths of the depth also gives the mean velocity within narrow limits. While the surface velocity should only be used for gauging purposes when other measurements are impracticable, its value, on a still day, is between 80 and 100% of the mean velocity in its own vertical. This factor increases with the depth of the stream and with the smoothness of the channel.

Gauging of Stream Flow.—The method to be adopted in stream gauging depends on the size of the stream, its state, and on the degree of accuracy required. Where the installation of a weir capable of taking the whole flow is feasible, this forms the most accurate method. For a stream of medium size the rectangular weir is most suitable. For small flows the triangular notch has advantages. For large streams the weir becomes too costly as a temporary measuring device, and if no permanent weir is available the only way of obtaining the discharge is to measure the mean velocity of the stream and to multiply this by the cross-sectional area. The mean velocity may be obtained in a number of ways. (a) by current meter; (b) by floats; (c) by colour or chemical methods.

Current Meters.—Various types of current meter are in use. In one common type the meter is suspended from a rod or cable, and is provided with a guide vane which keeps its axis perpendicular to the direction of the current. The wheel makes and breaks the contact in an electrical circuit at each fifth and tenth revolution, thus enabling the number of revolutions to be indicated by means of a buzzer or telephone carried by the observer. The instrument is previously calibrated by towing at known velocities through still water, the number of revolutions corresponding to these velocities being recorded. It has the disadvantages that it cannot be used where floating grass or weed is prevalent and that it requires rating at frequent intervals. Further, it is unsuitable for very low velocities. The minimum permissible velocity depends on the type of meter, but in general varies from 3 to 6 in. per second.



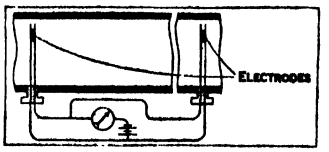
FROM GIBSON, "HYDRO-ELECTRIC ENGINEERING" (BLACKIE & SON)

FIG. 11.—VELOCITY AT THE CENTRAL VERTICAL IN AN OPEN CHANNEL

Meter Observations.—The most usual method of using the meter is the "point" method, in which it is held successively at certain points in a cross section. In a shallow stream this may be done by mounting it on a staff which is carried by an observer in waders. In deeper streams it is attached to a heavy sinker, and is suspended from a convenient bridge or from a car carried by a cable across the stream, or from an outrigger fixed to an anchored boat.

In this method, the meter may either be held (1) at several equidistant points in a number of equidistant verticals, the mean velocity being deduced from these readings; (2) at six-tenths, or at mid-depth in a series of equidistant verticals, the mean velocity in each of these verticals then being found by applying a factor; (3) at the surface and bottom only, or at two-tenths and eight-tenths of the depth in a series of verticals; (4) at the surface only. While the first method gives the most accurate results in a steady stream, the length of time necessary to obtain the many observations is a serious drawback, and renders it unsuitable in a stream which is rising or falling.

Generally speaking, the velocity at ·6 of the depth will give the mean velocity in that vertical within 5%, while the velocity at mid-depth multiplied by ·96 will give the mean velocity within about 3 per cent. Method (3) in which the surface and bottom velocities are measured, is only suitable for shallow streams. Experiments show that the results are fairly accurate if the bed is smooth or gravelly, the depth from ·4 to 1·0 ft., and the velocity from ·5 to 1·5 ft. per second. For deeper streams the mean of readings at $\cdot 2h$ and $\cdot 8h$ is in close agreement with the mean velocity in the vertical, and this method is often adopted for general stream gauging.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 12.—ELECTRICAL METHOD OF MEASURING MEAN VELOCITIES OF FLOW

While it is usually inadvisable to use the surface velocity alone for computing the discharge, it is sometimes impossible in times of flood to make any other measurements. The meter should then be sufficiently submerged to eliminate any disturbance of the surface. Except as affected by the wind, the surface velocity multiplied by a constant which varies from about $\cdot 85h$ in a shallow stream to $\cdot 95h$ in a deep stream gives the mean velocity in a vertical with a fair degree of approximation.

Soundings.—Simultaneously with the meter observations, soundings should be made from which the cross section of the stream may be obtained.

Having recorded the observations for a series of verticals over the cross section of the stream, these are plotted and a smooth curve is drawn through the plotted points. From this curve velocities are read off at the top and bottom, and at equal intervals of, say, each 0·5 feet and are set down in order.

Assuming that in a particular case there are six intervals of depth, giving seven such recorded velocities, including the surface velocity v_1 and the bottom velocity v_7, the mean velocity in the vertical is then computed from the prismoidal formula for seven abscissae.

$$v_m = \tfrac{1}{18}\{v_1+v_7+4(v_2+v_4+v_6)+2(v_3+v_5)\}.$$

The cross section having been plotted, the areas of the various compartments, having such verticals as their centre lines, may be measured and the discharge through each compartment calculated The sum of these gives the total discharge.

Float Measurements.—Floats may be divided into three classes: (1) surface floats; (2) sub-surface floats; (3) rod floats.

Surface floats are liberated at a series of points across the stream at the head of a long straight reach, whose length should be not less than about 200 ft., and the time occupied in covering a measured distance is noted. The surface velocity in each of a number of vertical sections is obtained by repeated observations, and the mean velocity in each vertical is then obtained by multiplying the surface velocity by a factor varying from ·85 to ·95, depending on the depth and condition of the channel. The stream sections may be marked, in a channel of moderate width, by ropes hanging from a bridge or temporary support and trailing in the stream. In a large river this method is impracticable, and observations with the theodolite are necessary to determine the path of the float. The effect of the wind on the surface velocity renders this method of measurement very unsatisfactory.

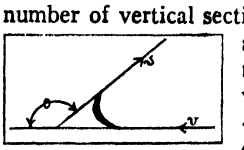

FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 13

Sub-surface floats consist of bodies having surfaces of large area, attached to small surface floats for ease of observation, the length of connection being adjusted so as to allow the true float to remain at any given depth. The velocity of the float will then be approximately that of the current at the required depth. A

series of such floats liberated at different points in the cross section of a stream, the depth of each being ·6 that of the stream at the point of introduction, may be taken as giving the mean velocities in their respective sections. This type is more reliable than the surface float. Experiments show that the errors involved by the use of such floats may be between 5 per cent and 25 per cent.

The "rod float" consists of a light wooden rod or tin tube about 1 in. in diameter, and made in adjustable lengths. The lower end of the bottom section is weighted, and the length adjusted until the rod floats vertically with its lower end clearing the bottom by a few inches. In a large river where these are not likely to interfere with navigation, logs of wood having their lower ends weighted, may be used. The velocity of the rod gives the mean velocity over the vertical in which it floats. The difficulty in using the rod lies in its tendency to drag over shoals and weeds, and to obviate this its lower end may be arranged to float at a height h_1 above the bed of the stream.

For such a case Francis gives the empirical formula

$$v_m = v_r\left[1{\cdot}012 - {\cdot}116\sqrt{\left(\frac{h_1}{h}\right)}\right]$$

giving the mean velocity in the vertical containing the rod in terms of the velocity of the rod v_1, and of h_1, and h the depth of the stream. Here h_1 should be less than $\cdot 25h$.

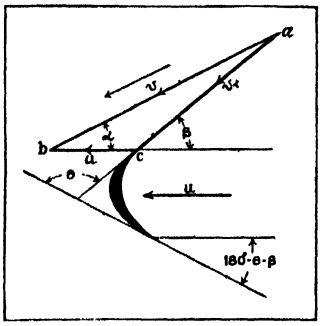
In channels of moderate and uniform depth, the rod float is capable of giving results in close agreement with weir gaugings.

Measurement of Velocity by Colour Injection.—The velocity may be determined by injecting colouring matter into the stream, and noting the time this takes to traverse a measured distance. For successful results the colour must be injected in a single burst. In clear water a solution of permanganate of potash may be used. In waters discoloured by organic matter or vegetable stains, red or green aniline dye gives good results.

Gauging by Chemical or Electrical Methods.—By adding a strong solution of some chemical, for which sensitive reagents are available, at a uniform and known rate into a stream, and by collecting and analyzing a sample taken from the stream at some point below, where admixture is complete, the volume of flow can readily be computed.

Electrical Method.—This is based on the fact that salt in solution increases the electrical conductivity of water. Two pairs of insulated electrodes (fig. 12) are mounted in the conduit at a measured distance apart, and are coupled to a battery with a voltmeter or ammeter in the circuit. Salt in solution is injected at a single burst at a point above the upper pair of electrodes and the passage of this over the electrodes is indicated by the deflection of the needle of the recording instrument. This method which is also applicable to pipe flow, is quicker, cheaper and probably more accurate than the chemical method.

These two methods are best adapted to rapid and irregular streams in which the admixture is most thorough and which, incidentally, are most difficult to gauge by other means.



FROM GIBSON, "HYDRAULICS AND ITS APPLICATIONS" (CONSTABLE & CO.)

FIG. 14.—VELOCITY DIAGRAM

Impact of Jets.—In the case of the impact of a jet on a stationary or moving surface, the force exerted in any direction is equal to the rate of change of momentum per second in that direction.

Impact on a Fixed Surface.—

Let a = sectional area of jet in square feet,
v = initial velocity in feet per second.

Then the weight of water impinging on the surface per second $= wav$ lb.

The initial momentum of this in the original direction of motion

$$= \frac{wav^2}{g} \text{ ft.-lb. units.}$$

If θ be the angle through which the jet is diverted (fig. 13), and if the relative velocity of the water and the vane is unaffected by the impact, the final velocity in the original direction will be $v\cos\theta$, and the final momentum in this direction will be $\frac{wav^2}{g}\cos\theta$.

∴ Change of momentum in this direction per second

$$= \frac{wav^2}{g}(1-\cos\theta)$$

Similarly the final momentum per second at right angles to the original direction is $\frac{wav^2}{g}\sin\theta$, and since the original momentum in this direction is zero, the change of momentum is $\frac{wav^2}{g}\sin\theta$.

It follows that:—

The force exerted parallel to the original direction of jet

$$= \frac{wav^2}{g}(1-\cos\theta) \text{ lb.}$$

The force exerted perpendicular to the original direction of jet

$$= \frac{wav^2}{g}\sin\theta \text{ lb.}$$

The resultant force on vane $= \frac{wav^2}{g}\sqrt{[(1-\cos\theta)^2+\sin\theta^2 \text{ lb.}]}$

$$= \frac{wav^2}{g}\sqrt{[2-2\cos\theta \text{ lb.}]}$$

Impact on a Series of Moving Vanes.—If the vanes are moving in the original direction of motion of the jet, with velocity u, f.s., the relative velocity of the water and the vane is $v-u$, and the final absolute velocity of the water in the original direction of motion is

$$u+(v-u)\cos\theta.$$

The change of velocity in this direction is then

$$v-u-(v-u)\cos\theta = (v-u)(1-\cos\theta),$$

and the change of momentum per second, or the force on the vanes, is given by

$$\frac{wav}{g}\cdot(v-u)(1-\cos\theta).$$

The work done on the vanes

$$= \frac{wavu}{g}(v-u)\{1-\cos\theta\} \text{ ft.-lb. per second.}$$

Differentiating with respect to u, it appears that this expression is a maximum when $u=\frac{v}{2}$, or when the velocity of the vanes is one-half that of the jet. If the friction on the vanes is taken into account, the best velocity for the vanes is slightly less than $\frac{v}{2}$, and in the case of a Pelton wheel, the ratio of u to v is usually between 0·45 and 0·47.

If $u=\frac{v}{2}$, the work done on the vanes

$$= \frac{wav^3}{2g}\left\{\frac{1-\cos\theta}{2}\right\} \text{ ft.-lb. per second.}$$

and since the kinetic energy of the jet per second is equal to $\frac{wav^3}{2g}$ ft.-lb., the efficiency is equal to $\frac{(1-\cos\theta)}{2}$.

When $\theta = 180°$, this equals unity, while if $\theta = 90°$, the efficiency is 0·5.

Impact on One of a Series of Recurved Vanes Whose Direction

of Motion Makes an Angle with That of the Jet.—This problem is one of much importance in the design of impulse turbines. Let α be the angle between the directions of v and of u, and let θ be the total angle through which the vane is recurved (fig. 14). Then if, as is usual, the incidence is tangential, the relative velocity v_r of jet and vane at impact is given by

$$v_r^2 = v^2 + u^2 - 2vu\cos\alpha \text{ (triangle } abc)$$

and, neglecting friction and eddy losses, the relative velocity at discharge will be the same as this.

Also, for tangential incidence, the direction of the vane at incidence must be parallel to the direction of the jet relative to the vane, and must therefore make an angle β with the direction of motion of the vane where β is obtained from the relationship (triangle *abc*).

$$\text{Sin}\beta = \frac{v}{v_r} \cdot \sin a.$$

The initial velocity of jet in the direction of motion of vane

$$= v\cos\alpha.$$

The final velocity of jet in the direction of motion of vane

$$= u - v_r\cos(180° - \theta - \beta)$$

$$= u + v_r\cos(\theta + \beta)$$

$\therefore$ Change of momentum per sec. in direction of motion of vane

$$= \frac{WQ}{g}\{v\cos\alpha - u - v_r\cos(\theta+\beta)\} \text{ lb.}$$

$\therefore$ Force on vane in this direction

$$= \frac{WQ}{g}\{v\cos\alpha - u - v_r\cos(\theta+\beta)\} \text{ lb.}$$

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HYDRAULIC TURBINE: *see* TURBINE, WATER.

HYDRAZINE. This compound of hydrogen and nitrogen is a colourless liquid boiling at 113·5° C and solidifying at about 0° C to colourless crystals (m.p. 1·4° C); it is somewhat heavier than water (sp.gr. 1·014/15° C) in which it dissolves with rise of temperature. Hydrazine, N_2H_4 or $H_2N{\cdot}NH_2$, was first prepared by Th. Curtius in 1887 during the study of the reactions of ethyl diazoacetate, $N_2{:}CH{\cdot}CO_2C_2H_5$, an ester obtained by the action of potassium nitrite on the hydrochloride of ethyl aminoacetate. On heating with concentrated aqueous caustic potash, ethyl diazoacetate is converted into bisdiazoacetic acid, $C_2H_2N_4(CO_2H)_2$, which on digestion with warm dilute sulphuric acid yields oxalic acid and hydrazine sulphate. Another preparation of hydrazine, also due to Curtius (1896), consists in boiling aminoguanidine with dilute acids or alkalis (*see* GUANIDINE). It can also be produced by reducing potassium dinitrososulphonate in cold water with sodium amalgam. F. Raschig (1908) obtained good yields of hydrazine by oxidising ammonia with sodium hypochlorite in aqueous solutions rendered viscous with 0·2% of joiner's glue, and this method is employed on a commercial scale. By fractional distillation of the aqueous solution, hydrazine hydrate, $H_2N{\cdot}NH_3OH$, is obtained as a colourless fuming liquid with strongly alkaline and caustic properties, corroding glass like the caustic alkalis and destroying cork and indiarubber. It boils at 119° C and has specific gravity 1·03 at 21° C. It remains liquid at −40° C.

On distilling hydrazine hydrate with an alkaline dehydrating agent such as barium oxide or solid caustic potash, anhydrous hydrazine is obtained (*see* above). Hydrazine forms a sparingly soluble sulphate, N_2H_4,H_2SO_4, employed in its commercial preparation, and mono- and di-hydrochlorides, N_2H_4,HCl and $N_2H_4,2HCl$. In aqueous solution hydrazine is a powerful reducing agent eliminating copper and silver from their salts; it is very poisonous, even through the skin.

Organic Hydrazines.—These properties persist in the organic derivatives of hydrazine of which *phenylhydrazine*, $C_6H_5{\cdot}NH{\cdot}NH_2$, is the most important. This useful reagent was discovered by E. Fischer in 1877 and employed by him in his classical researches on the sugars. It is best prepared by reducing benzenediazonium chloride, $C_6H_5{\cdot}N_2Cl$, with stannous chloride in hydrochloric acid solution, when phenylhydrazine is liberated by caustic soda from its precipitated hydrochloride. It is a colourless, oily liquid rapidly turning brown on exposure; it boils at 241° C and solidifies to tabular crystals melting at 23° C. Phenylhydrazine is a basic compound slightly soluble in water and forming well-defined salts with the strong acids. It serves to detect organic substances containing carbonyl groups (*see* ALDEHYDES, CARBOHYDRATES and KETONES) since it condenses with them to form hydrazones, with elimination of water. The hydrazones and orthodihydrazones (osazones) are generally well-characterised crystalline derivatives.

Phenylhydrazine, moreover, is an important synthetic reagent (*see* ANTIPYRINE) and its sulphonic acid is employed in the production of pyrazolone colours and tartrazine (*see* DYES, SYNTHETIC). (G. T. M.)

HYDRAZOIC ACID, a highly explosive chemical compound of the formula N_3H, known also as azoimide (*q.v.*); its salts are known as azides, and lead azide (*q.v.*) is a powerful detonator.

HYDRAZONE, in chemistry, a compound formed by the condensation of a hydrazine (*q.v.*) with an aldehyde (*q.v.*) or a ketone (*q.v.*).

HYDROCARBON, in chemistry, a compound of carbon and hydrogen. The simplest hydrocarbons are gaseous, many are liquid, and the more complicated are solid. Many occur in nature: for example, natural gas, petroleum and paraffin are mainly composed of such compounds; other natural sources are india-rubber, turpentine and certain essential oils. They are also revealed by the spectroscope in stars, comets and the sun. Of artificial productions the most fruitful and important is provided by the destructive or dry distillation of many organic substances; familiar examples are the distillation of coal, which yields ordinary lighting gas, composed of gaseous hydrocarbons, and also coal tar (*q.v.*) which, on subsequent fractional distillation or treatment with solvents yields many liquid and solid hydrocarbons, some of high industrial value. For details reference should be made to the articles wherein the above subjects are treated. From the chemical point of view the hydrocarbons are of fundamental importance, and, on account of their great number and still greater number of derivatives, they are studied as a separate branch of the science, namely, organic chemistry. (*See* CHEMISTRY: *Organic.*)

HYDROCELE, the medical term for any collection of fluid other than pus or blood in the neighbourhood of the testis or cord. The fluid is usually serous. Hydrocele may be congenital or arise in the middle-aged without apparent cause. The hydrocele appears as a rounded, fluctuating translucent swelling in the scrotum, and when greatly distended causes a dragging pain. Palliative treatment consists in tapping aseptically and removing the fluid, the patient afterwards wearing a suspender. The condition frequently recurs and necessitates radical treatment. Various substances may be injected; or the hydrocele is incised, the tunica partly removed and the cavity drained.

HYDROCEPHALUS, a term applied to disease of the brain which is attended with excessive effusion of fluid into its cavities. It exists in two forms—*acute* and *chronic hydrocephalus.* Acute hydrocephalus is another name for tuberculous meningitis (*see* MENINGITIS).

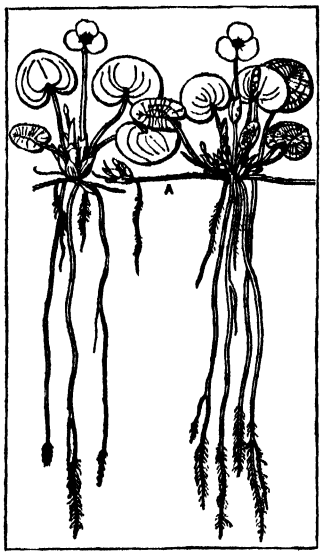
Chronic hydrocephalus, or "water on the brain," consists in an effusion of fluid into the lateral ventricles of the brain and depends upon congenital malformation or upon chronic inflammatory changes affecting the membranes. When the disease is congenital its presence in the foetus is apt to be a source of difficulty in parturition. It is, however, more often developed in the first six months of life; but it occasionally arises in older children, or even in adults. The chief symptom is the gradual increase in size of the upper part of the head out of all proportion to the face or the rest of the body. Occurring at an age when as yet the bones of the skull have not become welded together, the enlargement may go on to an enormous extent, the spaces between the bones

becoming more and more expanded. In a well-marked case the deformity is very striking; the upper part of the forehead projects abnormally, and the orbital plates of the frontal bone being inclined forwards give a downward tilt to the eyes, which have also peculiar rolling movements.

The expansibility of the skull minimises destructive pressure on the brain, yet this organ is materially affected by the presence of the fluid. The cerebral ventricles are distended, and the convolutions are flattened. As a consequence, the functions of the brain are interfered with and the mental condition is impaired. The child is dull, listless and irritable, and sometimes imbecile. The special senses become affected as the disease advances; sight and hearing are often lost. Hydrocephalic children generally sink in a few years; nevertheless, there have been instances of persons with this disease living to old age.

Various methods of treatment have been employed, but the results are uniformly unsatisfactory.

HYDROCHARITACEAE, in botany, a family of monocotyledons, belonging to the series Helobieae. They are water-plants, represented in Britain by frog-bit (*Hydrocharis Morsus-ranae*) and water-soldier (*Stratiotes aloides*). The family contains about 50 species in 13 genera, 10 of which occur in fresh water while 3 are marine: and includes both floating and submerged forms. *Hydrocharis* floats on the surface of still water, and has rosettes of kidney-shaped leaves, from among which spring the flower-stalks; stolons bearing new leaf-rosettes are sent out on all sides, the plant thus propagating itself in the same way as the strawberry. *Stratiotes aloides* has a rosette of stiff, sword-like leaves, which project above the surface when the plant is in flower. It is stoloniferous, the young rosettes sinking to the bottom at the beginning of winter and rising again to the surface in the spring. *Vallisneria* (eel-grass) contains two species, one native of tropical Asia, the other inhabiting the warmer parts of both hemispheres and reaching as far north as south Europe. It grows in the mud at the bottom of fresh water, and the short stem bears a cluster of long, narrow, grass-like leaves. New plants are formed at the end of horizontal runners. Another type is represented by *Elodea canadensis* or water-thyme, which has been introduced into the British Isles from North America. It is a small, submerged plant with long, slender, branching stems bearing whorls of narrow, toothed leaves; the flowers appear at the surface when mature. In *Hydrocharis,* a dioecious plant, the flowers are borne above the surface of the water, have conspicuous white petals, contain honey and are pollinated by insects. *Stratiotes* has similar flowers which come above the surface only for pollination, becoming submerged again during ripening of the fruit. In *Vallisneria* which is also dioecious, the small male flowers are borne in large numbers in short-stalked spathes; the petals are minute and scale-like, and only two of the three stamens are fertile; the flowers become detached before opening and rise to the surface, where the sepals expand and form a float bearing the two projecting semi-erect stamens. The female flowers are solitary and are raised to the surface on a long, spiral stalk; the ovary bears three broad styles, on which some of the large, sticky pollen-grains from the floating male flowers get deposited. After pollination the female flower is drawn below the surface by the spiral contraction of the long stalk, and the fruit ripens near the bottom.



FROG-BIT (HYDROCHARIS MORSUS-RANAE), COMMON IN EUROPE AND THE GREATER PART OF ASIA

The family is a widely distributed one; the marine forms are tropical or subtropical, but the fresh-water genera occur also in the temperate zones. In addition to the water-thyme (*Elodea*), found across the continent, and the eel-grass (*Vallisneria*), of the eastern States and Canada, the family is represented in North America by the American frog-bit (*Limnobium Spongia*), of the southeastern States, and the marine *Halophila Engelmannii,* of the Florida coast.

HYDROCHLORIC ACID, a liquid chemical reagent of great industrial significance sometimes known as *muriatic acid* or *spirits of salt.* It consists essentially of a solution of gaseous hydrogen chloride in water. This gas, which is less appropriately termed hydrochloric acid gas, is the compound actually evolved by the action of concentrated sulphuric acid on common salt.

In its physical and chemical properties, gaseous hydrogen chloride differs fundamentally from its aqueous solution which is hydrochloric acid. The former is a colourless gas liquefied only at a very low temperature (boiling point −83·4° C). When dry it has a very low electrical conductivity, and it retains this property even in the liquid and solid conditions. When thoroughly dry, hydrogen chloride and ammonia do not combine to form ammonium chloride. (*See* DRYNESS [CHEMICAL].)

Hydrochloric acid is a liquid which readily conducts the electric current and in doing so undergoes decomposition (electrolysis, *q.v.*). Hydrogen is evolved at the cathode (*q.v.*), whereas the anode (*q.v.*) gas is oxygen or chlorine, depending on the concentration of hydrogen chloride in the solution. A 20% solution of hydrogen chloride in water boils at 110° C under 730 mm. pressure.

Manufacture.—Hydrochloric acid is manufactured principally from common salt by the action of sulphuric acid.

$2NaCl$	+	H_2SO_4	=	Na_2SO_4	+	$2HCl$
(Common salt)		(sulphuric acid)		(sodium sulphate or salt cake)		(hydrochloric acid)

This process is accomplished commercially by mixing sulphuric acid with salt in large iron pans surrounded with brickwork so arranged that the pan can be heated underneath while the hydrochloric acid gas escapes through a flue. The hot gas is then cooled and passed into stone towers, filled with coke or earthenware shapes, down which water is made to trickle. This absorption, though apparently simple, is complicated in at least two respects. The general law governing the solution of any gas in a liquid is that the greater the concentration of that gas and the lower the temperature of the liquid the more gas will be taken up. Now the acid gas leaving the above apparatus is mixed with a considerable and sometimes large quantity of air, and the introduction of the gas into the water generates a large quantity of heat. It is evident, therefore, that the exclusion of as much air as possible from the initial process and thorough cooling during the subsequent stages are essential; and much ingenuity has been expended in devising plant to accomplish this.

Another method is the direct burning of chlorine in an atmosphere of hydrogen gas: this gives a very pure product and forms a convenient outlet for chlorine. Properly speaking, hydrochloric acid is a gas. As this would be a most inconvenient form in which to transport and use it, it is therefore absorbed (as described) in water in which it is extremely soluble. The resulting liquor usually contains from 27 to 37% by weight of the acid; it has a pungent and irritating smell, and is dangerous to handle by those who are not aware of its properties. It is packed mostly in glass carboys surrounded by an iron protective frame. Pure hydrochloric acid in this form is colourless, but the ordinary commercial variety frequently is tinged more or less yellow on account of impurities accumulated during the process of absorption in water. Chemically it is extremely active and belongs to the class of "strong" acids. The aqueous solution will readily attack nearly all metals, forming the corresponding chlorides and disengaging hydrogen gas; gold and platinum are not affected; lead, silver and mercury are only partially dissolved owing to the formation of a protective coating of insoluble chloride. It is thus evident that the handling of the acid in the process of manufacture, and subsequently, is beset with some difficulty and that the acid can only be allowed

to come into contact with stoneware, glass, ebonite and similar materials upon which it does not act.

It combines energetically, with the production of much heat, with strong bases such as soda, potash, ammonia and so on. It will readily dissolve metallic oxides, of which common rust (oxide of iron) is an example, and upon this property is based one of its most important commercial applications, namely, the cleaning of the surface of iron sheets previous to tinning or galvanizing. Huge quantities are used for this one purpose alone, and indeed this forms the principal item of the acid makers' trade. When mixed with nitric acid it forms the so-called "aqua regia," which has the property of dissolving gold, platinum and closely allied metals.

Hydrochloric acid can readily be converted into elementary chlorine by the action of atmospheric oxygen in conjunction with chloride of copper which in some way promotes the action. This formed the basis of the Deacon process for the manufacture of chlorine (*q.v.*), and provided an outlet for the large surplus of hydrochloric acid produced in the first stage of the Le Blanc soda process. As the Le Blanc process has now been replaced by the Solvay Ammonia-Soda method, which does not produce hydrochloric acid as a by-product, the former surplus of acid no longer exists and the Deacon process has fallen into disuse. The residue of the hydrochloric acid made, besides that used by the metal and galvanizing trades, is absorbed by the textile and artificial silk manufacturers, by dyestuff makers, and by chemical industry in general. (*See* CHLORINE IN INDUSTRY.)

See J. W. Mellor, *A Comprehensive Treatise of Inorganic and Theoretical Chemistry* (1922). (A. E. H.)

HYDRODYNAMICS, the branch of hydromechanics which deals with the motion of fluids (*see* HYDROMECHANICS).

HYDRO-ELECTRIC POWER GENERATION: *see* ELECTRICAL POWER GENERATION: *Hydro-Electric Generation.*

HYDROGEN, a chemical element, appears to have been recognized by Paracelsus in the 16th century, but the first definite experiments concerning its nature were made in 1766 by H. Cavendish, who showed that it was produced by the action of hydrochloric or sulphuric acid on certain metals. (Symbol H, atomic number 1, atomic weight 1·008.) Cavendish called it "inflammable air," and it was confused with other inflammable gases, all of which were supposed to contain "phlogiston," the inflammable principle, until he showed that water was the only substance produced when hydrogen was burned in air or oxygen, and that, contrary to A. L. Lavoisier's views, no acid was formed. W. Prout's hypothesis, that all other elements were built up from atoms of hydrogen (1815), remained unsubstantiated till the work of F. W. Aston, over 100 years later, showed that the proton, *i.e.*, the hydrogen atom deprived of its electron, does in fact fulfil this function.

Hydrogen is found in the free state in some volcanic gases, in certain stars and nebulae, in some meteorites and in the atmosphere of the sun. Although it forms only about 0·001% of our air at ordinary altitudes, it may constitute a much larger proportion at very great heights. In combination, it is found as a constituent of water, in the gases from certain mineral springs, in many minerals, and in most animal and vegetable tissue. It may be prepared by the electrolysis of acidified water, by the decomposition of water by various metals such as sodium, and by the action of acids or caustic alkalis on many metals. The decomposition of steam by red-hot iron was first studied by H. St. C. Deville; the reaction takes place in a series of stages but may be expressed as $3Fe+4H_2O \rightleftarrows Fe_3O_4+4H_2$. The lower the temperature the larger the ratio of hydrogen to water, but actually the equilibrium is set up very slowly below about 800° C. Calcium hydride, or "hydrolith," prepared by passing hydrogen over heated calcium, is used as a portable source of the gas for filling balloons, etc., since water decomposes it with the production of a cu. metre of gas per kg. of solid. In the "silical" process, a mixture of silicon (usually as ferro-silicon) and caustic soda (sometimes mixed with slaked lime and then known as "hydrogenite"), is used for the same purpose: $2Si+2NaOH+3H_2O=Na_2Si_2O_5+4H_2$. Aluminium amalgam and water, or aluminium, caustic soda and a little mercuric oxide, are also used in the production of hydrogen. The gas obtained from hydrochloric or sulphuric acid and metals (usually zinc or iron) is often very impure, and if pure acids and pure metals are used, the reaction is very slow but may be accelerated by the addition of a copper or platinum salt, the acceleration in either case being due to the formation of, *e.g.*, a zinc-copper couple.

Hydrogen is often prepared technically by the action of steam on red-hot coke ($C+H_2O \rightleftarrows CO+H_2$ and $C+2H_2O \rightleftarrows CO_2+2H_2$; *see* CARBON), but unless the resulting "water-gas" is to be utilized as such, the oxides of carbon may be harmful. F. Bergius claims that if the water is kept as a liquid at 340° C by high pressure, and 1% of thallium chloride is mixed with the coke, only the second reaction takes place, *i.e.*, no carbon monoxide is formed. The hydrogen for synthetic ammonia (*q.v.*) in Claude's process is obtained by the action of steam on calcium carbide at a red heat: $CaC_2+5H_2O=CaO+2CO_2+5H_2$, and the gas is freed from carbon dioxide by cooling and expansion (*see* LIQUEFACTION OF GASES). Hydrogen of 97% purity is prepared on a large scale by the electrolysis of a 15% solution of caustic soda at 70° C.

Pure hydrogen is a colourless, tasteless, odourless gas of density 0·06947 (air=1), *i.e.*, 1 litre at 0° C and 760 mm. weighs 0·089873 gram (Lord Rayleigh; E. W. Morley). The liquid, which has a specific gravity of only 0·07, boils at −252·6° C, and the solid melts at −259° C. The gas obeys Boyle's law at low pressures (up to 150mm.) but at higher pressures it is not sufficiently compressible, the deviation being 0·1% at 0° C and 760mm.; its specific heat at constant volume is 2·39 at 0° C and that at constant pressure is 1·41 times as great. Hydrogen is only slightly soluble in water (about 2% by volume under ordinary conditions), but is fairly soluble in liquid air It diffuses rapidly through porous materials and also through some metals at a red heat. Palladium and some other metals absorb large volumes of the gas, especially if they are finely divided as in palladium black; it was once thought that a hydride, Pd_2H, was formed, but C. Hoitsema showed that the process was purely one of adsorption (*q.v.*); moreover, E. B. Maxted showed that the extent of adsorption was influenced by impurities in the metal, and J. B. Firth found that it depended on the proportion of crystalline and amorphous palladium.

Hydrogen burns with a pale blue, non-luminous flame, but it does not support combustion. Its mixture with air or oxygen is highly explosive, especially if the volume of oxygen is half that of hydrogen (compare $2H_2+O_2=2H_2O$), but H. B. Baker has shown that the perfectly dry, pure gases will not combine (*see* DRYNESS [CHEMICAL]). Hydrogen combines violently with fluorine even at −250° C, and its reaction with chlorine is greatly accelerated by sunlight or other actinic light; it combines with carbon at 1,200° C to give methane under certain conditions (W. A. Bone and H. F. Coward), but at higher temperatures increasing amounts of acetylene are formed, *e.g.*, at 3,000° C in the electric arc (M. Berthelot). The alkali and alkali-earth metals give hydrides when heated in a current of hydrogen, and these have the formulae NaH, CaH_2, etc.; that of barium (*q.v.*) is the least stable. Hydrogen is a powerful reducing agent, especially when occluded in palladium (*see* above) or when in the "nascent" state, *i.e.*, when generated in the presence of the substance to be reduced, as in the reduction of ferric salts to ferrous by the addition of pure zinc to the acid solution, or as in the use of sodium amalgam in organic reductions. Gaseous hydrogen is not so effective, although its efficiency is sometimes increased by pressure, as in the reduction of mercuric chloride solution under 100 atmos. pressure; in conjunction with colloidal palladium, it has been applied by C. Paal to many reductions in organic chemistry. P. Sabatier and J. B. Senderens effected a number of reductions by the use of hydrogen in the presence of finely divided reduced nickel at 150–200° C, and a similar method is used commercially in reducing liquid (unsaturated) fats to solid (saturated) fats. (*See* HYDROGENATION.) Hydrogen is used in the reduction of metallic oxides to the metal, in the oxy-hydrogen flame for welding, etc., and in the fixation of atmospheric nitrogen. (*See* NITROGEN, FIXATION OF.)

A triatomic form of hydrogen, H_3, has been described by G. L.

Wendt and R. S. Landauer by electric discharge in the dry gas at low pressures; this is only stable for one minute and can only be obtained to the extent of 0·02%; it is very reactive chemically, reducing potassium permanganate solution or sulphur instantly, and condenses to a liquid when cooled by liquid oxygen. The existence of this active hydrogen is disputed by F. Panetti (1927).

Hydrogen combines with oxygen to produce water (*q.v.*) in the ratio of 2·00288 volumes to 1 (at 0° C and 760° mm.) or 2·0154 parts to 16 by weight. A second oxide, hydrogen peroxide, H_2O_2, is well known, and a third, ozonic acid, H_2O_4, has been described by A. Baeyer and V. Villiger (*Berichte*, 1902, 35, p. 3038).

Hydrogen peroxide was discovered by L. J. Thénard in 1818; it occurs in small quantities in the atmosphere, probably owing to the decomposition of resins, turpentine, etc., in damp air and sunlight, for it is known to be formed in many chemical reactions involving very slow oxidation processes. (It seems possible that much of the so-called "ozone" in air is really hydrogen peroxide.) It is also formed in traces when metals undergo slow oxidation in air and water. When the oxy-hydrogen flame is directed on a block of ice or on solid carbon dioxide, the instantaneous cooling of the products of the high-temperature reaction allows no time for the decomposition of the hydrogen peroxide which is formed, and it may be detected in the products; moreover, it is possible that the peroxide is the primary product ($H_2+O_2=H_2O_2$), and that water is only a secondary product ($2H_2O_2=2H_2O+O_2$). Hydrogen peroxide may be prepared, admixed with persulphuric acids (*see* below), by the electrolysis of 75% sulphuric acid; it is more usually prepared from barium peroxide or its hydrate, $BaO_2,8H_2O$, by adding them to a solution of hydrochloric, hydrofluosilicic, phosphoric, or, best, sulphuric acid, or to ice-cold water through which carbon dioxide is being bubbled; after filtration, the solution can be concentrated by freezing or by careful evaporation under reduced pressure.

Peroxide of 99·93% purity was obtained by O. Maass and W. H. Hatcher by concentrating a 3% solution of ordinary purity to 30% in a special apparatus, then distilling it at 65° C under 10mm. pressure, whereby the content reached 85%, again concentrating in a special apparatus to 90%, and finally separating it by fractional freezing. The pure product is not very explosive, but methods involving the extraction of the peroxide from its aqueous solutions by ether give rise to traces of organic peroxides which render the product highly explosive. The pure material boils at 69° C under 26mm. pressure, and freezes at −1·7° C, but it can be greatly supercooled without freezing; the liquid has a specific gravity of 1·4633 at 0° C, is very slightly more viscous than water, and is apparently associated to about the same extent as water, *i.e.*, it may be $(H_2O_2)_2$ or $(H_2O_2)_3$ (*see* ASSOCIATION), but in solution it has a normal molecular weight for H_2O_2. The solid has a specific gravity of 1·644. The aqueous solution is practically neutral in its reaction, and readily decomposes on being warmed, giving off oxygen violently if heated too quickly; it is sold as "10 volume," 20 volume, 40 volume, or as "perhydrol," the first three being about 3,6, or 12% solutions (and so named because they give up 10, 20 or 40 times their volume of oxygen), and the last 30% or 100 volume. Pure aqueous solutions have a slight metallic taste, and, being slowly decomposed by traces of alkali from glass vessels, are better kept in waxed glass, or they may be stabilized by the addition of a mere trace of sulphuric acid or of certain organic substances, such as acetanilide. A stable solid compound with urea, CH_4ON_2,H_2O_2, has been patented; it behaves exactly like hydrogen peroxide when dissolved in water.

Hydrogen peroxide frequently behaves as a powerful oxidizing agent; thus lead sulphide (black) is oxidized to the sulphate (white), and hence oil paintings, in which the "white lead" has become blackened by conversion to sulphide, are cleaned by treatment with dilute solutions of the peroxide. It converts hydroxides of the alkaline-earth metals to sparingly soluble peroxides of the type $BaO_2·8H_2O$, and with caustic potash or soda it gives perhydroxides, $2NaO·OH·H_2O_2$ (these reactions may be regarded as evidence of its feebly acidic character). It liberates iodine somewhat slowly from potassium iodide, converts ferrous salts to ferric, and oxidizes many sulphur compounds to sulphates. It has been applied to some interesting oxidations in organic chemistry by H. J. H. Fenton (1900), who used it in the presence of ferrous sulphate as a catalyst, and also to the oxidation of certain sugars. On the other hand, some oxidizing agents undergo mutual reduction with hydrogen peroxide, giving free oxygen; thus, silver oxide gives the metal, $Ag_2O+H_2O_2=Ag+H_2O+O_2$, and potassium permanganate is rapidly reduced in acid solution, $2KMnO_4+4H_2SO_4+5H_2O_2=2KHSO_4+2MnSO_4+8H_2O+5O_2$. A reaction of interest, in that it is neither an oxidation nor a reduction, is B. Radziszevski's hydrolysis of nitriles to amides by means of hydrogen peroxide, *e.g.*, benzonitrile, $C_6H_5·CN$, gives benzamide, $C_6H_5·CO·NH_2$. With concentrated sulphuric acid hydrogen peroxide sets up an equilibrium involving permonosulphuric acid (Caro's acid, *see* SULPHUR):

$$H_2O_2+H_2SO_4 \rightleftarrows H_2SO_5+H_2O.$$

Hydrogen peroxide is catalytically decomposed by a great number of substances; thus, platinum black or colloidal platinum readily effects decomposition, and many similar cases have been studied by G. Bredig and others. Its constitution may be represented as either HO·OH or O:OH_2, the latter being more probable (J. W. Brühl); from its production in numerous cases of slow oxidation, it would appear that the oxygen molecule is first absorbed as a whole and not as atoms, and that the unstable peroxides subsequently decompose to give hydrogen peroxide; in fact, it is known that on exposure to air benzaldehyde gives perbenzoic acid as a primary product, $C_6H_5·CHO+O_2=C_6H_5·CO·O·OH$, and many such cases are recorded in organic chemistry, so a similar hypothesis is extended to inorganic chemistry. For further information, reference should be made to the works of J. H. Kastle and A. S. Loevenhart, *Amer. Chem. J.*, 1903, 29, pp. 397, 517; C. F. Schönbein, 1858–68; M. Traube, 1882–89; S. Tanatar, *Berichte*, 1903, 36, p. 1893; and H. E. Armstrong, *Proc. Roy. Soc.* (1886 *et seq.*).

The per-acids and their salts (*e.g.*, perborates, percarbonates, persulphates) are discussed under the relevant headings (*see* BORAX, CARBONATES, SULPHUR, etc.), and hydrogen peroxide is readily obtainable from some of these. It may be mentioned that in a rational classification of super-oxides, those which give rise to hydrogen peroxide would be styled *peroxides*, and all others *dioxides, tetroxides*, etc.

Hydrogen peroxide is used as a bleaching agent, where it is especially valuable because it leaves no harmful products, as an "antichlor" for removing excess of chlorine (or of sulphur dioxide) left after bleaching, as an antiseptic wash, and as a preservative; it also finds extensive use in analytical chemistry. It may be estimated by titration with potassium permanganate in acid solution (*see* above), or with ferricyanide in alkaline solution: $2K_3Fe(CN)_6+2KOH+H_2O_2=2K_4Fe(CN)_6+2H_2O+O_2$; or by addition to excess of arsenious acid in alkaline solution and titration of the excess by iodine. It may be recognized by the blue coloration it gives when added to a very dilute acidic solution of potassium dichromate; this is more marked if the solution is shaken with a little ether which extracts the coloured perchromic acid, $HCrO_4$, H_2CrO_6 or, more probably, $HCrO_5$. An orange-red colour, due to pertitanic acid, is similarly given with a solution of titanium dioxide in concentrated sulphuric acid. (A. D. M.)

HYDROGENATION. The treatment of a substance with hydrogen so that this combines directly with the substance treated. The term has, however, developed a more technical and restricted sense. It is now generally used to mean the treatment of an "unsaturated" organic compound with hydrogen, so as to convert it by direct addition to a "saturated" compound. (*See* CHEMISTRY: *Organic.*) Thus, from ethylene, ethane is obtained: $CH_2:CH_2+H_2=C_2H_6$.

Free hydrogen in the absence of a catalyst is too inert to take part in such a reaction. In the nascent state hydrogen reacts with certain easily reducible compounds; for instance, a ketone may be reduced to a secondary alcohol or a nitro-compound to an amine in this way. But the great increase in the number of known hydrogenation reactions during the present century is almost entirely due to the work of Sabatier and Senderens, Paal, Skita and others on the hydrogen-activating powers of nickel, cobalt, iron, cop-

per and the whole platinum group. (*See* CATALYSIS.)

Catalytic hydrogenation has provided an easy method of preparing many difficultly accessible substances, and several technical processes of considerable importance depend on it. (*See* CATALYSIS.) The most important of these is probably the hardening of oils, whereby a liquid, chemically unsaturated oil is converted, by the introduction of hydrogen, into a solid fat suitable for use in the soap, candle or edible-fat industries. To a lesser degree naphthalene, phenol and benzene are hydrogenated commercially to liquid products which are important solvents; and various terpene derivatives, notably menthol, are produced technically by catalytic hydrogenation. If the substance to be treated is a gas or vapour at the temperature employed, a mixture of the substance with excess of hydrogen is passed over the catalyst contained in a tube or distilling flask as shown in fig. 1.

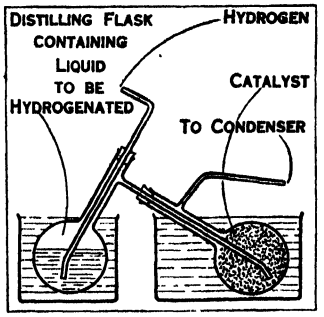


FIG. 1.—LABORATORY APPARATUS FOR CARRYING OUT HYDROGENATION

Hydrogen gas passes into liquid to be hydrogenated, which is then vaporized. The hydrogen-containing vapour then passes through a finely divided catalyst to the condenser

For the treatment of a non-volatile liquid, the simplest procedure is to bubble a current of hydrogen through the liquid mixed with a finely divided catalyst and contained in a distilling flask, which is heated in an oil-bath. This method is, however, wasteful, and it is often more convenient for non-volatile as well as for volatile liquids to use some form of shaker in which the volume of hydrogen absorbed can be read off, and the progress of the reaction thus followed. A laboratory apparatus of this type is shown in fig. 2. For some hydrogenations the process is preferably carried out under pressure. In this case an all-metal apparatus has to be employed.

Scope of Reaction.—The scope of the reaction is indicated by the following typical conversions:—

(*a*) Olefinic or ethylenic compounds are hydrogenated to the corresponding saturated or paraffinoid derivatives; thus propylene is reduced to propane: $CH_3{\cdot}CH{:}CH_2 \rightarrow CH_3{\cdot}CH_2{\cdot}CH_3$.

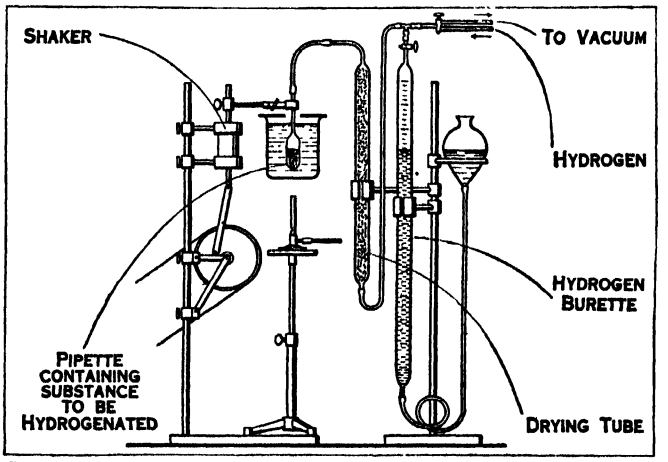


FIG. 2.—APPARATUS FOR FOLLOWING THE PROGRESS OF HYDROGENATION OF A NON-VOLATILE LIQUID, THE HYDROGEN BURETTE SHOWING HOW GREAT AN AMOUNT OF HYDROGEN HAS BEEN ABSORBED

(*b*) Acetylenic compounds are very easily saturated with hydrogen; indeed, in the case of acetylene itself, the reaction is sufficiently violent, if carried out in the gas phase, to cause considerable decomposition.

(*c*) Aromatic compounds are especially amenable to catalytic hydrogenation. Hexahydrobenzene is very difficult to prepare by other methods, yet Sabatier and Senderens found that it was readily formed on leading a mixture of benzene vapour and hydrogen over a nickel catalyst at 250° C; and it may also be obtained by shaking liquid benzene with hydrogen, in the presence of platinum or palladium. Naphthalene reacts similarly and is converted successively into tetrahydro- and decahydro-naphthalenes; and the reaction is general, as, for instance, hexahydrophenol (cyclohexanol) is obtained by the treatment of phenol. In hydrogenating ring compounds in the liquid phase, an increased pressure is of great advantage, especially if a nickel or other base-metal catalyst is used.

(*d*) Various unsaturated linkages, in addition to those between carbon atoms, are easily hydrogenated catalytically. From cyanides or isocyanides (R·C:N or R·N:C) primary or secondary amines ($R{\cdot}CH_2{\cdot}NH_2$ or $R{\cdot}NH{\cdot}CH_3$) are produced either by distillation with hydrogen over nickel or copper at 180–200° C, or by agitating in a liquid or dissolved form in the presence of a catalyst of the platinum group. The azo-group, —N:N—, is reduced to a hydrazo-group, —NH·NH—; thus azobenzene, on being shaken in alcoholic solution with hydrogen and a platinum catalyst, is quickly reduced to hydrazobenzene, which passes more slowly into aniline. Other non-carbon linkages, including those in heterocyclic rings, behave similarly: quinoline is reduced to decahydroquinoline by hydrogenation under pressure.

(*e*) The above reactions are processes of simple saturation. A recent process of a different type, but of great technical importance, which has been developed independently by Patart in France and by the Badische Anilin Fabrik in Germany, is the reduction of carbon monoxide to methyl alcohol (*q.v.*). (*See* PRESSURE CHEMISTRY.)

A carbonyl group in an organic compound is reduced similarly; thus acetone (*q.v.*) passes very easily into isopropyl alcohol, $(CH_3)_2CHOH$, in the presence of nickel, copper or a catalyst of the platinum group; or with nickel at a higher temperature, propane is obtained. Catalytic reduction is also applicable to a carbonyl group in a ring: thus, menthone is hydrogenated to menthol, or by further treatment to menthane. In place of the elimination of water, a hydrogen halide may be eliminated. Benzaldehyde is formed by hydrogenating benzoyl chloride in the presence of palladium black: $C_6H_5{\cdot}COCl + H_2 = C_6H_5{\cdot}CHO + HCl$.

Oxygen attached to nitrogen is easily replaced by hydrogen catalytically. The oxides of nitrogen themselves yield ammonia when passed with hydrogen over copper at 300–400° C. Aniline is obtained by shaking nitrobenzene with platinum in hydrogen at room temperature, whereas in alkaline solution azo- and hydrazobenzene are produced successively, with aniline as final product.

The catalytic reduction of sulphur compounds is of interest on account of the catalytically poisonous nature of many sulphur derivatives. Carbon disulphide is reduced at low temperatures to methylene dithiol, $CH_2(SH)_2$, and at about 450° C hydrogen sulphide is liberated. The latter reaction has been utilized by Carpenter and Evans as the basis of a process for the removal of sulphur from coal gas, the gas being passed over a nickel catalyst maintained at the temperature stated. The hydrogen sulphide is easily removed from the resulting gas by iron-oxide purifying boxes, and the deposit of carbon on the nickel is burnt off occasionally by treatment with air.

Dehydrogenation.—In certain cases hydrogenation is reversible, loss of hydrogen taking place on leading a hydrogenated body over a catalyst, usually at a relatively high temperature. Two important types of this reaction are the dehydrogenation of reduced benzene rings and the conversion of alcohols, by loss of hydrogen, to aldehydes or ketones. For the dehydrogenation of the reduced benzene nucleus, nickel may be used as a catalyst; but it is liable to induce side reactions. More satisfactorily, the hexahydrobenzene is distilled over palladium at 300–350° C. For alcohols, copper is a very suitable catalyst; for instance, dehydrogenation of ethyl alcohol to acetaldehyde, without the formation of appreciable quantities of subsidiary products, takes place on distillation of this compound over copper at 250–350° C; moreover, *iso*propyl alcohol yields acetone.

Preparation of Catalysts and of Hydrogen.—The catalysts employed may be divided into classes containing, respectively, the platinum metals (which for many reactions are active at room temperature) and the remaining elements of the

transition group, nickel, cobalt and iron, together with copper, all of which are usually used at 100–200° or at higher temperatures in the case of iron. The catalytic activity of the first class is, moreover, considerably higher than that of the second, 0·1% or less being a common proportion of a platinum catalyst, whereas the amount of nickel employed in practice is frequently about 1% of the weight of the substance to be hydrogenated. Platinum and palladium are the commonest catalysts of their group; and nickel is usually the most suitable base-metal catalyst, save for reactions in which it is too active. In such cases, copper is substituted for nickel.

If a platinum catalyst is required in its most active condition, it is prepared in a colloidal state, preferably in the presence of a protective colloid to prevent coagulation during use. Paal employs, as the protective colloid, sodium lysalbate, a product obtained by the action of alkalis on egg-albumen. For reactions in acid media, *e.g.*, in acetic acid solution, this protective colloid is replaced by that obtained by the partial hydrolysis of gluten by means of acetic acid (Kelber and Schwarz). In many cases a colloidal catalyst is not necessary. A simple method of preparing a non-colloidal platinum catalyst consists in suspending finely ground platinic oxide in the liquid to be hydrogenated, or in a suitable solvent, reduction to metal being effected either by bubbling hydrogen through the heated mixture or with hydrazine. Reduction by formaldehyde also gives a catalyst of very good activity.

In preparing a nickel catalyst, basic nickel carbonate is conveniently taken as the starting point; and a porous support, such as kieselguhr, is frequently used to increase the activity and stability of the nickel, the carbonate being precipitated on the support, and reduced with hydrogen at 300–320°. Iron and cobalt catalysts, although prepared similarly, are reduced at 450° C, and copper catalysts at 200° C. For the treatment of gases or vapours, asbestos or fragments of pumice soaked in nickel nitrate solution are heated just sufficiently to form black nickel sesquioxide.

In preparing catalysts, and indeed in carrying out the process of hydrogenation itself, great care must be taken to avoid contamination by catalyst poisons. Minute quantities of arsenic, sulphur, mercury, phosphorus and certain of their compounds are sufficient to inhibit completely the activity of the catalyst; and many of the early failures in hydrogenation were due to neglect of this precaution. Similarly, the hydrogen used should be free from hydrogen sulphide or carbon monoxide. A catalyst may also lose its activity by sintering caused by exposure to an excessive temperature, either in reduction or during use. Such supports as kieselguhr, etc., considerably reduce the liability to sintering; indeed, a supported nickel catalyst may be heated to 500° C without great loss in activity, whereas with unsupported nickel, temperatures higher than 350° C are to be avoided. In general, a relatively low temperature of reduction leads to a catalyst of relatively high activity.

The hydrogen required for the hardening of oils is prepared either electrolytically or by the alternate action of water gas and steam on iron, and subsequently purified from carbon monoxide and sulphur compounds. It is also usual to dry the hydrogen before use, since water vapour tends to cause the splitting of the oil into free fatty acid, which forms nickel soap with the catalyst and inhibits its action.

Technical Applications of Hydrogenation.—The oldest application of hydrogenation in industry is for the so-called hardening of oils (*see* above). The natural oils which can be hardened in this way consist of the glyceryl esters of various unsaturated fatty acids, the most important of which contain 18 carbon atoms and are transformed into stearic acid. Thus, with oleic acid:—

$$CH_3\cdot(CH_2)_7\cdot CH:CH\cdot(CH_2)_7\cdot COOH + H_2 = CH_3\cdot(CH_2)_{16}\cdot COOH.$$

Oleic acid — Stearic acid

Linoleic acid, which differs from oleic acid in containing two double bonds, also linolenic acid, which is present in linseed oil and contains three ethylenic bonds, and clupanodonic acid, the typical constituent of whale and fish oils, all pass similarly into stearic acid by absorption, respectively, of 2, 3 and 4 molecules of hydrogen.

For use in soaps or for the manufacture of candles, whale oil, various sorts of fish oil, linseed oil and cotton oil are of great importance, while ground-nut (arachis) oil and superior qualities of cotton oil are used in large quantities for the manufacture of artificial lard compounds and similar edible fats. On an industrial scale, the oil is usually first refined, to remove free fatty acids and albuminoid impurities, both of which tend to inhibit the activity of the nickel catalyst. The two refining processes commonly employed consist, first in gently agitating the oil with water containing the calculated amount of soda to neutralize the free fatty acid present, and in treatment of the oil with a small percentage of fuller's earth, to remove the albuminoid impurities.

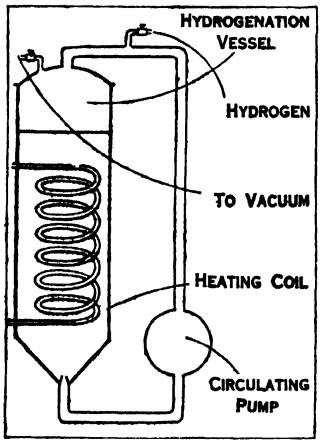


FIG. 3.—DIAGRAM OF WERK'S SCALE APPARATUS FOR HYDROGENATION FOR HARDENING OF OILS

A simple form of hydrogenation vessel of 5-ton capacity is show diagrammatically in fig. 3. It consists of a tall cylinder, containing the oil, which is maintained at the required temperature by means of the steam coil. The charge is subjected to a vacuum for several minutes to remove air and any traces of moisture that may be present in the oil; hydrogen is subsequently admitted under a pressure of several atmospheres and circulated through the oil by means of the pump shown, fresh hydrogen being supplied continuously to replace that absorbed by the oil. In order to increase the degree of contact between hydrogen and oil, baffles may be introduced into the reaction vessel, or the liquid mixture of oil and catalyst may be sprayed into the gas phase. Alternatively the oil is allowed to flow slowly over a stationary catalyst in a hydrogen atmosphere.

The period of reaction varies from 1 to 4 hours. The process of hydrogenation is appreciably exothermic, *i.e.*, the temperature of the charge usually rises during the course of the conversion, even if the passage of steam through the heating coil is discontinued. When the required volume of hydrogen has been absorbed, the mixture of oil and catalyst is run out into a closed tank and filtered in a steam-heated filter press. The catalyst thus recovered is used for a fresh charge of unhardened oil, while the hydrogenated oily filtrate is allowed to solidify. Hardened oil is a white, neutral, solid fat, having a degree of hardness and a melting point dependent on the volume of hydrogen introduced. For complete saturation, cotton oil requires about 3,500cu.ft. of hydrogen per ton, but considerably less is usually employed.

Nickel catalyst is prepared on a large scale in a manner similar to that already described, from solutions of nickel sulphate and of sodium carbonate in the presence of kieselguhr (reduction temperature 300–350° C). The easily oxidized, and often pyrophoric, catalyst is allowed to cool in hydrogen, and a current of carbon dioxide is then passed through the reduction chamber; or the hydrogen may be displaced by carbon dioxide while the catalyst is still hot. Nickel catalyst which has been protected by carbon dioxide in this way is sufficiently stable, when cold, to be handled for a short time in air without losing its activity. It is usually mixed with enough oil to form a paste, in which form it can easily be stored and added, as required, to charges of oil which are to be hardened.

For the technical hydrogenation of aromatic compounds a somewhat higher gas pressure, for instance 15–20 atmospheres, is usually employed, the reaction temperature being about 200° C. It is stated that the capacity of the plant of the Tetralin Co. at Rodleben, Germany, exceeds 100 tons of tetrahydro- and decahydro-naphthalene a day. The products are liquids which are used as solvents and as turpentine substitutes. The principal diffi-

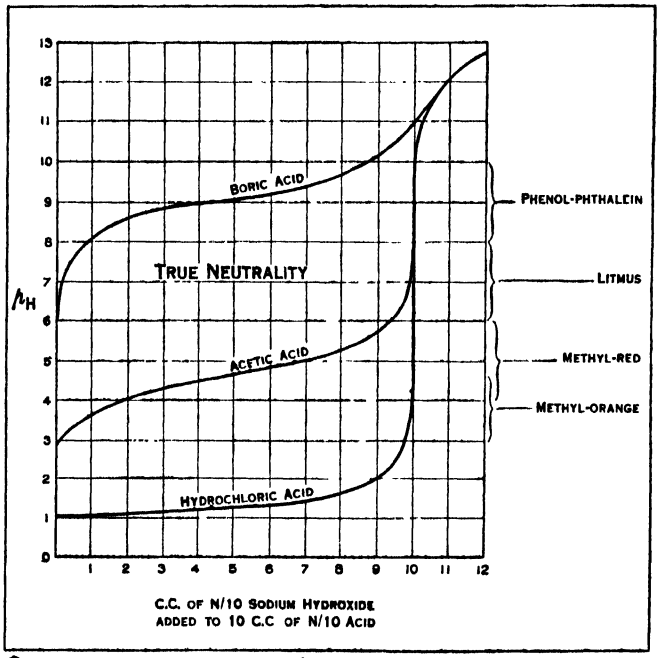
culty, in the case of naphthalene, lies in the presence of a small trace of a cyclic sulphur compound, difficult to separate from commercial naphthalene, which rapidly poisons the nickel catalyst employed. In order to eliminate this, the crude naphthalene is refluxed over metallic sodium or heated in contact with a finely divided metal such as iron, when the sulphur compound is decomposed.

Acetone is hydrogenated on a large scale under similar conditions, save that the temperature should not be allowed to exceed 120° C—a lower temperature still is preferable—in view of the reversibility of the hydrogenation. Nickel is a suitable catalyst, and the acetone is maintained by means of an increased pressure of hydrogen in the liquid state at the temperature employed.

(E. B. M.)

HYDROGEN-ION CONCENTRATION. If dilute solutions of, say, hydrochloric acid and acetic acid are examined, it is found that, whereas the former possesses to a marked degree all the properties generally associated with acids, the latter possesses them only to a very limited extent. On the other hand, if each of these solutions contains one gram-equivalent of its acid (36·5 grams of hydrochloric acid and 60 grams of acetic acid) they will both require the same amount of alkali for neutralization (*e.g.*, 40 grams of sodium hydroxide), and are therefore apparently equally acidic.

The reason for this seeming paradox is that, whilst hydrochloric acid is almost completely dissociated (*see* DISSOCIATION) into hydrogen ions and chlorine ions $HCl \rightarrow H^{\cdot} + Cl'$, the acetic acid



CURVES SHOWING CHANGES OF p_H DURING NEUTRALIZATION OF ACIDS BY A STRONG BASE

Hydrochloric, acetic and boric acids are typified respectively of a strong, a weak and a very weak acid, and the steepness of the curves decreases in this order. The addition of 10 C.C. of sodium hydroxide should give an exactly neutral solution ($P_H=7$), but this is the case only for the strongest acid: for the other two, the solution is alkaline ($P_H>7$).

An indicator is suitable for a particular titration only if it shows its colour change, which occurs over the P_H range indicated by the bracket at 10 C.C. Hence we see that: (1) for hydrochloric acid any of the four indicators is suitable (methyl-orange least so); (2) for acetic acid phenol-phthalein is best (litmus less so); and (3) for boric acid none of the indicators is suitable

is only very feebly dissociated $C_2H_4O_2 \rightleftarrows H^{\cdot} + C_2H_3O'_2$. Since the characteristic properties of acids depend largely on the hydrogen ions, the superiority of hydrochloric acid in this respect is intelligible. The equality in the neutralizing powers is due to the fact that the acetic acid exists in equilibrium (expressed by $\rightleftarrows$ above) with the hydrogen and acetate ions, so that, as fast as hydrogen ions are neutralized by alkali, more acetic acid dissociates in order to maintain the equilibrium (*see* CHEMICAL ACTION) and so supplies more hydrogen ions. Neutralization is therefore a measure, not only of hydrogen ions in solution, but also of the potential source of them (undissociated acid molecules). Now true neutrality is represented by the condition of pure water, which dissociates to such a feeble extent as to give only 10^{-7}, of an equivalent of hydrogen per litre (at 25° C) and the same concentration of hydroxyl ions: $H_2O \rightleftarrows H^{\cdot} + OH'$. We can therefore express the concentration of hydrogen ions (expressed in gram equivalents per litre) as $[H^{\cdot}] = 10^{-7}$, in a neutral solution, and similarly for hydroxyl ions. The product of these two concentrations is thus 10^{-14}; and in any aqueous solution, acidic or alkaline, at 25° C the law of mass action (*see* CHEMICAL ACTION) is fulfilled in that $[H^{\cdot}] \times [OH'] = 10^{-14}$.

Many liquids of biological importance, such as soil extracts, blood, cultures, milk, etc., are very nearly neutral as judged by ordinary criteria, but they are very sensitive to extremely slight changes in acidity or alkalinity. Titration of these solutions gives no clue to the degree of acidity, both because it is so slight and because of the reasons already given.

For the adequate study of such solutions, it is convenient to have a less cumbersome method of denoting acidity than the foregoing, and for this purpose the symbol p_H has been adopted, such that $p_H = -\log[H^{\cdot}]$. The neutral solution is therefore of $p_H = 7$; an acidic solution has a smaller p_H, and an alkaline solution a larger p_H. The acidity of, *e.g.*, saliva is more neatly expressed as $p_H 6{\cdot}9$ than as $[H^{\cdot}] = 10^{-6{\cdot}9}$ or $1{\cdot}26 \times 10^{-7}$, and the feeble alkalinity of blood as p_H 7·35 than as $3{\cdot}6 \times 10^{-8}$. Similarly, decinormal solutions of hydrochloric acid and caustic soda have, respectively, p_{H1} and p_H 13 (approx.). (A. D. M.)

DETERMINATION OF HYDROGEN-ION CONCENTRATION

ELECTROMETRIC METHODS

The use of an electrometric method, consisting of the measurement of an electrical potential, for the determination of hydrogen-ion concentrations was first made possible by means of a relation established by Nernst, which exists between the solution pressure of an element when surrounded by a liquid and the osmotic pressure of the ions already in solution. (*See* SOLUTIONS.) According to this theorem an element, such as a metal, when in contact with an ionizing medium, such as water, has a definite tendency to pass into solution in the form of ions or electrically charged particles. When the ions carry a positive charge, an equivalent negative charge remains on the surface of the element. An electrical double layer is consequently formed between the surface of the metal and the oppositely charged free ions in the solution. The process of ionic solution will proceed until the potential difference in this double layer reaches a certain critical value which is determined by the specific character of the metal. Further ionization is then arrested by the electrostatic charge of the ions in solution, and the potential difference between metal and solution gives a measure of the ionizing tendency. (*See* ELECTROLYSIS.)

It should be noted that the amount of metal which passes into solution to produce this equilibrium condition is ordinarily below the limits of the amount that can be detected by chemical means. If the metallic ions are already present in the solution in the form of dissociated salt, further ionization of the metal is opposed not only by the electrostatic layer but also by the osmotic pressure of the ions already present. In this case metal will dissolve or ionize until the potential of the electrostatic layer formed equals the excess of its solution pressure above the osmotic pressure of the ions. With metals such as copper and the noble metals which normally acquire a positive charge in contact with an electrolyte, the solution pressure of the metal is so low that it is below the osmotic pressure of the ions given by the smallest trace of salt of that metal in solution. With these metals deposition occurs of metal ions present in the solution, whereby the electrode becomes positively and the electrolyte negatively charged, until the potential difference balances the excess of osmotic pressure above the solution pressure. If an electrode of platinum or other noble metal be surrounded in its upper part by hydrogen, while the lower part is immersed in an electrolyte, the hydrogen which dissolves to a certain degree in the metal will tend to ionize and pass into the solution as hydrogen ions. A definite potential is thus produced which is determined solely by the pressure of

hydrogen in the surrounding atmosphere and by the concentration of hydrogen ions already in solution.

General Theory of the Hydrogen Electrode.—The first amounts of hydrogen are dissolved by platinum according to the distribution law that would prevail if the dissolved gases were in the atomic state, *i.e.*, $\sqrt{p}/c' = \text{constant}$, where c is the concentration of gas in the metal and p its pressure in the surrounding atmosphere. The quick saturation of the surface is followed by a slow diffusion into the interior. Palladium, which dissolves 500 times to 800 times its volume of hydrogen, is not very suitable for a hydrogen electrode, probably because the high solubility, conjoined with a high rate or diffusion, makes it impossible to set up a quick surface saturation with small quantities of hydrogen. Platinum, which dissolves one to ten times its volume, is the most satisfactory. The surface is greatly increased and its adsorptive capacity thereby raised by platinizing, or covering with finely divided platinum. Gold, which dissolves about half its volume, probably fails owing to its having too low an adsorptive capacity. It is, however, suitable for underlying material; gold or gold-plated electrodes, afterwards platinized, iridized or palladized, have been found satisfactory. The reaction occurring between the platinum and the gaseous hydrogen may be represented by the equation $H_2 \rightleftarrows 2H$, and that between the platinum and the electrolyte by the equation $H \rightleftarrows H^{\cdot}$. In order to obtain quick saturation of the electrode, it is necessary that much of this should be in contact with the gas phase.

According to the relation derived by Nernst, the potential E between two hydrogen electrodes immersed in solutions of hydrion activities or concentrations h_1 and h_2 is proved to be

$$E = \frac{RT}{nF} \log_e \frac{h_1}{h_2}$$

where R = gas constant = 8·313 joules, T = absolute temperature, n = valency of ion and F = the faraday = 96,500 coulombs. Thus, $E = 0{\cdot}0001984\ T \log h_1/h_2$, and at $T = 273°$, 291° and 298° respectively the factor $RT/nF = 0{\cdot}0541$, 0·0577 and 0·0591. The activity of hydrion from a "strong" acid such as HCl is very nearly equal to the total concentration, if this is low.

The normal potential on the hydrogen scale is defined as the potential of a hydrogen electrode in a solution of hydrion concentration h_2, measured against a hydrogen electrode in a solution of normal hydrion concentration or $h = 1$, that is:

$$E_H = 0{\cdot}058 \log 1/h_2 = -0{\cdot}058 \log h_2 \text{ volts.}$$

At 18° C in practice measurements are usually made against another standard half-cell usually the saturated or normal KCl-calomel electrode, the absolute potentials of which have been more or less closely defined against various kinds of null potential electrodes. Sörensen measured the e.m.f. of the combination

$$H_2Pt\ 0{\cdot}1\ HCl \parallel 0{\cdot}1\ KCl,\ H_gClH_g$$

at 18° C with diffusion potential eliminated. Assuming that the HCl is 91·7% dissociated, it is calculated that the potential of the normal hydrion hydrogen electrode against the decinormal KCl calomel is 0·3380 volt (calomel positive). If the e.m.f. of a hydrogen electrode against the decinormal KCl-calomel electrode is E_x, then

$$p_H = \frac{E_x - 0{\cdot}338}{0{\cdot}0577} \text{ at } 18° \text{ C.}$$

With a saturated KCl-calomel cell, the potential of the hydrogen electrode with normal hydrion concentration has been estimated as 0·2503 volt at 18° C. Consequently with this standard, we have

$$p_H = \frac{E_x - 0{\cdot}250}{0{\cdot}0577}.$$

(*Cf.* E. B. R. Prideaux, *J. Sci. Instr.*, 1924–25, ii., pp. 33 and 113.)

Experimental.—The hydrogen employed must be free from impurities, since compounds such as hydrogen sulphide or arsenide, which may be present in the gas prepared from ordinary zinc and acid, have a poisoning action on the platinum. The hydrogen is most suitably obtained from an electrolytic generator or from cylinders of the compressed gas. The potential of a hydrogen electrode against its solution becomes more positive with decrease in the pressure of the hydrogen (or of its partial pressure in a mixture of gases). The magnitude of the correction to be applied may be calculated by considering the maximum work involved in the transfer of ½ mol. of hydrogen through atoms and ions from p_1 to p_2; this is $dE = RT/2F\ ln\ p$ atmospheres. If hydrogen is saturated with water vapour of vapour pressure p' in mm, the total pressure being p, the correction becomes

$$\log \frac{p - p'}{760 - p'}.$$

With an enclosed electrode of the continuous hydrogen type, the general arrangement of the electrodes is shown in fig. 1.

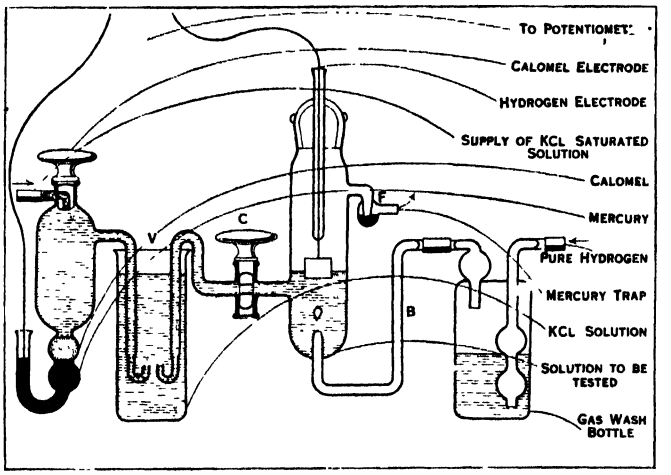


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FIG. 1.—APPARATUS FOR EXPERIMENTAL DETERMINATION OF HYDROGEN IONS

Hydrogen gas is bubbled through the solution to be tested at the rate of one bubble per second, until a constant potential is given by the electrode

A strip of platinum foil is welded to a short length of platinum wire which is then sealed into the glass tube and makes contact with a drop of mercury inside, or preferably, a copper wire is fused or soldered on this end. To prepare for use the electrodes are first cleaned by immersion in hot chromic acid for five to ten minutes and then well washed with distilled water. They are then coated electrolytically with "platinum black," by surrounding with an electrolyte consisting of

Platinum chloride	3 grams
Lead acetate	0·02 to 0·03 grams
Distilled water	100 cu.cm.

and electrolysing with the current from a 2 volt accumulator, so that a moderate evolution of gas occurs. The current is reversed every half minute for 15 minutes or longer. The electrodes are then placed in a solution of ferrous and ferric salts acidified with sulphuric acid, in order to eliminate occluded chlorine, and the electrodes are thoroughly washed with distilled water (they must always be kept in distilled water when not in use, as drying spoils the platinum black). To prepare for measurement the hydrogen electrode vessel is filled with the solution to be tested keeping C closed. In order to saturate with water vapour the gas is passed through a wash bottle filled with the same solution and connected with the rubber tubing to the bent tube B on the electrode vessel.

The gas, if not electrolytically generated, must first be passed through wash bottles containing potassium permanganate solution, and then through a saturated solution of mercuric chloride before passing through the electrode vessel through the tube B. C is opened and some of the solution displaced until it reaches the end of the side tube. C is then closed. A saturated calomel electrode is most conveniently used as the second electrode, and saturated potassium chloride for making the junction. The side tubes of the two electrodes dip into a vessel V containing saturated potassium chloride. Hydrogen is passed through the hydrogen electrode at the rate of a bubble per second for about three hours,

escaping through the trap F, until absorption by the platinum ceases and a constant potential is given by the electrode. Modifications in the type of electrode employed have been applied for special purposes. Point electrodes are used for giving quick readings with a fixed volume of hydrogen without stirring or shaking, and in cases where only small volumes of solution are available. The use of an oscillating electrode vessel has been applied in order to accelerate the attainment of equilibrium.

Measurements of the potential are made by the use of a suitable type of potentiometer, the readings of which are calibrated by means of a standard cell. If the solution to be measured has a low resistance a pointer type of galvanometer with a sensitivity of 2 micro-amperes for 1° may be used, but for general purposes a more sensitive portable mirror galvanometer with combined lamp and scale is more suitable. The hydrogen electrode is not applicable to solutions containing any material which interacts with the hydrogen on the surface of the platinum, or which exert a "poisoning" action on the platinum. The action of the electrode is in this way vitiated by the presence of ammonium salts, nitric acid, nitrous acids and other reducible substances, salts of metals more noble or electropositive than hydrogen, unsaturated organic bodies such as acrylic, crotonic, fumaric and maleic acids, also chloroacetic and similar acids, and sulphur dioxide and carbon dioxide at high concentrations. With these exceptions the hydrogen electrode can be applied to all strong and weak inorganic and organic acids, either in the free state or partly neutralized, and in so-called *buffered solutions* (where the hydrion concentration is held approximately constant), the e.m.f. is well defined on the alkaline side of neutrality from p_H 7 to 12.

Quinhydrone Electrode.—This system depends on the equilibrium which is attained through the tendency of quinol, formed by the dissociation of quinhydrone, to change into quinone with the liberation of free hydrogen,

$$\underset{\text{(Quinol)}}{C_6H_4O_2H_2} \rightleftarrows \underset{\text{(Quinone)}}{C_6H_4O_2} + H_2$$

This hydrogen at an estimated pressure of 10^{-24} atm. is liberated on a platinum wire or foil immersed in a solution containing quinhydrone, and develops instantaneously an e.m.f. of a magnitude determined by the hydrion concentration of the solution. On account of this extremely low though constant pressure of hydrogen, the mechanism is not disturbed by the presence of reducible substances which cannot be measured accurately by the usual hydrogen electrode.

The quinhydrone electrode has proved to be of particular value for measurements of substances which have a poisoning effect on the hydrogen electrode, while with physiological fluids its measurements are not disturbed through the displacement of carbon dioxide by hydrogen. For other purposes, such as electrometric titrations, advantages it possesses are due to the equilibrium potential being set up more rapidly than with the hydrogen electrode, while no outside supply of hydrogen is required. The system cannot be employed accurately, however, with strong alkaline solutions, or those with certain organic compounds which react with the quinhydrone and modify the potential. In many of these instances, however, advantage may be taken of the slowness of the reaction with the quinhydrone, and reliable determinations may be made shortly after mixing the substances and admitting to the electrode cell. The arrangement of the electrode system is shown in fig. 2.

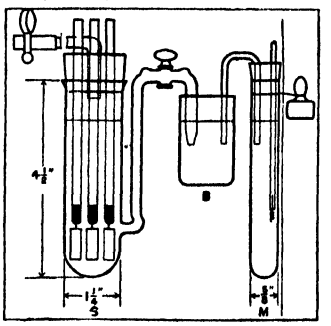

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FIG. 2.—QUINHYDRONE ELECTRODE APPARATUS

The liquid to be measured is placed in tube M, to which is added 0.04–0.05 gm. quinhydrone per 10 C.C. of solution. A platinum wire is then inserted and a potential difference is immediately developed proportional to the hydrogen-ion concentration of the solution

The liquid to be measured is placed in the tube M. For accurate work with liquids nearly neutral this tube needs to be of special resistance glass. A quantity of 0·05–0·05 grams of specially prepared quinhydrone per 10 cu.cm. of solution is added and, after inserting a glass stopper, the contents of the tube are shaken until the quinhydrone is dissolved. A platinum wire 4½ in. long and 0·3 mm. diameter wound as a spiral and sealed in a glass tube is then inserted, when a potential difference is instantly developed at the junction of the metal with the electrolyte and, as with the hydrogen electrode, the potential is proportional to the hydrogen ion concentration of the solution. The amounts of quinhydrone specified will give a saturated solution. Only a small influence on the potential is exerted by the actual concentration of the quinhydrone, however, unless selective adsorption or interaction of one of its components occurs.

Measurement is made by employing as a second electrode, either a standard calomel electrode, or else a second quinhydrone electrode surrounded by a buffered standard electrolyte of known hydrogen ion concentration. The solutions around the two electrodes are connected by tubes to a vessel B containing concentrated potassium chloride solution, whereby boundary potentials are minimized or eliminated. Diffusion is hindered and other advantages gained by having the potassium chloride electrolyte present in the connecting tubes set in an agar gel medium. The potential difference between the electrodes of the cell thus formed is determined by a potentiometer as described for the hydrogen electrode. The potential developed by the quinhydrone electrode with any given electrolyte is, at 18° C, 0·7044 volt more positive than the usual hydrogen electrode. When using a saturated potassium chloride-calomel standard, the value of the hydrion concentrations is, at 18° C, obtained from the equation:

$$p_H = \frac{0{\cdot}454 - E}{0{\cdot}0577} = 7{\cdot}87 - \frac{E}{0{\cdot}0577}$$

where E is the measured potential.

An alternative standard electrode may be formed from a second quinhydrone solution in presence of the buffer mixture 0·01N HCl+0·09 N KCl. With this standard, the relation between p_H and E, is at 18° C given by the equation

$$p_H = 2{\cdot}03 + \frac{E}{0{\cdot}0577}.$$

The general relation for other temperatures is given by the expression:

$$p_H = 2{\cdot}03 + \frac{E}{0{\cdot}000198\,T}.$$

The p_H value of the standard electrode is 2·03 and for p_H values of the solution under measurement higher than this, the potential of the standard will be positive relatively to the measuring electrode, while for p_H values lower or more acid than this the potential will be negative. It follows from the above relation that at 18° C a change in p_H of 0·01 causes a displacement of the potential of 0·58 millivolt. With regard to temperature control, to avoid an error greater than 0·01 p_H, a temperature constancy of ±2° C will suffice if the solution to be measured has a p_H value of 3, whereas with a p_H value of 9, it is necessary for the same accuracy to regulate the temperature to within ±0·4° C.

In measurements by the above procedure in concentrated salt solutions, such for instance as those generally employed in the electro-deposition of metals, deviations of potential from the calculated value may occur on account of the so-called *salt error*. These may generally be obviated by adding, together with the quantity of quinhydrone which is slightly in excess of the amount required to saturate the solution, an excess also of either quinone or quinol. With quinone a quantity of 0·1 g. per 10 cu.cm. of solution is necessary to saturate an aqueous solution, while the solubility of quinol is about 1 g. in 10 cu.cm. With these quinone-quinhydrone and quinol-quinhydrone cells, the single electrode potentials are different from those of the quinhydrone electrode, but if the same medium is employed around both electrodes, the combined potential of the cells is the same function of the hydrogen ion concentration as is given in the above equations. In selecting the system to be employed, it may be taken that accurate

values are as a rule indicated by constancy of potential over a long period.

Measurements in Acetone-water Solvents.—A good solvent for a large number of compounds which are insoluble in water is given by a mixture of acetone and water containing 10 cu.cm. of water in 100 cu.cm. of the mixture. In this medium a solution containing 0·005N HCl+0·005N KCl is found to have a p_H of 2·7 at 18° C. If a quinhydrone electrode composed of this electrolyte is employed as a standard, the p_H value of the solution under measurement is given by the equation

$$p_H = \frac{E}{0{\cdot}0577} + 2{\cdot}7.$$

The apparatus is connected as illustrated in the figure. For the purpose of accurate measurements the standard electrode vessel S is provided with three electrodes each containing platinum foil ¾ in.×¾ in.×0·05 mm. thick, curled round to about ¼ in. diameter. As a precautionary measure readings may, in this way, be taken with each of the multiple electrodes in turn. Only contamination of the platinum leading to error, such as by traces of mercury from the tube above, is thus detected by its disagreement with the remaining electrodes. A 3·5N solution of potassium chloride is employed for filling the intermediate connecting bath B.

Glass Electrodes.—The use of glass electrodes for the determination of hydrogen-ion concentrations has been developed by P. M. T. Kerridge (*J. Sci. Instr.*, 1926, iii., p. 404). This method depends on the principle that, if two solutions of different hydrogen-ion concentrations are separated by a thin glass membrane, a difference of electrical potential will be found between the two sides of the glass which is proportional to the ratio of the logarithms of the hydrogen-ion concentrations on the two sides, according to the Nernst formula. The glass behaves as a solid electrolyte though of a very high resistance, but the mechanism of the reactions is not fully understood. Many types of glass are suitable for this work, excepting those rich in borosilicate. A German soft soda glass has been most frequently used. The membrane should be about 0·025 to 0·030 mm. in its thinnest part and is preferably formed as a bulb inside another larger and thicker bulb. Contact with the solutions in the glass electrode is made by means of two calomel electrodes opposed to one another.

The general arrangement of a convenient type of apparatus is shown in fig. 3. An earthed metal stand is fitted with a rack and

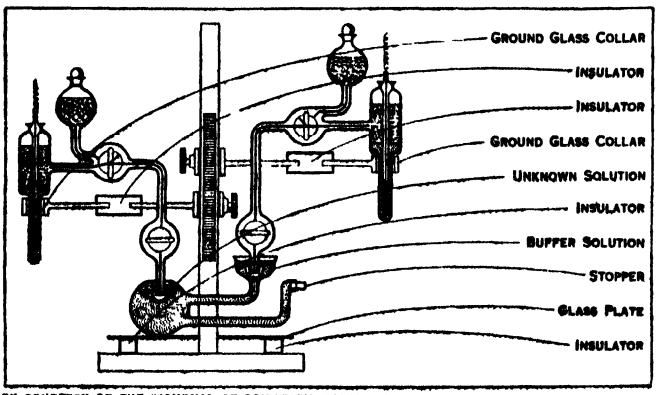

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FIG. 3.—SKETCH SHOWING STRUCTURE OF GLASS ELECTRODE APPARATUS
This method avoids the use of any additional material, and depends on the difference of potential developed on the two sides of a thin glass membrane by liquids of different hydrogen-ion contents

two pinions so that the levels of the electrodes may be easily altered at will. The calomel electrodes are held in sleeves ground to fit, to which are attached short lengths of glass rod fixed into insulating blocks of amberite or orca, these being similarly fixed to the stand. Diffusion of potassium chloride into the solutions in the glass electrode is prevented by small ground caps fitted over the tips of the calomel electrodes, and the two taps ungreased in the middle race are turned off while the measurements are being made. The resistance thus introduced is not great compared with that of the glass membrane. The glass electrode is placed on a glass plate carefully insulated by amberite or orca from the base of the stand.

As the resistance of the glass membrane is very high, it is necessary to use an electrometer as null point indicator in the potentiometer circuit. The most suitable potentiometer is that of Lindemann. It is necessary to take precautions to shield the apparatus from electrostatic charges and to ensure that the insulation resistance in the part of the circuit between the glass electrode and the electrometer is especially great. The buffer solution to be employed on the inside of the membrane vessel may conveniently be a mixture of potassium phosphates of about p_H 7. The electrode may be standardized by replacing the unknown solution by a N/20 solution of potassium hydrogen phthalate, and measuring the potential obtained. The p_H of this solution is 3·97 at 18° C. If E_s is the potential found with potassium hydrogen phthalate in the electrode, and E_x with the unknown solution, then the p_H value of the unknown solution p_{Hx} is given by the relation

$$p_{H_x} = 3{\cdot}97 + \frac{E_s - E_x}{0{\cdot}0577} \text{ at } 18° \text{ C.}$$

This method has been applied largely in physiological research for determinations of hydrogen ions in fluids with which accurate measurements cannot be made by other types of electrodes.

Bearing of Hydrogen-Ion Determinations.—The importance of hydrogen ion determinations is due to the predominating part these ions play in many varied classes of chemical reactions. The hydrogen ion concentration is thus the main determining chemical feature in electrolytic phenomena, physiological reactions and vital processes, such as fermentation, digestion and respiration. The far-reaching influence of this ion in these processes is associated with its unique constitution, the hydrogen ion consisting of one positively charged atomic nucleus, unaccompanied by any electron and is thus the smallest known positively charged particle. The hydrogen ion has thus the smallest atomic radius of any material structure and through the absence of any accompanying negative electrons is able to approach other negatively charged particles more closely than any other positive ion. As the attraction between ions vary inversely as the square of the distance, it follows that the affinity of negative ions for the hydrogen ion will be greater than that for any other positive ion. The hydrogen ion consequently possesses a high degree of absorbability by other molecular groups and this property facilitates chemical interactions. (J. N. P.)

INDICATOR OR TITRIMETRIC METHODS

A very large number of indicators (*q.v.*) used in determining acidity owe their utility to the fact that they undergo a change of colour within a certain range of hydrogen-ion concentration and can therefore be used to determine this concentration. Thus, phenolphthalein is colourless in solutions having a hydrogen-ion concentration stronger than 10^{-8}, pink at 10^{-9}, and deep red at 10^{-10}, or $p_H = 8$, $p_H = 9$ and $p_H = 10$ respectively. The causes of the colour changes cannot be discussed in detail, but it may be said that, as the phenolphthalein is a very weak acid, it exists almost entirely as undissociated molecules in the relatively more strongly acidic (less alkaline) solution, but commences to ionize, owing to salt formation, as the solution becomes more alkaline, and is fairly fully ionized in the most alkaline solution. Concurrently, the ion undergoes a change of structure from the colourless phenolic to the coloured quinonoid form (*see* COLOUR AND CHEMICAL CONSTITUTION), and it is to this cause, rather than to any difference between the colours of undissociated molecules and of ions (as Ostwald supposed), that the colour change is due. Similar explanations apply to all indicators used in acidimetry, for they are all either weak acids or weak bases and are capable of undergoing such tautomeric changes so rapidly as to give their indications instantly.

The process of neutralization of a *strong* acid by a *strong* base will be followed. If we take, say, 10 c.c. of a decinormal solution of hydrochloric acid, it has initially a hydrogen-ion concentration of 10^{-1} (approx.), *i.e.*, $p_H = 1$; the gradual addition of a deci-

normal solution of, say, caustic soda, brings about a diminution of hydrogen-ion concentration in the solution. When 9 c.c. have been added the concentration of free acid will be reduced to $\frac{1}{100}$ *i.e.*, $p_H = 2$, but thereafter the curve begins to undergo a rapid change, passes through the neutral point (p_H 7) when 10 c.c. have been added, and starts to reproduce a precisely similar curve on the alkaline side. It is obvious, therefore, that in titrating a strong acid by a strong base (or vice versa) any indicator which shows its colour change between p_H 4 and p_H 10 will be satisfactory and give a titration of about 9·95–10·05 instead of the theoretical 10 c.c. (provided the solutions are not too dilute). Hence methyl-orange (range 3·0–4·5), methyl-red (4·0–6·0), litmus (6·0–8·0), or phenolphthalein (8·0–10·0) will be equally satisfactory. The case is far otherwise, however, if one has to titrate a *weak* acid by a *strong* base, for, as the curve for acetic acid shows, an indicator has to be used of the p_H range 7–10 and, of the above four, only phenolphthalein fulfils this condition. A very weak acid, such as boric acid (*q.v.*) cannot be titrated as such, because its titration curves show no perceptible change at the theoretical neutral point.

Similar considerations apply *mutatis mutandis* to the titration of strong alkalis by strong or weak acids, and of weak alkalis (*e.g.*, ammonia) by strong acids; thus, the titration of ammonia by, *e.g.*, hydrochloric acid, is the reverse of the sodium hydroxide–acetic acid titration, and an indicator, showing changes in the range p_H 4–7, such as methyl-orange or methyl-red, is therefore suitable. Also, the direct titration of extremely weak bases, such as urea, is as impossible as that of boric acid. It will be clear, moreover, that the titration of weak bases by weak acids is impracticable by these methods.

Polybasic acids sometimes have their successive stages of dissociation so far apart, and therefore so well defined, that if they are in suitable p_H ranges they can be detected by the use of two indicators. Thus, phosphoric acid has a first dissociation constant $K_1 = [H^+][H_2PO_4']/[H_3PO_4] = 1{\cdot}1 \times 10^{-2}$ and a second, $K_2 = [H^+][HPO_4'']/[H_2PO_4] = 1{\cdot}95 \times 10^{-7}$; so it behaves in the first stage as a strong acid, and in the second as a weak acid; methyl-orange therefore indicates completion of the stage $H_3PO_4 + KOH = KH_2PO_4 + H_2O$, and phenolphthalein enables the stage $KH_2PO_4 + KOH = K_2HPO_4 + H_2O$ to be detected. The third stage of dissociation of the acid is so feeble ($K_3 = 3{\cdot}6 \times 10^{-13}$) that the titration is impossible.

In many liquids of biological importance (soil extracts, blood sera, cultures, etc.) there are complex mixtures of weak acids, weak bases, amphoteric electrolytes (*e.g.*, gelatin and proteins, which function either as weak acids or as weak bases, according to conditions) and colloids (*q.v.*), which are extremely sensitive to very slight changes of p_H. Owing to their nature, however, they are able to exert a "buffering" effect, *i.e.*, they tend to minimize such changes when external circumstances would tend to impose them. In connection with such liquids, a knowledge of their "reaction" or p_H is of great importance, and W. M. Clark and H. A. Lubs have specially synthesized a whole series of indicators which give brilliant colours and offer a wide selection of p_H ranges. For fuller details of this aspect of indicators the works of S. P. L. Sorensen, G. S. Walpole and also of others (*see* Bibliography) must be consulted; but the principles underlying their use may be given very briefly.

Relation of K (Dissociation Constant), p_H and c (Concentration).—If we consider a weak acid, HA, having a concentration c in dilute aqueous solution, and if we represent the concentration of the various ionic and molecular species by enclosing them in square brackets, we have $K[HA] = [H^+][A_i']$, K being the dissociation constant of the acid. (*See* CHEMICAL ACTION.) If no other solutes are present in the solution $[A'] = [H^+]$; further, since the acid is weak, it will be only very slightly dissociated and hence [HA] may be put equal to c without appreciable error. Thus we have

$$Kc = [H^+]^2 \text{ or } 2\log[H^+] = \log K + \log c$$

$$\text{or } -\tfrac{1}{2}\log K - \tfrac{1}{2}\log c = -\log[H^+] = p_H.$$

The foregoing equations show the relation existing between p_H, K, and c in a solution of the acid alone.

If the weak acid above is partially neutralized by a strong base, say sodium hydroxide, the sodium salt may be assumed, without appreciable error, to be completely dissociated, for this is nearly true of all salts of strong bases. If s equivalents of base have been added per litre of acid of concentration c (as before) the concentration of un-neutralized acid is $c-s$; hence $[H^+]+[HA] = c-s$, and since $[HA]+[A'] = c$, because the total concentration of salt and acid is still c. we therefore have

$$[H^+] = K[HA]/[A'] = K\frac{c-s-[H^+]}{s+[H^+]}$$; but as $[H^+]$ is very small compared with the other quantities in the fraction, we have $[H] = K(c-s)/s = K \times$ (un-neutralized acid)/(salt). From this equation two deductions can be made:

(1) The logarithmic equivalent is $p_H = -\log[H^+] = -\log K + \log \frac{s}{c-s}$.

(2) If $s = c/2$, *i.e.*, if the acid is half neutralized $[H^+] = K$. This is the state of affairs when a two-colour indicator is halfway through its colour change (although its ionization constant is an apparent one, owing to complications due to changes of structure); hence indicators are most effectively employed in solutions of acidity numerically equal to their apparent ionization constant, *i.e.*, of $p_H = -\log K$

The logarithmic equation in (1) enables a buffer solution of any desired p_H, to be prepared but numerous pairs of solutions have been studied and charted so that the ratio $s/(c-s)$ and the corresponding p_H are to be seen at a glance. Thus, by taking appropriate volumes of $N/5$-acetic acid and $N/5$-sodium acetate, we have 20 c.c. of a buffer solution of the p_H shown:

Acetic acid (c.c.) .	18·5	16·4	12·6	8·0	4·2	1·9
Sodium acetate (c.c.) .	1·5	3·6	7·4	12·0	15·8	18·1
p_H	3·6	4·0	4·4	4·8	5·2	5·6

These values are nearly those calculated from the formula given (where $K = 1{\cdot}8 \times 10^{-5}$ or $\log K = 4{\cdot}745$; $c-s =$ acetic acid; and $s =$ sodium acetate—the same as c of acetic acid and s of sodium hydroxide), but slight corrections have been introduced. The corresponding curve enables intermediate values to be obtained.

All buffer solutions depend upon the action of a weak acid, a weak base, or an amphoteric electrolyte, glycocoll being a good example of the last type.

The application of the foregoing principles to the determination of p_H (in, say, a feebly acidic solution of gelatin) will now be sketched briefly. The method is useless for coloured solutions, such as physiological fluids and electrometric methods have to be used for these. (*See* above.)

If the p_H is not known even approximately, tests with a few different indicators would soon give a rough idea; but in order to facilitate this preliminary survey use may be made of an ingenious device known as a "universal" indicator, which is a mixture of several indicators so designed that addition of a few drops to a solution gives a colour characteristic of the p_H, the succession of colours according with that which is found in the spectrum:—

p_H	Colour	p_H	Colour
3	Pale red	7-7·5	Greenish-yellow
4	Red	5	Green
5	Orange-red	9	Greenish-blue
6	Orange-yellow	10	Violet
6.5	Yellow	11	Reddish-violet

Having by this or any other means obtained an approximate idea of the p_H, it is then possible to select (1) an indicator and (2) a buffer solution of suitable ranges. Thus, if the universal indicator has given a reddish-orange tint, we must select an indicator and a buffer covering the range p_H4–6, say, acetic acid—sodium acetic, and methyl-red (red at p_H4·4; yellow at 6·0) or

bromophenol-blue (yellow at 3·0; bluish-purple at 4·6). A definite number of drops of the indicator is added to 20 c.c. of each of the five acetate buffer solutions (4·0–5·6) and also to 20 c.c. of the solution under investigation, all the solutions being contained in cylindrical vessels of clear glass standing on a white tile and equally illuminated (in the absence of a colorimeter). The tint in the unknown solution is seen to be between those in, say, the tubes corresponding to p_H 4·4 and 4·8, and solutions of p_H 4·5, 4·6, and 4·7 are then prepared so that a closer match may be made and the p_H determined to within 0·1 unit.

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HYDROGEN PEROXIDE, a heavy colourless liquid, usually sold as a dilute aqueous solution containing 3% ("10 volume"), and used as an antiseptic wash or as a bleacher. Its chemical formula is H_2O_2 and it is described under HYDROGEN.

HYDROGRAPHY, the science dealing with all the waters of the earth's surface (Gr. ὕδωρ, water, and γράφειν, to write), including the description of their physical features and conditions; the preparation of charts and maps showing the position of lakes, rivers, seas and oceans, the contour of the sea-bottom, the position of shallows, deeps, reefs and the direction and volume of currents; a scientific description of the position, volume, configuration, motion and condition of all the waters of the earth. *See* also SURVEYING: *Nautical,* and OCEAN AND OCEANOGRAPHY. The Hydrographic department of the British Admiralty, established in 1795, undertakes the making of charts for the admiralty, and is under the charge of the hydrographer to the admiralty (*see* CHART).

HYDROLYSIS, in chemistry, a decomposition brought about by water after the manner shown in the equation R·X+H·OH=R·H+X·OH. Modern research tends to prove that such reactions are not occasioned by water acting as H_2O, but by its ions (hydrions and hydroxyl ions), for the velocity is proportional (in many cases) to the concentration of one or both of these ions. This fact explains the so-called "catalytic" action of acids and bases in decomposing such compounds as the esters. The term "saponification" (Lat. *sapo,* soap) has the same meaning, but it is more properly restricted to the hydrolysis of the fats, *i.e.,* glyceryl esters of organic acids, into glycerin and a soap. (*See* GLYCERIDES.)

If R·X is the salt of a weak acid and a strong base, its aqueous solution will react as a base towards an indicator such as litmus, for the acid R·H is only feebly ionised, and hence the hydroxyl ions from the base will predominate; potassium cyanide and sodium carbonate are examples, and their solutions are said to undergo "hydrolysis." Conversely, the solution of the salt of a weak base and a strong acid, *e.g.,* ferric chloride, will be acidic. If both the acid and the base are weak, the salt may be so greatly hydrolysed as to be almost entirely decomposed into its constituent acid and base in aqueous solution. *See* also CHEMICAL ACTION and SOLUTIONS.

HYDROMECHANICS. An important property of a fluid is that the shape of any isolated mass depends largely upon the form of the containing vessel or confining walls. If water is poured from a jug into a glass the form of the water in the glass is determined largely by the shape of the glass, and not at all by the shape of the jug which previously contained it. The shape, but not the extent, of the water-glass surface is determined by the form of the glass. The shape of the water-air surface depends partly upon the form of the glass and partly upon the physical properties of water, air and glass. Generally this surface is very nearly a horizontal plane. This is particularly noticeable in the part which is not close to the glass, and the natural inference is that this levelling of the water-air surface is due to some physical properties of the two fluids. The water-air surface appears to be well defined, but if the glass contained chlorine, a greenish-yellow gas heavier than air, the boundary between the air and chlorine would not be so well defined and would become difficult to detect in a short time. The air and chlorine, in fact, diffuse into one another, and in a few hours the chlorine would have practically all disappeared. Water will also do this to some extent on account of evaporation, but this process is slow in comparison with the diffusion of gases.

The diffusivity of a gas and the slow evaporation of a liquid can only be adequately explained by a *kinetic theory* in which a fluid is supposed to be composed of discrete atoms or molecules. In hydromechanics a fluid is treated as a *continuous substance* and the phenomena of diffusion are largely ignored. The science may be expected, then, to describe the mechanics of liquids more perfectly than the mechanics of gases, and this is indicated by the choice of the prefix "hydro" which is derived from the Greek word ὕδωρ meaning water.

Hydromechanics is concerned chiefly with the visible motion of a fluid and with certain phenomena which manifest themselves when the fluid appears to be at rest. These phenomena are generally grouped under the heading *hydrostatics.* By means of the theory of hydrostatic pressure a reason is found for the fact that the free surface of a liquid at rest is very nearly a horizontal plane, while, with the aid of the theory of surface tension, it can be understood why the free surface rises or falls in the immediate neighbourhood of the wall of the containing vessel. The phenomena of capillarity or surface tension (*q.v.*) may be expected to enter when two or more different substances are in contact. In a preliminary treatment of hydromechanics these phenomena are ignored, attention being paid chiefly to the main body of the fluid which is generally treated as nearly or actually homogeneous. Except at a boundary between two different fluids, the nature of a fluid generally changes so slowly from point to point that capillary phenomena associated with such changes can certainly be ignored. In many hydrodynamical problems the density of the fluid is assumed to be constant, and this assumption is a good approximation to the truth, but when large masses of fluid are involved or when the fluid is moving very rapidly, the simplifying assumption of constant density may not be advisable.

HYDROSTATICS

It has already been pointed out that a mass of fluid has no natural durable shape. If a glass of water is tilted the water at once acquires a new boundary and some of it may be spilled. If, on the other hand, the glass contained granulated sugar it could be slightly tilted and the sugar would retain its position relative to the glass, behaving like a rigid body. With a larger tilt the sugar would change its position, and some of it might also be spilled. The difference of behaviour between the sugar and water may be attributed to a kind of static friction which acts between the particles of sugar but not between the particles of water. Now, in the theory of friction, the frictional force F increases with the angle of tilt up to a limiting value μR, where μ is the coefficient of friction and R is the normal force between the surfaces in contact. The existence of friction in the case of the sugar suggests the existence of a normal force R. The absence of friction in the case of water might be due to either $\mu=0$, or $R=0$, or both $\mu=0$ and $R=0$.

That R is not generally zero was first clearly shown by the Greek mathematician Archimedes (287–212 B.C.) who became interested in the mechanics of floating bodies. He discovered that, when a solid body is completely immersed in a fluid at rest or in two stationary fluids one of which lies above the other, the body is buoyed up by a vertical force equal in magnitude to the weight of fluid displaced, *i.e.,* the fluid which would normally occupy the space filled by the body. The form of the fluid is, of course, changed by the presence of an immersed solid, and it seems natural to say that there is a vertical force on the body because the fluid tries to push it away. This suggests the idea of *fluid pressure, i.e.,* a force exerted by the fluid on each surface element of a body with which it is in contact. The existence of such a pressure is indicated by simple observations whenever an effort is made to prevent water from flowing into an open space. The great importance of the foregoing *law of Archimedes* rests

on the fact that a simple explanation can be found for it on the basis of the hypothesis that the fluid pressure is always at right-angles to a stationary surface element of a body in contact with the fluid, and that the pressure still exists when any portion of the fluid is regarded as a body immersed in the rest of the fluid.

Fluid Pressure.—The idea of pressure is made more precise by defining a *pressure intensity,* in much the same way as a differential coefficient, as the limit of the ratio of the force to the area on which it acts when the area is decreased in magnitude indefinitely. The great advantage of this definition is that pressure intensity becomes a definite quantity associated with *a point in the fluid*—another invention of the mathematicians which is to be regarded as the limit of a process of infinite subdivision applied to a fluid particle.

Taking it for granted that a pressure intensity exists and is finite, the forces exerted by the fluid on the faces of a very small tetrahedral fluid element become multiplied by a factor which is approximately ϵ^2 when the linear dimensions of the element are diminished in the ratio ϵ:1, similarity in form being maintained. At the same time the weight of the element becomes multiplied by a factor which is approximately ϵ^3 if the density of the fluid does not vary too rapidly. Now as ϵ o the factor ϵ^3 becomes negligible in comparison with the factor ϵ^2, consequently, in considering the equilibrium of a very small fluid element, the weight of the element can be neglected in comparison with the individual forces due to the fluid pressure. The conditions of equilibrium for a small tetrahedral fluid element $DABC$ (fig. 1), with three mutually perpendicular faces meeting at D, are of type

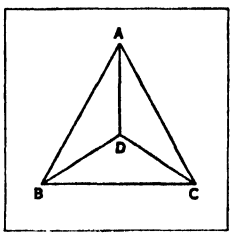

FIG. 1

$$p_D \cdot \cos\alpha \cdot \Delta ABC = p_A \cdot \Delta DBC,$$

where p_A, p_B, p_C, p_D are the pressure intensities for the faces BCD, CDA, DAB, ABC respectively, and α is the angle between the faces BCD, ABC. Now $\cos\alpha \cdot \Delta ABC = \Delta DBC$, and so $p_D = p_A$. The pressure intensity is thus approximately the same for each face. In the limit (ϵ=o); this means that the pressure intensity at a point is independent of the direction of a surface element used to define it. This pressure intensity will be called the *hydrostatic pressure* at the point; it has the dimensions of a force divided by an area, and may be regarded as the force per unit area. It will generally be called simply the pressure, and denoted by the symbol p.

For a long time the motion of a fluid was discussed with the aid of a simple extension of the idea of hydrostatic pressure to a fluid in motion. The proof that pressure intensity at a point is independent of the direction of the defining surface element then follows much the same lines as before. It is necessary to consider, besides the forces on the element, the product of its mass and acceleration, but this becomes multiplied by a factor which is approximately ϵ^3 when the linear dimensions are diminished in the ratio ϵ:1, and so can be neglected just like the weight.

Pressure-energy and Tension-energy.—The pressure intensity can be regarded as the density of a certain type of energy, the amount of which for a volume element dV is pdV. According to the kinetic theory, this energy is closely related to the average kinetic energy of translation of the molecules of the fluid and is always positive, consequently $p>$o. If the volume occupied by a fluid changes, say by a surface element of area dS being displaced so that its points move on an average a distance h in a normal direction, the work done by the pressure in moving this surface element is $h(pdS)=pdV$, where dV is the increase of volume and p is the pressure intensity at the position of dS. The energy pdV may be called *pressure-energy*. If p is constant throughout a mass of fluid its total pressure-energy is pV, where V is the total volume.

In addition to pressure-energy there is tension-energy associated with the boundary surface between two different substances. The amount of this energy associated with a surface element of area dS is TdS, where T is a positive constant called the *surface tension.* If the area of a surface decreases because a line of length l is displaced in such a manner that each point moves normal to this line through an average distance h, the area decreases by hl and the tension-energy by hlT. This, however, is the work that would have been done by a force Tl acting at right-angles to the line so as to pull it in the direction of the actual displacement. Both pressure-energy and tension-energy are regarded in hydromechanics as forms of potential energy.

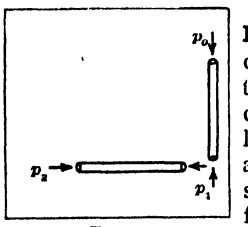

FIG. 2

The Increase of Pressure with Depth.—Consider the equilibrium of a cylindrical portion of fluid at rest under the action of gravity, the generators of the cylinder, being vertical (fig. 2) and of length h, while the end faces are horizontal and of area A. If p_0, p_1 denote the hydrostatic pressures on the upper and lower faces respectively $(p_1-p_0)\,A$ must be equal to the weight of the fluid cylinder, and is consequently equal to shA where s is the specific weight of the fluid. This gives the equation

$$p_1-p_0=sh.$$

The quantity s may be replaced by pg, where g is the acceleration of gravity and p is the density of the fluid. Next consider the equilibrium of a similar portion of fluid when the generators of the cylinder are horizontal. The pressures on the elements of the curved surface have no longitudinal components, consequently, if p_1 and p_2 denote the hydrostatic pressures at the two ends, the conditions for a balance of the axial components of force give

$$p_2-p_1=\text{o}.$$

These equations determine the pressure at an arbitrary point Q of the fluid, when the pressure p_0 at some particular point Q_0 is given. This pressure p_0 can have any assigned value which is consistent with the requirement that the pressure is to be everywhere positive. If p_0 is one value which satisfies this requirement and P is any positive pressure, then p_0+P is another possible value. For the foregoing equations show that, if p is the pressure at Q when the pressure at Q_0 is p_0, then $p+P$ is the pressure at Q when the pressure at Q_0 is p_0+P, and clearly if p is positive so also is $p+P$. The result indicates that, if the pressure at Q_0 is increased by P, the geometrical boundary of the fluid being practically unchanged, the pressure at an arbitrary point Q is also increased by P. This is the transmissibility of fluid pressure discovered by Leonardo da Vinci (1452–1519) and by Blaise Pascal (1623–62). It is utilized in the hydraulic press.

Form of the Free Surface of a Liquid.—The air just above the free surface of a stationary liquid is assumed in hydrostatics to be at a constant pressure π. This is the atmospheric pressure at the level of the fluid surface, it generally varies from day to day and sometimes from hour to hour, but at any given instant it may be assumed to vary only slightly with position because, on account of the lightness of air, any appreciable difference of pressure at two points a few feet apart would be soon obliterated by a slight motion of the air. If it should be assumed at once that the pressure just above the free surface of the liquid is equal to the pressure just below the surface, then it would follow immediately that a horizontal plane is a possible form of free surface, but on account of the existence of surface forces the foregoing assumption needs justification.

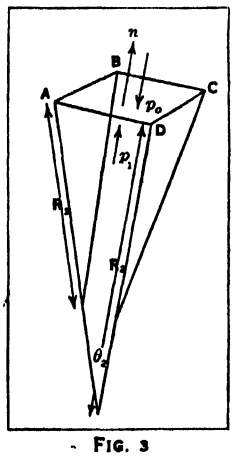

FIG. 3

Supposing for the moment that the free surface is curved and that the pressures p_0 and p_1 on the upper and lower sides are not equal, the relation between them can be found by studying the equilibrium of a small thin cap containing a portion of the free surface and enclosing both liquid and air. The surface of the cap will be supposed (for simplicity) to consist of portions of two surfaces parallel to the free surface and of portions of developable surfaces generated by normals to the free surface. Since

the cap is very small these developable surfaces may be treated as planes bounded laterally by lines that intersect. The traces of these planes on the free surface may be taken to be lines of curvature which form what is approximately a rectangle $ABCD$ (fig. 3) with sides of lengths $R_1\theta_1$, $R_2\theta_2$, where R_1, R_2 are the radii of curvature and θ_1, θ_2 angles between normals which intersect.

A condition for the equilibrium of the cap is obtained by resolving along the normal (n) to the free surface at the centre of the rectangle. The fluid pressures give a normal force approximately of magnitude $(p_1-p_0)R_1\theta_1R_2\theta_2$. By the theory of surface tension, there is a force on AD tangential to the free surface and of magnitude $T(R_1\theta_1)$, where T is the surface tension. The component of this force outwards along (n) is approximately $-\frac{1}{2}\theta_2T(R_1\theta_1)$. The surface tensions on DC, CB, BA likewise give components along (n), and the conditions of equilibrium lead eventually to the equation

$$p_1-p_0=T\left(\frac{1}{R_1}+\frac{1}{R_2}\right). \qquad (1)$$

If the free surface is plane, $\frac{1}{R_1}=\frac{1}{R_2}=0$ and so $p_1=p_0=\pi$. This equation is quite consistent with the previous result that the pressure is constant over a horizontal plane, and so the conclusion may be drawn that a free surface can have the form of a horizontal plane. The reason for the departure from this form near a boundary wall is that at the wall there are forces arising from surface tension which are not tangential to the free surface.

The boundary surface between two liquids that do not mix can likewise be a horizontal plane. It can, however, take a different form if the liquids are separated partly by a diaphragm with a hole in the middle. The surface separating the two liquids may then be curved and there may be a difference of pressure on the two sides. If this difference is constant and the surface tension is also constant, the boundary will be a surface for which $\frac{1}{R_1}+\frac{1}{R_2}$ is constant.

The Equilibrium and Stability of a Floating Body.—When a body floats partly immersed in water, the pressure of the water on an element of area dS of the wetted surface has a vertical component $p\,dA$, where dA is the horizontal projection of dS. Since $p=\pi+sh$, where h is the depth of the element dS below the free surface and s the specific weight of water,

$$p\,dA=\pi\,dA+sh\,dA=\pi\,dA+dW$$

approximately, where dW is the weight of the vertical column of water terminated by dA and dS.

The forces of type $p\,dA$ arising from the pressure of the water are thus seen to be equivalent to a vertical force πA acting through the centroid of the area A in which the free surface would cut the body if it were conditioned as a horizontal plane, and a vertical force W equal in magnitude to the weight of a quantity of water which would just fill the space below the area A that is occupied by the body. This imaginary water is called the *water displaced*, and its weight W the (water) *displacement*. The vertical force W acts through the centre of gravity of the water displaced and is called the *hydrostatic force of buoyancy*. The downward components of the forces due to the pressure of the air on the unwetted surface of the body are similarly equivalent to a force πA, acting vertically downwards through the centroid of the area A, and a force w acting vertically upwards through the centre of gravity of the air displaced and equal in magnitude to the weight of air displaced. This force w may be called the *aerostatic force of buoyancy*. When the forces due to the pressures of air and water are combined, the two forces πA cancel, and the two forces of buoyancy may be combined into a single force of buoyancy which acts through the centre of gravity of the fluid displaced, a point which is called the *centre of buoyancy*. In order that the body may be in equilibrium, its centre of gravity and the centre of buoyancy must be in a vertical line, and the force of buoyancy $W+w$ must be equal in magnitude to the weight of the body.

If a floating body is given different positions consistent with the last condition, the difference of level between the centre of gravity and the centre of buoyancy will generally be either a maximum or a minimum in a position of equilibrium. If the latter, equilibrium is *stable*, while if it is a maximum the equilibrium is *unstable*. This may be seen by calculating the potential energy for each position and using the usual criterion for stability that the potential energy must be a minimum. The foregoing criterion for the stability of a floating body was given by Christian Huygens (1629–95).

Another criterion, due to Pierre Bouguer (1698–1758) and François Pierre Charles Dupin (1784–1873), depends upon the idea of the *metacentre*. Let GH be that line in the body which was originally the line joining the centre of gravity G and the centre of buoyancy H. In a displaced position of the body there is a new centre of buoyancy, H', and the vertical force through this point is generally inclined at an angle θ with GH and forms with the weight $W+w$, acting vertically downwards through G, a couple which may or may not tend to right the body. When the vertical line through H' meets GH in a point M, the displacement is called a *principal displacement*, and the limiting position of M as $\theta\to0$ is called the *metacentre*. The position of equilibrium is stable for this type of displacement if M lies above G; it is unstable when M is below G, and neutral when G and M coincide. There are generally two types of principal displacement and two *metacentres*. These points are the two centres of curvature of the surface of buoyancy for the point H, this surface being defined as the locus, in the body, of the centre of buoyancy when the body is placed in different positions for which the force of buoyancy is equal in magnitude to the weight of the body. The positions of equilibrium may be found by drawing normals from the centre of gravity G to the centre of buoyancy, for then GH is a maximum or minimum.

HYDRODYNAMICS

A point in, or a "particle" of, a fluid in motion generally describes a curve, in the course of time, which is called the *path of the particle*. The rate of change of position of the particle may be represented by a directed quantity, or vector, q called the *velocity* of the particle. The magnitude of this velocity will be denoted by the symbol q, and the components in the directions of a selected set of rectangular axes by u, v, w. If the position of a point in space is specified by its rectangular co-ordinates x, y, z relative to these axes, and the time by a variable quantity t, then at each place occupied by fluid there will be a vector at each instant t, and its components u, v, w can be regarded as functions of x, y, z and t.

At a given time t the distribution of velocities in the fluid may be conveniently specified by *lines of motion* and *surfaces of constant velocity*. A line of motion is a curve such that the tangent at each point is in the direction of the velocity of the fluid particle which happens to be at the point at time t. The lines of motion are not generally the same as the paths of particles and do not indicate the magnitude of the velocity at each point. This is why it is advantageous to use also a set of surfaces over each of which the velocity has some constant magnitude.

When at every point occupied by fluid the velocity is constant in magnitude and direction (u, v, w independent of t), the motion is said to be *steady*. The lines of motion are in this case the same as the paths of the particles and are called *stream-lines*. The stream-lines drawn through an infinitesimal contour form what is called a *stream-tube*. Such a tube possesses the property that fluid in the tube remains in the tube, and important inferences may be drawn by using the principles of the conservatism of mass and energy.

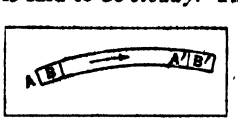

FIG. 4

The Equation of Continuity.—Consider two slices of a stream-tube, terminated by areas A, B, A', B' respectively (fig. 4) and such that the mass of fluid between A and B at each instant is equal to the mass of fluid between A' and B'. If the distance between A and B is very small and the areas A, B, A', B' are

all perpendicular to the sides of the tube, the fluid between A and A' may be supposed, at a slightly later time, to occupy the region between B and B', the direction of flow being from A to B. This means that, while a small mass of fluid sufficient to fill the slice $A'B'$ flows across the area A' in a small interval of time dt, an equal amount of fluid will in the same time cross the area A and fill the slice AB, which would otherwise be left empty. If q, q' denote the velocities at A and A' respectively, the small mass of fluid may be represented by the two expressions $\rho Aqdt$, $\rho'A'q'dt$, where ρ, ρ' are the densities at A and A'. When $\rho=\rho'$ this gives the equation

$$Aq=A'q';$$

which is generally attributed to Benedetto Castelli (1577–1644) but the idea of continuity of flow seems to have been familiar to Leonardo da Vinci.

If a quantity of fluid is represented by its mass, the rate of discharge of fluid across the area A may be represented by the quantity $Q=\rho Aq$, and the equation $\rho Aq=\rho'A'q'$ may be regarded as a form of the equation of continuity. A more general form of the equation, which is due to Leonhard Euler (1707–83), may be obtained by considering the amount of fluid which in a small interval of time dt crosses the faces of a small parallelopiped with sides parallel to the axes of co-ordinates. Denoting the lengths of the sides by dx, dy, dz respectively, the change in the mass of the fluid enclosed in time dt is approximately $\frac{\partial\rho}{\partial t}dxdydz$. Equating this to the change due to the flow across the faces, an equation is obtained, which may be finally written in the form

$$\frac{\partial\rho}{\partial t}+\frac{\partial}{\partial x}(\rho u)+\frac{\partial}{\partial y}(\rho v)+\frac{\partial}{\partial z}(\rho w)=0.$$

An alternative form is

$$\frac{d\rho}{dt}+\rho\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}\right)=0,$$

where

$$\frac{d\rho}{dt}\equiv\frac{\partial\rho}{\partial t}+u\frac{\partial\rho}{\partial x}+v\frac{\partial\rho}{\partial y}+w\frac{\partial\rho}{\partial z}$$

represents the rate of change of ρ for a particle of fluid. This quantity is zero when the fluid is incompressible, and the equation of continuity takes the simple form

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0;$$

which means that the volume of an element of fluid remains unchanged during motion. These equations were given by Euler in 1755 in the great memoir in which he laid the foundations of the science of hydrodynamics. The principle that the volume of an element of an incompressible fluid remains unchanged had, however, been laid down by Jean le Rond d'Alembert in 1752. He also indicated the type of modification needed for the case of a compressible fluid.

The Equations of Motion, Energy and Pressure.—*The equations of motion* were obtained by Euler by a method, suggested by d'Alembert, which amounts to an application of what is now called d'Alembert's principle; they are of type

$$\rho\frac{du}{dt}=\rho X-\frac{\partial p}{\partial x},$$

where X, Y, Z are the components of the total external force (per unit mass) including gravitation.

Bernoulli's Equation.—Referring again to the stream-tube, the fluid within the slice AB will at some later time occupy the slice $A'B'$ and will have the same total energy as before. If V denotes the volume of the slice AB, the total energy is made up of three parts when the fluid is incompressible. These are the kinetic energy $\frac{1}{2}\rho Vq^2$, the pressure-energy pV, and the potential energy of external forces (such as gravitation) which may be represented by $\rho V\Omega$. Assuming that there are no other external forces, and using primes to denote corresponding quantities in the second position of the small mass of fluid, the principle of the conservation of energy, when no heat is transferred, gives

$$p'V'+\tfrac{1}{2}\rho'V'q'^2+p'V'\Omega'=pV+\tfrac{1}{2}\rho Vq^2+pV\Omega.$$

Since $V'=V$ the equation takes the form

$$\frac{p'}{\rho}+\tfrac{1}{2}q'^2+\Omega'=\frac{p}{\rho}+\tfrac{1}{2}q^2+\Omega$$

This equation which has many important applications was first given by Daniel Bernoulli (1700–82).

Pressure of Impact.—If a stream of fluid moving with velocity is deflected by a plate, or other obstacle, and the velocity is zero at a point I (where the fluid strikes the plate normally), the pressure p at this point is given by the equation

$$\frac{p_1}{\rho}+\Omega_1=\frac{p}{\rho}+\tfrac{1}{2}q^2+\Omega$$

(where p, q and Ω refer to a point far in front of the body). Furthermore, if Ω is constant, then $p_1=p+\frac{1}{2}\rho q^2$, and is greater than at any other point in the fluid except at a point of confluence or stagnation, where the velocity again is zero.

Barotropic Fluids.—When the fluid is compressible there is an equation,

$$\int\frac{dp'}{\rho'}+\tfrac{1}{2}q'^2+\Omega'=\int\frac{dp}{\rho}+\tfrac{1}{2}q^2+\Omega,$$

analogous to Bernoulli's equation, in the case when ρ is a function of p alone. This condition is not always satisfied in a real fluid, and a study of the general type of compressible fluid has been made by Vilhelm Bjerknes, who calls a fluid in which ρ is a function of p a *barotropic* fluid, and uses the name *baroclinic* for a fluid in which the surfaces of constant density are not the same as the surfaces of constant pressure.

Torricelli's Theorem.—Sextus Julius Frontinus, inspector of the public fountains in Rome about 106 B.C., remarked that the amount of water discharged through an orifice in a given interval of time depends, not only upon the size of the orifice, but also upon its depth h below the surface of the water in the reservoir from which the water is supplied. Castelli came to the conclusion that the velocity q is proportional to h, but his disciple Evangelista Torricelli (1608–47), by reasoning based upon the results of Galileo's experiments with falling bodies, came, in 1643, to the conclusion that q is proportional to the square root of h (except for small corrections due to the resistance of the air and friction at the orifice). The truth of this conclusion was confirmed by the experiments of Raffaello Magiotti (1648), Domenico Guglielmini (1683), and Esmé Mariotte (1684). The relation $q^2=2gh$ was finally deduced by Daniel Bernoulli from his equation (2). It is sufficient, in fact, to remark that the pressure p is approximately the same at the orifice and at the surface of the water in the reservoir, while the two values of Ω differ by gh. Assuming that q may be neglected at the surface the equation is at once obtained. Torricelli's relation thus received a rational explanation and Castelli's relation was abandoned.

Circulation.—The line integral

$$\int(udx+vdy+wdz),$$

taken round a closed curve, is called the *circulation* round the curve. This integral is zero in the case when

$$u=\frac{\partial\phi}{\partial x},\quad v=\frac{\partial\phi}{\partial y},\quad w=\frac{\partial\phi}{\partial z},$$

where ϕ is a single-valued function of x, y and z. The motion is then said to be *irrotational*, and, if the fluid is incompressible, the velocity potential θ satisfies the equation

$$\nabla^2\phi\equiv\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}=0.$$

In 1781 Joseph Louis Lagrange gave the theorem that, in a barotropic fluid under the influence of forces which have a single-valued potential, the motion remains irrotational if it is initially irrotational. Satisfactory proofs of this theorem were given later by Augustin Louis Cauchy (1789–1857) and Sir George Gabriel Stokes (1819–98).

The irrotational flow round an obstacle is derived by finding a solution of $\nabla^2\phi=0$ which satisfies the boundary condition that there is no normal component of relative velocity between the fluid and the obstacle. When the motion is steady the variation of pressure over the surface of the stationary obstacle may be obtained by means of Bernoulli's theorem, and it is found that the forces exerted by the fluid on the body either balance or reduce to a couple. This is quite contrary to experience, for it is well known that fluid flowing past a body exerts a force on the body. This contradiction between the irrotational theory and experiment is called the paradox of d'Alembert.

Vortex Motion.—Mathematicians next turned their attention to the study of fluid motion in which the circulation is not zero for every closed curve. In this case the quantities

$$\xi=\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z},\qquad \eta=\frac{\partial u}{\partial z}-\frac{\partial w}{\partial x},\qquad \zeta=\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}$$

are not generally zero, and are called the *components of spin or vorticity*. The lines defined by the equations

$$\frac{dx}{\xi}=\frac{dy}{\eta}=\frac{dz}{\zeta}$$

are called *vortex lines*, and the vortex lines through the points of a small closed curve form a vortex tube. The fluid contained within such a tube forms a *vortex filament*.

The theory of vortex motion was developed greatly by Hermann von Helmholtz (1821–94) and by William Thomson (Lord Kelvin 1824–1907). Helmholtz showed that the circulation is the same for all circuits embracing a vortex tube and drawn on it, and is equal to $\omega\sigma$, where σ is the area enclosed by the circuit, and $\omega=(\xi^2+\eta^2+\zeta^2)^{\frac{1}{2}}$ is the resultant vorticity of the fluid at the point. He also showed that, in the case of a barotropic fluid subject to forces with a single valued potential, vortex lines move with the fluid and so remain vortex lines. Kelvin amplified this theorem, and proved it anew by showing that the circulation in any circuit moving with the fluid remains constant. These results led to the conclusion that in a barotropic fluid circulation can neither be created nor destroyed so long as all external forces have a single-valued potential.

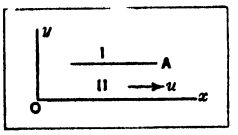

FIG. 5

Viscous Flow.—Sir Isaac Newton in his *Principia* (1687) commenced the study of tangential forces in a moving fluid by considering the case of flow in one direction (that of Ox), when the velocity u varies in a perpendicular direction Oy (fig. 5). A layer I., moving faster than the lower layer II., exerts on the latter a viscous drag depending on the difference of velocities. Newton's hypothesis means, mathematically, that the tangential force, acting across a small area A separating I. from II., is $\mu A\frac{\partial u}{\partial y}$, where μ is a physical quantity called the *coefficient of viscosity* of the fluid. μ has the dimensions of a momentum, divided by an area. Sometimes the *kinetic viscosity* $\nu=\mu/\rho$ is used in place of μ; this has the dimensions of a velocity multiplied by a length.

In the kinetic theory the viscous drag is attributed to fast-moving molecules crossing from I. to II., and slow-moving molecules crossing from II. to I. In the type of fluid motion which is called *turbulent*, there is a similar transfer of momentum from one layer to another, in which aggregates of fluid particles endowed with vorticity are the wandering elements instead of single molecules.

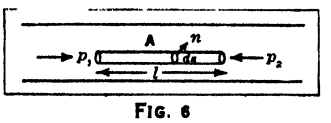

FIG. 6

In the case of viscous flow under pressure along a straight tube, the condition for the steady motion of a cylindrical element (fig. 6) is that the difference of pressure at the two ends should be equal to the surface integral of the viscous drag over the curved surface. This leads to the equation

$$(p_1-p_2)A=\mu\int\frac{\partial u}{\partial n}ds=\mu A\left(\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}\right),$$

when A is small. The velocity u is subject also to the boundary condition that there should be no slipping at the surface of the tube, *i.e.*, $u=0$ at the boundary. In the case of a circular tube of radius a, the conditions are satisfied by

$$u=\frac{p_1-p_2}{4\mu l}(a^2-r^2),$$

where r is the distance of a point from the axis of the tube. The amount of fluid passing through the tube in unit time is thus

$$\frac{\pi a^4}{8\mu}\frac{p_1-p_2}{l}.$$

This law, which is due to Jean Louis Marie Poiseuille, has been confirmed by experiments in the case of flow through capillary tubes and very slow motion through wide tubes. The applicability of the law seems to depend upon the value of the ratio $R=\frac{uc}{\nu}$, which is called the *Reynolds number*, after Osborne Reynolds (1842–1912) who showed that the flow ceases to be viscous when this number exceeds a certain critical value. For a very viscous liquid like oil, Poiseuille's law is usually applicable because R is small.

In the case of a tube of arbitrary section, the equation for u may be compared with an equation which occurs in Saint Venant's theory of the torsion of a straight bar, or with the equation

$$2T\left(\frac{\partial^2 x}{\partial y^2}+\frac{\partial^2 x}{\partial z^2}\right)+p_1-p_2=0,$$

which may be deduced from equation (1), and gives the approximate form of a liquid film covering a hole in a diaphragm, and subjected to a greater pressure on one side than on the other (fig. 7). A soap film method of solving problems of viscous flow and of the torsion of prisms was proposed by Ludwig Prandtl, and has been developed by English investigators. The inclination of each element of the film, the contour lines and the volume under the film are determined by simple measurements. Two Belgian investigators have recently devised an improved arrangement depending upon the use of the boundary surface of two liquids of equal density which do not mix.

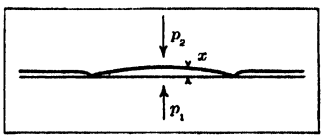

FIG. 7

The Boundary Layer.—The actual flow of a fluid seldom obeys the laws either of irrotational or of viscous flow, and Prandtl has consequently developed a theory in which the flow, within a thin boundary layer next the wall of the containing vessel or immersed solid, is approximately viscous, while the flow outside the layer is approximately irrotational. In the case of flow past a plane wall parallel to the direction of flow (fig. 8), the thickness of the boundary layer increases gradually with the distance from the leading edge, and is at first exceedingly small if the viscosity of the fluid is low.

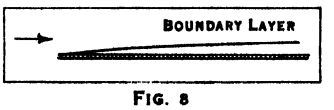

FIG. 8

In the case of flow through a long tube, the boundary layer (fig. 9) will eventually fill the tube, and the flow at the entrance is materially different from the turbulent flow in the main part of the tube, for in this latter part the boundary layer theory is inapplicable. The turbulent flow leads to a much more uniform distribution of velocity over the cross section of the tube than the viscous flow, and to an entirely different law of resistance. (*See* HYDRAULICS.)

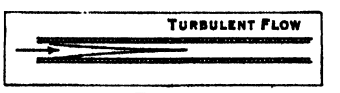

FIG. 9

The flow in the boundary layer at the surface of a solid immersed in the fluid is regular when it is in the direction of decreasing pressure, but, when the flow is from low pressure to high pressure, the momentum of the fluid in the boundary layer may not be sufficient to overcome the resistances, and the streamlines break away from the boundary. Isolated vortex filaments, or eddies, form behind the body more or less close to the place

where the stream-lines break away, and to the place where there is a confluence of stream-lines which separated at the front of the body.

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HYDROMEDUSAE, a technical name for a class of the Coelenterata. The term is more particularly applicable to those members of the group which have the form of *medusae* or jelly-fish, and is interchangeable with the more usually employed name Hydrozoa. (*See* COELENTERATA; HYDROZOA; MEDUSA.)

HYDROMETERS. The first account of the use of hydrometers in England is in a paper published by Robert Boyle in 1675, *Phil. Trans.*, June 1675, and fig. 1 is reproduced from an illustration of a hydrometer contained in that paper.

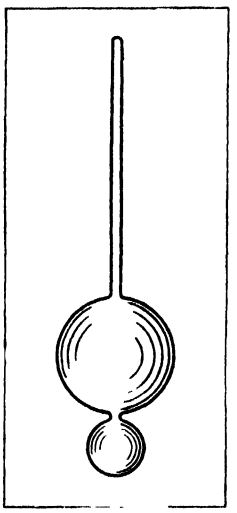

FIG. 1.—BOYLE'S HYDROMETER

The recognition of the fact that such an instrument provides a ready means of determining the density of a liquid dates from very early times and there is evidence that Archimedes (287–212 B.C.) was familiar with it. The hydrometer remained of little importance until it was developed for industrial purposes. This development began with the use of hydrometers in the 18th century for determining the strength of spirits and has gone on until at the present time hydrometers have very widespread industrial applications.

Boyle's hydrometer (fig. 1) was made of glass and differs in no essential feature from modern glass hydrometers (fig. 2). The principle on which the construction of hydrometers is based is that a body floating partially immersed in a liquid is in equilibrium when the volume of liquid displaced, which is equal to the volume of the submerged portion of the body, has a mass equal to that of the floating body. When placed in a liquid in which it can float freely a hydrometer will therefore come to rest in such a position that it displaces a volume of liquid having a mass equal to that of the hydrometer. A hydrometer is read in a liquid by noting the intersection of the level liquid surface with the stem of the hydrometer when the hydrometer is at rest and floating freely in the liquid. The reading is taken on a scale sealed inside the stem of the hydrometer.

If V' is the volume of that portion of a hydrometer which is below a particular graduation mark on the scale, then $\delta V'$ is the mass of liquid, of density δ, displaced when the hydrometer is floating freely with this graduation in the level of the liquid surface. If M is the mass of the hydrometer it follows that $\delta V' = M$ and $\delta = M/V'$. Consequently if V is the volume of that portion of a hydrometer which is below the lowest graduation mark on the scale and v is the volume of the portion of the stem between the highest and lowest graduation marks the range of densities which can be determined by means of the hydrometer is that lying between the values $\delta = M/V + v$ and $\delta = M/V$.

A Logical System of Hydrometry.—Neglecting, for the moment, the comparatively small effects of surface tension and changes of temperature, the plane of intersection of the level of a liquid surface with the stem of a hydrometer is determined solely by the density of the liquid. If, therefore, a scale is sealed inside a hydrometer stem having graduation marks suitably spaced and numbered to enable the density corresponding to any point on the scale to be easily read, the hydrometer will indicate directly the property of the liquid which determines the reading of the hydrometer. Densities are generally most conveniently expressed in terms of grammes per millilitre which is therefore a convenient basis for the density scale of hydrometers.

Let us assume, therefore, that we have decided to have our hydrometers provided with scales to indicate densities in grammes per millilitre, this being a basis resting on fundamental units of mass and volume and free from all ambiguity.

The next thing to consider is the practical use of such a hydrometer. In the petroleum industry the density of petroleum products (often expressed as the equivalent specific gravity $\frac{S_{60°F}}{60°F}$) is used as one of the criteria of quality. Since the liquids in question have comparatively high coefficients of expansion it is necessary to use the density at some specified temperature as a criterion for comparative purposes. The temperature generally adopted is 60° F, and a hydrometer adjusted to indicate densities at this temperature will give directly the desired density if read in a sample at 60° F. It is not always convenient, however, to bring the temperature of the sample to 60° F, and it is often more economical in expenditure of time to take the hydrometer reading at the prevailing temperature of the sample and to use tables to obtain from the hydrometer reading the density of the sample at 60° F.

The correction tables can conveniently take the form shown at bottom of page

Alternatively, to eliminate the need for addition or subtraction, the actual densities at 60° F corresponding to the observed hydrometer readings can be entered in the body of the table. If this is done, more voluminous tables are required, as the first column should then progress by small increments, *e.g.*, ···0·700, 0·701, 0·702··· and so on. The combination of hydrometer and tables provides a rapid and reliable means of ascertaining the density of a petroleum spirit at 60° F from simple observations carried out at any convenient temperature.

As another example we will consider the use of a density hydrometer for ascertaining the percentage composition of sugar solutions. The hydrometer is read in the sugar solution whose temperature is also noted and then by means of tables prepared as indicated below the required percentage of sugar is obtained.

Observed Reading on Hydrometer	Temperature at which hydrometer reading was taken—° C.										
	10	11	12	13	14	15	16	17	18	19	20
1·050 gms./ml.	12·38	12·41	12·46	12·50	12·54	12·59	12·63	12·68	12·73	12·78	12·84

Summarizing the scheme, the hydrometer is used to determine density and tables are used to convert the observations to a standard basis, *i.e.*, to percentage composition, etc. The advantages of such a system are:—(1) The hydrometer scale is clearly defined and not dependent on the properties of a particular liquid; (2) the onus on the manufacturer is simply to produce accurate density hydrometers; (3) the conversion of density to percentage composition, etc., is left to the users who should be in the best position to employ the most reliable data relating to the liquids in which they are interested; (4) tables can be revised without rendering any hydrometers obsolete; (5) the hydrometers can

Observed reading on hydrometer	Temperature at which hydrometer reading was taken—° F.										
	50	52	54	56	58	60	62	64	66	68	70
0·700 gms.-ml.	−·0048	−·0038	−·0029	−·0019	−·0010	·0000	+·0009	+·0019	+·0028	+·0038	+·0048
0·750 gms./ml.	−·0044	−·0035	−·0025	−·0017	−·0009	·0000	+·0009	+·0018	+·0026	+·0035	+·0043

be used in a variety of liquids provided there are not too great variations in surface tension.

The general acceptance of the principle that it is the function of the hydrometer to determine density and of tables to interpret the results would lead to considerable simplification in hydrometry and remove much existing confusion.

Details of Construction of Glass Hydrometers.—Glass hydrometers should be well annealed and made from glass having

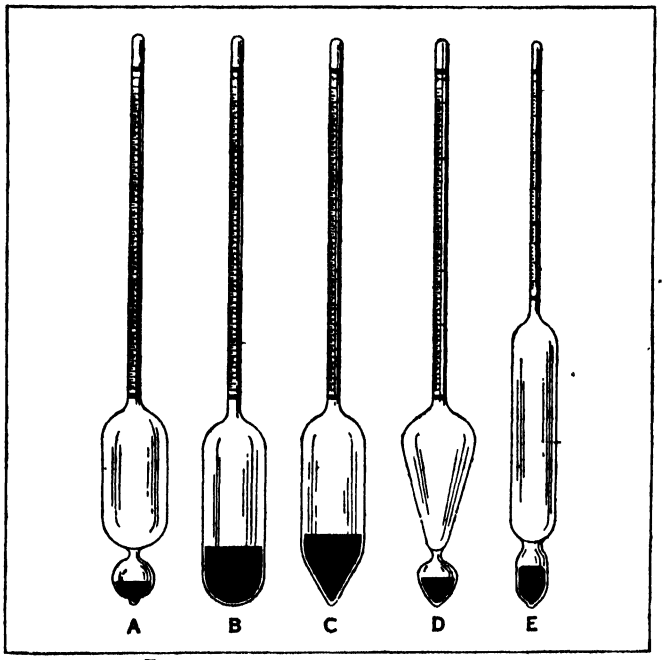

FIG. 2.—MODERN GLASS HYDROMETERS

low thermal hysteresis, resistant to chemical action and free from striae and similar defects. The stem should be cylindrical but considerable latitude is permissible in the shape of the bulb. Some common forms are shown in fig. 2. The hydrometer must be loaded so that it floats with its stem vertical. The loading material, if mercury, should be confined to a lower bulb (figs. *2a, 2d, 2e*); if lead shot, it should be confined to a lower bulb or fixed in position with wax if placed in the main bulb as in figs. *2b* and *2c*.

Good quality paper should be used for the scale which must be securely fixed in position in the stem and there should be a reference mark etched on the stem coincident with a second reference mark on the paper scale so that any accidental shift of the scale is made evident by a separation of the reference marks.

The graduation marks must be horizontal when the stem is vertical and the scale should be free from twist so that the graduation marks lie vertically beneath each other and do not lie on a spiral round the stem. The length of the graduation marks should be suitably varied and sufficient marks numbered to enable the hydrometer to be read at a glance. The distance between adjacent graduation marks should not be less than 1 mm. nor more than 3 mm.

The scale should bear an inscription indicating precisely the basis of graduation, *e.g.*, "Gms./ml. at 15° C" is a suitable inscription for a hydrometer adjusted to indicate densities in grammes per millilitre at 15° C.

Relation Between Volume of Stem and Volume of Bulb.—Let

M = the mass of the hydrometer in grammes.

δ_0 = the density corresponding to the highest graduation mark in gram./ml.

δ_N = the density corresponding to the lowest graduation mark in gram./ml.

V = volume of portion of hydrometer below the lowest graduation mark.

v = volume of stem between highest and lowest graduation marks in ml.

Then we have

$$M = \delta_0(V+v) = \delta_N V$$

whence

$$V = v \times \frac{\delta_0}{\delta_N \delta_0}$$

Spacing of Graduation Marks on Density Hydrometer.—Let δ gms./ml. be the density corresponding to any graduation mark intermediate between those corresponding to the limiting densities δ_0 and δ_N and let v' be the volume of the stem between the marks corresponding to the densities δ_0 and δ_N. Then we have

$$M = \delta_0(V+v) = \delta(V+v-v') = \delta_N V$$

and by eliminating M and V we obtain

$$v' = v \times \frac{\delta-\delta_0}{\delta_N-\delta_0} \times \frac{\delta_N}{\delta}.$$

If the stem is of uniform diameter and L is the distance between the marks corresponding to δ_0 and δ_N and l is the distance from the highest graduation mark of the mark corresponding to δ then

$$l = L \times \frac{\delta-\delta_0}{\delta_N-\delta_0} \times \frac{\delta_N}{\delta_0}.$$

For a hydrometer of range 1·000 gms./ml. (δ_0) to 1·050 gms./ml. (δ_N) having $L = 150$mm. the above relation gives the following values:

Density corresponding to graduation mark (gms./ml.)	1·000	1·010	1·020	1·030	1·040	1·050
Distance of graduation mark from highest graduation mark (mm.)	0	31·2	61·8	91·8	121·2	150·0

From the above values we have:—

Distance from 1·000gms./ml. mark to 1·010gms./ml. mark = 31·2mm
" " 1·010 " " " " 1·020 " " " = 30·6 "
" " 1·020 " " " " 1·030 " " " = 30·0 "
" " 1·030 " " " " 1·040 " " " = 29·4 "
" " 1·040 " " " " 1·050 " " " = 28·8 "

The length corresponding to a change in density of 0·010 gms./ml. therefore decreases towards the lower end of the scale, *i.e.*, the graduation marks on a density hydrometer become more closely spaced towards the lower end of the scale.

Temperature Corrections for Density Hydrometers.—Suppose a density hydrometer, adjusted to indicate densities in gms./ml. correctly at t° C, to read δ gms./ml. in a liquid having a temperature t° C and also to read δ gms./ml. when placed in a second liquid having a temperature t'°C.

The density of the first liquid is δ gms./ml. at t° C where $\delta = M/V$, M gms. being the mass of the hydrometer and V the volume of the portion of the hydrometer below the mark δ.

When the hydrometer is reading δ gms./ml. in the second liquid having a temperature t'° C the volume of the submerged portion of the hydrometer is $V\{1+\alpha(t'-t)\}$ml. where α is the coefficient of cubical expansion of the glass from which the hydrometer is made. The density δ gms./ml. at t'° C of the second liquid is therefore given by the equation

$$\delta' = \frac{M}{V\{1+\alpha(t'-t)\}}$$

or to a close approximation

$$\delta' = \delta\{1-\alpha(t'-t)\}$$

Let c be a correction to be applied to the reading δ gms./ml. in the second liquid in order to give the density δ' gms./ml. of that liquid at t'°C. Then

$$\delta' = \delta + c$$

whence

$$c = \delta\alpha \cdot (t-t').$$

An average value for α is 0·000026, so that if $(t-t')$ is equal to 10°C we obtain the following values of c for various values of δ:

δ	0·6	1·0	1·5	2·0
c	0·0002	0·0003	0·0004	0·0005

Now an error of 0·0005 gms./ml. in density is negligible for most purposes for which hydrometers are used and so the above values of c are negligible in magnitude. Hence a density hydrometer which indicates densities correctly in gms./ml. at its standard temperature $t°$ C may be used at any temperature within the range $(t \pm 10)°$ C and will still indicate densities *at the temperature of observation* with a sufficient degree of accuracy for all ordinary purposes.

Effects of Surface Tension on Hydrometer Readings.—When a hydrometer is floating in a liquid the surface of the liquid does not remain level up to the point of contact with the emergent stem of the hydrometer, but liquid piles up against the stem as shown in fig. 3. There is a downward pull on the stem of the hydrometer equal to the product of the surface tension of the liquid and the perimeter of the stem, *i.e.*, equal to $(T \times \pi \times d/10)$ dynes for a stem of circular cross section where T is the surface tension in dynes per centimetre and d mm. is the diameter of the stem. The effect of this is virtually to increase the mass of the hydrometer by an amount equal to $\frac{\pi d T}{10g}$ gms. where g cm./sec² is the acceleration due to gravity.

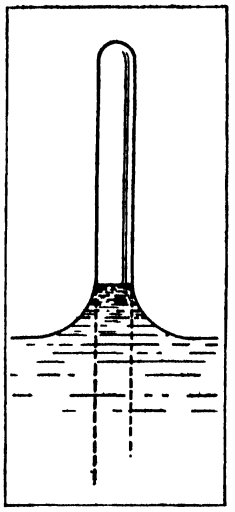

FIG 3.—SURFACE TENSION ON A HYDROMETER

Suppose that a hydrometer reads δ gms./ml. in a liquid having a surface tension T_1 dynes/cm. and that this reading correctly represents the density of the liquid. Now suppose the hydrometer to be placed in a second liquid having the same density δ but a greater surface tension T_2 dynes/cm. The virtual increase in mass due to surface tension in the second liquid will be greater than that in the first liquid by an amount equal to

$$\frac{\pi d}{10g} \cdot \{T_2 - T_1\}$$

Hence the hydrometer will sink further in the second liquid than in the first until the increase in the mass of liquid displaced by the hydrometer is equal to the increase in the mass of liquid in the meniscus. If l mm. is the additional length of stem submerged in the second liquid the increase in the mass of liquid displaced by the hydrometer is

$$\frac{\pi}{4} \cdot \frac{d^2}{100} \cdot \frac{l}{10} \cdot \delta$$

Hence we have

$$\frac{\pi d}{10g}\{T_2 - T_1\} = \frac{\pi}{4} \cdot \frac{d^2}{100} \cdot \frac{l}{10} \cdot \delta$$

from which

$$l = \frac{400}{\lambda d \delta g}\{T_2 - T_1\}.$$

Let λ be the length of a subdivision on the hydrometer scale near the point corresponding to the density δ and let $\phi = l/\lambda$. From the above equations we have

$$\phi = \frac{400}{\delta d \delta g}\{T_2 - T_1\}$$

and ϕ represents the error in terms of subdivisions corresponding to a change in surface tension amounting to $\{T_2 - T_1\}$. It is obviously desirable that ϕ should be as small as possible, *i.e.*, that λd should be as large as possible. Sufficient attention is not always paid to this fact in the design of hydrometers.

The following example will serve to illustrate the magnitude of surface tension effects. For a hydrometer of range 1·000 gms./ml. to 1·040 gms./ml. having $\lambda = 1·5$ mm. and equivalent to 0·001 gms./ml. we have if $\delta = 1·030$ gms./ml. and $d = 5$mm.

$$\phi = 0·053\{T_2 - T_1\}.$$

If such a hydrometer were to be adjusted to read correctly at 1·030 gms./ml. in dilute sulphuric acid having a surface tension of 70 dynes/cm. and were subsequently to be used in milk of the same density but having a surface tension of 50 dynes/cm. then ϕ is 1·03, so that the hydrometer would be in error when used in milk by slightly more than one whole subdivision, *i.e.*, slightly more than 0·001 gms./ml.

Some liquids, notably dilute aqueous solutions, have high surface tensions when the liquid surface is perfectly clean but even very slight contamination may lower the surface tension considerably, *e.g.*, by as much as 20 dynes/cm. The errors consequent upon such variations in surface tension are the most serious of the limitations to the accuracy attainable with hydrometers.

Specific Gravity Hydrometers and Density Hydrometers.—Glass specific gravity hydrometers are very extensively used in many industries and in this country the majority are adjusted to indicate specific gravity $\frac{S_{60° F}}{60° F}$ at 60° F. If n is a reading on such a hydrometer at 60° F the density of the liquid in which the reading is taken is $n \times 0·999041$ gms./ml. since the density of water at 60° F is 0·999041 gms./ml. and specific gravity $\frac{S_{t_1°}}{t_2°}$ is simply the ratio:—density of liquid at t_1: density of water at t_2. The scale of a specific gravity hydrometer becomes more closely spaced towards the bottom exactly as on a density hydrometer, in fact, a hydrometer indicating $\frac{S_{60° F}}{60° F}$ at 60° F could be converted to indicate densities in grammes per millilitre at 60° F simply by increasing its mass in the ratio 1: 0·999041.

Though the basis given is that most commonly employed, many others are also used, e.g., $\frac{S_{15° C}}{15° C}$ at 15° C, $\frac{S_{17·5° C}}{17·5° C}$ at 17·5° C, $\frac{S_{20° C}}{20° C}$ at 20° C and so on.

Hydrometers adjusted to indicate densities in grammes per millilitre are preferable from a scientific point of view to hydrometers indicating specific gravity, because their scales are more directly related to the fundamental units of measurement. They are not so widely used as specific gravity hydrometers but they are coming into more general use.

Hydrometers for Ascertaining the Strength of Alcohol. *History of Development in Great Britain.*—Hydrometers came into use for ascertaining the strength of spirits towards the end of the 17th century, when they began to displace such comparatively crude tests as the well-known powder test. In the powder test spirit was poured on to a small quantity of gunpowder and then a light was applied to the wet powder. If it burned the spirit was "over-proof" and if not the spirit was "under-proof." The earliest hydrometers resembled that shown in fig. 1 and had a mark near the middle of the stem at which the hydrometer would float in a mixture of about equal parts of alcohol and water. A mark at the bottom of the stem indicated the reading in water and one at the top the reading in the strongest alcohol then known. If the middle mark came well below the surface of a sample of spirit the spirit was "over-proof." This form of hydrometer gave some degree of precision to the term "proof-spirit" but only roughly indicated "over" and "under-proof" strengths. With the increase in duties and the increased need for more accurate discrimination between the strengths of different spirits considerable development of hydrometers occurred in the 18th century, more closely divided scales were used, and metal hydrometers with detachable weights of various sizes were made. It was not, however, until quite the end of the 18th century that the necessary data for placing alcoholometry on a sound basis was available.

In 1794 George Gilpin, clerk to the Royal Society, published a comprehensive set of tables based on a long series of determinations of the specific gravity of mixtures of alcohol and water.

These tables gave the specific gravity $\frac{S_t°\,F}{60\,F}$ for each degree Fahrenheit from $t=30°$ F to $t=80°$ F, of 201 different mixtures of alcohol water, the strength of the mixtures being expressed thus:—

Spirit—Parts by weight . .	100	100	100	...	100	100	99	...	2	1	0		
Water—Parts by weight .	0	1	2	...	99	100	100	.	100	100	100		

The tables also gave the percentage composition by volume of each mixture and by 1794 all the necessary data existed for obtaining the strength of any sample of spirit from a determination of its density. The problem remained, however, of linking up the available data with the simplest method of determining density, *i.e.*, by means of a hydrometer.

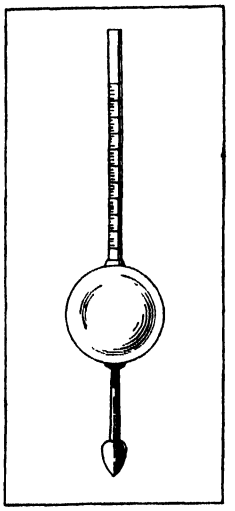

FIG. 4.—THE SIKES HYDROMETER

In 1802 the Government asked for hydrometers to be submitted to them for examination with a view to the adoption for revenue purposes of the one considered most suitable for determining the strength of spirits. As a result a hydrometer and tables submitted by Bartholomew Sikes were adopted for revenue purposes and legalized by Acts of Parliament of 1816 and 1818. In all its essentials Sikes's system remains in use at the present time.

The outstanding features of Sikes's proposals were: (1) he gave precision to the then customary method of expressing strength in terms of "proof-spirit"; (2) he appreciated the desirability of keeping the hydrometer as simple as possible and the necessity for providing tables to obtain adequate accuracy in determining proof-strength from hydrometer readings; (3) he prepared his tables accurately and in a form convenient for use.

Proof spirit was defined (56 Geo. III. c. 140, 1816) as "that which at the temperature of 51° F weighs exactly $\frac{12}{13}$ parts of an equal measure of distilled water." Proof spirit so defined contains 49·28% by weight of pure anhydrous alcohol. If from 100gals. of a given spirit containing more alcohol than an equal volume of proof spirit, 120gals. of proof spirit could be obtained by the addition of water, the spirit was said to be 20% over-proof, and 100gals. of that spirit would be charged the same duty as 120gals. of proof spirit. Similarly a spirit 100gals. of which contained the same amount of alcohol as 80gals. proof spirit was 20% under-proof and dutiable at 80% of the rate fixed for proof spirit. On this basis it is only necessary to fix the amount of duty payable on one gallon of proof spirit and the duty chargeable on any particular quantity of spirit can then be reckoned from its bulk and proof strength. By his hydrometer and tables, Sikes provided a ready means of ascertaining proof strengths.

Sikes's Hydrometer.—The Sikes hydrometer in use at the present time is shown in fig. 4. It is a gold-plated brass hydrometer with a spherical bulb about 4cm. in diameter. Above the bulb is a hollow rectangular stem about 9·5cm. in length and 5mm.×2mm. in cross section. On this stem a scale about 6·5cm. in length and subdivided into 50 equal parts is engraved. The highest graduation mark is carried completely across the face of the stem and numbered "0," the next four graduation marks are shorter lines, the fifth line is carried completely across the stem and numbered "1" and so on down to the lowest mark which is numbered "10." In the original hydrometer there were no subdivisions between the graduation marks. Below the bulb is a stem about 3cm. in length which is circular in cross-section, tapers towards the bulb and has a balancing poise fixed at its lower end.

There are a series of nine gold-plated brass weights for use with the hydrometer. Each weight is in the form of a disc with a central hole and slot cut in it as shown in fig. 5. The size of the slot is such that it will easily pass over the upper end of the lower stem of the hydrometer but will not pass over the thicker lower end of this stem. The central hole is large enough to allow the weight to be placed on the lower stem and rest on the top of the balancing poise. The weights are graded in size and numbered 10, 20, 30 and so on up to 90. They are adjusted so that if the hydrometer reading in a suitable sample of spirit is 10 on the scale when the 20 weight is attached to the hydrometer, then the scale reading in the same sample of spirit when the 20 weight is replaced by the 30 weight will be 0. The hydrometer reading in any sample of spirit is the sum of the number marked on the weight required to make the hydrometer float with part of its stem submerged in the liquid and the scale reading at the intersection of the level liquid surface with the stem. The complete range of readings is thus 0 to 100, since the hydrometer may be used alone or with any one of the nine weights placed on the lower stem.

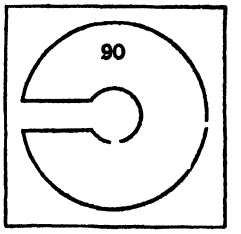

FIG. 5.—HYDROMETER WEIGHT

Tables for Use with Sikes's Hydrometer.—The present tables for use with Sikes's hydrometer differ from the original ones only in that they cover a larger range of temperature, progress by fifths of a degree Sikes instead of whole degrees, and are based on later determinations of the density of alcohol-water mixtures. A portion of the table for 60° Fahrenheit is given below:—

Indication	Per cent. U.P.	Indication	Per cent. U.P.	Indication	Per cent. U.P.	Indication	Per cent. U.P.	Indication	Per cent. U.P.
50·0	12·9	60·0	1·7	70·0	18·6	80·0	40·3	90·0	71·9
50·2	12·6	60·2	2·0	70·2	19·0	80·2	40·8	90·2	72·6
50·4	12·3	60·4	2·3	70·4	19·4	80·4	41·3	90·4	73·2
50·6	12·1	60·6	2·7	70·6	19·7	80·6	41·9	90·6	73·9
50·8	11·8	60·8	3·0	70·8	20·1	80·8	42·4	90·8	74·5
51·0	11·5	61·0	3·3	71·0	20·5	81·0	42·9	91·0	75·2

The table for 60° F extends over the whole range from 0 to 100 on the Sikes scale in steps of 0·2 as above and there is a similar table for each degree Fahrenheit from 30° F to 100° F inclusive. To ascertain the strength of a sample of spirit all that is necessary is to read the hydrometer in the spirit, observe the temperature of the sample at the time the reading is taken, and then refer to the table for the particular temperature observed in which the required proof strength will be found against the observed hydrometer reading.

Extension of Range.—Sikes's hydrometer instrument, used without any weight attached, sinks below the 0 mark at 30° F in spirits containing more than 97·1% by weight of alcohol (72·2% O.P.) and at 100° F in spirits containing more than as little as 85·5% by weight of alcohol (57·5% O.P.). For strong spirits an additional hydrometer, similar to the Sikes hydrometer, and having a scale numbered "A" 0 to "A" 10 has therefore been introduced for revenue purposes in Great Britain. The hydrometer reads "A" 10, the lowest mark on the stem, in a spirit in which the ordinary range Sikes hydrometer reads 0. In India a hydrometer of range "A" 0 to "A" 20 is used for strong spirits, "A" 20 on this scale being equivalent to 0 on the ordinary Sikes scale, and "A" 10 being equivalent to "A" 0 on the English scale for strong spirits. Such complications seem inevitably to follow the adoption of arbitrary scales.

Alcohol Hydrometry in Other Countries.—Hydrometers and appropriate tables are widely used for ascertaining the strength of spirits. (For details see *Alcoholometric Tables* by Sir Edward Thorpe.) A proof standard similar to the English is used in America and Holland but both differ from the English and also from each other. In Russia, France and Italy the strength of spirits is expressed as percentage of alcohol by volume, and in Germany as percentage of alcohol by weight. There is even greater diversity in the hydrometers employed. There are purely arbitrary scales like the Sikes; in Russia a hydrometer indicating 100 in water, and 0 in strong spirits, is used and in Holland a scale of 28 degrees each representing an equal length on the scale is

used. Other hydrometers in use are adjusted to indicate percentage of alcohol, some by weight, some by volume, and still other hydrometers have scales indicating proof strengths.

Since the density of a spirit serves as a measure of its strength and since also its density determines the position of equilibrium of any hydrometer placed in the spirit it is obviously possible to correlate any hydrometer scale and spirit strengths. The same thing applies to other liquids and it is therefore easy to understand how a large variety of hydrometers has come into use not only in alcoholometry but for other purposes also. The result is obviously not without its disadvantages.

Saccharometers.—Bates saccharometers are used for estimating the duty on the sugar content of worts, the liquid from which beer is produced by fermentation. The duty is reckoned on the basis of the specific gravity $\left(\frac{S_{60^\circ F}}{60^\circ F}\right)$ of the worts and the Bates saccharometer is a gold-plated metal hydrometer adjusted to indicate specific gravity $\left(\frac{S_{60^\circ F}}{60^\circ F}\right)$ when read in worts at 60° F. It has a rectangular stem on which a scale numbered 0 to 30 is engraved, this range being equivalent to a change in specific gravity of 0·030. The scale is divided into 30 intervals, each corresponding to 0·001 change in specific gravity. A series of weights numbered 1,000, 1,030, 1,060 and so on are used with the hydrometer. They are olive-shaped and each is provided with a conical stem which is a tight fit in a conical hole in a vertical ring fixed to a short stem below the hydrometer bulb (*see* fig. 6). With the 1,000 weight attached the range of the hydrometer is from $\frac{S_{60^\circ F}}{60^\circ F}$ 1·000 to $\frac{S_{60^\circ F}}{60^\circ F}$ 1·030 with the 1,030 weight $\frac{S_{60^\circ F}}{60^\circ F}$ 1·030 to 1·060 and so on. In order that the same scale may be used with each weight it is necessary not only that the mass of the weights must be adjusted correctly but also the volume of each weight must be greater than that of the next smaller weight by an amount equal to the volume of the stem between 0 and 30.

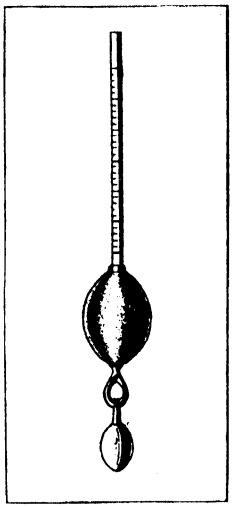

FIG. 6.—BATES SACCHAROMETER

Glass hydrometers adjusted to indicate density and also those adjusted to indicate specific gravity are extensively used both in the brewing and the sugar industries.

The Brix saccharometer simply indicates percentage of sugar by weight when read in sugar solutions at 17·5° C.

Some glass hydrometers are scaled so that when read in hot sugar solutions, *e.g.*, at 150° F, they indicate the specific gravity $\frac{S_{60^\circ F}}{60^\circ F}$ which the solution would have if cooled down to 60° F.

Other hydrometers have an enclosed thermometer but the thermometer scale indicates not temperature but corrections to be applied to observed readings on the hydrometer scale due to any difference between the temperature of the solution and that at which the hydrometer scale is correct.

The last two types of hydrometer are not to be recommended. It is a mistake to try to make a hydrometer perform the function of both hydrometer and correction tables.

Twaddle Hydrometers are generally made of glass and adjusted for use at 60° F. The Twaddle scale is defined by the relation

$$\frac{200+n}{200} = S \text{ or } n = 200(S-1)$$

where n is the scale reading at 60° F in degrees Twaddle and s is the corresponding specific gravity $\frac{S_{60^\circ F}}{60^\circ F}$.

A complete set of Twaddle hydrometers consists of six hydrometers having the ranges 0°–24°; 24°–48°; 48°–74°; 74°–102°; 102°–138°, 138° to 170° respectively. The complete range 0° to 170° (i.e., $\frac{S_{60^\circ F}}{60^\circ F}$ 1·000 to $\frac{S_{60^\circ F}}{60^\circ F}$ 1·850) covers the range of specific gravities of mixtures of sulphuric acid and water from that of pure water to that of pure acid. The hydrometer scales in hydrometers forming a set like the above are usually subdivided into intervals representing 0·5° on the Twaddle scale.

The above ranges are those most frequently met with, but Twaddle hydrometers are also made in a variety of other ranges and with various degrees of openness of scale.

It is clear from the relation defining the Twaddle scale that a change in reading of one degree on a Twaddle hydrometer represents a change of 0·005 in specific gravity. Hence a specific gravity hydrometer indicating $\frac{S_{60^\circ F}}{60^\circ F}$ at 60° F and subdivided into intervals representing 0·005 change in specific gravity could be converted into a Twaddle hydrometer simply by re-numbering the scale. The only apparent reason for having Twaddle hydrometers as well as specific gravity hydrometers is that they give a scale confined to three figure numbers, and when an accuracy of 1° Twaddle suffices avoid the use of a decimal point. Twaddle hydrometers serve no purpose which could not equally well be fulfilled by either density or specific gravity hydrometers.

Baumé Hydrometer.—In 1768 Antoine Baumé published in *L'Avant* directions for making the hydrometers which are known by his name. The hydrometer for use in liquids heavier than water was to read 0° Bé in water at a temperature of 10° Réaumur and 15° Bé in a 15% salt solution at the same temperature. The scale between 0° Bé and 15° Bé was to be divided into 15 divisions each equal in length, and prolonged by similarly spaced graduation marks beyond the 15° Bé mark. The hydrometer for use in liquids lighter than water was to read 0° Bé in a 10% salt solution at 10° Réaumur and 10° Bé in water at the same temperature, the scale being prolonged upwards above the water point by equally spaced divisions each equal in length to one-tenth the distance between the 0° Bé and 10° Bé marks.

The Baumé hydrometer appeared at a time when other hydrometers were becoming unduly complicated. Clarke's hydrometer, for example, which was used for spirit assaying prior to the introduction of Sikes's hydrometer, had become encumbered with 54 weights. The Baumé hydrometer, with its evenly spaced scale, was easy to manufacture and simple to use. It is not surprising, therefore, that it came into general use for the scale readings, although in a sense entirely arbitrary, it could, if necessary, be correlated with density or any property varying with density.

However, in course of time differences became noticeable when Baumé hydrometers from different sources were compared. It may be shown that the readings on any hydrometer having an evenly spaced scale can be expressed by a relation of the type

$$d = \frac{A}{B+n}$$

where d is the density corresponding to the reading n and A and B are constants. Consequently, in order to provide greater precision in definition of the scale and to preserve the continuity of scales in current use, formulae of the above type were introduced. Unfortunately, however, no one formula was universally adopted—formulae were based on particular instruments and a variety of different ones came into use. In Germany, for example, an inquiry in 1892 showed that there were three different formulae in common use. Consequently the formula

$$\frac{S_{15^\circ C}}{15^\circ C} = \frac{144{\cdot}3}{144{\cdot}3 \pm n}$$

was proposed, which made the reading 0° Bé in water at 15° C on both the heavy and light hydrometers, the − sign being used for the heavy hydrometers and the + sign for the light ones. This relation, it was proposed, should supersede the three others in common use and later, in 1904, it was adopted as the basis of the official testing of Baumé hydrometers by the Kaiserliche-Normal-Eichungs-Kommission. However, the three original formulae have survived alongside the new one so that the attempt at standardization has merely resulted in Germany having four

different Baumé scales in 1928 as compared with three in 1892.

Again, in America, the Bureau of Standards about 1904 adopted the formulae

$$\frac{S_{60°F}}{60°F} = \frac{145}{145-n} \text{ and } \frac{S_{60°F}}{60°F} = \frac{140}{130+n}$$

for the heavy and light scales as representing the then customary practice in America. In June 1916, however, the Bureau of Standards found it necessary to protest against the use in America of the formula

$$\frac{S_{60°F}}{60°F} = \frac{141{\cdot}5}{131{\cdot}5+n}$$

for the light Baumé hydrometer. Yet in 1921 the Bureau of Standards agreed to accept this basis for light Baumé hydrometers for use in the petroleum industry, the scale so defined to be known as the A.P.I. scale, but retained its original formula for light Baumé hydrometers for use in liquids other than petroleum (The Bureau of Standards *Circular* 59, 1916, and *Circular* 154, 1924).

So much for modern attempts to standardize the Baumé hydrometer, but it should also be noted that already in 1881 Prof. Chandler had collected 23 different formulae, proposed at one time or another, for the heavy Baumé hydrometer and 11 for the light hydrometer. There is only one practical way of ending the confusion which has grown up around the Baumé hydrometer. This is to discontinue its use entirely and to substitute hydrometers indicating density directly. (See *Glas und Apparat*, 1928, IX.–23.)

Constant Displacement Hydrometers.—In all the hydrometers considered so far the variation in displacement—*i.e.*, volume submerged—of a hydrometer of constant mass has served as a means of determining density. It is obviously possible to determine densities by using a hydrometer of known mass and determining the additional mass necessary to immerse the hydrometer to a single fixed mark corresponding to a known displacement. Hydrometers, of which the best known is Nicholson's, based on this principle, have been made but they are not so convenient to use as ordinary hydrometers and are of little practical importance.

Relative Merits of Metal and Glass Hydrometers.—The disadvantages of metal hydrometers are:—(1) They are liable to change in weight due to corrosion and wear; (2) the stem is not so readily wetted as the stem of a glass hydrometer; (3) the joints are apt to develop leaks; (4) the bulbs are necessarily made of thin metal and are very liable to become dented. It will be realized that through wear, slight leakage, or a small dent, a metal hydrometer may become seriously in error without this being suspected unless the accuracy of the hydrometer is checked at frequent intervals. A glass hydrometer is free from such disadvantages and provides a much more reliable instrument than a metal one. It is more liable to breakage than a metal hydrometer, but once broken the damage is apparent and there is no risk of using a hydrometer which has become seriously out of adjustment, which is one of the most serious objections to a metal hydrometer.

Standardization of Hydrometers.—Since the readings on any hydrometer scale can be converted into equivalent densities, the errors of a hydrometer may obviously be obtained by reading the hydrometer in a liquid of known density. It is more convenient, for example, to determine the errors of a hydrometer indicating percentages of sugar by weight, by determining the densities corresponding to various points on the scale rather than by making up a series of sugar solutions to definite concentrations and reading the hydrometer in them.

The best method is to determine the density of the liquid and to observe simultaneously the reading of the hydrometer in the liquid. This can be done most conveniently by employing the sinker method of determining density. (*See* DENSITY.) The hydrometer and sinker can be placed side by side in the liquid and the hydrometer reading observed under precisely the same conditions as those under which the density is determined. Thorough stirring immediately previous to the observations and efficient temperature control are essential to secure uniform density throughout the liquid, and to bring the temperature of the liquid to that at which the corrections to the hydrometer are required.

The direct standardization of hydrometers by the above method takes considerable time and is generally only employed for hydrometers intended for use as standards for verifying other hydrometers. Given a hydrometer whose scale errors are known, a similar hydrometer may be verified by floating it side by side with the standard and taking simultaneous readings on both hydrometers. The difference between the readings combined with the known error of the standard gives the correction to the scale of the hydrometer under test. If the two hydrometers differ appreciably in dimensions, due allowance must be made for surface tension effects unless they are compared in the same liquid as that in which the hydrometer under test is to be used and the corrections to the standard in this liquid are known.

The extensive use of hydrometers in industry and the necessity for accuracy in construction has led to arrangements being made whereby hydrometers may be submitted for verification to national institutions—in England to the National Physical Laboratory, in America to the Bureau of Standards, Washington, in France to the Laboratoire d'Essais, Paris, and in Germany to the Physikalische Technische Reichsanstalt, Charlottenburg.

BIBLIOGRAPHY.—*Philosophical Transactions* (1794, 1790, 1792); J. Scarisbrick, *Spirit Assaying* (Wolverhampton, 1898); *Spirit Tables Sikes Hydrometer* issued by authority of the Commissioners H.M. Customs and Excise (1916); Bureau of Standards, *Circular* 59 (1916); Bureau of Standards, *Circular* 154 (1924). (V. St.)

HYDROPATHY, the name given to the treatment of disease by water, used outwardly and inwardly. The active agents in the treatment are heat and cold, of which water is little more than the vehicle, and not the only one.

Hydropathy, as a formal system, dates from about 1829, when Vincenz Priessnitz (1801–51), a farmer of Gräfenberg in Silesia, Austria, began his public career in the paternal homestead, extended so as to accommodate the increasing numbers attracted by the fame of his cures. Two English works, however, on the medical uses of water had been published in 1702 and 1797 before the rise of the movement under Priessnitz. These were by Sir John Floyer (1649–1734), a physician of Lichfield (largely drawn upon by Dr. J. S. Hahn, of Silesia, in a work published in 1738) and by Dr. James Currie (1756–1805) of Liverpool (translated into German in 1801 and 1807). Hahn's writings had meanwhile created much enthusiasm among his countrymen, societies having been everywhere formed to promote the medicinal and dietetic use of water; and in 1804 Professor Örtel of Ansbach republished them and quickened the popular movement by unqualified commendation of water drinking as a remedy for all diseases. In him the rising Priessnitz found a zealous advocate, and doubtless an instructor also.

Captain Claridge introduced hydropathy into England in 1840, his writings and lectures, and later those of Sir W. Erasmus Wilson (1809–84), James Manby Gully (1808–83) and Edward Johnson, making numerous converts and filling the establishments opened at Malvern and elsewhere. In Germany, France, and America hydropathic establishments multiplied with great rapidity.

At first, hydropathists treated mainly a sturdy order of chronic invalids well able to bear a rigorous regimen. Later, to suit more delicate cases, the system was modified by John Smedley, a manufacturer of Derbyshire, who, about 1852, founded at Matlock a counterpart of the establishment at Gräfenberg.

Ernst Brand (1826–97) of Berlin, Räljen, and Theodor von Jürgensen of Kiel, and Karl Liebermeister (1833–1901) of Basle, between 1860 and 1870, employed the cooling bath in typhoid fever with striking results that led to its introduction to England by Dr. Wilson Fox. In the Franco-German war the cooling bath was largely employed, in conjunction frequently with quinine; and it now holds a recognized position in the treatment of hyperpyrexia. The wet sheet pack has become part of medical practice; the Turkish bath, introduced by David Urquhart (1805–77) into England on his return from the East, and ardently adopted by Dr. Richard Barter (1802–70) of Cork, has

become a public institution, and, with the "morning tub" and the general practice of water drinking, is the most noteworthy of the many contributions by hydropathy to public health. (*See* BATHS, *ad fin.*)

The appliances and arrangements by means of which heat and cold are brought to bear on the economy are—(a) Packings, hot and cold, general and local, sweating and cooling; (b) hot air and steam baths; (c) general baths, of hot water and cold; (d) sitz, spinal, head, and foot baths; (e) bandages (or compresses), wet and dry; also (f) fomentations and poultices, hot and cold, sinapisms, stupes, rubbings, and water potations, hot and cold.

BIBLIOGRAPHY.—A useful work dealing comprehensively with the subject is Richard Metcalfe's *Rise and Progress of Hydropathy* (1906).

HYDROPHOBIA or **RABIES,** an acute disease occurring particularly in dogs, and liable to be communicated by them to other animals and to man. In the nerve cells from cases of rabies, and in no other disease, certain bodies, named after Negri, their discoverer, are found with so much regularity that they are held to be diagnostic of the disease. Moreover, if rabies be transferred experimentally to other animals Negri bodies are found in their brains also. Negri bodies are 1–20 μ in diameter and their relation to the filter-passing virus of the disease is uncertain. They are not found in the saliva.

In Dogs, etc.—The occurrence of rabies in the fox, wolf, hyaena, jackal, raccoon, badger, and skunk has been asserted; but probably it is originally a disease of the dog. It is caused by a filter-passing virus (*q.v.*) and is communicable to other warm-blooded creatures. The affected animal, at a certain stage of the disease and upon slight excitement, tends to attack with its natural weapons—dogs and other carnivora attacking with teeth, herbivora their hoofs or horns, and birds with beaks.

Symptoms.—The malady, which runs its whole course in about a week, commences with a change in the habits of the dog; it becomes dull and uneasy and seeks to isolate itself in out-of-the-way places, and is apt to gather up straw, thread, bits of wood, etc., to lick anything cold, as iron, stones, and to lick other animals. Sexual excitement is frequently an early symptom. At this period no disposition to bite is observed. These symptoms gradually become more marked; snapping and excited movements occur, but the dog still recognizes its master's voice; restlessness and agitation increase.

There is no dread of water in the rabid dog; the animal is thirsty and, if water be offered, will lap it with avidity and swallow it—at the commencement of the disease. And when, at a later period, the constriction about the throat—symptomatic of the disease—renders swallowing difficult, the dog will none the less endeavour to drink.

At first the dog does not usually refuse to eat; but soon perversion occurs, and the litter of its kennel, wool, wood, earth, stones, or whatever else may come in its way are devoured.

A mad dog does not usually foam at the mouth. The saliva is not much increased in quantity, but soon becomes viscid and clings to the angles of the mouth, fauces, and teeth. Thirst is great, and the dog sometimes furiously attempts to detach the saliva with its paws. There is another symptom connected with the mouth in that form of the disease named "dumb madness," which has frequently proved deceptive. The lower jaw drops, from paralysis of its muscles, and the mouth remains open. In this condition the creature cannot bite but the saliva is none the less virulent. The mouth should not be touched, numerous deaths having occurred through people, thinking a dog had some foreign substance lodged in its throat, thrusting their fingers down to remove it. Vomiting of blood occurs in some cases.

The voice of a rabid dog is characteristic. Owing to the alterations taking place in the larynx the voice becomes hoarse, cracked, and stridulous, like that of a child affected with croup. A high-toned bark with open mouth is immediately succeeded by six or eight decreasing howls. This alteration in the voice is frequently the earliest indication of the malady. In dumb madness the voice is frequently lost from the first—hence the designation.

Though cutaneous sensation is much diminished, mental excitability is increased. A rabid dog is usually stirred to fury at the sight of one of its own species. All rabid animals, even the sheep, indeed become furious at the sight of a dog, and attack it.

In most cases such a dog is inoffensive, in the early period of the disease, to those to whom it is familiar; but it is continually endeavouring to escape, and, when free, runs aimlessly forward, perhaps attacking every living creature it meets. It attacks in silence, and should it be hurt in return it emits no cry or howl of pain. The degree of ferocity appears to be related to natural disposition and training. Some dogs only snap in passing, others bite with such violence as to break their teeth, or even their jaws. Soon paralytic symptoms become evident in the intervals of exhaustion between paroxysms; the limbs become feeble and are dragged; the walk is unsteady, while drooping tail and head, open mouth, and protruded tongue present a very characteristic picture. At last, exhausted, it shelters itself in an obscure place—frequently a ditch by the roadside—and lies there in a somnolescent state until paralysis and coma end in death.

In other species of animals the symptoms differ more or less from those manifested by the dog, but they are generally marked by a change in the manner and habits of the creatures affected, combined with paroxysmal ferocity.

In Man.—The disease is communicated to man by the saliva of the affected animal entering a wound or abrasion of the skin or mucous membrane. In 90% of cases this is due to the bite of a rabid dog, but bites of rabid cats, wolves, foxes, jackals, etc., are occasionally the means of conveying the disease. The period of incubation of the disease appears to vary in a remarkable degree, being in some cases as short as a fortnight, and in others as long as several months or even years. On an average it seems to be from about six weeks to three months, but it mainly depends on the part bitten; bites on the head are the most dangerous. The incubation period is also said to be shorter in children. The rare instances of the appearance of hydrophobia many years after the introduction of the poison are always more or less open to question as to subsequent inoculation.

When the disease is about to declare itself the wound, which had quickly and entirely healed after the bite, often begins to exhibit evidence of irritation or inflammation or to be the seat of numbness, tingling, or itching. Knowing he has been bitten, the patient's symptoms during the premonitory stage are great mental depression, restlessness, and indefinite fear. There is an unusual tendency to talk, and articulation is abrupt and rapid. There is also some feverishness, loss of appetite, sleeplessness, headache, great nervous excitability, respiration of a peculiar sighing or sobbing character, and even occasionally a noticeable aversion to liquids. These symptoms—constituting what is termed the melancholic stage—continue in general for one or two days, when they are succeeded by the stage of excitement. Sometimes the disease first shows itself in this stage, without antecedent symptoms.

The agitation of the sufferer now becomes greatly increased, and the countenance exhibits anxiety and terror. There is marked embarrassment of the breathing, but the most striking and terrible features of this stage are the effects produced by attempts to swallow fluids. The patient suffers from thirst and desires eagerly to drink, but on making the effort is seized with a violent suffocative paroxysm, produced by spasm of the muscles of swallowing and breathing, which continues for several seconds and is succeeded by a feeling of intense alarm and distress. Indeed the very thought of drinking suffices to bring on a choking paroxysm, as does also the sound of running water. The patient is extremely sensitive to any kind of external impression; a bright light, a loud noise, a breath of cool air, and contact with any one are all apt to bring on one of these seizures. There also occur general convulsions, and occasionally a condition of tetanic spasm. These various paroxysms increase in frequency and severity with the advance of the disease, but alternate with intervals of comparative quiet, in which, however, there is intense anxiety and more or less constant difficulty of breathing, accompanied with a peculiar sonorous expiration, which has suggested the notion that the patient barks like a dog. In many instances there are fits of maniacal excitement, succeeded by calm intervals. During all this

stage of the disease the patient is tormented with a viscid secretion accumulating in his mouth, which from dread of swallowing he is constantly spitting about him. There may also be noticed snapping movements of the jaws as if he were attempting to bite, but these are in reality a manifestation of the spasmodic action which affects the muscles generally. There is no great amount of fever, but there is constipation, diminished flow of urine, and often sexual excitement.

After two or three days of suffering of the most terrible description the patient succumbs, death taking place either in a paroxysm of choking or from exhaustion, all the symptoms having abated and the power of swallowing returned before the end. The duration of the disease from the first declaration of the symptoms is generally from three to five days.

Apart from the inoculation method (*see* below), the treatment of most avail is excision or cauterisation of the part bitten. This should always be done as soon as possible after the injury, even though Pasteur treatment is to follow.

THE PASTEUR TREATMENT

The Pasteur treatment was first applied to human beings in 1885, after prolonged investigation and experimental trial on animals. It is based on the fact that the virus contained in the spinal cord of a rabid animal can be attenuated or intensified in the laboratory at will. By a system of graduated doses the resistance of the patient is raised until he can resist the strongest virus (*see* PASTEUR; IMMUNITY). For instance, the natural virus of dogs is always of the same strength; but when inoculated into monkeys it becomes weakened, and the process of attenuation can be carried on by passing the virus through a succession of monkeys until it loses the power of causing death. If this weakened virus is then passed back through guinea-pigs, dogs, or rabbits it regains its former strength. Again, if it be passed through a succession of dogs it becomes intensified up to a maximum of strength which is called the *virus fixe*. Pasteur further discovered that the strength can be reduced by temperature and by keeping the dried tissues of a rabid animal containing the virus. The system of treatment consists in making an emulsion of the cord and graduating the strength of the dose by using a succession of cords, which have been kept for a progressively diminishing length of time. Those which have been kept for fourteen days are used as a starting-point, yielding virus of a minimum strength. They are followed by preparations of diminishing age and increasing strength, day by day, up to the maximum, which is three days old. These are successively injected subcutaneously. The original method has since been modified in details.

The first patient was treated by Pasteur's system in July 1885. Two forms of treatment are now used—(1) the "simple," in which the course from weak to strong virus is extended over nine days; (2) the "intensive," in which the maximum is reached in seven days. When the maximum—the third-day cord—is reached the injections are continued with fifth-, fourth-, and third-day cords. The whole course is 15 days in the simple treatment and 21 in the intensive. The doses injected range from 1 to 3 cubic centimetres. Injections are made alternately into the right and left flanks.

Later treatment with an anti-rabic serum was suggested. Babes and Lepp and later Tizzoni and Centanni worked out a method of serum treatment, curative and protective. In this method not the rabic poison itself, as in the Pasteur treatment (active immunisation), but the protective substance formed is injected into the tissues (passive immunisation). At the end of 20 days' injections they found they could obtain so potent an anti-rabic serum (Babes using the dog, Centanni, the sheep) that even 1 part of serum to 25,000 of the body weight would protect an animal. This method of vaccination is useful as a protective to those in charge of kennels.

Muzzling Order in Britain.—The attempt to stamp out rabies in Great Britain was an experiment undertaken by the Government. The means adopted were the muzzling of dogs in infected areas and prolonged quarantine for imported animals. The efficacy of dog-muzzling in checking the spread of rabies and diminishing its prevalence has been repeatedly proved in various countries, but it was not applied systematically in England until 1897. Sometimes the regulations were in the hands of the Government, and sometimes they were left to local authorities; in either case they were allowed to lapse as soon as rabies had died down. In April 1897 the Board of Agriculture determined to enforce muzzling over large areas in which the disease existed, and to maintain it for six months after the occurrence of the last case In spite of much opposition and criticism, this was resolutely carried out under Mr. Walter (afterwards Viscount) Long, the responsible minister, and met with great success. By the spring of 1899—that is, in two years—the disease had disappeared in Great Britain, except for one area in Wales; and, with this exception, muzzling was everywhere relaxed in Oct. 1899. It was taken off in Wales also in the following May, no case having occurred since Nov. 1899. Rabies was then pronounced extinct. During the summer of 1900, however, it reappeared in Wales, and several counties were again placed under the order. The year 1901 was the third in succession in which no death from hydrophobia was registered in the United Kingdom. In the ten years preceding 1899, 104 deaths were registered, the death-rate reaching 30 in 1889 and averaging 20 annually. In 1902 two deaths from hydrophobia were registered. From that date the disease has been held in check in the United Kingdom.

See *Annales de l'Institut Pasteur*, from 1886; *Journal of the Board of Agriculture*, 1899; Makins, "Hydrophobia," in Treves's *System of Surgery;* Woodhead, "Rabies," in Allbutt's *System of Medicine*.

HYDROPLANE. The hydroplane is so different from any other boat that it requires separate explanation.

Everyone has played "ducks and drakes" with a flat piece of stone on the seashore, and watched the projected object making a certain number of hops or ricochets over the surface of the water until the speed gets too low, and the stone sinks, being heavier than the water. It is obvious that if the stone were kept moving at full speed it would skim for ever. This is the principle of the hydroplane. The hydroplane is a lightly constructed boat with a comparatively flat bottom, and shaped to present an angle of attack to the water when driven at a high speed. The pressure of the water on the bottom raises the boat on the surface where the boat will stay as long as the pressure is maintained.

In the case of an ordinary boat the weight of the water displaced by the boat equals the weight of the boat. That is to say, the volume of hole the boat makes in the water represents the weight of the boat. It is therefore seen that bodies heavier than water cannot float. When a boat travels at an ordinary speed it still makes a hole equal to its weight and the water has to be pushed aside to allow the boat to progress. At high speeds this causes great resistance. A body such as a hydroplane moving

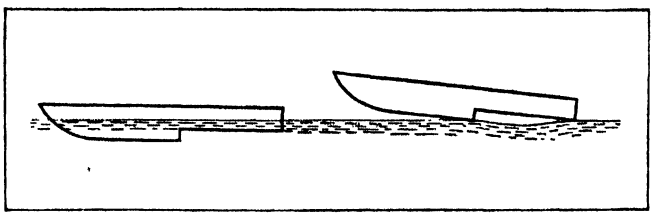

DIAGRAM ILLUSTRATING A HYDROPLANE AT REST AND AT SPEED

very fast stays at the top of the water without displacing its own weight and making only a very shallow hole in the water.

One may ask what is the advantage in building a boat to skim over the water. The answer simply is greatly increased speed. This being so, why not build all boats of hydroplane form. For certain motor launches of about 18 knots, the hydroplane principle can be used; under this speed, the inertia of the water is not great enough to produce much lifting effect, and then the hydroplane hull is bad as regards speed. In an ordinary boat practically all the power available is absorbed in wave making and skin friction, that is rubbing of the particles of water against the sides of the boat. A hydroplane is so designed that when a high speed is attained the normal pressure of the water on the

hull shall have a large vertical component which raises the boat, the support being obtained from the reaction of water to which a downward velocity is imparted by the under surface of the hull. There results the continuous formation of a trough which decreases the wetted surface as a whole, but increases the pressure on the remaining wetted surface. In dealing with pressure, two totally different conditions are involved. First, floating where the hydro-dynamic force is practically nothing and the whole weight is supported by hydrostatic force due to immersion and, secondly, skimming where the hydrostatic effect is practically nil and all the support is due to the hydro-dynamic effects.

The credit for the first hydroplane form belongs to the late Rev. Charles Meade Ramus, Rector of Playden, Rye, Sussex, in about 1870. The want of a sufficiently light engine, however, prevented his experiments getting beyond the model stage until about 35 years later. The Rev. Charles Ramus died in 1896 and thus had not the satisfaction of seeing the practical adoption of his proposals. When the petrol engine began to be used for racing boats much higher speeds were obtained by ordinary round-bottom boats, and the idea of the hydroplane principle again recurred to men's minds The "Ricochet" hydroplane was probably the first practical boat of the type. The bottom was quite flat like a punt with a suitable inclined plane to make her skim. In others the bottom was quite flat in cross sections, but longitudinally was shaped like a saw, so that there were a series of inclined planes. Most of these boats had serious objections as the flat bottom is a very weak structure, and unless the water was quite smooth, the pounding even of small waves produced serious strain on the boats and damage was often done. Sir John Thornycroft experimented at an early date with both model and boats of single-step type and, as long ago as 1877, took out patents for boats designed to skim. Thornycroft's experiments in the early steam days were with boats of quite flat bottom, with a single step, and arranged so that a hollow bottom should support the boat on a cushion of air. This latter method has attained prominence in America under the name of the "Sea Sled." In about 1910 Thornycroft made a very distinct advance by making the hull of a round or barrel form and the plane was built on, and a chine or angle piece was constructed on the bow of the boat. By this means the bow wave could not rise, but was thrown down laterally, concave sections were introduced below the bow portion which became flatter and re-curved as they approached the step.

Another type of hydroplane was introduced by W. H. Fauber. This type resembles an ordinary boat above the water but the under water portion is of a hollow *vee* form which becomes progressively flatter aft. A series of steps forming a number of inclined planes are built on the bottom of the hull. The single step form is a type that has been universally developed. Either plane can be arranged to carry all the weight, the other acting as a balancing plane. A large number of the fastest hydroplanes in America carry most of the weight on the after plane or, again, the weights may be distributed over the two planes, like the "Miranda" type, evolved by Thornycroft. Another type of hydroplane is the stepless. This type has developed rapidly during the past few years. The hull above the water resembles an ordinary boat but the under water sections are of a vee form, the deeper part being at the keel, the sections becoming flatter aft.

HYDROSPHERE, the whole mass of oceanic waters filling the major depressions in the earth's crust, and covering about 72% of its surface (Gr. *ὕδωρ*, water, and *σφαῖρα*, sphere). The name is used in distinction from the atmosphere (*q.v.*), the lithosphere (*q.v.*) and the centrosphere or mass within the crust.

HYDROSTATICS, the branch of hydromechanics which deals with the equilibrium of fluids (*see* HYDROMECHANICS).

HYDROSULPHITE OF SODA, a chemical compound of considerable use in the bleaching industry, a special brand being marketed under the name "Hydros." Its chemical formula is $Na_2S_2O_4$, and its correct name in systematic chemistry is sodium hyposulphite, but this term is also used for the quite distinct sodium thiosulphate (*see* HYPOSULPHITE OF SODA). "Hydros" and "Rongalite" are described in the article SULPHUR.

HYDROXIDE, in chemistry, a compound containing oxygen and hydrogen, linked together in the group, OH, the univalent "hydroxyl" radical, of which one or more are linked to another element or radical. This name has generally replaced the term "hydrate," now confined to substances in which molecules of water as such form a constituent part of the molecule. The above definition, taken in the most general sense, includes such compounds as boric acid, $B(OH)_3$ and ethyl alcohol, $C_2H_5{\cdot}OH$ (*qq.v.*), where the hydroxyl group is combined with a non-metallic and an organic radical respectively, but in practice the term is generally restricted to the hydroxides of metallic elements. The most stable hydroxides are those of the alkali metals, lithium, sodium, potassium, rubidium and caesium. These compounds are powerful alkalis (*see* ALKALI); they are solid substances readily soluble in water to highly alkaline solutions. Sodium hydroxide, also known as caustic soda, and potassium hydroxide, or caustic potash, are the commonest members of this series. Calcium, strontium and barium, the metals of the alkaline earths, also give rise to alkaline hydroxides of which calcium hydroxide, or slaked lime, is the commonest. These three hydroxides are soluble in water to give alkaline solutions, of which lime water, which is used in medicine as an astringent and desiccative when applied externally, is the best known example.

Other metals, such as magnesium, copper, cadmium, iron, furnish hydroxides which are only very sparingly soluble in water. The hydroxides of aluminium, $Al(OH)_3$, and of zinc, $Zn(OH)_2$, have both basic and acidic properties; they dissolve in aqueous solutions of either acids or alkalis. Hydroxides and other substances with these dual properties are termed amphoteric compounds.

See H. B. Weiser, *The Hydrous Oxides* (1926).

HYDROXYLAMINE or HYDROXY-AMMONIA, a compound (NH_2OH) prepared in 1865 by W. C. Lossen by the reduction of ethyl nitrate with tin and hydrochloric acid. In 1870 E. Ludwig and T. H. Hein obtained it by passing nitric oxide through a series of bottles containing tin and hydrochloric acid, to which a small quantity of platinum tetrachloride had been added, pouring off the liquid after reaction had ceased, precipitating the tin with sulphuretted hydrogen, evaporating the liquid to dryness, and extracting hydroxylamine hydrochloride with absolute alcohol. E. Divers obtained it by mixing cold saturated solutions containing one molecular proportion of sodium nitrite, and two molecular proportions of acid sodium sulphite, and then adding a saturated solution of potassium chloride to the mixture. After standing for 24 hours potassium hydroxylamine disulphonate, $HO{\cdot}N(SO_3K)_2$, crystallized out. This was boiled for some hours with water and the solution cooled, when potassium sulphate separated first, and then hydroxylamine sulphate. The method used for the commercial preparation of this salt is similar to the foregoing. Pure anhydrous hydroxylamine was first obtained by C. A. Lobry de Bruyn from the hydrochloride by dissolving it in absolute methyl alcohol and then adding sodium methylate. The precipitated sodium chloride is filtered, and the solution of hydroxylamine distilled in order to remove methyl alcohol, and finally fractionated under reduced pressure. It is better prepared by distilling the phosphate in a vacuum, $(NH_4O)_3PO_4 = H_3PO_4 + 3NH_2OH$. The free base is a colourless, odourless, crystalline solid, melting at 33° C, and boiling at 58° C (under a pressure of 22mm.). It deliquesces and oxidizes on exposure, inflames in dry chlorine and is reduced to ammonia by zinc dust. Its aqueous solution is strongly alkaline, and with acids it forms well-defined stable salts. It is a strong reducing agent, giving a precipitate of cuprous oxide from alkaline copper solutions at ordinary temperature converting mercuric chloride to mercurous chloride, and precipitating metallic silver from solutions of silver salts. With aldehydes and ketones it forms oximes (*q.v.*). W. R. Dunstan (1899) found that the addition of methyl iodide to a methyl alcohol solution of hydroxylamine resulted in the formation of trimethylamine oxide, $N(CH_3)_3O$.

Many substituted hydroxylamines are known, substitution taking place either in the α or β position ($\overset{\beta}{NH_2}\overset{\alpha}{OH}$). β-phenylhydroxylamine, $C_6H_5{\cdot}NH{\cdot}OH$, is obtained in the reduction of

nitrobenzene in neutral solution (*e.g.*, by the action of zinc dust upon nitrobenzene suspended in ammonium chloride solution at about 10° C). It also appears as an intermediate product in the electrolytic reduction of nitrobenzene in sulphuric acid solution. By gentle oxidation it yields nitrosobenzene. By the action of ammonia and amyl nitrite upon it in ethereal solution, one obtains "cupferron," the ammonium salt of nitrosophenylhydroxylamine, $C_6H_5{\cdot}N(NO){\cdot}ONH_4$, which finds extensive application in quantitative analysis.

Substituted hydroxylamines are also obtained by oxidizing primary amines by Caro's acid (H_2SO_5). Dihydroxyammonia, $NH(OH)_2$, a hydrated form of the hypothetical "nitroxyl," N·OH, has not been isolated, but its existence in solution has been demonstrated by A. Angeli, *Sopra alcuni composti ossigenati dell'azoto* (1907).

Under certain conditions hydroxylamine may act as an oxidizing agent; thus in alkaline suspension it oxidizes ferrous hydroxide to ferric hydroxide, and it oxidizes solutions of ferrous salts in ammoniacal tartrate solution to ferric salts. It therefore seems probable that it possesses alternative structures—$NH_2{\cdot}OH$ in acid solution or when acting as a reducing agent, and NH_3O in alkaline solution (F. Haber). Although many methods have been suggested for the estimation of hydroxylamine, most of them depend on very careful adjustment of the acidity of the solution. That of F. Raschig, however, is less sensitive to conditions and is the most trustworthy; the hydroxylamine solution is boiled with a considerable excess of ferric sulphate in sulphuric acid, and the ferrous salt thus formed by reduction $2Fe_2(SO_4)_3+2NH_2OH = 4FeSO_4+2H_2SO_4+N_2O+H_2O$ is titrated with potassium permanganate. *See* A. D. Mitchell, *Journ. Chem. Soc.* (1926).



END OF ELEVENTH VOLUME

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